ENVIRONMENTAL ASSESSMENT

Duralie Extension Project

APPENDIX F
AQUATIC ECOLOGY ASSESSMENT

GLOUCESTER COAL

ResourceStrategies

APPENDIX F

DURALIE EXTENSION PROJECT

AQUATIC ECOLOGY ASSESSMENT

ResourceStrategies

PREPARED BY

CENWEST ENVIRONMENTAL SERVICES

AND RESOURCE STRATEGIES

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F1 INTRODUCTION

Duralie Coal Pty Ltd (DCPL) proposes to extend its open pit coal mining operations at the Duralie Coal Mine (DCM), located approximately 10 kilometres (km) north of the village of Stroud and 20 km south of Stratford in the Gloucester Valley in New South Wales (NSW) (Figure F-1). Another Gloucester Coal Ltd subsidiary, Stratford Coal Pty Ltd, owns and operates the Stratford Coal Mine (SCM), which is located some 20 km to the north of the DCM. The proposed development is known as the Duralie Extension Project (the Project).

The main activities associated with the development of the Project would include (Figure F-2):

- continued development of open pit mining operations at the DCM to facilitate a ROM coal production rate of up to approximately 3 million tonnes per annum, including:
  - extension of the existing approved open pit in the Weismantel Seam to the north-west (i.e. Weismantel Extension open pit) within Mining Lease (ML) 1427 and Mining Lease Application (MLA) 1; and
  - open pit mining operations in the Clareval Seam (i.e. Clareval North West open pit) within ML 1427 and MLA 1;
- ongoing exploration activities within existing exploration tenements;
- progressive backfilling of the open pits with waste rock as mining develops, and continued and expanded placement of waste rock in out-of-pit waste rock emplacements;
- increased run-of-mine (ROM) coal rail transport movements on the North Coast Railway between the DCM and SCM in line with increased ROM coal production;
- continued disposal of excess water through irrigation (including development of new irrigation areas within ML 1427 and MLA 1) (Figure F-3);
- raising of the existing approved Auxiliary Dam No. 2 from relative level (RL) 81 metres (m) to approximately RL 100 m to provide significant additional on-site storage capacity to manage excess water on-site;
- progressive development of dewatering bores, pumps, dams, irrigation infrastructure and other water management equipment and structures;
- development of new haul roads and internal roads;
- upgrade of existing facilities and supporting infrastructure as required in line with increased ROM coal production;
- continued development of soil stockpiles, laydown areas and gravel/borrow pits;
- establishment of a permanent Coal Shaft Creek alignment adjacent to the existing DCM mining area;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Assessment (EA).

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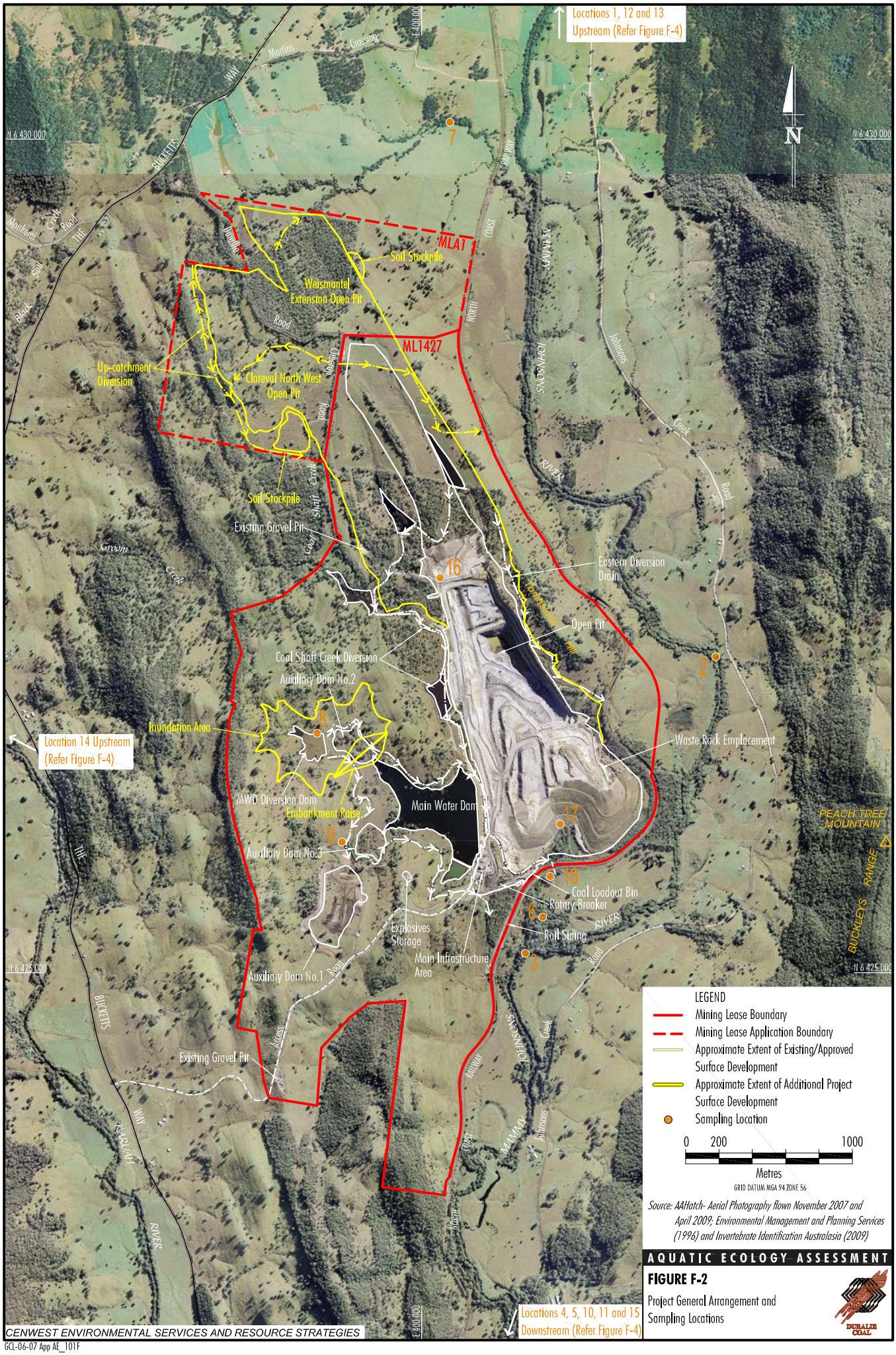

AQUATIC ECOLOGY ASSESSMENT

FIGURE F-2

Project General Arrangement and Sampling Locations

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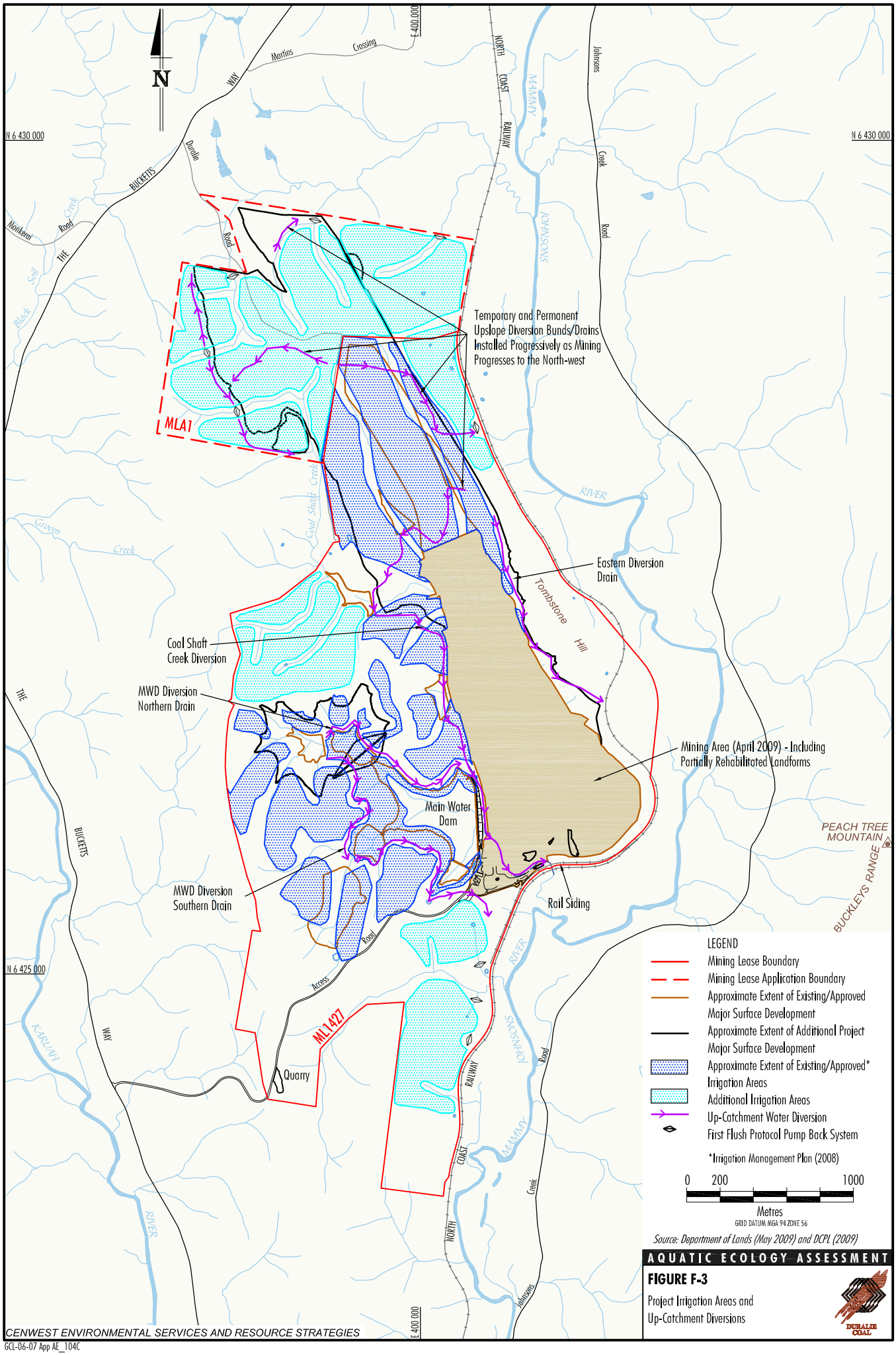

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FIGURE F-3

Project Irrigation Areas and Up-Catchment Diversions

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The aims of this aquatic ecology assessment were to:

- compile the results from previous aquatic ecology surveys and monitoring relevant to the Project area;
- describe the aquatic biota (including macroinvertebrate and fish assemblages) and aquatic habitats, based on previous aquatic ecology surveys and monitoring;
- assess the potential impacts of the Project on aquatic ecology (including threatened species); and
- develop measures to avoid, mitigate and/or remediate potential impacts on aquatic ecology, if required.

F2 DESCRIPTION OF THE PROJECT AREA AND SURROUNDS

The surface water characteristics of the Project area and surrounds have been described by Gilbert & Associates (2009), and are presented in the Surface Water Assessment (Appendix A of the EA). A description of the streams within the Project area and surrounds from Gilbert & Associates (2009) is provided below. Additional detail on the stream characteristics as described by Environmental Management and Planning Services (EMPS) for the *Duralie Coal Project Environmental Impact Statement* (the Duralie EIS) (DCPL, 1996) are also referenced where relevant.

Surface water catchments which overlie the area have been mapped by Gilbert & Associates (2009). A summary of the catchments overlying the Project area and surrounds is provided in Table F-1.

Table F-1
Catchment Area Summary

Stream	Location	Catchment Area (km^2)
Coal Shaft Creek (following existing diversion [Figure F-2])	Within existing DCM area and additional Project disturbance areas.	5.7
Unnamed tributary of the Mammy Johnsons River	Within additional Project disturbance areas.	2.9
Mammy Johnsons River	To the north-east and south of the Project area.	320.0
Karuah River	To the north-west and south of the Project area.	1,470.0

Source: Gilbert & Associates (2009).

km^2= square kilometres.

Mammy Johnsons River

The Project is located predominately within the Mammy Johnsons River catchment. The Mammy Johnsons River is a major tributary of the Karuah River and drains an area of approximately 320 km^2 (Gilbert & Associates, 2009). The confluence of the Mammy Johnsons River and the Karuah River occurs near the village of Stroud, approximately 10 km south of the Project. Mammy Johnsons River is almost the same length as the Karuah at the confluence (i.e. approximately 45 km in river length) and the respective catchment areas of the two rivers are similar at that point (EMPS, 1996). However, the Mammy Johnsons River rises at a much lower altitude (approximately 200 m) and flows through more undulating landscape which has been cleared for the purposes of cattle grazing (EMPS, 1996).

Karuah River

The Karuah River is a relatively short coastal drainage system, which rises high in the mountains of the Chichester State Forest at an altitude of some 500 m (EMPS, 1996). The Karuah River flows west and south of the Project area and drains a total area of approximately 1,470 km^2 (Table F-1), eventually draining to Port Stephens some 40 km south of the DCM (Gilbert & Associates, 2009). The river flows through deeply incised mountain slopes densely wooded with sclerophyll forest, and descends to an altitude of 120 m within 35 km of its source (EMPS, 1996). Approximately 52 km from its source (i.e. at approximately the location of Stroud Road), the Karuah River is joined by the Mammy Johnsons River (EMPS, 1996). From the confluence of the Karuah River and the Mammy Johnsons River (at an altitude of approximately 40 m), the Karuah River maintains a pool and riffle morphology for a further 17 km downstream to Booral (EMPS, 1996). From Booral, the Karuah River occupies a single channel meandering through open cattle and dairying country until it reaches the sea at Karuah, a further 40 km downstream (or approximately 90 km from its source) (EMPS, 1996). The township of Allworth marks the upstream end of the Karuah estuary where the river is both tidal and saline as evidenced by mangrove development (EMPS, 1996).

Tributaries of the Mammy Johnsons River

Unnamed Tributary

The Project would involve the extension of mining into the catchment of an unnamed tributary that flows in a north-easterly direction to join the Mammy Johnsons River approximately 4 km upstream of the Coal Shaft Creek confluence with the Mammy Johnsons River. The current condition of the headwater section of the unnamed tributary within the Project disturbance area is best described as a degraded and incised ephemeral drainage line that provides limited aquatic habitat. Prior to European settlement, the upper reaches were very likely little more than a valley floor without a channel i.e. a first order Strahler stream. Further down stream the tributary likely remained without a channel but became more swampy as the tributary grade decreased. Sections of this pre-European valley floor are still visible. Overgrazing from stock and rabbits together with widespread clearing coinciding with drought and episodic rainfall events, likely induced head cutting that migrated upstream accounting for the extant channel. Geomorphic and ecological thresholds within this tributary were crossed as a result of past landuse. Consequently this section of stream is now predominantly dry with woodland species dominating the riparian fringes, some invasion by introduced flora species and some species such as *Melaleuca* found within the channel bed. Further details on the tributary's characteristics at the Sampling Location (e.g. flow and stream bed characteristics) are provided in Section F3.3.

Coal Shaft Creek

Coal Shaft Creek is a small tributary of the Mammy Johnsons River that originally traversed a large proportion of the DCM deposit. Coal Shaft Creek is the main stream situated within the DCM area. Tombstone Hill (at an elevation of 130 m) divides the Coal Shaft Creek catchment from the Mammy Johnsons River to the east (Figure F-2) (Gilbert & Associates, 2009).

The staged construction of a diversion for Coal Shaft Creek has been required to allow for the approved development of the DCM (EMPS, 1996). The lower section of Coal Shaft Creek has been diverted around the DCM operations via a purpose-built diversion channel, which rejoins the original Coal Shaft Creek alignment near the DCM rail spur (Gilbert & Associates, 2009). The confluence of Coal Shaft Creek with the Mammy Johnsons River is south of the DCM rail loading infrastructure (Figure F-2) and approximately 10 km upstream of the Karuah River confluence (Gilbert & Associates, 2009).

Similar to the un-named tributary, the headwater section of Coal Shaft Creek within the Project disturbance area is degraded incised ephemeral drainage line. Prior to European settlement, and similar to the unnamed tributary, the upper reaches were very likely little more than a valley floor without a channel i.e. a first order Strahler stream. Further down stream the tributary likely remained without a channel but became more swampy as the tributary grade decreased. Sections of the pre-European valley floor are still visible. Overgrazing from stock and rabbits together with widespread clearing coinciding with drought and episodic rainfall events, likely induced head cutting that migrated upstream accounting for the extant channel. Geomorphic and ecological thresholds within this tributary were crossed as a result of past landuse. This section of Coal Shaft Creek has limited riparian vegetation, some invasion by introduced flora species and provides very marginal aquatic habitat during or post rainfall events.

F3 SAMPLING LOCATIONS AND METHODS

F3.1 Overview of Previous Surveys

A substantial number of aquatic ecology surveys and monitoring rounds have been undertaken in the Project area and surrounds on behalf of DCPL. Baseline aquatic surveys of the Karuah River, Mammy Johnsons River and Coal Shaft Creek were conducted in August 1995, September 1995, December 1995 and March 1996 for the Duralie EIS. Aquatic ecosystem parameters sampled included macroinvertebrates, fish and water quality (EMPS, 1996). Sampling locations (as described in Section F3.2 of this report) surveyed by EMPS for the Duralie EIS include Locations 10 to 18.

Schedule 2, Condition 8 (iii) of the DCM Development Consent (DA 168/99) granted by the NSW Minister for Urban Affairs and Planning in August 1997 required the development of a biological monitoring program that included:

> *(iii) The monitoring programme will include the development of adequate chemical and biological monitoring on the Mammy Johnsons River and associated alluvial groundwater by suitably qualified and experienced staff or consultants to the satisfaction of the DLWC and EPA. The DLWC and EPA must be satisfied as to sampling design, including sample locations, sample frequency, sample handling, transport and analysis, sampling parameters and reporting of analysis results. Biological monitoring must conform to requirements specified in the SIGNAL index developed by Chessman (1995).*

A monitoring program was subsequently developed to monitor the chemical and biological attributes of the Mammy Johnsons River in consultation with the NSW Department of Land and Water Conservation (now the NSW Office of Water of the Department of Environment, Climate Change and Water), NSW Environment Protection Authority (now the Department of Environment, Climate Change and Water) and NSW Agriculture (now the Department of Industry and Investment – Agriculture).

The objectives of the monitoring program were to (DCPL, 2009):

- collect baseline data on the macroinvertebrate community utilising the NSW Australian River System (AUSRIVAS) sampling protocols;
- utilise biotic indices (i.e. SIGNAL HU97, EPT richness, number of families, functional feeding groups and silt tolerant taxa) and community parameters to assess stream “health”; and
- sample stream water quality.

Subsequently, as part of the DCM environmental monitoring program, Invertebrate Identification Australasia (IIA) was commissioned to undertake a biological monitoring program of the stream systems within and near the DCM, including the Mammy Johnsons River, Karuah River, Coal Shaft Creek and an unnamed tributary of Mammy Johnsons River, as well as the Main Water Dam diversion drain dams.

The monitoring undertaken by IIA includes sampling of macroinvertebrates and water quality and is undertaken in autumn and spring each year. A total of 15 monitoring rounds have been undertaken and reported on by IIA since September 2002. Sampling locations (as described in Section F3.2 of this report) monitored by IIA as part of the ongoing monitoring program include Locations 1 to 9.

F3.2 Sampling Locations and Timing

This report describes the sampling undertaken by EMPS between 1995 and 1996 and IIA between 2002 and 2009 at the following locations:

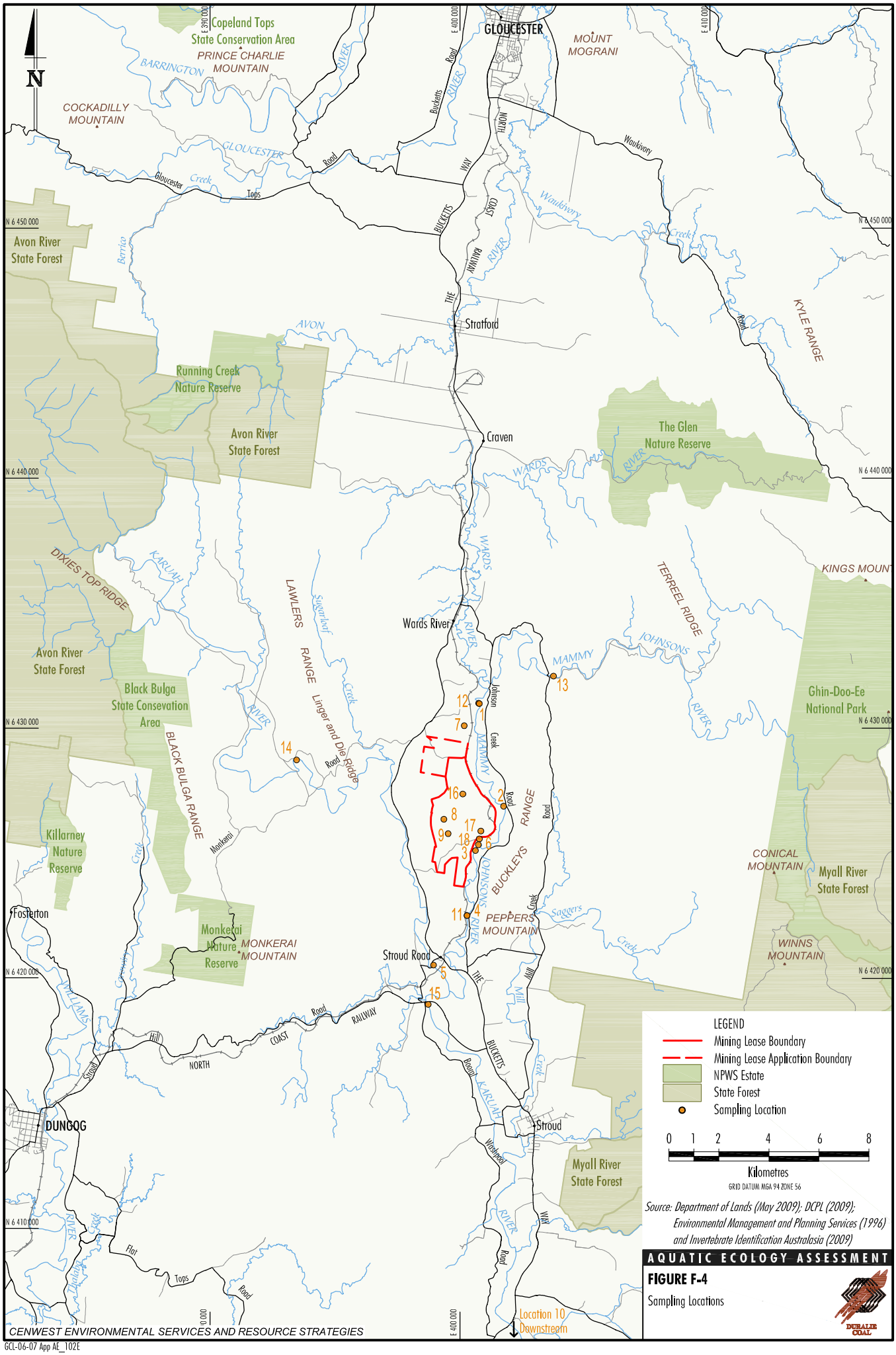
- Mammy Johnsons River (Locations 1 to 4, 11 to 13);
- Karuah River (Locations 5, 10 and 14);
- Coal Shaft Creek (Locations 6 and 16 to 18);
- unnamed tributary (Location 7);
- Diversion Drain Dam No. 1 (DDD1) (Location 8);
- Diversion Drain Dam No. 2 (DDD2) (Location 9); and
- Confluence of Mammy Johnsons River and Karuah River (Location 15).

A summary of the sampling locations and sampling periods is provided in Table F-2. The sampling locations are shown on Figures F-2 and F-4.

Table F-2
Summary of Sampling Locations and Sampling Periods

Sampling Location	Sampling Location No.	Sampling Location Description	Sampling Period (Previous Sampling Reference)
Mammy Johnsons River	1	Upstream of the DCM.	September 2002 to March 2009 (M1)
Mammy Johnsons River	2	Downstream of Location 1, upstream of the DCM.	September 2002 to March 2009 (M2)
Mammy Johnsons River	3	Downstream of Location 2, downstream of the DCM.	September 2002 to March 2009 (M3)
Mammy Johnsons River	4	Downstream of Location 3, below the DCM, west of Johnsons Creek Road.	September 2002 to March 2009 (M4)
Karuah River	5	At Stroud Road crossing.	September 2002 to March 2009* (M5)
Coal Shaft Creek	6	At last pool before the creek enters the Mammy Johnsons River, above Location 3.	September 2008 to March 2009 (SW2)
Unnamed tributary	7	Upstream (approximately 200 m) of the confluence with the Mammy Johnsons River.	September 2008 to March 2009 (SW7)
DDD1	8	Adjacent to Location 9, above the Main Water Dam at the DCM.	March 2009 (DDD1)
DDD2	9	Adjacent to Location 8, above Main Water Dam at the DCM.	March 2004 to September 2008 (DDD2)
Karuah River	10	Downstream of the DCM, at Booral.	August 1995 (Station 5)
Mammy Johnsons River	11	Adjacent to the DCM.	August 1995 (Station 11)
Mammy Johnsons River	12	Adjacent to the DCM.	August 1995 (Station 12)
Mammy Johnsons River	13	Upstream of the DCM.	August 1995 (Station 15)
Karuah River	14	Upstream (approximately 3 km) of the confluence with the Mammy Johnsons River.	August 1995 (Station 18)
Mammy Johnsons River and Karuah River	15	At the confluence of the Mammy Johnsons River and Karuah River.	August 1995 (Station 19)
Coal Shaft Creek	16	Upper section of creek at the DCM.	August 1996 (Upper Coal Shaft Creek)
Coal Shaft Creek	17	Middle section of creek at the DCM.	August 1996 (Middle Coal Shaft Creek)
Coal Shaft Creek	18	Lower section of creek at the DCM.	August 1996 (Lower Coal Shaft Creek)

* Location 5 was not sampled during the June 2004 sampling period.



Source: Department of Lands (May 2009); DCPL (2009); Environmental Management and Planning Services (1996) and Invertebrate Identification Australasia (2009)

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FIGURE F-4

Sampling Locations

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F3.3 Sampling Location Characteristics

For a description of the location characteristics at the time of the 1995 and 1996 EMPS surveys, refer to Appendix Ge (Aquatic Biology) of the Duralie EIS (Attachment F-A). A contemporary description of the aquatic habitats at the streams sampled is provided below. Information for the below descriptions has substantially been sourced from IIA (2002 to 2009).

Mammy Johnsons River

The Mammy Johnsons River is a small meandering coastal stream that passes through predominantly heavily wooded native forest with a small amount of cleared, grazing country found mainly in the lower sections (IIA, 2003b). The river has a dense, narrow riparian zone along the majority of its length, consisting predominantly of native vegetation that forms a closed to semi closed canopy along the majority of the river. Water quality is consistently high along the stream's gradient (IIA, 2003b). The riverbed is typical of a high-energy coastal river system which experiences frequent high flow events. The river is characterised by a steeply incised channel with a broad, multi-channelled bed, unless confined by bedrock. The stream consists of a series of large pools separated by long riffle/glide sections. The substrate in the riffles consist of course, rounded, cobbles and boulders, with cobbles ranging from 3 to 10 centimetres (cm) and boulders from 15 to 35 cm (IIA, 2003b). Pool substrate also consists of course, rounded, cobble and boulders, however, finer grained sand and small areas of silts occur in the bottom of the deep pools (>1.5 m depth) (IIA, 2006b). The cobbles and boulders are typically devoid of algae and silt at most locations along the Mammy Johnsons River, however green filamentous algae have been observed on occasion (IIA, 2003b, 2004b). Submerged macrophytes have also been observed in the riffle zones (IIA, 2004b, 2005a).

Sampling locations along the Mammy Johnsons River include those currently monitored by IIA (i.e. Locations 1, 2, 3 and 4) and those surveyed in 1995/1996 by EMPS (i.e. Locations 11, 12, 13 and 15) (Table F-2).

Photographs of Locations 1 to 4 are provided in Plates F-1 to F-4.

Karuah River

The Karuah River possesses similar river geomorphological characteristics and substrate composition to that of the Mammy Johnsons River (IIA, 2003a). The Karuah River, however, is a larger river than the Mammy Johnsons River and therefore, has higher velocities and much larger (coarser) substrate size in the riffle zones (IIA, 2008a). Filamentous algae have been observed in the river system (IIA, 2003b), usually indicative of nutrient enrichment, possibly resulting from agricultural fertiliser runoff from adjacent paddocks (IIA, 2002). After a rainfall event, excess nutrients runoff into the stream and stimulate algal growth particularly in areas exposed to solar radiation (IIA, 2002). The Karuah River has been observed to be generally more turbid than the Mammy Johnsons River (IIA, 2004a).

Sampling locations along the Karuah River include Location 5 at the Stroud Road crossing (currently sampled by IIA) and Locations 10, 14 and 15 (surveyed by EMPS) (Table F-2). A photograph of Location 5 is provided in Plate F-5.

Plate F-1: Mammy Johnsons River - Location 1 (2009)

Plate F-2: Mammy Johnsons River - Location 2 (2009)

Plate F-3: Mammy Johnsons River - Location 3 (2009)

Plate F-4: Mammy Johnsons River – Location 4 (2009)

Plate F-5: Karuah River – Location 5 (2009)

Diversion Drain Dam No. 2 (DDD2)

This sampling location (Location 9) was established to assess possible impacts of saline runoff on water quality and/or the local macroinvertebrate community within DDD2 (IIA, 2004a), resulting from the irrigation of mine water onto the ridges and slopes within ML 1427 on water quality and/or the local macroinvertebrate community (IIA, 2004a). DDD2 (Location 9) is located to the west of the Main Water Dam situated to the west of the open pit mining operations (Figures F-2 and F-3). The development of a foreshore riparian zone and macrophyte beds has been observed at this location along with the natural colonisation of the near shore zone by sedges and floating macrophytes (IIA, 2007b). DDD2 was temporarily decommissioned in early 2009 due to the construction of a larger reservoir in an adjacent location.

A photograph of Location 9 is provided in Plate F-6.

Plate F-6: Diversion Drain Dam No. 2 – Location 9 (2008)

Diversion Drain Dam No. 1 (DDD1)

Sampling commenced at DDD1 (Location 8) in March 2009 to replace the temporarily decommissioned DDD2 (Location 9). DDD1 (Location 8) is located north-west of the Main Water Dam within the inundation area footprint of the proposed Auxiliary Dam No. 2 Embankment Raise (Figures F-2 and F-3). DDD1 was constructed with a valved release pipe that allows for the controlled discharge of the water from the dam, whereas DDD2 was originally constructed with an unregulated spill pipe that essentially created a constant water level within the dam and, therefore, more stable internal conditions (IIA, 2009). The greater variability in water level at DDD1 compared with DDD2 has resulted in the creation of a greater range of aquatic habitats. Observations at this location indicate that there has been little development of macrophyte communities to date and that the water has been generally turbid (IIA, 2009).

A photograph of Location 8 is provided in Plate F-7.

Plate F-7: Diversion Drain Dam No. 1 – Location 8 (2009)

Coal Shaft Creek

Coal Shaft Creek is a small ephemeral stream that discharges into the Mammy Johnsons River approximately 50 to 100 m upstream of Location 3 (IIA, 2009). The middle reach of Coal Shaft Creek as described in Section F2, is diverted around the DCM open pit. The diverted section of the creek has limited riparian vegetation but in the lower reaches adjoining Mammy Johnsons River, has a dense riparian zone, mainly dominated by native plants. This dense riparian vegetation provides substantial shading and habitat for terrestrial and aquatic invertebrates. The creek, below the diversion, contains permanent large pools which are possibly fed by groundwater seepage (IIA, 2009). The creek in the lower reaches responds quickly to rainfall events and low flows continue for extended periods after rain. The substrate within the lower pools is bedrock lined with deep fine sediments and detrital material. The sediments are anoxic (i.e. without oxygen) at depth due to the build up of leaves and twigs. The creek has been observed to be quite turbid following rainfall events (IIA, 2009).

Sampling locations along Coal Shaft Creek include the currently monitored Location 6 by IIA and the previously surveyed Locations 16, 17 and 18 monitored by EMPS (Table F-2).

A photograph of Location 6 is provided in Plate F-8.

Plate F-8: Coal Shaft Creek – Location 6 (2009)

Unnamed Tributary

Sampling commenced at this unnamed tributary (Location 7) of the Mammy Johnsons River in September 2008 (Table F-2). The tributary is a small drainage line/stream composed of a steep upper section and chain of ponds above and within the agricultural floodplain. The unnamed tributary drains into the Mammy Johnsons River between survey Locations 1 and 2. The tributary consists of a steep, mostly dry ephemeral upper gully that only flows during rainfall, with a dense, open, dry sclerophyll riparian zone that narrows down in the lower portion to a series of small pools connected by small runnels surrounded by a narrow riparian zone of Paperbark (*Melaleuca*) and wet sclerophyll species (IIA, 2009). The sampling location (Location 7) is in the break of slope at the beginning of the lower reaches of the stream where the first, large permanent pool is encountered. The lower half of the stream is essentially fed by seepage. Several springs/seepage zones along the tributary have been identified (IIA, 2009).

The tributary is within a grazing property that is predominantly cleared. The substrate is sand and clay in the upper section with the lower chain of ponds consisting of a sand substrate with a layer of coarse allochthonous matter i.e. leaves from the surrounding paperbark trees. The stream has been observed to be relatively clear although the water has been observed to be tea-coloured from the leaching of tannins from the surrounding riparian vegetation (IIA, 2009).

A photograph of Location 7, taken downstream of and outside the Project disturbance area, is provided in Plate F-9.

Plate F-9: Unnamed Tributary – Location 7 (2009)

F3.4 Water Quality

A number of water quality variables were measured *in situ* at each sampling location by EMPS and IIA using electro-chemical field sampling equipment calibrated daily against proprietary standards. Water quality variables measured include:

- conductivity (microSiemens per centimetre [µS/cm]);
- pH (pH units);
- temperature (degrees Celsius [^{o}C]); and
- dissolved oxygen (DO) (milligrams per litre [mg/L]).

Water samples taken from each sampling location during the August 1995 and December 1995 EMPS surveys were also tested for concentrations of trace elements (EMPS, 1996). Samples were filtered in the field (0.45 micrometres [µm]) and acidified with analytical grade concentrated nitric acid prior to analysis for dissolved trace elements. Trace elements were determined using standard methods (atomic absorption spectroscopy) (EMPS, 1996).

F3.5 Assemblages of Macroinvertebrates

IIA sampled each location (i.e. Locations 1 to 9) using two standardised methods as described below:

The first method involves the rapid assessment technique (i.e. AUSRIVAS [Turak *et al*., 2004]) whereby two habitats are sampled (*viz.* pool edge and riffles).

Pool edges were sampled with a kick net, which is drawn through the water over the substrate starting from 1.5 m off the edge and working along the edge in a rapid motion for approximately 10 m. In order to sample a large area of a river reach, smaller samples of approximately 1 to 2 m are taken along the edge of the pool to a maximum combined length of 10 m. Samples of stream edge habitats were collected using a 250 µm dip net (IIA, 2006b).

Riffles were sampled with a kick net held in the riffle with the net extending downstream while the substrate directly upstream is agitated with either hands or feet. Care was taken to turn over boulders and cobbles and clean / wash them with the hands to remove any encrusting animals. Each habitat sampled was combined to give a comprehensive species list for the whole location (IIA, 2006b).

The second method involves targeted sampling of macroinvertebrates from a variety of habitats and substrates. Habitats sampled included (IIA, 2006b):

- logs and wood from within pools, pool edges and riffles;
- large rocks and boulders from within pools and riffles;
- kick net sweeps through macrophyte beds; and
- kick net sweeps under bank overhangs.

All IIA samples were sorted under a stereomicroscope and stored in a 70% alcohol solution. Specimens were identified to genus where possible (except for Chironomidae, Oligochaeta and Platyhelminthes which are identified to family/subfamily) using a combination of current taxonomic works and keys and comparison with voucher specimens in the reference collections of IIA (IIA, 2009). The following taxonomic guides were used: Williams (1981) and the taxonomic identification series produced by the Murray Darling Freshwater Research Centre (IIA, 2006b).

At Locations 10 to 18, EMPS (1996) used a Surber sampler to collect benthic (streambed) invertebrates in shallow riffle zones. In the lower end of Coal Shaft Creek a PVC corer was used to sample deep muds and silt (90 millimetre [mm] diameter × 300 mm depth). Four replicate samples were taken from each location. The contents of the Surber sampler was washed into calico bags and preserved in 70% alcohol at each location prior to processing in the laboratory. Cores from Coal Shaft Creek were washed through an Endecott sieve (1 mm aperture) to recover macrobenthos (EMPS, 1996).

EMPS also used gillnets (25, 35, 55 and 70 mm stretched mesh dimensions), dipnets, setlines with baited hook and traps to collect nekton (motile aquatic organisms from the water column) at appropriate locations (EMPS, 1996).

F3.6 Assemblages of Fish

Sampling of fish was undertaken by EMPS in 1995 and 1996 at Locations 10 to 18. Collections of fish were undertaken in accordance with a scientific collecting permit issued by NSW State Fisheries (now the Department of Industry and Investment – Fisheries) and the inventory of species collected was provided for application to the NSW State Fisheries database (EMPS, 1996). Fish traps were used to collect fish during a special survey of Coal Shaft Creek in March 2006 (EMPS, 1996).

Captured specimens were stored on ice in the field prior to processing. The catch was then sorted, identified to species and the standard length and weight of individual fish recorded (EMPS, 1996).

Reference specimens were preserved in 10% v/v formaldehyde, transferred to 70% alcohol and registered with the collection at the Queensland Museum, Brisbane (EMPS, 1996).

F3.7 Threatened Species

The field sampling methods undertaken are considered appropriate to have recorded threatened aquatic biota.

F3.8 Data Analyses

EMPS used a variety of statistical methods to analyse the diversity and abundance of macroinvertebrate species sampled during the 1995 and 1996 surveys. A comprehensive description of the data analysis methodologies used for the surveys is provided in Appendix Ge (Aquatic Biology) of the Duralie EIS (Attachment F-A). A description of the more contemporary IIA data analysis methodologies is provided below.

The biological indices utilised by IIA to assess the ecological condition of the locations sampled included SIGNAL HU97 (Chessman *et al*., 1997), EPT richness, number of families, functional feeding groups and silt tolerant species. These indices are described in further detail below.

SIGNAL HU97

SIGNAL is an acronym for ‘Stream Invertebrate Grade Number - Average Level’, is a biotic index of pollution tolerance or sensitivity of stream invertebrates and was originally developed for use in the lower Blue Mountains (Chessman, 1995 in IIA, 2002). Chessman *et al*. (1997) released a modified version, SIGNAL HU97, developed for the Hunter Valley. The aquatic communities in SIGNAL HU97 are more comparable to those found within the study area and has therefore been used rather than SIGNAL (IIA, 2002). Table F-3 provides an interpretation of water quality status using the SIGNAL HU97 scores (Chessman *et al*., 1997).

Table F-3
Interpretation of Water Quality Status using SIGNAL HU97 Scores

SIGNAL HU97	Probable Water Quality Status
>7	Excellent
6-7	Good
5-6	Fair
4-5	Poor
<4	Very poor

EPT Richness

The EPT richness index is based on three groups of insects that contain a majority of pollution sensitive taxa (IIA, 2002). All species of Ephemeroptera, Plecoptera and Trichoptera (EPT) are identified and then the number of distinct taxa counted. The EPT measure is based on the observation that the majority of taxa in these groups are particularly pollution sensitive. This feeding guild is important to the 'health' of an aquatic ecosystem because they break down the allochthonous material (leaves and twigs) that falls in or is washed into streams (IIA, 2002). Coarse allochthonous matter is the primary energy source for most aquatic ecosystems. By breaking down this material, energy is transferred from one feeding group to another, thereby, increasing the food resources for other feeding groups and in turn increasing biodiversity. An absence or low number of these groups, due for example to increases in water pollution and/or disturbance, would result in decreased energy processing and species diversity (IIA, 2002).

Table F-4 provides an interpretation of the EPT richness scores (Besley *et al*., 1998 in IIA, 2002).

Table F-4
Interpretation of the EPT Richness Scores

EPT Richness	Probable Condition of Macroinvertebrate Community
>6	Healthy
5-6	Slightly impaired
3-4	Moderately impaired
1-2	Severely impaired
0	Grossly impaired

Number of Families

All macroinvertebrate families are separated and counted. The number of families present generally decreases with decreasing water quality and this change is used as a comparative measure of community change, and therefore water quality change, over time (IIA, 2002).

Functional Feeding Groups

There are four feeding groups of macroinvertebrates (i.e. shredders, filter-collectors, grazers and predators) (Quinnipiac River Watershed Association, 1998). The description of each group provided below is sourced from DeLange (1994).

> *Shredders such as Stoneflies (Plecoptera) feed on plant material and some animal material, which is generally dead, and break it into smaller particles through their feeding and digestive process. Collectors, such as Caddisflies (Trichoptera) and Blackflies (Diptera), feed on this fine particle material which they filter from the water. Grazers, such as snails and beetles, feed on algae and other plant material living on rocks and on plant surfaces. Predators such as Dobsonflies (Megaloptera) or Dragonflies (Odonata) feed on other macroinvertebrates. Individual species may be generalists, and fit into more than one of these groups (as opposed to specialists).*

Of these four feeding groups, IIA reported on the relative abundance of shredder taxa (as a shredder ratio) and grazer taxa over time as an indicator of changing water quality. Similar to number of families, generally the higher the ratio of shredders and grazers, the better the water quality (IIA, 2002).

Silt Tolerant Taxa

Aquatic fauna assemblages are assessed for silt tolerant taxa, as the presence and dominance of such fauna can provide an indication of the degree of heavy sediment pollution. The main indicator families are the Dugesiidae, Lymnaeidae, Ancylidae, Planorbidae, Psephenidae, Chironomidae, Caenidae, Pyralidae and Ecnomidae (IIA, 2002). The silt tolerant taxa values are best examined against the total number of taxa sampled from each location (i.e. the silt tolerant taxa ratio), as the variation of values is significantly reduced compared with examining the number of taxa alone. This ratio index is used as a comparative measure of community changes over time (IIA, 2002).

F4 RESULTS

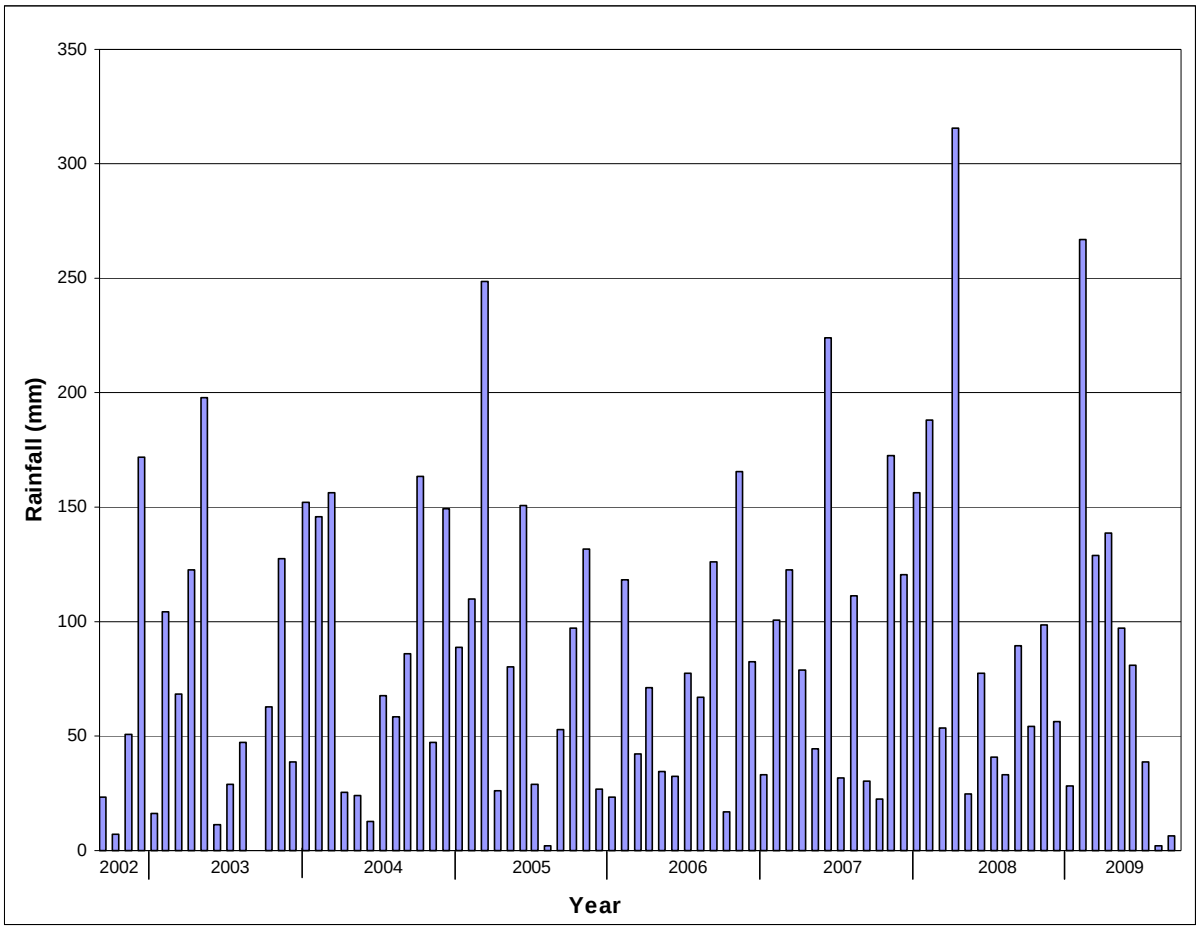
This report presents and describes the results of the IIA macroinvertebrate and water quality sampling undertaken between 2002 and 2009 at Locations 1 to 9[1], as well as the results of the EMPS fish sampling undertaken in 1995 and 1996 at Locations 10 to 18. For the EMPS macroinvertebrate and water quality sampling results, refer to Appendix Ge (Aquatic Biology) of the DCM EIS (Attachment F-A – available on request).

F4.1 Rainfall

There have been 17 major rainfall events (i.e. greater than 50 mm) recorded during the 2002 to 2009 sampling period. These major rainfall events (which are generally associated with flooding) have been observed to have a substantial impact on the aquatic community at each location, with varying severities of scouring occurring during these events (IIA, 2009).

Recorded rainfall during the 2002 to 2009 sampling period is shown on Chart F-1.

Chart F-1
Rainfall Data



Source: DCPL in IIA (2002 to 2009)

[1] Note that monitoring of DDD1 (Location 8) commenced in March 2009.

F4.2 Water Quality

Water temperature at all sampling locations across the 2002 to 2009 sampling period ranged from 9.8°C at the Mammy Johnsons River (Location 2) to 28.9°C at DDD2 (Location 9) (Table F-5). The recorded mean temperatures in the Mammy Johnsons River (Locations 1 to 4) ranged from 16.2°C to 16.9°C compared to the Karuah River (Location 5) mean temperature of 17.6°C (Table F-5). The recorded temperatures in the diversion drain dams (i.e. DDD1 [Location 8] and DDD2 [Location 9]) were typically higher than that of the river system sampling locations.

Table F-5
Summary of Water Quality Variables Recorded at each Sampling Location

Water Quality Variable	Sampling Locations								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Conductivity (µs/cm)									
Minimum	170	184	178	199	**80**	429	585	633	133
Mean	265	280	276	292	148	502	595	-	380
Maximum	398	432	419	436	245	575	606	633	732
pH (pH units)									
Minimum	6.5	6.5	6.5	6.6	6.7	7.9	7.5	8.0	6.6
Mean	7.3	7.3	7.3	7.4	7.4	7.9	7.6	8.0	7.6
Maximum	8.2	8.1	8.1	8.1	8.3	7.9	7.8	8.0	8.5
Temperature (°C)									
Minimum	11.9	9.8	10.2	9.9	13.0	16.1	13.7	25.2	17.0
Mean	16.5	16.2	16.3	16.9	17.6	19.2	16.2	25.2	21.9
Maximum	21.9	22.0	21.9	22.3	22.6	22.3	18.8	25.2	28.9
Dissolved Oxygen (%Saturation [S])[2]									
Minimum	**48**	**28**	**38**	**50**	**66**	**62**	**32**	100	**68**
Mean	**77**	**72**	**71**	88	97	**66**	**47**	100	98
Maximum	**114**	110	110	**116**	**120**	**70**	**62**	100	**140**

Note:

1. Guideline values recommended by the Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guidelines for protection of aquatic ecosystems in lowland rivers: pH (6.5 to 8.5); Conductivity (125 to 2200 µS/cm); Dissolved Oxygen (85 to 110% Saturation). There are no ANZECC and ARMCANZ (2000) guideline values for Temperature. Values in bold are outside the guideline values recommended by ANZECC (2000).
2. DO values presented represent a conversion from dissolved oxygen (mg/L) (as recorded by IIA and presented in Attachment F-B) to dissolved oxygen (%Saturation) in accordance with Commonwealth of Australia (2002). Approximate values only.

The mean pH at all sampling locations were within the recommended ANZECC and ARMCANZ (2000) guidelines (i.e. pH 6.5 to 8.5) for the protection of aquatic ecosystems in lowland rivers (i.e. systems at < 150 m altitude) (Table F-5).

All mean conductivity values (range = 148 to 595 µS/cm) were within the recommended ANZECC and ARMCANZ (2000) guidelines for the protection of aquatic ecosystems in lowland rivers (Table F-5). Coal Shaft Creek (Location 6), the unnamed tributary (Location 7) and DDD1 (Location 8) all recorded consistently higher conductivity levels than the river sampling locations (Locations 1 to 5) (Table F-5).

The two upstream locations on the Mammy Johnsons River (Locations 1 and 2) and one downstream location on the Mammy Johnsons River (Location 3) recorded mean DO levels below the recommended ANZECC (2000) guidelines (Table F-5). One downstream location on the Mammy Johnsons River (Location 4) and the Karuah River location (Location 5) recorded mean DO levels within the recommended ANZECC (2000) guidelines (Table F-5). Both tributaries of the Mammy Johnsons River (Coal Shaft Creek – Location 6 and the unnamed tributary – Location 7) had recorded DO values all below the recommended ANZECC (2000) guidelines (Table F-5).

IIA (2003a and 2007a) note that the March 2003 and March 2007 sampling periods (which correlated to the lowest recorded DO values) were proceeded by prolonged dry periods. The raw water quality data are provided in Attachment F-B.

F4.3 Assemblages of Macroinvertebrates

A consolidated list of the macroinvertebrates recorded by IIA is provided in Attachment F-C. Separate lists of macroinvertebrates recorded in each of the 15 monitoring rounds (undertaken by IIA) between 2002 and 2009 are provided in Attachment F-D. The raw macroinvertebrate data collected by EMPS during the 1995 and 1996 surveys and an analysis of these data can be found in Appendix Ge (Aquatic Biology) of the Duralie EIS (Attachment F-A – available on request).

A summary of macroinvertebrate based biological indices recorded by IIA between 2002 and 2009 at Locations 1 to 9 is provided in Table F-6. Individual data for each sampling location at each monitoring round is provided in Attachment F-E.

Table F-6
Summary of Recorded Biological Indices

Biological Indices	Sampling Locations								
	1	2	3	4	5	6	7	8	9
SIGNAL HU97									
Minimum	5.0	4.8	5.2	5.2	5.2	4.5	5.6	5.1	3.9
Mean	5.6	5.7	5.8	5.9	6.1	4.8	5.6	5.1	4.5
Maximum	6.4	6.8	6.4	6.7	6.7	5.1	5.7	5.1	5.1
Number of Families									
Minimum	31	32	23	26	29	16	4	15	23
Mean	27	27	23	27	25	20	14	15	19
Maximum	33	38	34	36	30	23	23	15	25
Number of Taxa									
Minimum	29	22	20	28	25	20	6	19	18
Mean	34	34	30	35	33	24	18	19	25
Maximum	45	47	44	45	43	28	29	19	30
EPT									
Minimum	7	4	4	7	10	6	1	2	1
Mean	12	11	11	12	13	8	4	2	4
Maximum	18	17	14	16	17	9	7	2	6
EPT Ratio									
Minimum	0.23	0.14	0.20	0.24	0.32	0.30	0.16	0.10	0.04
Mean	0.35	0.34	0.35	0.35	0.41	0.31	0.20	0.10	0.18
Maximum	0.49	0.55	0.48	0.47	0.56	0.32	0.24	0.10	0.27

Table F-6 (Continued)
Summary of Recorded Biological Indices

Biological Indices	Sampling Locations								
	1	2	3	4	5	6	7	8	9
Shredder Ratio									
Minimum	0.26	0.22	0.29	0.26	0.27	0.39	0.16	0.31	0.16
Mean	0.46	0.44	0.46	0.46	0.51	0.45	0.31	0.31	0.24
Maximum	0.7	0.68	0.63	0.64	0.68	0.5	0.45	0.31	0.32
Silt Tolerant Taxa									
Minimum	2	1	2	2	2	4	1	2	2
Mean	5	5	4	5	5	5	3	2	4
Maximum	8	9	9	8	7	5	4	2	5
Silt Tolerant Taxa Ratio									
Minimum	0.06	0.04	0.07	0.06	0.06	0.18	0.14	0.10	0.09
Mean	0.15	0.14	0.14	0.15	0.15	0.19	0.15	0.10	0.16
Maximum	0.23	0.26	0.26	0.21	0.21	0.20	0.16	0.10	0.22

The results for each of the above indices are described in further detail below.

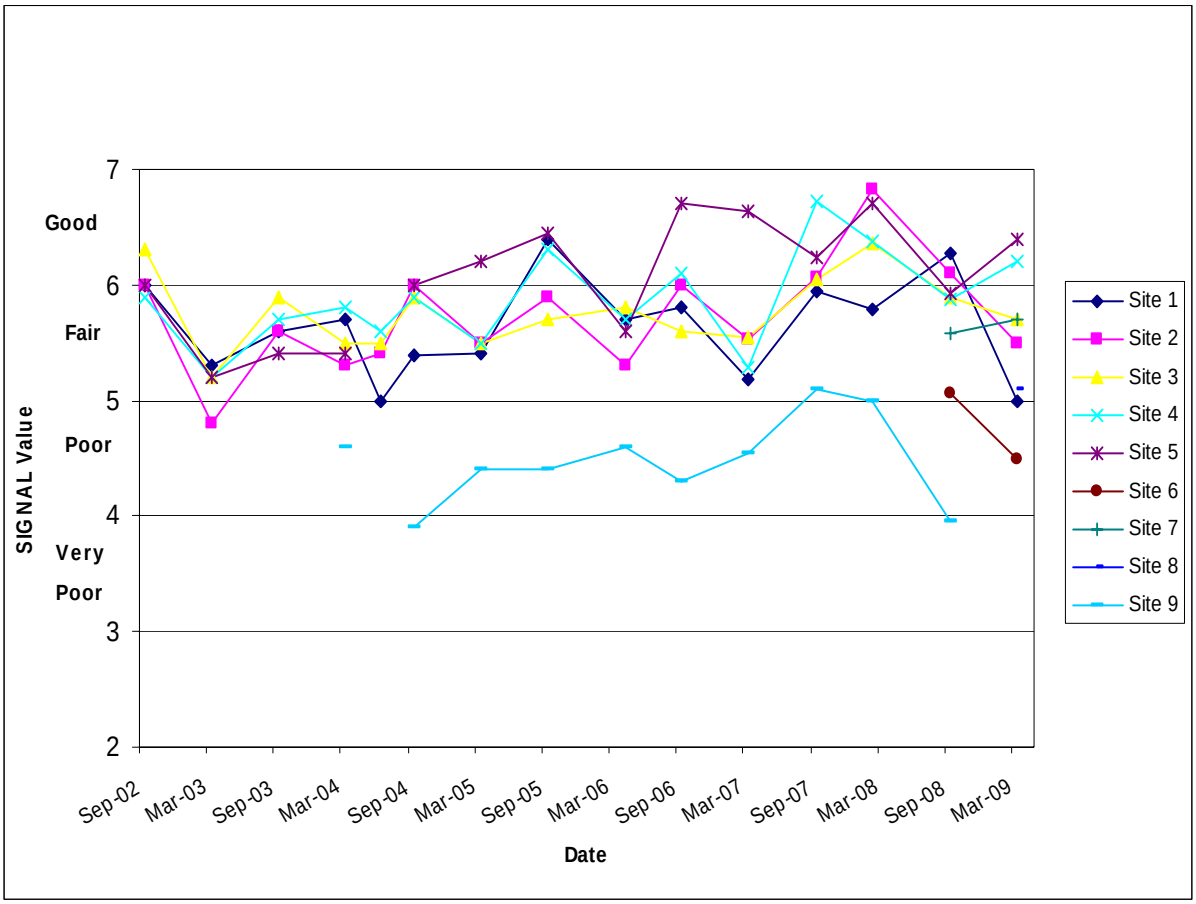
Signal HU97

The SIGNAL HU97 values recorded along the Mammy Johnsons River (Locations 1 to 4) have been consistent with no major deviations (Chart F-2).

The mean SIGNAL HU97 values recorded for the Mammy Johnsons and Karuah Rivers (Locations 1 to 5) ranged from 5.6 to 6.1, indicating Fair to Good condition (Table F-6). The lowest mean SIGNAL HU97 values were 4.5 (Poor condition) and 4.8 (Poor condition) for DDD2 (Location 9) and Coal Shaft Creek (Location 6), respectively (Table F-6). A significant feature of these results is the consistently Fair to Good condition values recorded along the surveyed length of the Mammy Johnsons River (Locations 1 to 4) and its comparative similarity to the Karuah River (Location 5) (IIA, 2009). The SIGNAL HU97 values indicate that Mammy Johnsons River and Karuah River (Locations 1 to 5), unnamed tributary (Location 7) and DDD1 (Location 8) remained in Fair to Good condition throughout the monitoring period while Coal Shaft Creek (Location 6) and DDD2 (Location 9) were generally in Poor condition.

IIA (2008a) consider that the higher SIGNAL HU97 value (and corresponding lower silt tolerant taxa) observed at the Karuah River reflects the slightly different geomorphology and flow rates i.e. higher flow and coarser substrate of the Karuah River, which provides more favourable conditions for the EPT group of taxa.

Chart F-2
Observed Variation in the SIGNAL HU97 Index Values

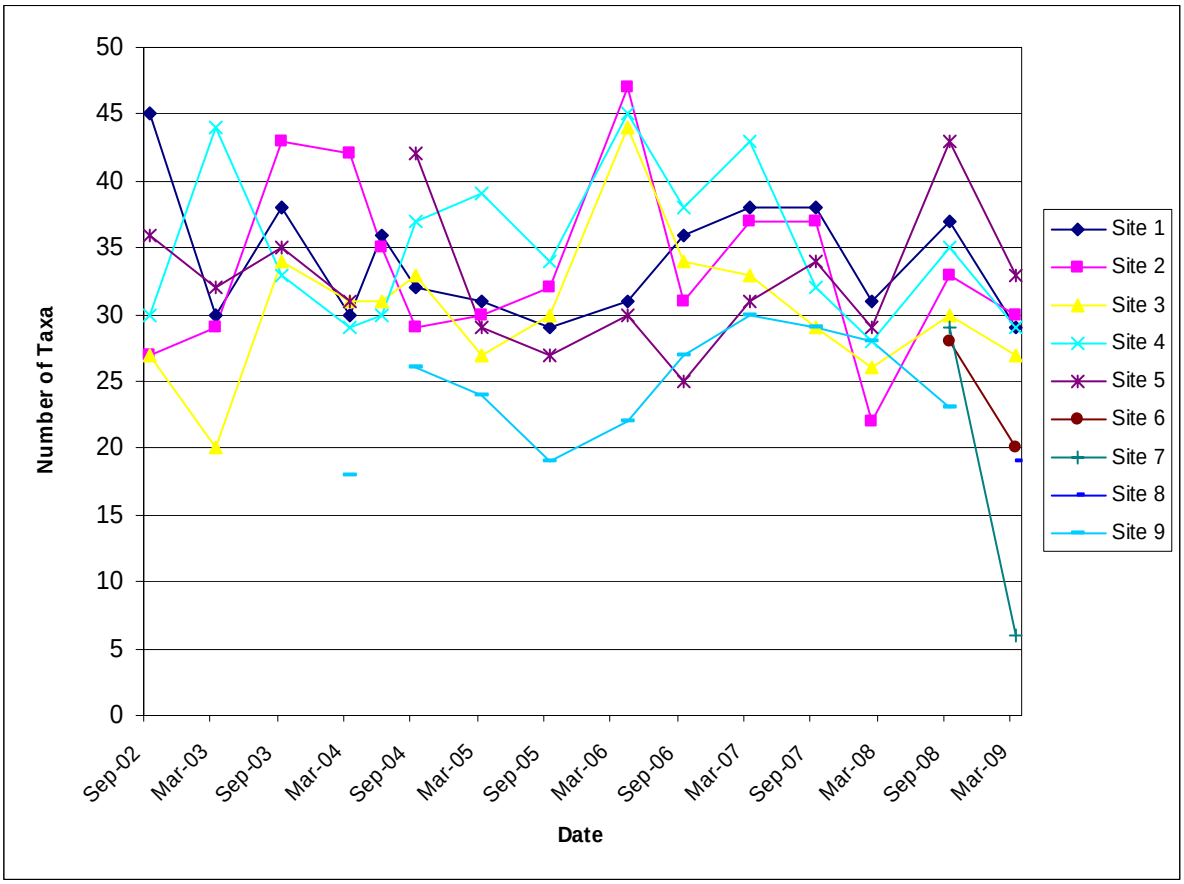


Number of Taxa

A total of 153 taxa from 74 families were recorded between 2002 and 2009 at Locations 1 to 9.

The number of taxa recorded for the surveys indicate a relatively consistent trend (Chart F-3). Over the 2002 to 2009 sample period, the total number of taxa recorded during any single monitoring round has ranged from 58 in September 2002 to 76 in September 2007 and 73 in March 2009 (IIA, 2009) (Attachment F-E). The highest number of taxa recorded at an individual location was on the Mammy Johnsons River (Location 2), with 47 taxa recorded (Table F-6) in April 2006 and the lowest number of taxa was recorded at the unnamed tributary (Location 7), with a total of six taxa being recorded (Table F-6) in March 2009 (IIA, 2009) (Attachment F-E).

Chart F-3
Number of Recorded Macroinvertebrate Taxa



IIA (2009) indicate that the decrease in the number of taxa recorded for the March 2009 survey (Chart F-3) occurred as a result of a flood event in February 2009 (Section F4.1).

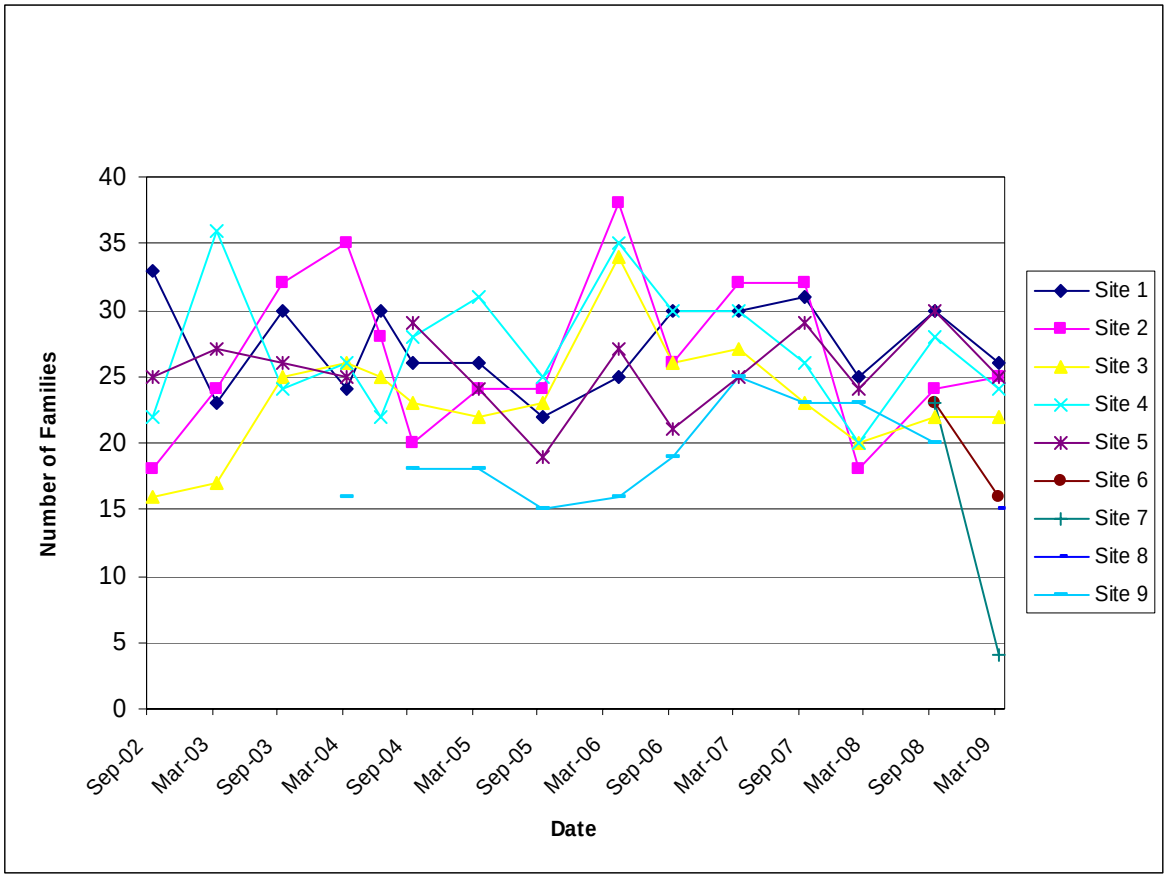
Commonly recorded taxa during the 2002 to 2009 sampling period included (IIA, 2002 to 2009):

- *Paratya australiensis* (Freshwater Shrimp);
- Coleoptera (Beetles), especially from the family Elmidae;
- the Dipteran families Chironomidae (Midges) and sub-families (including Orthocladinae);
- the Ephemeropteran (Mayflies) families Baetidae and Leptophlebiidae;
- the Trichopteran (Caddisflies) families Calamoceratidae, Hydrobiosidae, Hydropsychidae, Leptoceridae and Philopotamidae;
- the Plecopteran (Stoneflies) family Grypopterygidae;
- the Molluscan (Mollusc) family Sphaeridae; and
- Hydrobiidae (Mud Snails).

IIA (2002 to 2009) also note that there have been some noticeable absences or low numbers observed in the macroinvertebrate community composition, particularly in the upper reaches of the Mammy Johnsons River. These included many of the common larger, highly mobile and predominantly predatory insects such as the water beetles (Dystiscidae), dragonflies and damselflies (Odonata) and many of the common true bugs (Hemiptera) such as the Notonectidae and the larger Corixidae (IIA, 2009). IIA (2009) indicate that a combination of an absence of pool macrophytes and the low light conditions produced by the closed canopy as well as high flow levels are considered contributing factors for the absences.

The majority of common insect taxa found at all Locations are those that do not fly far or high as adults and require a natural riparian zone close to the river to complete their life cycles (IIA, 2002 to 2009). The larvae of these insect taxa also require good water quality and a constant supply of high quality allochthonous material to feed on (IIA, 2002 to 2009). The insect taxa that were generally absent are the highly mobile (wide dispersers) predators that hunt by sight and are commonly found in more open water bodies such as Site DDD2. Therefore, the natural structure of the river and the riparian zone is contributing directly to the high biodiversity and overall community structure. The number of recorded families for the surveys are shown on Chart F-4.

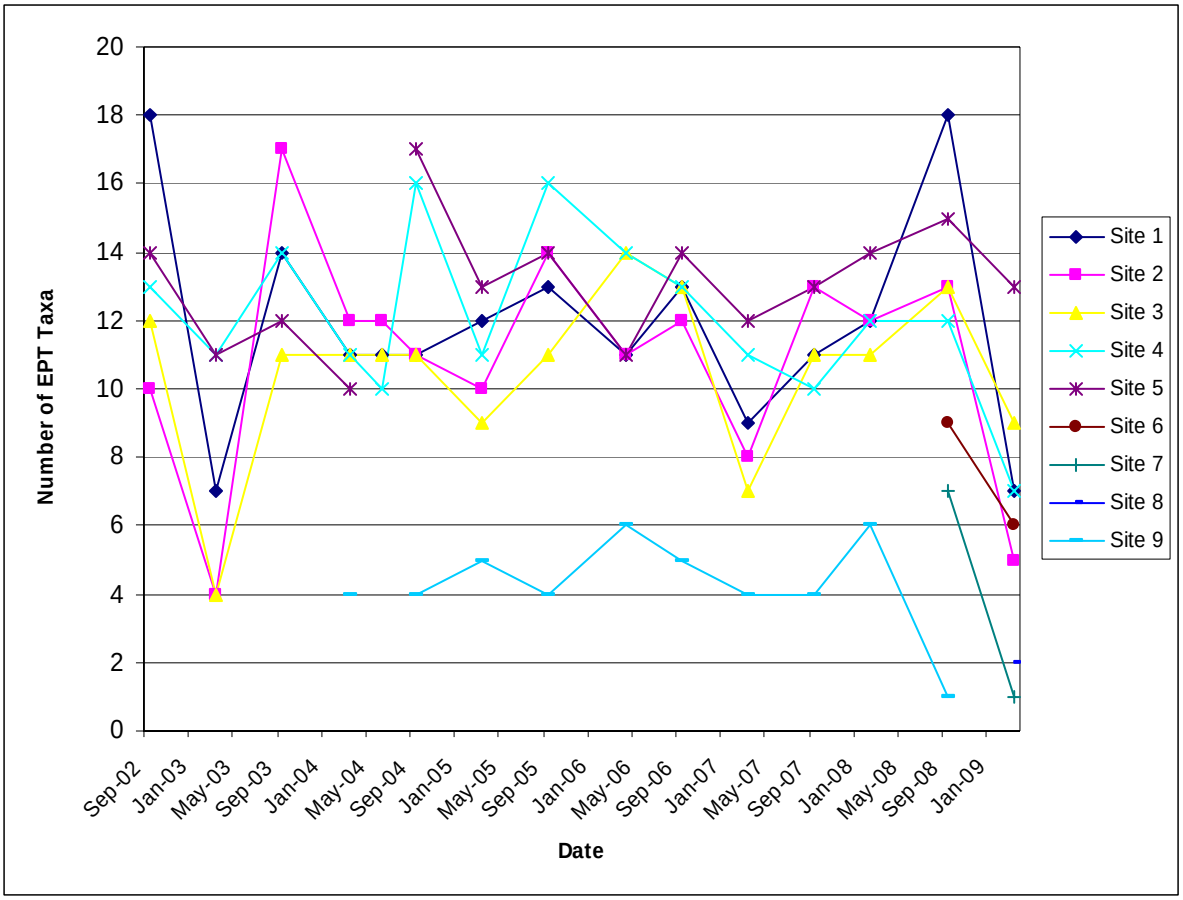
Chart F-4
Number of Recorded Macroinvertebrate Families



Number of EPT Taxa and EPT Taxa Ratio

The number of recorded EPT taxa at each location over time is provided on Chart F-5. IIA (2009) indicate that the annual trends have consistently corresponded to increases and decreases in spring and autumn EPT taxa numbers, respectively.

Chart F-5
Number of Recorded Macroinvertebrate EPT Taxa

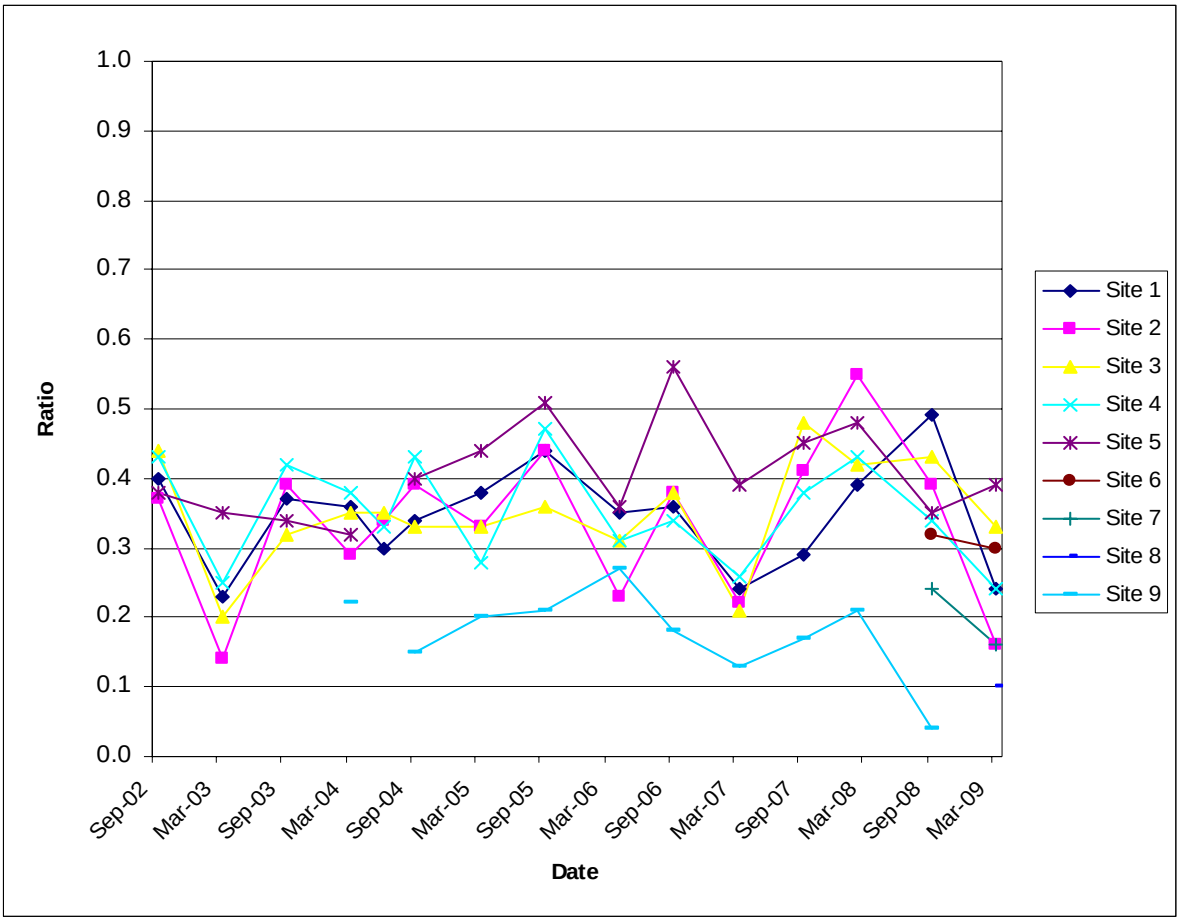


The EPT values are best examined against the total number of taxa sampled (i.e. the EPT ratio) (IIA, 2009). Chart F-6, Table F-6 and Attachment F-E demonstrate variations in the EPT ratios over time. The mean EPT ratio values range from 0.34 to 0.41 for the Mammy Johnsons and Karuah Rivers (Locations 1 to 5) to 0.10 at DDD2 (Location 9) (Table F-6). The Karuah River (Location 5) had the highest mean ratio of EPT taxa (0.56) (Table F-6). During the March 2009 survey, the EPT ratio indicated a substantial decrease in recorded values for all locations compared with previous results, excluding Karuah River (Location 5), which recorded a small increase when compared with previous surveys (IIA, 2009) (Attachment F-E). As described in Section F4.1, IIA (2009) considered that the flooding event prior to the March 2009 survey was likely to have contributed to these reductions.

During the 2002 to 2009 sampling period, IIA observed that the EPT ratio values generally separated the three major aquatic habitats i.e. the Karuah River (Location 5 – the higher flow system) recording a relatively high value; the Mammy Johnsons River (Locations 1 to 4 - lower flow, finer sediment and coarser substrate system) recording similar high mean values at all sampling locations; and DDD1 and DD2 (Locations 8 and 9 - the non-flowing system) recording the lowest mean values (IIA, 2008b). An exception to this was the unnamed tributary (Location 7), which recorded the lowest EPT ratio in March 2009 (IIA, 2009).

IIA has observed that the differences between the Mammy Johnsons and Karuah River systems have been most noticeable during periods of low flow when mean flow velocities are higher in the Karuah River with larger substrate types, leading to a greater scouring effect (IIA, 2009).

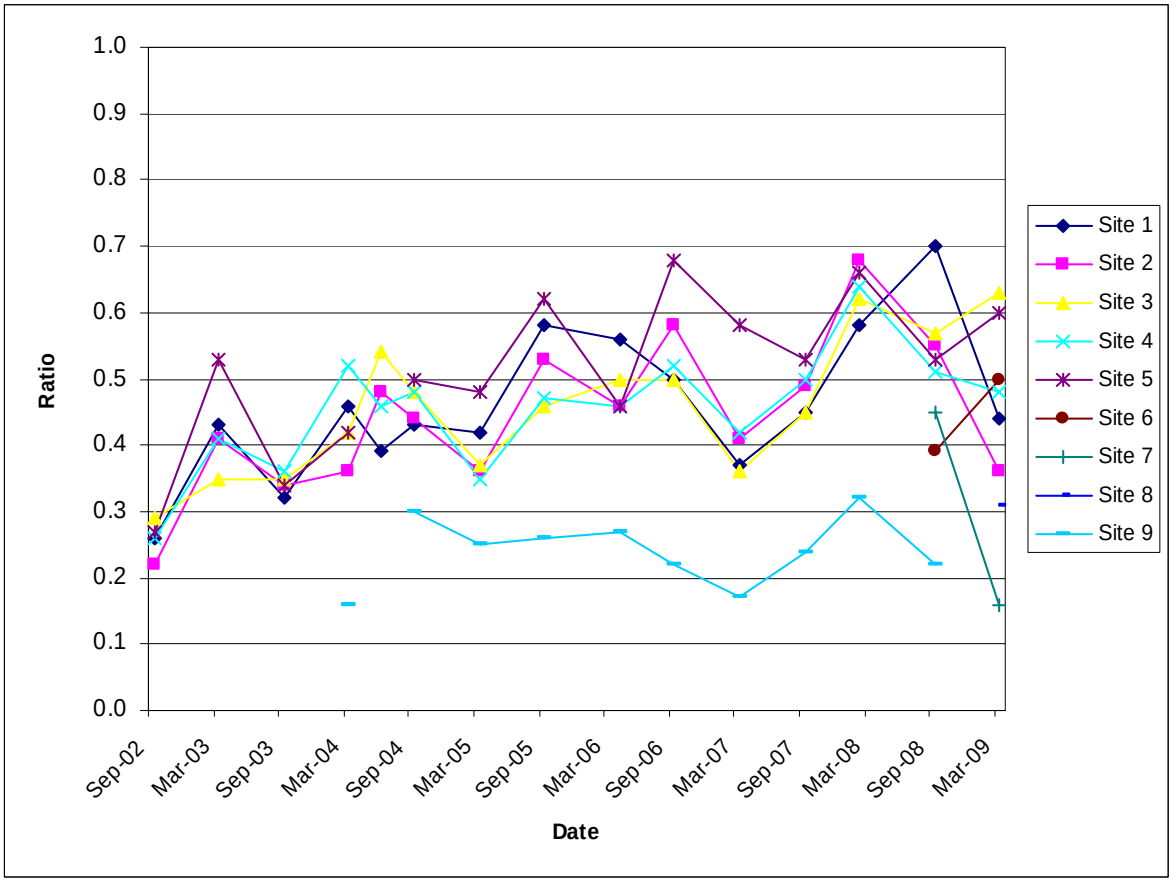
Chart F-6
Recorded EPT Taxa Ratio



Functional Feeding Groups

The shredder ratio has increased over time at most sampling locations (Chart F-7). Recent surveys recorded an increase in the number of grazer species (including the EPT group of taxa) compared with a varied response in numbers of silt tolerant taxa (IIA, 2009). IIA (2002 to 2009) report that the common and consistently recorded taxa belong to the following groups: Freshwater Shrimp *Paratya australiensis*, the Coleopteran family Elmidae (Beetles); the Dipteran subfamilies Chironominae and Orthocladinae (Midges); the Ephemeropteran families Leptophlebiidae and Baetidae (Mayflies), the Plecopteran family Grypopterygidae (Stoneflies), the Trichopteran families Hydropsychidae, Philopotamidae (Caddisflies) and the Molluscan families Sphaeridae (Pea clams) and Hydrobiidae (Snails).

Chart F-7
Recorded Shredder Ratio



The predominance of native species in the aquatic macroinvertebrate communities of both river systems (i.e. Mammy Johnsons and Karuah) is considered by IIA to be largely attributed to the undisturbed nature of the river systems, particularly the Mammy Johnsons River, and the heavily forested upper sections and dense riparian zone, which often forms a closed canopy.

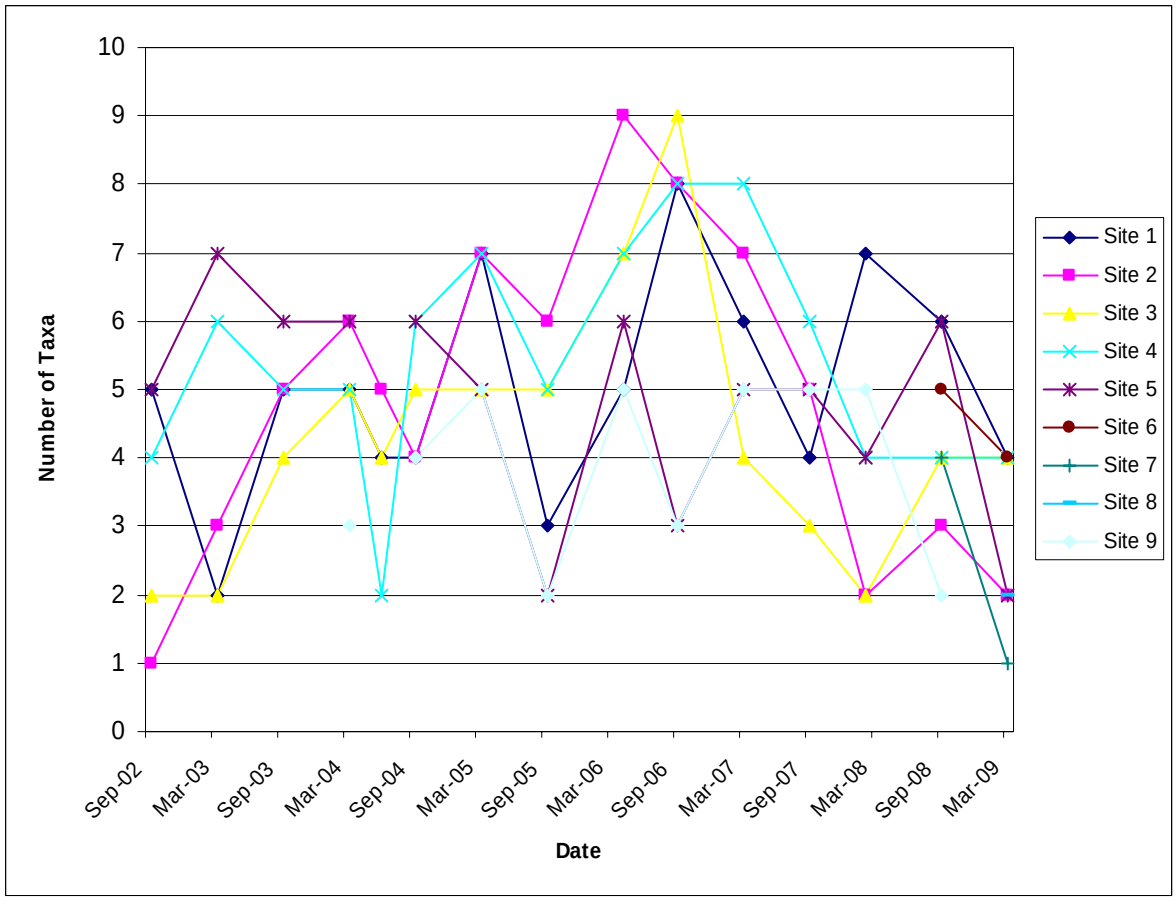
The sampling locations along the Mammy Johnsons and Karuah Rivers generally recorded the highest mean shredder ratios, with the Karuah River (Location 5) recording the highest mean ratio (0.51) and the unnamed tributary (Location 7), DDD1 (Location 8) and DDD2 (Location 9) recording the lowest mean ratios of 0.31, 0.31 and 0.24, respectively (Table F-6).

IIA (2003b; 2006b; 2008b; 2009) indicate that a notable feature has been the increase in the numbers of the EPT/shredder/grazer functional feeding group within the invertebrate community over time. The major components of this feeding group include: the Coleopteran family Elmidae, the Ephemeroptera, Plecoptera, Trichoptera and Gastropoda (2003b; 2006b; 2008b; 2009). The presence of this guild is noteworthy, as they normally comprise a large proportion of healthy aquatic communities. The consistently high number of EPT and shredder taxa, particularly the Trichopteran and Ephemeropteran families Baetidae and Leptophlebiidae, is considered to be an indicator of very healthy environmental conditions in the Mammy Johnsons and Karuah River systems (IIA, 2003b; 2006b; 2008b; 2009). Another notable feature of both river systems is the consistently high numbers of Plecoptera, represented by the species *Illiesoperla brevicauda* (Grypopterygidae) (IIA, 2003b; 2004a; 2007a; 2009). Most of the EPT and shredder taxa recorded at river sampling locations register 8 - 10 on the SIGNAL HU97 index, as they are highly sensitive to pollution (IIA, 2009). This is another indicator that the Mammy Johnsons and Karuah Rivers are considered to be both in very good condition (IIA, 2009).

Silt Tolerant Taxa

The number of silt tolerant taxa recorded at the sampling locations over the 2002 to 2009 sampling period shows substantial variation (Chart F-8). IIA (2008b) indicates that the large increases and decreases in silt tolerant taxa over time correlate to the flow conditions that have prevailed at each sampling location (i.e. the sites that had the lowest numbers were likely to have had the highest scouring effect from higher flows). During periods of low flow, there is a gradual build-up of silt in the streams as reduced flow allows the settling of fine particles and a reduction in scouring. This in turn encourages silt tolerant taxa to increase in numbers (IIA, 2008b). However, under normal flow conditions, these coastal cobble systems typically have regular high-energy flows that remove most of the silt within the system which leads to relatively low numbers of silt tolerant taxa in these communities under normal flows (IIA, 2006b; 2007a; 2009).

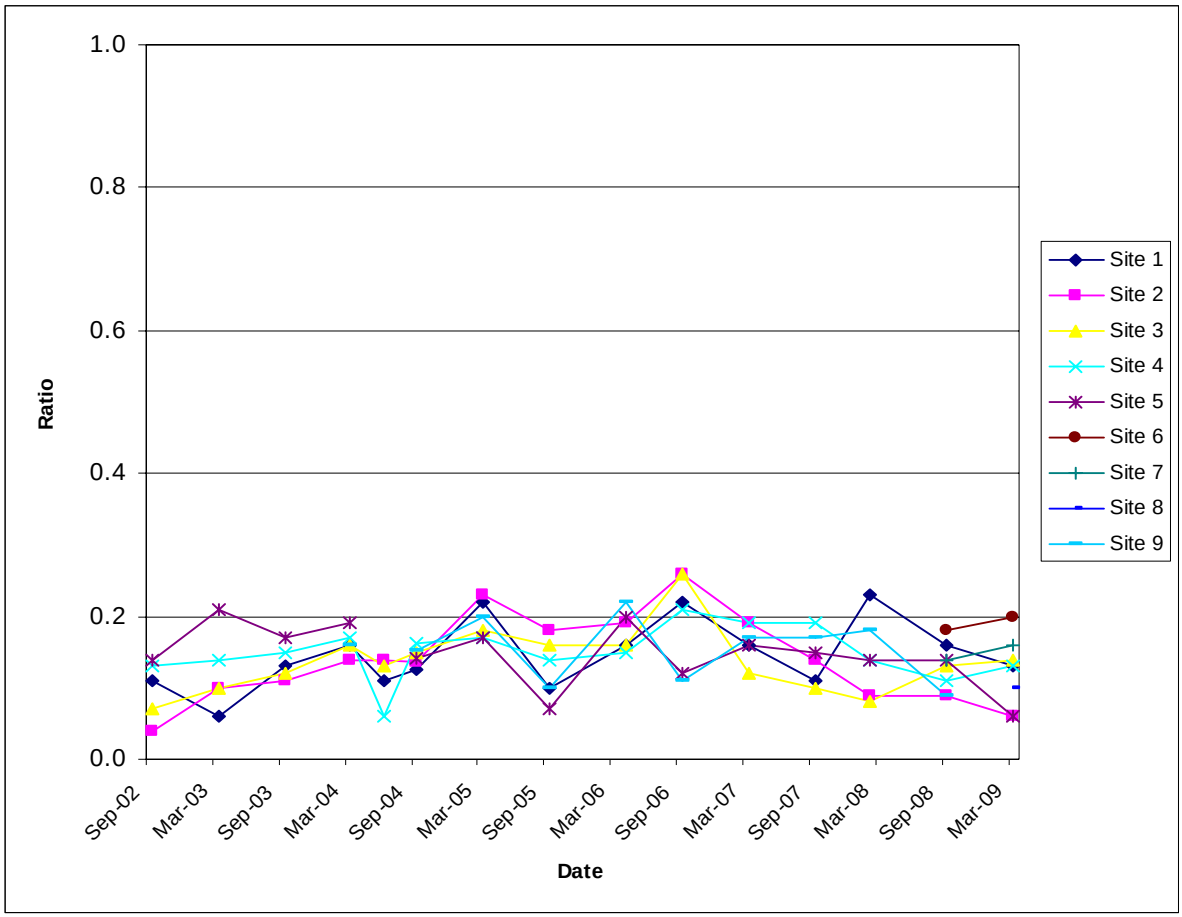
Chart F-8
Number of Recorded Silt Tolerant Macroinvertebrate Taxa



As was the case for EPT taxa, the ratio of silt tolerant taxa demonstrates less variation than the number of silt tolerant taxa (Chart F-9).

Although only recently added to the monitoring program, Location 6 on Coal Shaft Creek had the highest mean silt tolerant taxa ratio (Table F-6). This may be due to a catchment area reduction of Coal Shaft Creek due to the existing DCM operations and therefore lower flow volumes and velocities allowing more of the accumulated silt to remain.

Chart F-9
Recorded Silt Tolerant Macroinvertebrate Taxa Ratio



F4.4 Assemblages of Fish

The recorded fish species are provided in Table F-7 and described below. During the EMPS surveys, the Karuah River (Locations 10 and 14) recorded the highest diversity of fish species with ten and six species, respectively; followed by the Mammy Johnsons River (Location 11) with four species; the confluence of the Mammy Johnsons and Karuah Rivers (Location 15) with three species; and the Mammy Johnsons River (Locations 13 and 12) with two and one species, respectively (Table F-7).

In addition to recording the highest diversity of fish species, the Karuah River (Location 10) also recorded the highest abundance of fish with a total of 128 individuals (Table F-7). Location 15 recorded the second highest abundance of fish (30 individuals), followed by Location 11 (23 individuals), Location 17 (19 individuals), Location 13 (17 individuals), Location 14 (ten individuals), Location 18 (six individuals), Location 16 (two individuals) and Location 12 (one individual) (Table F-7).

At the time of the survey, the most abundant fish species included the Australian bass (44 individuals), Australian smelt (41 individuals), Freshwater mullet (35 individuals), Fire-tailed gudgeon (34 individuals) and Western carp gudgeon (29 individuals). The least common species were the Nepean herring, Bullrout (two individuals each) and Cox's gudgeon (one individual) (Table F-7).

Table F-7
Fish Species Recorded

Scientific Name	Common Name	Location 10	Location 11	Location 12	Location 13	Location 14	Location 15	Location 16	Location 17	Location 18	Total
		Karuah River	Mammy Johnsons River	Mammy Johnsons River	Mammy Johnsons River	Karuah River	Karuah River	Upper Coal Shaft Creek	Middle Coal Shaft Creek	Lower Coal Shaft Creek	
Anguilla reinhardtii	Long-finned eel	2	2	-	-	4	1	-	-	-	9
Gambusia affinis	Mosquito fish	-	1	-	-	-	-	-	15	-	16
Gobiomorphus australis	Striped gudgeon	-	-	1	-	1	-	-	-	2	4
Gobiomorphus coxii	Cox's gudgeon	-	-	-	-	1	-	-	-	-	1
Hypseleotris galii	Fire-tailed gudgeon	5	6	-	15	-	6	1	-	1	34
Hypseleotris klunzingeri	Western Carp gudgeon	26	-	-	-	-	-	-	-	3	29
Macquaria colonorum	Estuarine bass	11	-	-	-	-	-	-	-	-	11
Macquaria novemaculeata	Australian bass	42	-	-	-	2	-	-	-	-	44
Myxus petardi	Freshwater mullet	35	-	-	-	-	-	-	-	-	35
Mugil cephalus	Sea mullet	3	-	-	-	-	-	-	-	-	3
Notesthes robusta	Bullrout	1	-	-	-	1	-	-	-	-	2
Philypnodon grandiceps	Flathead gudgeon	1	-	-	-	-	-	1	3	-	5
Pomatalosa richmondia	Nepean herring	2	-	-	-	-	-	-		-	2
Retropinna semoni	Australian smelt	-	14	-	2	1	23	-	1	-	41
Total		128	23	1	17	10	30	2	19	6	236

Location 10 = Station 5 as reported in EMPS (1996).
Location 11 = Station 11 as reported in EMPS (1996).
Location 12 = Station 12 as reported in EMPS (1996).
Location 13 = Station 15 as reported in EMPS (1996).
Location 14 = Station 18 as reported in EMPS (1996).
Location 16 = Upper Coal Shaft Creek as reported in EMPS (1996).
Location 17 = Lower Coal Shaft Creek at Gauging Station as reported in EMPS (1996).
Location 18 = Large Pool, Coal Shaft Creek below Railway Culvert as reported in EMPS (1996).
Location 15 = Station 19 as reported in EMPS (1996).

F4.5 Threatened Species

No threatened aquatic species listed in the schedules of the TSC Act, FM Act, or EPBC Act were recorded during either the surveys undertaken in 1995 and 1996 by EMPS (EMPS, 1996) or in any of the 15 monitoring rounds undertaken between 2002 and 2009 by IIA (IIA, 2002 to 2009).

In addition to the surveys and monitoring undertaken, a number of database sources have been reviewed to determine if any threatened aquatic species (in particular fish) have been recorded within the Project area or surrounds. Databases reviewed include:

- Australian Museum fauna database records within a search area of approximately 2,500 square kilometres (km^2) centred on the Project area (Australian Museum, 2009);
- BioNet (2009) database records within a search area of 100 km^2 centred on the Project area;
- DECCW Atlas of NSW Wildlife database records for the Dungog 9233 1:100,000 map sheet (DECCW, 2009); and
- EPBC Act Protected Matters Search (DEWHA, 2009) for an area of approximately 7,580 km^2 centred on the Project area.

These databases indicate that no threatened aquatic species have been recorded within the Project area or surrounds.

F4.6 Summary of Monitoring Results to Date

The following quotes from IIA (2009) provide a summary of the results from the extensive aquatic ecology monitoring undertaken at DCM to date:

> "*The results of the current survey indicate that both the Mammy Johnsons and Karuah Rivers are still in fair to very good condition and possess a healthy, highly complex and diverse aquatic ecosystem*".
>
> "*This indicates that the riverine sites have remained stable. The condition indices (SIGNAL, EPT Ratio and Shredder Ratio) mirrored each other. These results indicate that the riverine ecosystem condition values at Sites M1 - M5* [Sampling Locations 1 to 5] *are in fair to good condition or slightly impaired (Site M2* [Sampling Location 2]*) to healthy (all other sites* [Sampling Locations 6 to 9]*), whereas, the high species diversity and number of EPT taxa indicate that the sites are in good to excellent condition. This signifies that the community composition has remained very consistent in the number of pollution/disturbance sensitive taxa in a highly dynamic flow regime*".
>
> "*Therefore, the results of the current survey confirm what has previously been predicted and demonstrated, i.e. that the aquatic biodiversity is continuing to show the same or similar trends to that observed in previous years. The continued presence of high numbers of EPT taxa recorded at all river sites (11 - 20 taxa) indicates that both river systems are very healthy and showing no signs of environmental stress. The other off river sites recorded much lower values than the river sites with Site SW2* [Sampling Location 6] *recording the highest values both in EPT taxa and EPT ratio, followed by Site SW7* [Sampling Location 7] *and Site DDD1* [Sampling Location 8] *recording the lowest values. Site DDD1 also recorded the lowest values compared with all previous surveys*".
>
> "*In conclusion, the results from the current survey suggest that the overall biodiversity and river environmental conditions are very good and that there are no apparent adverse effects on the aquatic macroinvertebrate fauna in the Mammy Johnsons River as a result of any activities arising from the operations of the Duralie Mine*".

F5 ASSESSMENT OF POTENTIAL IMPACTS

F5.1 Disturbance and Alteration of Aquatic Habitat

Some marginal aquatic habitat would be removed or altered as a result of the Project. This would include the diversion of a headwater ephemeral section of Coal Shaft Creek to enable flows from the north to connect with the existing Coal Shaft Creek Diversion. It would also include the removal of a headwater ephemeral section of an unnamed tributary of Mammy Johnsons River, located at the northern extent of the Project area. Part of the current drainage to this headwater section of the unnamed tributary would be captured and diverted south to the Coal Shaft Creek Diversion as a result of the Project.

The alteration of natural flow regimes of rivers and streams is recognized as a key threatening process under the *Threatened Species Conservation Act 1995* and FM Act. The degradation of native riparian vegetation along NSW watercourses is also listed as a key threatening process under the FM Act.

The sections of stream in the Project disturbance area are the headwater sections of shallow ephemeral drainage lines that provide limited habitat for aquatic biota. In addition, portions of these sections of streams have been subject to long term adverse impacts due to grazing by cattle, erosion and invasion by introduced species.

F5.2 Surface Water Flow and Aquatic Biota

As described in Section F5.1, marginal aquatic habitat would be removed or altered as a result of the Project. Changes to surface water flows in streams located outside the Project disturbance area (i.e. the Mammy Johnsons River) also has the potential to adversely impact aquatic ecosystems through changes in the availability and/or reliability of available surface water or changes in the flow power and/or depth of surface water. The Project Surface Water Assessment (Gilbert and Associates [2009], Appendix A of the EA) has assessed the potential for the alteration of stream flows as a result of the Project. The assessment indicates that the Project would result in an insignificant change to flows along the Mammy Johnsons River and therefore is considered unlikely to have a significant impact on aquatic biota.

F5.3 Surface Water Quality and Aquatic Biota

Surface water runoff from mine landforms and disturbed areas has the potential to adversely impact the water quality of the local stream system. The potential surface water quality impacts of the Project are described in detail in the Appendix A of the EA and summarised in Section 4 in the Main Report of the EA. The Surface Water Assessment and Section 4 in the Main Report of the EA also describe a range of measures that would be implemented as part of the Project to minimise the potential for impacts on surface water quality.

The key potential surface water quality issue relating to impacts on aquatic biota is the continued irrigation of mine water over a large proportion of the cleared agricultural lands surrounding the open pit areas, a small area of regrowth forest, and the progressively rehabilitated waste rock emplacement area (Figure F-3).

Rainfall runoff after prolonged dry periods can result in high salinity concentrations as a result of salt build-up in irrigated soils. High salinity concentrations can have a deleterious impact on assemblages of macroinvertebrates, fish and aquatic plants. The effects of increased salinity on aquatic macroinvertebrates have been well documented in the Hunter region (Chessman *et al*., 1997).

Irrigation within the Project area would be undertaken generally in accordance with the currently implemented *Duralie Coal Mine Irrigation Management Plan* (the Irrigation Management Plan) (DCPL, 2008b). As a precaution, the Irrigation Management Plan includes a first flush protocol. The first flush protocol is designed to collect initial (or "first flush") rainfall runoff from irrigation areas that drain to Coal Shaft Creek or the Mammy Johnsons River following prolonged dry periods. The initial (or first flush) rainfall runoff is captured by diversion dams and diversion drain sumps located around the Project area. By capturing the water with high salt concentrations, the first flush protocol minimises any likely impacts on the water quality (specifically salinity) of the receiving waters i.e. the Mammy Johnsons River and its downstream users.

Further details of the first flush protocol are provided in Appendix A of the EA and in Section 2 in the Main Report of the EA.

The monitoring results collected by IIA since 2002 indicate that environmental conditions in the Mammy Johnsons River have remained stable since the commencement of mining operations and the practice of irrigating pastures within ML 1427 with excess mine water. Specifically, the monitoring results demonstrate that there have been no apparent adverse impact on the Mammy Johnsons River as a result of ongoing operations at the existing DCM, as follows (IIA, 2009):

> *The results of the current survey indicate that both the Mammy Johnsons and Karuah Rivers are still in fair to very good condition and possess a healthy, highly complex and diverse aquatic ecosystem.*
>
> *…*
>
> *In conclusion, the results from the current survey suggest that the overall biodiversity and river environmental conditions are very good and that there are no apparent adverse effects on the aquatic macroinvertebrate fauna in the Mammy Johnsons River as a result of any activities arising from the operations of the Duralie Mine.*

With the proposed continued implementation of the current irrigation management measures, the Project is considered highly unlikely to have a measureable impact on the aquatic ecosystems of the Mammy Johnsons River.

Potential impacts to the surface water quality of Mammy Johnsons River also includes possible changes in groundwater quality reporting to the Mammy Johnsons River. This potential impact is assessed in Appendices A and B of the EA. These studies conclude that the Project is anticipated to result in inconsequential effects on baseflow and water quality of the Mammy Johnsons River, and subsequent impacts to aquatic biota are therefore considered to be highly unlikely.

F5.4 Barriers to Fish Movement

The Project would include the diversion of an additional degraded headwater section of Coal Shaft Creek and the removal of a degraded headwater section of an unnamed tributary. These headwater reaches are currently unlikely suited to any native fish.

The degraded headwater section of Coal Shaft Creek proposed to be diverted is located upstream from the existing Coal Shaft Creek Diversion which includes design features that would inhibit the movement of fish upstream. Movement of fish from the Mammy Johnsons River into the lower sections of the non-impacted sections of the unnamed tributary and Coal Shaft Creek will remain intact. The Project is very unlikely to create a new barrier to existing fish movement.

Based on the above and the assessment provided in Sections 5.1 to 5.7, the following guidelines are not considered relevant to this assessment:

- *Policy & Guidelines – Aquatic Habitat Management and Fish Conservation* (NSW Fisheries).
- *Policy & Guidelines – Fish Friendly Waterway Crossings* (NSW Fisheries).

F5.5 Threatened Aquatic Biota

No threatened aquatic biota listed in the schedules of the TSC Act, FM Act or EPBC Act were identified during aquatic surveys or subsequent monitoring, nor are any considered likely to occur in the Project area or surrounds. Therefore, in consideration of the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005), the Project is considered very unlikely to have a significant impact on threatened aquatic biota.

F5.6 Groundwater Dependent Aquatic and Riparian Ecosystems

River flow is often maintained or supplemented by groundwater, providing baseflows long after a rainfall event (DLWC, 2002). The baseflow typically emerges as springs or as diffuse flow from saturated sediments or rock underlying the stream and banks (DLWC, 2002). In addition, water exchange occurs between the surface and groundwater in the hyporheic zone[2], which provides habitat for aquatic invertebrates (Boulton et. al., 1998 in DLWC, 2002). As a result, aquatic and riparian ecosystems can be dependent on the baseflows supplied by groundwater to a stream.

Potential impacts of the Project on aquatic biota associated with changes in flow are discussed above. In summary, the predicted changes to flows in Mammy Johnsons River associated with the Project are considered negligible and very unlikely to alter the physical structure of the habitats in the creek. Hence, the small-scale predicted changes are considered unlikely to adversely impact the existing aquatic ecological components.

Changes to the groundwater system also have the potential to impact on riparian vegetation by de-saturating the alluvial and colluvial deposits adjacent to streams. Results of the groundwater modelling predict a negligible change to the baseflow of the Mammy Johnsons River (Appendix B of the EA). As a result, it is considered very unlikely that riparian vegetation would be deleteriously impacted by the Project.

F5.7 Cumulative Impacts on Aquatic Ecology

Cumulative impacts of the Project on aquatic ecosystems predominantly relate to additional habitat disturbance and alteration. The assessment of cumulative impacts has taken into consideration the extent and type of habitat disturbance associated with the Project, the existing assemblages of aquatic biota, the condition of the streams and the Project ameliorative measures.

[2] Hyporheic zone - the saturated interstitial sediments below streams and their banks where water exchanges between the surface and subsurface.

The Project is situated in a valley which is bound by ridgelines to the east (Buckleys Range) and west (Linger and Die Ridge). The wider area is rural and the landuses are cattle grazing on native and improved pastures, along with some poultry farming and other kinds of agricultural production. Almost all of the pre-European forest and woodland which once occurred in the Project area (and likely also that which occurred in the region) has been extensively cleared as part of past rural landuse practices and logging.

These past and present actions impact aquatic ecology via (for example): removal of riparian vegetation; disturbance to stream banks and substrate from livestock; changes in natural flow regimes due to the damming of drainage lines and extraction of water from streams; creation of stream crossings that restrict fish movements and effect water quality by increasing sedimentation; and contaminants (chemical and livestock waste) in surface runoff adversely impacting water quality. These agricultural related actions are considered to have had the greatest impact on regional aquatic ecology.

The DCM and the SCM are the main mining developments in the area. As described in the sections above, potential impacts of the Project on aquatic ecology parameters are considered likely to be minimal. Substantial aquatic monitoring undertaken at the DCM has concluded that the current operations are having "*no apparent adverse effects on the aquatic macroinvertebrate fauna in the Mammy Johnsons River*". Management measures relevant to aquatic ecology, such as the first flush protocol, would continue to be implemented as part of the Project in addition to the relevant enhancement and conservation commitments summarised in Section F5.9 and detailed in Section 4 in the Main Report of the EA.

The SCM is located east of the township of Stratford approximately 20 km north of the DCM. The SCM is located approximately 3 km south-east of the Avon River in a separate catchment to Duralie. The Avon River has a catchment area of some 290 km^2 and is one of approximately 30 tributary rivers contributing to the greater Manning River system. The Manning River system drains some 8,000 km^2 and extends from the Great Dividing Range to the sea near Taree.

As the drainage lines within the SCM area have small catchments, they typically exhibit low to zero flow for extended periods during dry weather, while heavy rainfall events result in short duration, high flow events. The SCM operates in accordance with Development Application 23-98/99 and Environment Protection Licence No.5161

With continued implementation of the current irrigation management measures it is considered highly unlikely that the Project would result in a measureable increase in cumulative adverse impacts on aquatic ecosystems, particularly when compared to the impact from ongoing regional agricultural activities on aquatic ecosystems.

F5.8 Management, Mitigation and Monitoring Measures

A range of management, mitigation and monitoring measures have been developed that would minimise the potential impacts of the Project on aquatic ecosystems. These measures are detailed in Section 4 in the Main Report of the EA and include:

- continued implementation of the Irrigation Management Plan, including the first flush protocol; and
- continued macroinvertebrate, stream health and water quality monitoring.

The following measures have been developed for the Project that would assist with improving the quality of aquatic habitats within the vicinity of the Project. These measures are detailed in Section 4 in the Main Report of the EA and include:

- enhancement of the riparian habitat along a length of the Mammy Johnsons River (e.g. increasing the width of the riparian vegetation and implementing weed control measures); and
- enhancement and conservation of existing freshwater wetlands (listed under the TSC Act as an endangered ecological community) located on the eastern side of the Mammy Johnsons River.

F5.9 Summary and Conclusions

An assessment of aquatic habitats within the Project area and surrounds was conducted as part of current investigations being undertaken for the Project. Data from extensive field surveys and monitoring rounds were used to describe and assess the condition of aquatic habitats and water quality. Data were also collected on the diversity and abundance of assemblages of macroinvertebrates and fish. No threatened aquatic biota was found during field surveys or associated monitoring rounds and furthermore it is considered unlikely that any would occur in the Project area.

Potential impacts of the Project on aquatic ecosystems were considered in relation to: habitat disturbance/alteration; changes to stream flow and surface water quality; the occurrence of threatened aquatic biota; occurrence of introduced species; barriers to fish movement; and cumulative impacts.

Planned enhancement and conservation works are expected to have a positive affect on the in-stream ecology of the Mammy Johnsons River. The continued implementation of the Irrigation Management Plan, including the first flush protocol, is expected to maintain the aquatic health of the Mammy Johnsons River. The Project is considered very unlikely to have a significant impact on aquatic ecology.

F6 ACKNOWLEDGEMENTS

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ATTACHMENT F-A

APPENDIX GE (AQUATIC ECOLOGY) OF THE DURALIE COAL MINE ENVIRONMENTAL IMPACT STATEMENT (AVAILABLE UPON REQUEST)

ATTACHMENT F-B

PHYSIOCHEMICAL WATER QUALITY (IIA, 2002 TO 2009)

Physiochemical Water Quality

Date	Temperature (°C)								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
Sep-02	14.8	13.0	13.7	13.9	15.1	-	-	-	-
Mar-03	17.3	17.9	18.9	22.3	20.7	-	-	-	-
Sep-03	18.4	16.1	16.2	18.5	19.5	-	-	-	-
Mar-04	20.2	20.2	20.2	20.3	20.4	-	-	-	28.9
Jun-04	11.9	9.8	10.2	9.9	-	-	-	-	-
Sep-04	12.1	12.3	12.6	13.7	15.1	-	-	-	19.7
Mar-05	21.9	22.0	21.9	22.2	22.6	-	-	-	25.6
Sep-05	13.3	12.7	12.4	13.5	13.1	-	-	-	19.0
Apr-06	16.5	16.7	15.9	17.1	16.6	-	-	-	22.5
Sep-06	13.9	13.6	14.0	13.5	14.3	-	-	-	20.0
Mar-07	20.8	20.6	20.9	21.4	22.0	-	-	-	24.6
Sep-07	13.0	13.0	13.0	13.0	13.0	-	-	-	17.0
Feb-08	19.9	19.6	19.6	19.4	19.1	-	-	-	22.4
Sep-08	14.2	14.7	14.3	14.3	14.4	16.1	13.7	-	19.1
Mar-09	20.2	20.5	20.5	20.4	20.5	22.3	18.8	25.2	-
Minimum	11.9	9.8	10.2	9.9	13.0	16.1	13.7	25.2	17.0
Mean	16.5	16.2	16.3	16.9	17.6	19.2	16.2	25.2	21.9
Maximum	21.9	22.0	21.9	22.3	22.6	22.3	18.8	25.2	28.9

Date	Conductivity (µS/cm)								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
Sep-02	366	357	391	408	188	-	-	-	-
Mar-03	320	324	283	301	177	-	-	-	-
Sep-03	398	432	419	436	245	-	-	-	-
Mar-04	189	192	188	199	113	-	-	-	178
Jun-04	322	360	343	330	-	-	-	-	-
Sep-04	296	340	334	331	146	-	-	-	133
Mar-05	309	315	294	318	194	-	-	-	340
Sep-05	304	325	324	341	136	-	-	-	463
Apr-06	181	184	178	257	80	-	-	-	732
Sep-06	218	221	226	251	143	-	-	-	419
Mar-07	229	236	276	320	164	-	-	-	641
Sep-07	170	200	200	200	130	-	-	-	350
Feb-08	245	246	239	233	116	-	-	-	218
Sep-08	197	241	201	202	122	575	585	-	329
Mar-09	229	232	239	255	124	429	606	633	-
Minimum	170	184	178	199	80	429	585	633	133
Mean	265	280	276	292	148	502	595	633	380
Maximum	398	432	419	436	245	575	606	633	732

Physiochemical Water Quality

Date	pH Units								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
Sep-02	8.2	8.1	8.1	8.1	8.3	-	-	-	-
Mar-03	6.9	6.7	6.9	7.1	7.4	-	-	-	-
Sep-03	7.2	7.3	7.4	7.4	7.2	-	-	-	-
Mar-04	6.7	6.5	6.6	6.7	6.8	-	-	-	7.1
Jun-04	7.4	7.3	7.1	7.2	-	-	-	-	-
Sep-04	7.5	7.6	7.6	7.8	7.8	-	-	-	8.2
Mar-05	6.7	6.8	7.0	7.1	7.3	-	-	-	8.0
Sep-05	7.3	7.3	7.2	7.4	7.2	-	-	-	7.8
Apr-06	7.0	6.9	6.7	7.1	7.1	-	-	-	8.5
Sep-06	6.5	6.5	6.5	6.6	6.7	-	-	-	6.6
Mar-07	7.0	7.0	7.1	7.1	7.1	-	-	-	7.7
Sep-07	7.5	7.5	7.4	7.4	7.5	-	-	-	7.5
Feb-08	8.1	8.0	8.0	8.0	8.1	-	-	-	8.1
Sep-08	7.9	7.8	7.6	7.7	7.6	7.9	7.5	-	6.9
Mar-09	7.8	7.9	7.9	7.8	8.0	7.9	7.8	8.0	-
Minimum	6.5	6.5	6.5	6.6	6.7	7.9	7.5	8.0	6.6
Mean	7.3	7.3	7.3	7.4	7.4	7.9	7.6	8.0	7.6
Maximum	8.2	8.1	8.1	8.1	8.3	7.9	7.8	8.0	8.5

Date	Dissolved Oxygen (% Saturation)*								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
Sep-02	82	72	76	98	100	-	-	-	-
Mar-03	48	44	52	98	92	-	-	-	-
Sep-03	72	76	64	90	104	-	-	-	-
Mar-04	96	72	80	90	120	-	-	-	98
Jun-04	96	100	70	100	-	-	-	-	-
Sep-04	56	58	78	96	106	-	-	-	128
Mar-05	82	82	74	92	96	-	-	-	140
Sep-05	62	62	68	64	66	-	-	-	72
Apr-06	68	60	42	80	100	-	-	-	126
Sep-06	90	80	82	82	96	-	-	-	100
Mar-07	60	28	38	50	70	-	-	-	74
Sep-07	-	-	-	-	-	-	-	-	-
Feb-08	114	110	110	116	120	-	-	-	74
Sep-08	60	90	80	98	96	62	62	-	68
Mar-09	98	80	82	80	100	70	32	100	-
Minimum	48	28	38	50	66	62	32	100	68
Mean	77	72	71	88	97	66	47	100	98
Maximum	114	110	110	116	120	70	62	100	140

*DO values presented represent a conversion from dissolved oxygen (mg/L) (as recorded by IIA) to dissolved oxygen (%Saturation) in accordance with Commonwealth of Australia (2002). Approximate values only.

ATTACHMENT F-C

CONSOLIDATED RECORDED MACROINVERTEBRATES
(IIA, 2002 TO 2009)

Consolidated Recorded Macroinvertebrates

Order	Family	Species	Site								
			1	2	3	4	5	6	7	8	9
Acarina	Eylaidae	*Eylais*	*					*			*
Acarina	Hygrobatidae	*undetermined*	*	*	*	*	*	*	*		*
Acarina	Hygrobatidae	*undetermined sp.1*	*		*	*	*				
Acarina	Hygrobatidae	*undetermined sp.2*					*				
Acarina	Ixodidae	*Ixodes sp.*	*								
Acarina	Oribatida	*undetermined*					*				
Arachnida	Araneae	*Undetermined*		*	*	*	*				
Bivalvia	Hyriidae	*Alathyria profuga*	*	*	*	*	*				
Bivalvia	Hyriidae	*Hyridella sp.*	*	*	*	*	*				
Bivalvia	Sphaeridae	*Pisidium sp.*	*	*	*	*	*	*	*		*
Coleoptera	Dytiscidae	*Antiporus*	*	*	*	*					*
Coleoptera	Dytiscidae	*Barrethydrus sp.*	*	*	*	*	*				*
Coleoptera	Dytiscidae	*Barratthydrus tibialis*	*	*			*				
Coleoptera	Dytiscidae	*Batrachomatus*	*	*	*	*	*				
Coleoptera	Dytiscidae	*Bidessodes*		*		*		*		*	*
Coleoptera	Dytiscidae	*Bidessus*	*		*	*	*	*	*	*	
Coleoptera	Dytiscidae	*Chostonectes*	*	*	*	*	*	*	*		*
Coleoptera	Dytiscidae	*Hyphydrus*		*	*	*	*	*			*
Coleoptera	Dytiscidae	*Lancetes*	*	*		*	*				
Coleoptera	Dytiscidae	*Necterosoma*	*	*	*	*	*		*	*	*
Coleoptera	Dytiscidae	*Rhantus*					*				
Coleoptera	Dytiscidae	*Sternopriscus*	*			*					*
Coleoptera	Elmidae	*Austrolimnius sp.*	*	*	*	*	*		*		*
Coleoptera	Elmidae	*Austrolimnius sp.2*					*				
Coleoptera	Elmidae	*Kingolus flavosignatus*	*				*				
Coleoptera	Elmidae	*Kingolus sp.*	*	*	*	*	*				
Coleoptera	Elmidae	*Notriolus*	*	*	*	*	*				
Coleoptera	Elmidae	*Notriolus simsoni*	*	*	*	*	*		*		
Coleoptera	Elmidae	*Simsonia*	*	*	*	*	*				
Coleoptera	Gyrinidae	*Macrogyrus*	*	*	*	*	*	*	*		*
Coleoptera	Haliplidae	*Haliplus*	*	*	*	*	*	*	*	*	*
Coleoptera	Hydraenidae	*undetermined*	*	*	*	*	*		*		*
Coleoptera	Hydrophilidae	*Berosus sp.*	*	*	*	*	*	*		*	*
Coleoptera	Hydrophilidae	*Enochrus*									*
Coleoptera	Hydrophilidae	*Helochares sp.*	*	*	*	*					*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*	*	*	*	*				
Coleoptera	Scirtidae	*Undetermined*	*	*	*	*	*				
Coleoptera	Scirtidae	*Scirtis*	*		*						
Decapoda	Atyidae	*Australatya striolata*	*	*		*	*				
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*	*		*
Diptera	Ceratopogonidae	*Bezzia sp.*	*	*	*	*	*	*	*		*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*	*	*		*
Diptera	Chironomidae	*Undetermined*		*	*	*	*				
Diptera	Culicidae	*Chaoborus*						*			*
Diptera	Culicidae	*Culicinae*	*	*	*	*		*		*	*
Diptera	Dixidae	*Dixa sp.*		*	*	*	*				
Diptera	Ephydridae	*sp.*				*					
Diptera	Psychodidae	*Pericoma*		*							
Diptera	Simulidae	*Simulium sp.*	*	*	*	*	*	*	*		*
Diptera	Stratiomyidae	*Odontomyia*	*								
Diptera	Tabanidae	*Tabanus*	*	*	*	*					*
Diptera	Tanyderidae	*Tanyderus sp.*	*	*	*		*		*		
Diptera	Tipulidae	*sp.*	*	*	*	*	*		*		*
Ephemeroptera	Ameletopsidae	*Mirawara sp.*	*				*				
Ephemeroptera	Baetidae	*Bungona*	*	*	*	*	*				*
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*	*		*
Ephemeroptera	Baetidae	*Bungona sp. 2*	*	*	*	*	*	*			
Ephemeroptera	Baetidae	*Centroptilum*	*	*		*	*				
Ephemeroptera	Caenidae	*Caenid Genus C sp.*	*	*	*	*	*	*			*

Consolidated Recorded Macroinvertebrates

Order	Family	Species	Site								
			1	2	3	4	5	6	7	8	9
Ephemeroptera	Caenidae	*Tasmanocoenis*	*	*	*	*	*	*	*		*
Ephemeroptera	Leptophlebiidae	*Atalophlebia*	*	*	*	*	*				
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Austrophlebioides*	*	*	*	*	*				
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Jappa*	*	*	*	*	*				
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*	*				
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia*	*		*						
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*	*	*	*	*		*			
Gastropoda	Ancylidae	*Ferrissia petterdi*	*	*	*	*	*				*
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	*	*		
Gastropoda	Lymnaeidae	*Austropeplea*		*							
Gastropoda	Lymnaeidae	*Pseudosuccinea columella*									*
Gastropoda	Physidae	*Physa acuta*	*	*	*	*	*				*
Gastropoda	Physidae	*Haitia acuta*						*		*	*
Gastropoda	Planorbidae	*Glyptophysa*		*	*	*	*	*			*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*				*	*			*	*
Gastropoda	Planorbidae	*Gyraulus sp.*	*	*	*	*	*	*	*		*
Gastropoda	Planorbidae	*Helicorbus*				*	*				
Gastropoda	Planorbidae	*Isidorella*									*
Hemiptera	Corixidae	*Agraptocorixa*	*		*	*	*	*		*	*
Hemiptera	Corixidae	*Micronecta sp.*	*	*	*	*	*	*		*	*
Hemiptera	Corixidae	*Sigara*		*							*
Hemiptera	Gelastocoridae	*Nerthra sp.*	*	*		*					*
Hemiptera	Gerridae	*Limnogonus*	*	*	*	*	*		*		*
Hemiptera	Gerridae	*sp.*	*	*			*				
Hemiptera	Hydrometridae	*Hydrometra strigosa*	*	*	*						*
Hemiptera	Mersoveliidae	*Mesovelia*	*	*	*	*					
Hemiptera	Naucoridae	*Naucoris*									*
Hemiptera	Nepidae	*Laccotrephes tristis*				*					
Hemiptera	Notonectidae	*Anisops*	*			*		*		*	*
Hemiptera	Notonectidae	*Enithares*		*		*			*		*
Hemiptera	Pleidae	*Plea*	*			*	*				*
Hemiptera	Veliidae	*Microvelia*	*	*	*	*	*	*	*		*
Hirudinea	Erpobdellidae	*undetermined*		*	*	*					
Hirudinea	Glossiphoniidae	*Undetermined*	*	*	*	*	*	*			*
Isopoda	Sphaeromatidae	*Cymodetta sp.*		*		*	*				
Isopoda	Oniscidea	*Undetermined*		*	*						
Lepidoptera	Pyralidae	*Parapoynx*									*
Lepidoptera	Pyraludae	*sp.*					*				
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*	*	*	*				
Megaloptera	Sisyridae	*Sisyra*			*						
Odonata	Coenagrionidae	*Ischnura*		*		*					*
Odonata	Coenagrionidae	*Ischnura heterosticta*						*		*	*
Odonata	Gomphidae	*Austrogomphus*	*		*	*	*				
Odonata	Gomphidae	*Hemigomphus sp.*	*	*	*	*	*				*
Odonata	Hemicorduliidae	*Hemicordulia*									*
Odonata	Libellulidae	*Diplacodes*		*	*	*			*	*	*
Odonata	Libellulidae	*Nannophlebia*	*	*	*	*	*				*
Odonata	Macromiidae	*Macromia*	*								
Odonata	Megapodagrionida	*Austroargiolestes*				*	*				
Odonata	Telephlebiidae	*Notoaeschna germinata*	*								
Odonata	Telephlebiidae	*Spinaeschna*					*				*
Odonata	Telephlebiidae	*Spinaeschna tripunctata*					*				
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*	*	*	*	*			*
Oligochaete	Tubificidae	*Undetermined*	*	*	*	*	*	*			*
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*	*	*	*	*		*
Plecoptera	Gripopterygidae	*Illiesoperla sp.*	*	*	*	*	*				
Plecoptera	Gripopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*				
Poifora	-	sp.	*								
Trichoptera	Atriplectidae	*Atriplectides dubius*	*		*	*					
Trichoptera	Calamoceratidae	*Anisocentropus sp.*	*	*	*	*	*	*	*		*
Trichoptera	Conoesucidae	*Coenoria*					*				

Consolidated Recorded Macroinvertebrates

Order	Family	Species	Site								
			1	2	3	4	5	6	7	8	9
Trichoptera	Conoesucidae	*Coenoria sp. AV1*	*	*	*	*	*				
Trichoptera	Conoesucidae	*Costora*	*		*	*	*				
Trichoptera	Ecnomidae	*Ecnomus* sp.	*	*	*	*	*	*			*
Trichoptera	Ecnomidae	*Ecnomus cygnitus c.f.*	*			*					
Trichoptera	Glossosomatidae	*Agapetus sp. AV1*	*			*	*				
Trichoptera	Hydrobiosidae	*Apsilochorema sp.*	*	*	*	*	*				
Trichoptera	Hydrobiosidae	*Ethochorema brunneum*	*	*	*	*	*				
Trichoptera	Hydrobiosidae	*sp.*				*					
Trichoptera	Hydrobiosidae	*Taschorema*	*	*	*		*				
Trichoptera	Helicopsychidae	*Helicopsyche sp.*	*	*	*		*				
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*	*	*		*	*				
Trichoptera	Hydropsychidae	*Cheumatopsyche*	*	*	*	*	*				
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*				
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV3*	*	*	*		*				
Trichoptera	Hydroptilidae	*Hellyethira*	*	*		*	*				
Trichoptera	Hydroptilidae	*Hellyethira sp.1*	*			*	*				
Trichoptera	Hydroptilidae	*Hellyethira sp.2*				*	*				
Trichoptera	Hydroptilidae	*Hydroptila scamandra*	*		*	*	*				
Trichoptera	Hydroptilidae	*Orthotrichia tortuosa*					*				
Trichoptera	Hydroptilidae	*Oxyethira*				*	*				
Trichoptera	Leptoceridae	*Notalina spira*	*	*	*	*	*	*	*		*
Trichoptera	Leptoceridae	*Oecetis sp.*	*	*	*	*	*	*			*
Trichoptera	Leptoceridae	*Triplectides*		*	*	*					*
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*	*	*	*	*	*	*	*		*
Trichoptera	Leptoceridae	*Triplectides volda*	*	*	*	*	*	*			*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*				*
Trichoptera	Philopotamidae	*Hydrobiosella sp.*	*	*	*	*	*				
Trichoptera	Philopotamidae	*sp.*	*	*	*	*	*				

ATTACHMENT F-D

RECORDED MACROINVERTEBRATES (IIA, 2002 TO 2009)

Recorded Macroinvertebrates - Survey No. 1, September 2002

Order	Family	Species	1	2	3	4	5
Acarina	Ixodidae	*Ixodes sp.*	*				
Acarina	Hygrobatidae	*Undetermined sp.1*	*			*	
Acarina	Hygrobatidae	*Undetermined sp.2*					*
Acarina	Oribatida	*Undetermined*					*
Bivalvia	Hyriidae	*Alathyria profuga*	*	*	*	*	*
Bivalvia	Sphaeridae	*Pisidium sp.*	*				
Coleoptera	Dystiscidae	*Barratthydrus tibialis*	*	*			*
Coleoptera	Elmidae	*Kingolus flavosignatus*	*				
Coleoptera	Elmidae	*Kingolus sp.*	*	*			*
Coleoptera	Elmidae	*Notriolus simsoni*	*		*	*	*
Coleoptera	Elmidae	*Austrolimnius sp.*	*	*	*	*	*
Coleoptera	Hydraenidae	*Undetermined*		*			*
Coleoptera	Hydrophilidae	*Berosus sp.*	*	*		*	
Coleoptera	Hydrophilidae	*Helochares sp.*	*				
Coleoptera	Psephenidae	*Sclerocyphon maculatus*			*		*
Coleoptera	Scirtidae	*Undetermined*	*	*	*	*	*
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia sp.*		*		*	
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*
Diptera	Chironomidae	*Undetermined*		*	*		
Diptera	Dixidae	*Dixa sp.*			*		
Diptera	Simulidae	*Simulium sp.*	*	*	*	*	*
Diptera	Tipulidae	*Undetermined*	*	*			*
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*		*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*	*		*	*	*
Ephemeroptera	Caenidae	*Caenid Genus C sp.*	*			*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*	*	*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*	*				*
Gastropoda	Hydrobiidae	*Posticobia brazieri sp.*	*				*
Gastropoda	Physidae	*Physa acuta*	*				
Gastropoda	Planorbidae	*Gyraulus sp.*					*
Hemiptera	Corixidae	*Micronecta sp.*	*		*	*	
Hemiptera	Gelastocoridae	*Nerthra sp.*	*				
Isopoda	Sphaeromatidae	*Cymodetta sp.*				*	
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*		*		*
Odonata	Telephlebiidae	*Notoaeschna germinata*	*				
Odonata	Gomphidae	*Hemigomphus sp.*	*	*		*	
Oligochaete	Lumbriculidae	*Lumbricus variegatus*		*	*	*	*
Platyhelminthes	Dugesiidae	*Undetermined*	*			*	*
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*		*
Trichoptera	Calamoceratidae	*Anisocentropus sp.*	*		*	*	*
Trichoptera	Conoesucidae	*Coenoria sp. AV1*	*				*
Trichoptera	Ecnomidae	*Ecnomus c.f. cygnitus*	*			*	
Trichoptera	Glossosomatidae	*Agapetus sp. AV1*	*				*
Trichoptera	Hydrobiosidae	*Ethochorema brunneum*	*	*	*	*	*
Trichoptera	Helicopsychidae	*Helicopsyche sp.*		*			*
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*	*				*
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*
Trichoptera	Hydroptilidae	*Hydroptila scamandra*	*		*	*	
Trichoptera	Hydroptilidae	*Orthotrichia tortuosa*					*
Trichoptera	Leptoceridae	*Notalina spira*				*	
Trichoptera	Leptoceridae	*Oecetis sp.*	*	*	*	*	*
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*	*		*		
Trichoptera	Philopotomidae	*Hydrobiosella sp.*	*	*	*	*	
Total Number of Taxa			45	27	27	30	36

Recorded Macroinvertebrates - Survey No. 2, March 2003

Order	Family	*Species*	1	2	3	4	5
Acarina	Hygrobatidae	*Undetermined*				*	
Bivalvia	Hyriidae	*Hyridella depressa*				*	
Bivalvia	Sphaeridae	*Pisidium*	*	*	*		
Coleoptera	Dytiscidae	*Batrachomatus*	*		*		
Coleoptera	Dytiscidae	*Chostonectes*	*	*			
Coleoptera	Dytiscidae	*Lancetes*		*		*	*
Coleoptera	Dytiscidae	*Necterosoma*				*	
Coleoptera	Dytiscidae	*Sternopriscus*	*				
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*
Coleoptera	Elmidae	*Kingolus*		*		*	
Coleoptera	Elmidae	*Notriolus*	*				
Coleoptera	Elmidae	*Simsonia*		*			
Coleoptera	Haliplidae	*Haliplus*	*	*		*	
Coleoptera	Hydraenidae	*Undetermined*				*	
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*
Coleoptera	Hydrophilidae	*Helochares*				*	
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*				*
Coleoptera	Scirtidae	*Scirtis*	*		*		
Decapoda	Atyidae	*Australatya striolata*	*				*
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*			*	*	
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*
Diptera	Culicidae	*Culicinae*		*			
Diptera	Simulidae	*Simulium*	*	*	*	*	*
Diptera	Tipulidae	*Undetermined*		*		*	
Ephemeroptera	Baetidae	*Bungona*	*	*		*	*
Ephemeroptera	Caenidae	*Caenid Genus C*					*
Ephemeroptera	Caenidae	*Tasmanocoenis*				*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides*	*			*	*
Ephemeroptera	Leptophlebiidae	*Nousia*	*		*	*	
Gastropoda	Ancylidae	*Ferrissia petterdi*		*		*	*
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*
Gastropoda	Physidae	*Physa acuta*	*	*	*		*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*				*	*
Gastropoda	Planorbidae	*Gyraulus*		*	*	*	*
Hemiptera	Corixidae	*Micronecta*	*	*		*	*
Hemiptera	Gelastocoridae	*Nerthra*				*	
Hemiptera	Gerridae	*Limnogonus*		*		*	
Hemiptera	Veliidae	*Microvelia*				*	
Hirudinea	Glossiphoniidae	*Undetermined*		*		*	*
Isopoda	Sphaeromatidae	*Cymodetta*				*	
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*		*	*	*
Odonata	Coenagrionidae	*Ischnura*				*	
Odonata	Gomphidae	*Austrogomphus*	*				
Odonata	Libellulidae	*Nannophlebia*				*	*
Odonata	Macromiidae	*Macromia*	*				
Oligochaete	Lumbricidae	*Lumbricus variegatus*	*	*	*	*	*
Oligochaete	Tubificidae	*Undetermined*		*		*	
Platyhelminthes	Dugesiidae	*Undetermined*		*		*	*
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*		*	*	*	*
Trichoptera	Calamoceratidae	*Anisocentropus*					*
Trichoptera	Conoesucidae	*Coenoria*					*
Trichoptera	Ecnomidae	*Ecnomus*				*	*
Trichoptera	Hydropsychidae	*Cheumatopsyche*	*			*	*
Trichoptera	Hydroptilidae	*Hellyethira*	*			*	*
Trichoptera	Leptoceridae	*Triplectides*				*	
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*
Total Number of Taxa			30	29	20	44	32

Recorded Macroinvertebrates - Survey No. 3, September 2003

Order	Family	Species	1	2	3	4	5
Acarina	Hygrobatidae	*Undetermined*		*	*		
Bivalvia	Hyriidae	*Hyridella depressa*	*	*	*	*	
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	
Coleoptera	Dystiscidae	*Barrethydrus*	*	*	*	*	*
Coleoptera	Dytiscidae	*Batrachomatus*			*		
Coleoptera	Dytiscidae	*Necterosoma*				*	
Coleoptera	Dytiscidae	*Rhantus*					*
Coleoptera	Dytiscidae	*Sternapriscus*		*	*		
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*
Coleoptera	Elmidae	*Kingolus*					*
Coleoptera	Elmidae	*Notriolus simsoni*			*		
Coleoptera	Elmidae	*Simsonia*				*	*
Coleoptera	Gyrinidae	*Macrogyrus*	*				
Coleoptera	Haliplidae	*Haliplus*		*	*		
Coleoptera	Hydraenidae	*Undetermined*	*		*		
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*					*
Coleoptera	Scirtidae	*Undetermined*				*	*
Decapoda	Atyidae	*Australatya striolata*					*
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*		*	*	*	*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*
Diptera	Nannochoristidae	*Nonnochorista*	*	*	*		
Diptera	Dolichopodidae	*Rhaphium*		*			
Diptera	Psychodidae	*Pericoma*	*	*		*	
Diptera	Simulidae	*Simulium*	*	*			
Ephemeroptera	Baetidae	*Bungona*	*	*			
Ephemeroptera	Baetidae	*Centroptilum*	*	*	*	*	*
Ephemeroptera	Caenidae	*Caenid Genus C*				*	*
Ephemeroptera	Caenidae	*Tasmanocoenis*	*	*		*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia*	*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Austrophlebioides*	*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Jappa*				*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia*	*	*	*	*	
Gastropoda	Ancylidae	*Ferrissia petterdi*			*		
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*
Gastropoda	Physidae	*Physa acuta*	*	*	*		*
Gastropoda	Planorbidae	*Gyraulus*	*	*	*	*	*
Hemiptera	Corixidae	*Micronecta*	*	*		*	*
Hemiptera	Corixidae	*Sigara*	*	*			
Hemiptera	Notonectidae	*Anisops*	*				
Hemiptera	Veliidae	*Microvelia*	*	*	*		
Hirudinea	Glossiphoniidae	*Undetermined*		*			*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*				*	*
Odonata	Gomphidae	*Hemigomphus*					*
Odonata	Libellulidae	*Nannophlebia*	*		*		
Odonata	Telephlebiidae	*Spinaeschna*					*
Oligochaete	Lumbricidae	*Lumbricus variegatus*		*		*	*
Oligochaete	Tubificidae	*Undetermined*	*				
Platyhelminthes	Dugesiidae	*Undetermined*	*	*			
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*		
Trichoptera	Calamoceratidae	*Anisocentropus*					*
Trichoptera	Ecnomidae	*Ecnomus*	*	*	*	*	*
Trichoptera	Hydrobiosidae	*Apsilochorema*	*	*		*	*
Trichoptera	Hydropsychidae	*Cheumatopsyche*	*	*	*	*	*
Trichoptera	Hydroptilidae	*Hellyethira*	*	*		*	*
Trichoptera	Hydroptilidae	*Hydroptila scamandra*		*			
Trichoptera	Hydroptilidae	*Oxyethira*	*	*		*	*
Trichoptera	Leptoceridae	*Oecetis*		*	*		*
Trichoptera	Leptoceridae	*Triplectides*		*	*	*	
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	
Total Number of Taxa			38	43	34	33	35

Recorded Macroinvertebrates - Survey No. 4, March 2004

Order	Family	Species	1	2	3	4	5	9
Acarina	Hygrobatidae	*Undetermined*		*				*
Bivalvia	Hyriidae	*Alathyria*	*	*	*	*	*	
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	*	
Coleoptera	Dystiscidae	*Barrethydrus*		*			*	
Coleoptera	Dystiscidae	*Chostonectes*	*	*		*	*	
Coleoptera	Dystiscidae	*Hyphydrus*						*
Coleoptera	Dystiscidae	*Necterosoma*		*	*		*	
Coleoptera	Elmidae	*Australimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Notriolus simsoni*				*		
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*	*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*	*		*	*	
Decapoda	Atyidae	*Australatya striolata*	*					
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	
Diptera	Ceratopogonidae	*Bezzia*		*				
Diptera	Chironomidae	*Chironominae*	*		*			*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*	*	*	*		*	
Diptera	Psychodidae	*Pericoma*		*				
Diptera	Simulidae	*Simulium*	*	*	*	*	*	
Diptera	Tabanidae	*Tabanus*						*
Ephemeroptera	Baetidae	*Bungona*	*	*	*	*	*	*
Ephemeroptera	Baetidae	*Centroptilum*	*	*		*	*	
Ephemeroptera	Caenidae	*Caenid Genus C*	*	*		*	*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*	*	*	*	*	*	
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*	*	*		*		*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*					*	
Gastropoda	Planorbidae	*Gyraulus*	*	*	*	*	*	*
Hemiptera	Corixidae	*Micronecta*		*	*			
Hemiptera	Corixidae	*Sigara*						*
Hemiptera	Gerridae	*Limnogonus*		*	*			
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Notonectidae	*Enithares*						*
Hemiptera	Veliidae	*Microvelia*		*				
Hirudinea	Erpobdellidae	*Undetermined*				*		
Hirudinea	Glossiphoniidae	*Undetermined*		*				
Isopoda	Sphaeromatidae	*Cymodetta*		*				
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*	*	*	*	
Odonata	Gomphidae	*Hemigomphus*		*				
Odonata	Libellulidae	*Nannophlebia*		*	*			
Odonata	Coenagrionidae	*Ischnura*		*				*
Odonata	Hemicorduliidae	*Hemicordulia*						*
Odonata	Libellulidae	*Diplacodes*						*
Odonata	Megapodagrionidae	*Austroargiolestes **					*	
Oligochaete	Lumbricidae	*Lumbricus variegatus*	*	*	*	*	*	*
Oligochaete	Tubificidae	*Undetermined*	*		*	*	*	
Platyhelminthes	Dugesiidae	*Undetermined*		*	*		*	
Plecoptera	Grypopterygidae	*Illiesoperla sp.*	*	*	*	*	*	
Trichoptera	Conosucidae	*Costora*	*		*		*	
Trichoptera	Ecnomidae	*Ecnomus*		*	*	*		
Trichoptera	Hydropsychidae	*Cheumatopsyche*	*	*	*	*	*	
Trichoptera	Leptoceridae	*Oecetis*	*	*	*	*	*	*
Trichoptera	Leptoceridae	*Triplectides*		*	*			*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*	
Total Number of Taxa			30	42	31	29	31	18

Recorded Macroinvertebrates - Survey No. 5, June 2004

Order	Family	Species	1	2	3	4
Bivalvia	Hyriidae	*Alathyria*		*	*	*
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*
Coleoptera	Dystiscidae	*Barrethydrus*	*			
Coleoptera	Dystiscidae	*Chostonectes*				*
Coleoptera	Dystiscidae	*Hyphydrus*		*	*	*
Coleoptera	Dystiscidae	*Necterosoma*	*	*		*
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*
Coleoptera	Elmidae	*Notriolus simsoni*		*	*	*
Coleoptera	Haliplidae	*Haliplus sp.*	*	*		
Coleoptera	Hydrophilidae	*Berosus*	*	*		*
Decapoda	Atyidae	*Australatya striolata*	*	*		*
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*		*	*
Diptera	Chironomidae	*Chironominae*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*
Diptera	Simulidae	*Simulium*	*	*	*	
Diptera	Tipulidae	*sp.*	*	*		
Ephemeroptera	Baetidae	*Bungona*	*	*	*	*
Ephemeroptera	Baetidae	*Centroptilum*		*		
Ephemeroptera	Caenidae	*Caenid Genus C*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Atalophlebia*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Austrophlebioides*	*		*	*
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia*	*		*	
Gastropoda	Ancylidae	*Ferrissia petterdi*		*	*	*
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*
Gastropoda	Physidae	*Physa acuta*	*		*	
Gastropoda	Planorbidae	*Gyraulus*		*	*	
Hemiptera	Corixidae	*Micronecta*	*		*	*
Hemiptera	Corixidae	*Sigara*		*		
Hirudinea	Glossiphoniidae	*Undetermined*	*	*	*	
Isopoda	Sphaeromatidae	*Cymodetta*				*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*		*
Odonata	Gomphidae	*Hemigomphus*	*			
Odonata	Libellulidae	*Nannophlebia*	*		*	
Oligochaete	Lumbricidae	*Lumbricus variegatus*	*	*		*
Oligochaete	Tubificidae	*Undetermined*	*		*	
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*	
Plecoptera	Grypopterygidae	*Illiesoperla*	*	*	*	*
Poifora	-	*sp.*	*			
Trichoptera	Calamoceratidae	*Anisocentropus sp.*		*	*	*
Trichoptera	Ecnomidae	*Ecnomus*	*	*		*
Trichoptera	Hydrobiosidae	*Apsilochorema sp.*	*	*		
Trichoptera	Hydropsychidae	*Cheumatopsyche*	*	*	*	*
Trichoptera	Leptoceridae	*Triplectides*		*	*	*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*
Total Number of Taxa			36	35	31	30

Recorded Macroinvertebrates - Survey No. 6, September 2004

Order	Family	Species	1	2	3	4	5	9
Acarina	Eylaidae	*Eylais*						*
Acarina	Hygrobatidae	*Undetermined*			*		*	
Bivalvia	Hyriidae	*Hyridella depressa*	*	*	*	*	*	
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*		
Coleoptera	Dystiscidae	*Barratthydrus*	*					*
Coleoptera	Dystiscidae	*Batrachomatus*			*			
Coleoptera	Dystiscidae	*Chostonectes*						*
Coleoptera	Dystiscidae	*Hyphydrus*			*	*	*	*
Coleoptera	Dystiscidae	*Necterosoma*						*
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Kingolus flavosignatus*					*	
Coleoptera	Elmidae	*Kingolus*	*	*	*	*	*	
Coleoptera	Elmidae	*Notriolus simsoni*			*		*	
Coleoptera	Haliplidae	*Haliplus*	*	*		*		
Coleoptera	Hydraenidae	*Undetermined*	*					*
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*	*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*			*	*	*	
Decapoda	Atyidae	*Australatya striolata*		*			*	
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*				*	*	*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*	*
Diptera	Chironomidae	*Undetermined*		*	*	*	*	
Diptera	Dixidae	*Dixa*		*		*		
Diptera	Simulidae	*Simulium*	*	*	*	*	*	
Diptera	Tipulidae	*Undetermined*					*	
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	
Ephemeroptera	Baetidae	*Bungona sp. 2*	*				*	
Ephemeroptera	Caenidae	*Caenid Genus C*	*	*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*		*	*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*	*		*	*	*	
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*	*					*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*					*	*
Gastropoda	Planorbidae	*Gyraulus*		*	*	*		*
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta sp.*	*		*	*		*
Hemiptera	Gelastocoridae	*Nerthra sp.*						*
Hemiptera	Gerridae	*Undetermined*	*					
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Pleidae	*Plea*						*
Hemiptera	Veliidae	*Microvelia*					*	
Hirudinea	Glossiphoniidae	*Undetermined*			*			*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*				*	
Odonata	Coenagrionidae	*Ischnura hesterosticta*						*
Odonata	Libellulidae	*Diplacodes*						*
Odonata	Libellulidae	*Nannophlebia*			*			
Oligochaete	Lumbricidae	*Lumbricus variegatus*	*	*		*	*	
Oligochaete	Tubificidae	*Undetermined*	*					
Platyhelminthes	Dugesiidae	*Undetermined*		*			*	
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*	
Trichoptera	Calamoceratidae	*Anisocentropus*				*		
Trichoptera	Conoesucidae	*Coenoria sp. AV1*					*	
Trichoptera	Ecnomidae	*Ecnomus*	*			*		
Trichoptera	Helicopsychidae	*Helicopsyche*					*	
Trichoptera	Hydrobiosidae	*Apsilochorema*			*	*	*	
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*					*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*		*	*	
Trichoptera	Hydroptilidae	*Hellyethira sp.1*	*			*	*	
Trichoptera	Hydroptilidae	*Hellyethira sp.2*				*	*	
Trichoptera	Leptoceridae	*Notalina spira*					*	*
Trichoptera	Leptoceridae	*Oecetis*		*	*	*	*	*
Trichoptera	Leptoceridae	*Triplectides volda*		*	*	*	*	*
Trichoptera	Philopotmidae	*Undetermined*	*	*	*	*	*	
Total Number of Taxa			32	29	33	37	42	26

Recorded Macroinvertebrates - Survey No. 7, March 2005

Order	Family	Species	1	2	3	4	5	9
Acarina	Hygrobatidae	*Undetermined*						*
Bivalvia	Hyriidae	*Hyridella*	*	*	*	*		
Bivalvia	Sphaeridae	*Pisidium*	*		*	*		
Coleoptera	Dystiscidae	*Batrachomatus*	*					
Coleoptera	Dystiscidae	*Chostonectes*						*
Coleoptera	Dystiscidae	*Hyphydrus*		*	*	*	*	
Coleoptera	Dystiscidae	*Necterosoma*						*
Coleoptera	Dytiscidae	*Lancetes*	*	*		*		
Coleoptera	Dytiscidae	*Sternopriscus*						
Coleoptera	Elmidae	*Australimnius*	*	*	*	*	*	*
Coleoptera	Elmidae	*Kingolus*		*				
Coleoptera	Elmidae	*Notriolus*				*	*	
Coleoptera	Elmidae	*Simsonia*			*			
Coleoptera	Hydrophilidae	*Berosus*	*		*	*	*	*
Coleoptera	Hydrophilidae	*Enochrus*						*
Coleoptera	Hydrophilidae	*Helochares*		*		*		
Coleoptera	Psephenidae	*Sclerocyphon maculatus*		*		*	*	
Decapoda	Atyidae	*Australatya striolata*	*	*		*		
Decapoda	Atyidae	*Caridinides*						
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Chironomidae	*Chironominae*		*	*	*		*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*		*
Diptera	Culicidae	*Chaoborus*						*
Diptera	Ephydridae	*sp.*				*		
Diptera	Simulidae	*Simulium*		*		*	*	
Diptera	Tanyderidae	*Tanyderus*			*			
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	
Ephemeroptera	Baetidae	*Bungona sp. 2*					*	
Ephemeroptera	Caenidae	*Caenid Genus C sp.*	*	*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*				*		
Ephemeroptera	Leptophlebiidae	*Nousia*			*			
Gastropoda	Ancylidae	*Ferrissia petterdi*	*			*		
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*	*					*
Gastropoda	Planorbidae	*Glyptophysa*						*
Gastropoda	Planorbidae	*Gyraulus*	*	*	*	*		
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta*	*		*	*	*	*
Hemiptera	Gelastocoridae	*Nerthra*				*		
Hemiptera	Gerridae	*Limnogonus*				*	*	
Hemiptera	Naucoridae	*Naucoris*						
Hemiptera	Notonectidae	*Anisops*				*		*
Hirudinea	Erpobdellidae	*Undetermined*		*	*			
Hirudinea	Glossiphoniidae	*Undetermined*						*
Lepidoptera	Pyraludae	*sp.*					*	
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*		*	*	
Odonata	Coenagrionidae	*Ischnura*						*
Odonata	Gomphidae	*Hemigomphus*				*		
Odonata	Libellulidae	*Diplacodes*						*
Odonata	Libellulidae	*Nannophlebia*			*			
Odonata	Megapodagrionidae	*Austroargiolestes*				*	*	
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*	*	*	*	
Oligochaete	Tubificidae	*Undetermined*	*	*				
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*	*	*	
Plecoptera	Grypopterygidae	*Illiesoperla*	*	*			*	
Trichoptera	Calamoceratidae	*Anisocentropus*	*	*	*	*	*	*
Trichoptera	Conoesucidae	*Coenoria sp. AV1*	*					
Trichoptera	Conosucidae	*Costora*				*	*	
Trichoptera	Ecnomidae	*Ecnomus*	*	*	*	*		*
Trichoptera	Helicopsychidae	*Helicopsyche*					*	
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*					*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*	
Trichoptera	Hydroptilidae	*Hellyethira*				*		
Trichoptera	Leptoceridae	*Oecetis*	*	*	*		*	*
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*	*					
Trichoptera	Leptoceridae	*Triplectides volda*						*
Trichoptera	Philopotamidae	*Chimarra*	*	*		*	*	
Total Number of Taxa			31	30	27	39	29	24

Recorded Macroinvertebrates - Survey No. 8, September 2005

Order	Family	Species	1	2	3	4	5	9
Acarina	Hygrobatidae	*Undetermined*			*			*
Bivalvia	Hyriidae	*Hyridella*	*	*		*		
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	*	
Coleoptera	Dystiscidae	*Antiporus*						*
Coleoptera	Dystiscidae	*Batrachomatus*			*		*	
Coleoptera	Dystiscidae	*Hyphydrus*			*			
Coleoptera	Dystiscidae	*Necterosoma*		*	*	*		*
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Simsonia*	*				*	
Coleoptera	Haliplidae	*Haliplus*	*	*				
Coleoptera	Hydrophilidae	*Berosus*		*		*	*	
Coleoptera	Hydrophilidae	*Helochares*		*				
Coleoptera	Psephenidae	*Sclerocyphon maculatus*				*		
Decapoda	Atyidae	*Australatya striolata*				*	*	
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*		*
Diptera	Ceratopogonidae	*Bezzia*			*			*
Diptera	Chironomidae	*Chironominae*	*	*	*		*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*	*
Diptera	Simulidae	*Simulium*	*	*	*	*	*	
Diptera	Tanyderidae	*Tanyderus*		*	*			
Diptera	Tipulidae	*sp.*	*					
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*	*			*	*	
Ephemeroptera	Caenidae	*Caenid Genus C sp.*		*	*	*		*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*		*	*	*		
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*		*	*	
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Haitia acuta*						*
Gastropoda	Planorbidae	*Gyraulus*			*			
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta*						*
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Pleidae	*Plea*				*		*
Hemiptera	Veliidae	*Microvelia*	*					
Hirudinea	Glossiphoniidae	*Undetermined*		*				*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*			*	*	
Odonata	Gomphidae	*Austrogomphus*				*	*	
Odonata	Gomphidae	*Hemigomphus*	*					
Odonata	Libellulidae	*Diplacodes*			*			*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*		*		*		
Oligochaete	Tubificidae	*Undetermined*	*	*	*			
Platyhelminthes	Dugesiidae	*Undetermined*		*	*	*		
Plecoptera	Grypopterygidae	*Illiesoperla*	*	*	*	*	*	
Trichoptera	Atriplectidae	*Atriplectides dubius*			*	*		
Trichoptera	Calamoceratidae	*Anisocentropus*	*	*	*	*	*	*
Trichoptera	Ecnomidae	*Ecnomus*	*	*	*	*	*	
Trichoptera	Hydrobiosidae	*Taschorema*	*	*	*		*	
Trichoptera	Hydrobiosidae	*Apsilochorema*		*	*			
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*				*	*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*		*	*	
Trichoptera	Leptoceridae	*Oecetis*	*	*	*	*	*	
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*		*		*	*	*
Trichoptera	Leptoceridae	*Triplectides volda*	*			*		
Trichoptera	Philopotamidae	*Chimarra*	*			*	*	
Total Number of Taxa			29	32	30	34	27	19

Recorded Macroinvertebrates - Survey No. 9, April 2006

Order	Family	Species	1	2	3	4	5	9
Acarina	Eylaidae	*Eylais*						*
Acarina	Hygrobatidae	*Undetermined*			*	*	*	
Arachnida	Araneae	*Undetermined*		*	*	*	*	
Bivalvia	Hyriidae	*Hyridella*	*	*		*		
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*		*
Coleoptera	Dystiscidae	*Antiporus*		*	*	*		*
Coleoptera	Dystiscidae	*Necterosoma*	*	*		*		*
Coleoptera	Dytiscidae	*Lancetes*				*		
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Notriolus*		*	*	*		
Coleoptera	Elmidae	*Simsonia*		*	*			
Coleoptera	Gyrinidae	*Macrogyrus*	*	*				
Coleoptera	Haliplidae	*Haliplus*	*	*	*	*		
Coleoptera	Hydraenidae	*Undetermined*		*				
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*	
Coleoptera	Psephenidae	*Sclerocyphon maculatus*		*				
Coleoptera	Scirtidae	*Undetermined*	*					
Decapoda	Atyidae	*Australatya striolata*				*		
Decapoda	Atyidae	*Paratya australiensis*	*		*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*		*	*	*		*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*	*	*	*	*	*	*
Diptera	Culicidae	*Culicinae*	*	*	*	*		
Diptera	Simulidae	*Simulium*	*	*	*	*	*	
Diptera	Tabanidae	*Tabanus*		*				
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*	*			*		
Ephemeroptera	Caenidae	*Caenid Genus C sp.*		*	*	*	*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*		*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Jappa*		*	*			
Ephemeroptera	Leptophlebiidae	*Nousia*	*		*	*		
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*			*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*				*		
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Lymnaeidae	*Austropeplea*		*				
Gastropoda	Physidae	*Physa acuta*	*	*	*	*	*	
Gastropoda	Planorbidae	*Glyptophysa*		*	*			
Gastropoda	Planorbidae	*Gyraulus*		*	*	*		
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta*		*	*	*	*	*
Hemiptera	Hydrometridae	*Hydrometra strigosa*	*		*			
Hemiptera	Gelastocoridae	*Nerthra*		*				
Hemiptera	Gerridae	*Limnogonus*			*	*	*	
Hemiptera	Mersoveliidae	*Mesovelia*	*	*	*	*		
Hemiptera	Nepidae	*Laccotrephes tristis*				*		
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Notonectidae	*Enithares*				*		*
Hemiptera	Veliidae	*Microvelia*		*	*	*	*	
Hirudinea	Glossiphoniidae	*Undetermined*		*	*	*	*	
Megaloptera	Corydalidae	*Archichauliodes guttiferus*		*		*	*	
Megaloptera	Sisyridae	*Sisyra*			*			
Odonata	Coenagrionidae	*Ischnura*		*				*
Odonata	Gomphidae	*Hemigomphus*		*			*	
Odonata	Libellulidae	*Diplacodes*			*			*
Odonata	Libellulidae	*Nannophlebia*	*	*	*			
Odonata	Megapodagrionidae	*Austroargiolestes*					*	
Odonata	Telephlebiidae	*Spinaeschna*						*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*		*				
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*		*	*
Plecoptera	Grypopterygidae	*Illiesoperla*	*	*	*		*	
Trichoptera	Calamoceratidae	*Anisocentropus*			*	*	*	
Trichoptera	Conoesucidae	*Coenoria sp. AV1*	*		*	*	*	
Trichoptera	Ecnomidae	*Ecnomus*		*	*	*	*	*
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*	*				*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*	
Trichoptera	Hydroptilidae	*Hellyethira*				*		
Trichoptera	Leptoceridae	*Notalina spira*		*		*		*
Trichoptera	Leptoceridae	*Oecetis*		*	*		*	*
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*	*		*			*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*	
Total Number of Taxa			31	47	44	45	30	22

Recorded Macroinvertebrates - Survey No. 10, September 2006

Order	Family	Species	1	2	3	4	5	9
Acarina	Eylaidae	*Eylais*						*
Bivalvia	Hyriidae	*Hyridella*	*			*		
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	*	*
Coleoptera	Dystiscidae	*Antiporus*						*
Coleoptera	Dystiscidae	*Barratthydrus*	*		*			*
Coleoptera	Dystiscidae	*Necterosoma*			*			*
Coleoptera	Dytiscidae	*Sternopriscus*						*
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Kingolus*	*	*	*	*		
Coleoptera	Haliplidae	*Haliplus*	*	*		*		
Coleoptera	Hydrophilidae	*Berosus*		*	*	*		
Coleoptera	Hydrophilidae	*Enochrus*						*
Coleoptera	Hydrophilidae	*Helochares*						*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*		*		*	*	
Decapoda	Atyidae	*Australatya striolata*				*		
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*	*		*		*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	*
Diptera	Chironomidae	*Tanypodinae*	*		*	*		*
Diptera	Culicidae	*Culicinae*				*		*
Diptera	Dixidae	*Dixa*				*		
Diptera	Simulidae	*Simulium*	*	*	*	*	*	*
Diptera	Tabanidae	*Tabanus*	*			*		
Diptera	Tanyderidae	*Tanyderus*			*			
Diptera	Tipulidae	*sp.*	*		*	*		
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*		*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*			*		*	
Ephemeroptera	Caenidae	*Caenid Genus C sp.*		*	*			*
Ephemeroptera	Caenidae	*Tasmanocoenis*	*		*			
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*	*			*		
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*						*
Gastropoda	Planorbidae	*Gyraulus*		*	*	*		
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta*	*				*	*
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Notonectidae	*Enithares*						*
Hemiptera	Pleidae	*Plea*						*
Hemiptera	Veliidae	*Microvelia*	*					
Hirudinea	Glossiphoniidae	*Undetermined*		*	*			
Isopoda	Sphaeromatidae	*Cymodetta*				*	*	
Isopoda	Oniscidea	*Undetermined*		*	*			
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*	*	*	*	
Odonata	Coenagrionidae	*Ischnura*						*
Odonata	Gomphidae	*Hemigomphus*	*	*				
Odonata	Libellulidae	*Diplacodes*						*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*	*	*		
Oligochaete	Tubificidae	*Undetermined*	*		*			
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*	*		
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*	
Trichoptera	Calamoceratidae	*Anisocentropus*	*		*	*	*	
Trichoptera	Conoesucidae	*Coenoria sp. AV1*				*	*	
Trichoptera	Ecnomidae	*Ecnomus*	*	*	*	*		*
Trichoptera	Glossosomatidae	*Agapetus sp. AV1*				*	*	
Trichoptera	Helicopsychidae	*Helicopsyche*					*	
Trichoptera	Hydrobiosidae	*Apsilochorema*	*	*	*		*	
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*					*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*	
Trichoptera	Leptoceridae	*Notalina spira*						*
Trichoptera	Leptoceridae	*Oecetis*	*	*	*	*	*	*
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*		*		*		
Trichoptera	Philopotamidae	*Chimarra*	*	*		*	*	
Trichoptera	Philopotomidae	*Hydrobiosella*	*			*		
Total Number of Taxa			36	31	34	38	25	27

Recorded Macroinvertebrates - Survey No. 11, March 2007

Order	Family	Species	1	2	3	4	5	9
Acarina	Eylaidae	*Eylais*						*
Acarina	Hygrobatidae	*Undetermined*	*	*	*			*
Bivalvia	Hyriidae	*Alathyria*	*	*		*		
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	*	*
Coleoptera	Dystiscidae	*Antiporus*		*	*			
Coleoptera	Dystiscidae	*Barratthydrus*	*					
Coleoptera	Dystiscidae	*Batrachomatus*	*			*		
Coleoptera	Dystiscidae	*Bidessus*	*		*	*		
Coleoptera	Dystiscidae	*Hyphydrus*						*
Coleoptera	Dystiscidae	*Necterosoma*				*		*
Coleoptera	Dytiscidae	*Lancetes*	*					
Coleoptera	Dytiscidae	*Sternopriscus*	*			*		
Coleoptera	Elmidae	*Australimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Kingolus*					*	
Coleoptera	Elmidae	*Notriolus*		*		*		
Coleoptera	Gyrinidae	*Macrogyrus*	*	*	*		*	
Coleoptera	Haliplidae	*Haliplus*	*	*	*	*	*	
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*	*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*	*	*	*	*	
Decapoda	Atyidae	*Australatya striolata*				*	*	
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*	*		*		*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*		*	*	*		
Diptera	Chironomidae	*Tanypodinae*		*	*	*		*
Diptera	Culicidae	*Culicinae*		*	*			*
Diptera	Simulidae	*Simulium*		*		*	*	
Diptera	Tipulidae	*sp.*			*			*
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*				*		
Ephemeroptera	Caenidae	*Caenid Genus C sp.*					*	
Ephemeroptera	Caenidae	*Tasmanocoenis*	*	*				*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*					*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*		*		*	
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*		*	*	*		
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*	*	*	*			*
Gastropoda	Planorbidae	*Glyptophysa*				*		
Gastropoda	Planorbidae	*Gyraulus*		*		*	*	
Hemiptera	Corixidae	*Agraptocorixa*	*		*	*		*
Hemiptera	Corixidae	*Micronecta*	*	*		*	*	*
Hemiptera	Gelastocoridae	*Nerthra*						*
Hemiptera	Gerridae	*Limnogonus*	*	*				
Hemiptera	Hydrometridae	*Hydrometra strigosa*						*
Hemiptera	Naucoridae	*Naucoris*						*
Hemiptera	Notonectidae	*Anisops*	*					*
Hemiptera	Pleidae	*Plea*						*
Hemiptera	Veliidae	*Microvelia*	*		*			
Hirudinea	Erpobdellidae	*Undetermined*		*	*			
Hirudinea	Glossiphoniidae	*Undetermined*	*	*	*	*		
Isopoda	Sphaeromatidae	*Cymodetta*				*	*	
Lepidoptera	Pyralidae	*Parapoynx*						*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*	*	*	*	
Odonata	Coenagrionidae	*Ischnura*				*		*
Odonata	Gomphidae	*Austrogomphus*			*	*	*	
Odonata	Libellulidae	*Nannophlebia*						*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*	*	*	*	*
Oligochaete	Tubificidae	*Undetermined*	*	*		*		*
Platyhelminthes	Dugesiidae	*Undetermined*	*	*	*	*		
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*		*	*	
Trichoptera	Calamoceratidae	*Anisocentropus*	*	*	*	*	*	
Trichoptera	Conoesucidae	*Coenoria sp. AV1*					*	
Trichoptera	Ecnomidae	*Ecnomus*				*		
Trichoptera	Helicopsychidae	*Helicopsyche*					*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*				*	*	
Trichoptera	Leptoceridae	*Notalina spira*	*			*		*
Trichoptera	Leptoceridae	*Oecetis*	*	*	*	*		*
Trichoptera	Leptoceridae	*Triplectides volda*					*	*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*	
Total Number of Taxa			38	37	33	43	31	30

Recorded Macroinvertebrates - Survey No. 12, September 2007

Order	Family	Species	1	2	3	4	5	9
Acarina	Eylaidae	*Eylais*						*
Acarina	Hygrobatidae	*Undetermined*	*			*		*
Bivalvia	Hyriidae	*Alathyria*	*	*		*		
Bivalvia	Sphaeridae	*Pisidium*		*	*	*	*	*
Coleoptera	Dystiscidae	*Antiporus*	*					*
Coleoptera	Dystiscidae	*Barratthydrus*			*			
Coleoptera	Dystiscidae	*Batrachomatus*	*	*				
Coleoptera	Dystiscidae	*Bidessus*	*				*	
Coleoptera	Dystiscidae	*Chostonectes*						*
Coleoptera	Dystiscidae	*Hyphydrus*			*			
Coleoptera	Dystiscidae	*Necterosoma*	*			*		*
Coleoptera	Dytiscidae	*Sternopriscus*						*
Coleoptera	Elmidae	*Australimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Kingolus*	*				*	
Coleoptera	Elmidae	*Notriolus*		*				
Coleoptera	Gyrinidae	*Macrogyrus*	*	*			*	*
Coleoptera	Haliplidae	*Haliplus*	*	*		*		
Coleoptera	Hydrophilidae	*Berosus*	*	*		*	*	
Coleoptera	Hydrophilidae	*Helochares*			*			
Coleoptera	Psephenidae	*Sclerocyphon maculatus*				*	*	
Coleoptera	Scirtidae	*Undetermined*		*		*		
Decapoda	Atyidae	*Australatya striolata*					*	
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*	*	*			*
Diptera	Chironomidae	*Chironominae*		*	*	*		*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*			*	*		
Diptera	Culicidae	*Culicinae*	*					
Diptera	Simulidae	*Simulium*	*	*	*	*	*	
Diptera	Tabanidae	*Tabanus*			*			
Diptera	Tanyderidae	*Tanyderus*	*	*	*			
Ephemeroptera	Baetidae	*Bungona sp. 1*		*	*			*
Ephemeroptera	Caenidae	*Caenid Genus C sp.*	*	*	*	*	*	
Ephemeroptera	Caenidae	*Tasmanocoenis*					*	*
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*		
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*	*			*	*	
Ephemeroptera	Leptophlebiidae	*Nousia*	*		*	*		
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*		*	*	*		
Gastropoda	Ancylidae	*Ferrissia petterdi*		*		*	*	
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	
Gastropoda	Physidae	*Physa acuta*	*					*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*						*
Gastropoda	Planorbidae	*Gyraulus*	*			*		*
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Corixidae	*Micronecta*	*	*		*	*	*
Hemiptera	Gerridae	*Limnogonus*					*	
Hemiptera	Hydrometridae	*Hydrometra strigosa*			*			
Hemiptera	Naucoridae	*Naucoris*						
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Notonectidae	*Enithares*		*				*
Hemiptera	Pleidae	*Plea*	*					*
Hemiptera	Veliidae	*Microvelia*						*
Hirudinea	Erpobdellidae	*Undetermined*		*				
Hirudinea	Glossiphoniidae	*Undetermined*	*		*			*
Isopoda	Sphaeromatidae	*Cymodetta*				*	*	
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*		*	*	
Odonata	Coenagrionidae	*Ischnura heterosticta*						*
Odonata	Gomphidae	*Austrogomphus*	*			*	*	
Odonata	Libellulidae	*Diplacodes*		*				*
Odonata	Libellulidae	*Nannophlebia*			*		*	*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*		*	*	*
Oligochaete	Tubificidae	*Undetermined*	*		*		*	
Platyhelminthes	Dugesiidae	*Undetermined*		*				
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*	
Trichoptera	Calamoceratidae	*Anisocentropus*		*			*	*
Trichoptera	Conoesucidae	*Coenoria sp. AV1*		*	*		*	
Trichoptera	Ecnomidae	*Ecnomus*		*		*		
Trichoptera	Helicopsychidae	*Helicopsyche*	*					
Trichoptera	Hydrobiosidae	*Taschorema*	*				*	
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*		*			*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*		*	*	
Trichoptera	Hydroptilidae	*Hydroptila scamandra*			*		*	
Trichoptera	Leptoceridae	*Oecetis*	*	*	*		*	
Trichoptera	Leptoceridae	*Triplectides volda*						*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*	
Total Number of Taxa			38	37	29	32	34	29

Recorded Macroinvertebrates - Survey No. 13, February 2008

Order	Family	Species	1	2	3	4	5	9
Acarina	Hygrobatidae	*Undetermined*						*
Bivalvia	Sphaeridae	*Pisidium*	*	*	*	*	*	*
Coleoptera	Dystiscidae	*Chostonectes*	*		*			
Coleoptera	Dystiscidae	*Necterosoma*	*					
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*	
Coleoptera	Elmidae	*Kingolus*					*	
Coleoptera	Elmidae	*Simsonia*	*	*	*	*		
Coleoptera	Gyrinidae	*Macrogyrus*	*	*				
Coleoptera	Haliplidae	*Haliplus*	*		*	*	*	
Coleoptera	Hydrophilidae	*Berosus*	*			*	*	*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*		*	*	*	
Decapoda	Atyidae	*Australatya striolata*				*		
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*	*				
Diptera	Chironomidae	*Chironominae*	*		*	*		*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*	*		*	*	*	*
Diptera	Dixidae	*Dixa*					*	
Diptera	Tanyderidae	*Tanyderus*					*	
Diptera	Tipulidae	*sp.*			*	*		
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*
Ephemeroptera	Baetidae	*Bungona sp. 2*		*	*	*		
Ephemeroptera	Caenidae	*Tasmanocoenis*	*	*				*
Ephemeroptera	Ameletopsidae	*Mirawara sp.*					*	
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*			*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*			*	*		
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*		*	*	
Gastropoda	Ancylidae	*Ferrissia petterdi*				*		*
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*		
Gastropoda	Planorbidae	*Glyptophysa*						*
Gastropoda	Planorbidae	*Gyraulus*	*				*	
Gastropoda	Planorbidae	*Isidorella*						*
Hemiptera	Corixidae	*Agraptocorixa*						*
Hemiptera	Gerridae	*Limnogonus*			*			*
Hemiptera	Naucoridae	*Naucoris*						*
Hemiptera	Notonectidae	*Anisops*						*
Hemiptera	Notonectidae	*Enithares*						*
Hemiptera	Pleidae	*Plea*						*
Hemiptera	Veliidae	*Microvelia*			*			*
Hirudinea	Glossiphoniidae	*Undetermined*						*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*	*	*	*	
Odonata	Coenagrionidae	*Ischnura heterosticta*						*
Odonata	Gomphidae	*Hemigomphus*		*				
Odonata	Hemicorduliidae	*Hemicordulia*						*
Odonata	Libellulidae	*Diplacodes*						*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*				*	*
Oligochaete	Tubificidae	*Undetermined*	*			*	*	*
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*	
Trichoptera	Calamoceratidae	*Anisocentropus*	*	*	*	*	*	
Trichoptera	Conoesucidae	*Coenoria sp. AV1*					*	
Trichoptera	Ecnomidae	*Ecnomus*	*	*		*		
Trichoptera	Helicopsychidae	*Helicopsyche*					*	
Trichoptera	Hydrobiosidae	*Apsilochorema*	*	*	*	*	*	
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*	*	*	*	
Trichoptera	Leptoceridae	*Notalina spira*			*			*
Trichoptera	Leptoceridae	*Oecetis*	*	*		*	*	
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*				*		*
Trichoptera	Leptoceridae	*Triplectides volda*						*
Trichoptera	Philopotamidae	*Chimarra*	*		*		*	*
Trichoptera	Philopotomidae	*Hydrobiosella*			*		*	
Total Number of Taxa			31	22	26	28	29	28

Recorded Macroinvertebrates - Survey No. 14, September 2008

Order	Family	Species	1	2	3	4	5	6	7	9
Acarina	Hygrobatidae	*Undetermined*							*	
Bivalvia	Hyriidae	*Hyridella*	*	*		*	*			
Bivalvia	Sphaeridae	*Pisidium*		*	*	*		*	*	*
Coleoptera	Dystiscidae	*Batrachomatus*					*			
Coleoptera	Dystiscidae	*Chostonectes*							*	*
Coleoptera	Dystiscidae	*Hyphydrus*			*	*	*	*		*
Coleoptera	Dystiscidae	*Necterosoma*	*	*	*	*			*	
Coleoptera	Elmidae	*Australimnius*	*	*	*	*	*		*	
Coleoptera	Elmidae	*Kingolus*	*	*		*	*			
Coleoptera	Elmidae	*Notriolus simsoni*					*		*	
Coleoptera	Elmidae	*Simsonia*					*			
Coleoptera	Gyrinidae	*Macrogyrus*	*		*			*	*	
Coleoptera	Haliplidae	*Haliplus*	*	*		*			*	*
Coleoptera	Hydraenidae	*Undetermined*	*						*	*
Coleoptera	Hydrophilidae	*Berosus*	*	*	*	*	*	*		*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*	*			*	*			
Decapoda	Atyidae	*Australatya striolata*				*	*			
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*		*
Diptera	Ceratopogonidae	*Bezzia*				*	*	*	*	*
Diptera	Chironomidae	*Chironominae*	*	*	*	*	*	*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*	*	*	*	*	
Diptera	Chironomidae	*Tanypodinae*		*	*	*	*	*	*	*
Diptera	Culicidae	*Culicinae*						*		*
Diptera	Dixidae	*Dixa*		*		*				
Diptera	Simulidae	*Simulium*	*	*		*	*	*		
Diptera	Tanyderidae	*Tanyderus*		*	*				*	
Diptera	Tipulidae	*sp.*					*		*	
Ephemeroptera	Ameletopsidae	*Mirawara sp.*	*							
Ephemeroptera	Baetidae	*Bungona sp. 1*	*	*	*	*	*	*	*	
Ephemeroptera	Baetidae	*Bungona sp. 2*	*	*			*			
Ephemeroptera	Caenidae	*Tasmanocoenis*	*		*		*	*	*	
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*	*	*	*	*	*	*	
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*	*	*	*		*	*	*	
Ephemeroptera	Leptophlebiidae	*Jappa*		*						
Ephemeroptera	Leptophlebiidae	*Nousia*	*	*	*	*	*			
Gastropoda	Ancylidae	*Ferrissia petterdi*	*		*	*	*			
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*		*	
Gastropoda	Physidae	*Haitia acuta*						*		*
Gastropoda	Planorbidae	*Glyptophysa*					*	*		*
Gastropoda	Planorbidae	*Gyraulus*	*	*	*				*	
Hemiptera	Corixidae	*Agraptocorixa*						*		*
Hemiptera	Corixidae	*Micronecta*					*			*
Hemiptera	Gerridae	*Limnogonus*					*		*	
Hemiptera	Naucoridae	*Naucoris*								*
Hemiptera	Notonectidae	*Anisops*						*		*
Hemiptera	Notonectidae	*Enithares*				*			*	
Hemiptera	Pleidae	*Plea*								*
Hemiptera	Veliidae	*Microvelia*	*				*	*	*	*
Hirudinea	Glossiphoniidae	*Undetermined*			*		*	*		*
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*		*	*			
Odonata	Coenagrionidae	*Ischnura*		*						*
Odonata	Gomphidae	*Hemigomphus*			*		*			
Odonata	Libellulidae	*Diplacodes*		*	*				*	*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*				*	*			
Oligochaete	Tubificidae	*Undetermined*	*			*		*		
Platyhelminthes	Dugesiidae	*Undetermined*		*			*	*	*	
Plecoptera	Grypopterygidae	*Illiesoperla*	*	*	*	*	*			
Trichoptera	Calamoceratidae	*Anisocentropus*	*		*	*		*	*	
Trichoptera	Conoesucidae	*Coenoria sp. AV1*			*	*				
Trichoptera	Ecnomidae	*Ecnomus*	*			*		*		
Trichoptera	Helicopsychidae	*Helicopsyche*	*				*			
Trichoptera	Hydrobiosidae	*Apsilochorema*	*	*		*	*			
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*	*				*			
Trichoptera	Hydropsychidae	*Cheumatopsyche sp.AV1*	*	*		*	*			
Trichoptera	Leptoceridae	*Notalina spira*		*	*		*	*	*	
Trichoptera	Leptoceridae	*Oecetis*	*	*	*	*	*	*		
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*	*	*	*	*		*	*	
Trichoptera	Leptoceridae	*Triplectides volda*			*		*			*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*			
Trichoptera	Philopotomidae	*Hydrobiosella*	*							
Total Number of Taxa			37	33	30	35	43	28	29	23

Recorded Macroinvertebrates - Survey No. 15, March 2009

Order	Family	Species	1	2	3	4	5	6	7	8
Acarina	Eylaidae	*Eylais*								*
Acarina	Hygrobatidae	*Undetermined*								*
Bivalvia	Sphaeridae	*Pisidium*		*		*	*	*		
Coleoptera	Dystiscidae	*Bidessodes*						*		*
Coleoptera	Dystiscidae	*Bidessus*							*	
Coleoptera	Dystiscidae	*Chostonectes*	*	*	*	*		*		
Coleoptera	Dystiscidae	*Necterosoma*	*							
Coleoptera	Elmidae	*Austrolimnius*	*	*	*	*	*			
Coleoptera	Elmidae	*Kingolus*	*				*			
Coleoptera	Elmidae	*Notriolus*		*		*	*			
Coleoptera	Elmidae	*Simsonia*		*	*	*				
Coleoptera	Gyrinidae	*Macrogyrus*		*		*	*			
Coleoptera	Haliplidae	*Haliplus*	*	*	*	*	*	*		
Coleoptera	Hydraenidae	*Undetermined*			*		*			
Coleoptera	Hydrophilidae	*Berosus*		*	*					*
Coleoptera	Psephenidae	*Sclerocyphon maculatus*		*	*	*	*			
Decapoda	Atyidae	*Australatya striolata*				*	*			
Decapoda	Atyidae	*Paratya australiensis*	*	*	*	*	*	*	*	*
Diptera	Ceratopogonidae	*Bezzia*	*	*	*	*	*			
Diptera	Chironomidae	*Chironominae*		*	*	*		*	*	*
Diptera	Chironomidae	*Orthocladinae*	*	*	*		*		*	*
Diptera	Chironomidae	*Tanypodinae*	*	*	*			*		
Diptera	Simulidae	*Simulium*	*		*	*			*	
Diptera	Stratiomyidae	*Odontomyia*	*							
Diptera	Tabanidae	*Tabanus*		*						
Diptera	Tipulidae	*sp.*	*	*	*	*				
Ephemeroptera	Baetidae	*Bungona sp. 1*	*		*		*	*		
Ephemeroptera	Baetidae	*Bungona sp. 2*			*		*	*		
Ephemeroptera	Caenidae	*Caenid Genus C sp.*				*		*		
Ephemeroptera	Ameletopsidae	*Mirawara sp.*					*			
Ephemeroptera	Leptophlebiidae	*Atalophlebia sp. AV12*	*			*	*			
Ephemeroptera	Leptophlebiidae	*Austrophlebioides sp. AV9*				*	*			
Ephemeroptera	Leptophlebiidae	*Jappa*					*			
Ephemeroptera	Leptophlebiidae	*Nousia*		*		*				
Ephemeroptera	Leptophlebiidae	*Ulmerophlebia sp. AV1*			*			*		
Gastropoda	Ancylidae	*Ferrissia petterdi*	*		*					
Gastropoda	Hydrobiidae	*Posticobia brazieri*	*	*	*	*	*	*		
Gastropoda	Lymnaeidae	*Pseudosuccinea columella*								*
Gastropoda	Physidae	*Haitia acuta*						*		*
Gastropoda	Planorbidae	*Glyptophysa gibbosa*								*
Gastropoda	Planorbidae	*Gyraulus*	*		*	*		*		
Hemiptera	Corixidae	*Agraptocorixa*								*
Hemiptera	Corixidae	*Micronecta*	*			*		*		*
Hemiptera	Gerridae	*Limnogonus*	*			*	*			
Hemiptera	Gerridae	*sp.*	*	*			*			
Hemiptera	Hydrometridae	*Hydrometra strigosa*	*	*						
Hemiptera	Notonectidae	*Anisops*								*
Hemiptera	Notonectidae	*Enithares*								*
Hemiptera	Pleidae	*Plea*								*
Hemiptera	Veliidae	*Microvelia*		*		*				
Hirudinea	Erpobdellidae	*Undetermined*		*						
Isopoda	Sphaeromatidae	*Cymodetta*				*	*			
Megaloptera	Corydalidae	*Archichauliodes guttiferus*	*	*		*	*			
Odonata	Coenagrionidae	*Ischnura heterosticta*						*		*
Odonata	Gomphidae	*Hemigomphus*		*		*				
Odonata	Hemicorduliidae	*Hemicordulia*								*
Oligochaete	Lumbriculidae	*Lumbricus variegatus*	*	*			*			
Oligochaete	Tubificidae	*Undetermined*	*	*	*		*	*		
Platyhelminthes	Dugesiidae	*Undetermined*	*				*			
Plecoptera	Grypopterygidae	*Illiesoperla brevicauda*	*	*	*	*	*			
Trichoptera	Atriplectidae	*Atriplectides dubius*	*							
Trichoptera	Calamoceratidae	*Anisocentropus*			*					
Trichoptera	Conoesucidae	*Coenoria sp. AV1*					*			
Trichoptera	Ecnomidae	*Ecnomus*	*					*		
Trichoptera	Helicopsychidae	*Helicopsyche*		*	*					
Trichoptera	Hydrobiosidae	*Apsilochorema*					*			
Trichoptera	Hydropsychidae	*Asmicridea sp.AV1*				*	*			
Trichoptera	Leptoceridae	*Notalina spira*			*			*		*
Trichoptera	Leptoceridae	*Oecetis*	*		*		*	*		
Trichoptera	Leptoceridae	*Triplectides ciuskus cuiskus*					*		*	
Trichoptera	Leptoceridae	*Triplectides volda*								*
Trichoptera	Philopotamidae	*Chimarra*	*	*	*	*	*			
Trichoptera	Philopotomidae	*Hydrobiosella*		*						
Total Number of Taxa			30	30	27	29	33	20	6	19

ATTACHMENT F-E

MACROINVERTEBRATE BASED BIOLOGICAL INDICIES (IIA, 2002 TO 2009)

Macroinvertebrate Based Biological Indices

Date	SIGNAL - HU97B								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	6.0	6.0	6.3	5.9	6.0	-	-	-	-
28/03/2003	5.3	4.8	5.2	5.2	5.2	-	-	-	-
25/09/2003	5.6	5.6	5.9	5.7	5.4	-	-	-	-
19/03/2004	5.7	5.3	5.5	5.8	5.4	-	-	-	4.6
3/06/2004	5.0	5.4	5.5	5.6	-	-	-	-	-
21/09/2004	5.4	6.0	5.9	5.9	6.0	-	-	-	3.9
10/03/2005	5.4	5.5	5.5	5.5	6.2	-	-	-	4.4
15/09/2005	6.4	5.9	5.7	6.3	6.4	-	-	-	4.4
7/04/2006	5.7	5.3	5.8	5.7	5.6	-	-	-	4.6
19/09/2006	5.8	6.0	5.6	6.1	6.7	-	-	-	4.3
7/03/2007	5.2	5.5	5.5	5.3	6.6	-	-	-	4.5
12/09/2007	5.9	6.1	6.0	6.7	6.2	-	-	-	5.1
29/02/2008	5.8	6.8	6.4	6.4	6.7	-	-	-	5.0
16/09/2008	6.3	6.1	5.9	5.9	5.9	5.1	5.6	-	4.0
5/03/2009	5.0	5.5	5.7	6.2	6.4	4.5	5.7	5.1	-
Minimum	5.0	4.8	5.2	5.2	5.2	4.5	5.6	5.1	3.9
Mean	5.6	5.7	5.8	5.9	6.1	4.8	5.6	5.1	4.5
Maximum	6.4	6.8	6.4	6.7	6.7	5.1	5.7	5.1	5.1

Date	Number of Families									
	Sampling Locations									
	1	2	3	4	5	6	7	8	9	Totals
3/09/2002	33	18	16	22	25	-	-	-	-	43
28/03/2003	23	24	17	36	27	-	-	-	-	45
25/09/2003	30	32	25	24	26	-	-	-	-	44
19/03/2004	24	35	26	26	25	-	-	-	16	43
3/06/2004	30	28	25	22	-	-	-	-	-	35
21/09/2004	26	20	23	28	29	-	-	-	18	47
10/03/2005	26	24	22	31	24	-	-	-	18	44
15/09/2005	22	24	23	25	19	-	-	-	15	39
7/04/2006	25	38	34	35	27	-	-	-	16	53
19/09/2006	30	26	26	30	21	-	-	-	19	48
7/03/2007	30	32	27	30	25	-	-	-	25	49
12/09/2007	31	32	23	26	29	-	-	-	23	52
29/02/2008	25	18	20	20	24	-	-	-	23	44
16/09/2008	30	24	22	28	30	23	23	-	20	49
5/03/2009	26	25	22	24	25	16	4	15	-	51
Minimum	31	32	23	26	29	16	4	15	23	-
Mean	27	27	23	27	25	20	14	15	19	-
Maximum	33	38	34	36	30	23	23	15	25	-

Macroinvertebrate Based Biological Indices

Date	Number of Taxa									
	Sampling Locations									
	1	2	3	4	5	6	7	8	9	Totals
3/09/2002	45	27	27	30	36	-	-	-	-	58
28/03/2003	30	29	20	44	32	-	-	-	-	60
25/09/2003	38	43	34	33	35	-	-	-	-	64
19/03/2004	30	42	31	29	31	-	-	-	18	58
3/06/2004	36	35	31	30	-	-	-	-	-	47
21/09/2004	32	29	33	37	42	-	-	-	26	68
10/03/2005	31	30	27	39	29	-	-	-	24	70
15/09/2005	29	32	30	34	27	-	-	-	19	57
7/04/2006	31	47	44	45	30	-	-	-	22	72
19/09/2006	36	31	34	38	25	-	-	-	27	67
7/03/2007	38	37	33	43	31	-	-	-	30	71
12/09/2007	38	37	29	32	34	-	-	-	29	76
29/02/2008	31	22	26	28	29	-	-	-	28	61
16/09/2008	37	33	30	35	43	28	29	-	23	70
5/03/2009	29	30	27	29	33	20	6	19	-	73
Minimum	29	22	20	28	25	20	6	19	18	-
Mean	34	34	30	35	33	24	18	19	25	-
Maximum	45	47	44	45	43	28	29	19	30	-

Date	EPT Taxa								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	18	10	12	13	14	-	-	-	-
28/03/2003	7	4	4	11	11	-	-	-	-
25/09/2003	14	17	11	14	12	-	-	-	-
19/03/2004	11	12	11	11	10	-	-	-	4
3/06/2004	11	12	11	10	-	-	-	-	-
21/09/2004	11	11	11	16	17	-	-	-	4
10/03/2005	12	10	9	11	13	-	-	-	5
15/09/2005	13	14	11	16	14	-	-	-	4
7/04/2006	11	11	14	14	11	-	-	-	6
19/09/2006	13	12	13	13	14	-	-	-	5
7/03/2007	9	8	7	11	12	-	-	-	4
12/09/2007	11	13	11	10	13	-	-	-	4
29/02/2008	12	12	11	12	14	-	-	-	6
16/09/2008	18	13	13	12	15	9	7	-	1
5/03/2009	7	5	9	7	13	6	1	2	-
Minimum	7	4	4	7	10	6	1	2	1
Mean	12	11	11	12	13	8	4	2	4
Maximum	18	17	14	16	17	9	7	2	6

Macroinvertebrate Based Biological Indices

Date	EPT Taxa Ratio								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	0.4	0.4	0.4	0.4	0.4	-	-	-	-
28/03/2003	0.2	0.1	0.2	0.3	0.4	-	-	-	-
25/09/2003	0.4	0.4	0.3	0.4	0.3	-	-	-	-
19/03/2004	0.4	0.3	0.4	0.4	0.3	-	-	-	0.2
3/06/2004	0.3	0.3	0.4	0.3	-	-	-	-	-
21/09/2004	0.3	0.4	0.3	0.4	0.4	-	-	-	0.2
10/03/2005	0.4	0.3	0.3	0.3	0.4	-	-	-	0.2
15/09/2005	0.4	0.4	0.4	0.5	0.5	-	-	-	0.2
7/04/2006	0.4	0.2	0.3	0.3	0.4	-	-	-	0.3
19/09/2006	0.4	0.4	0.4	0.3	0.6	-	-	-	0.2
7/03/2007	0.2	0.2	0.2	0.3	0.4	-	-	-	0.1
12/09/2007	0.3	0.4	0.5	0.4	0.5	-	-	-	0.2
29/02/2008	0.4	0.6	0.4	0.4	0.5	-	-	-	0.2
16/09/2008	0.5	0.4	0.4	0.3	0.4	0.3	0.2	-	0.0
5/03/2009	0.2	0.2	0.3	0.2	0.4	0.3	0.2	0.1	-
Minimum	0.2	0.1	0.2	0.2	0.3	0.3	0.2	0.1	0.0
Mean	0.3	0.3	0.3	0.4	0.4	0.3	0.2	0.1	0.2
Maximum	0.5	0.6	0.5	0.5	0.6	0.3	0.2	0.1	0.3

Date	Shredder Radio								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	0.3	0.2	0.3	0.3	0.3	-	-	-	-
28/03/2003	0.4	0.4	0.4	0.4	0.5	-	-	-	-
25/09/2003	0.3	0.3	0.4	0.4	0.3	-	-	-	-
19/03/2004	0.5	0.4	0.4	0.5	0.4	-	-	-	0.2
3/06/2004	0.4	0.5	0.5	0.5	-	-	-	-	-
21/09/2004	0.4	0.4	0.5	0.5	0.5	-	-	-	0.3
10/03/2005	0.4	0.4	0.4	0.4	0.5	-	-	-	0.3
15/09/2005	0.6	0.5	0.5	0.5	0.6	-	-	-	0.3
7/04/2006	0.6	0.5	0.5	0.5	0.5	-	-	-	0.3
19/09/2006	0.5	0.6	0.5	0.5	0.7	-	-	-	0.2
7/03/2007	0.4	0.4	0.4	0.4	0.6	-	-	-	0.2
12/09/2007	0.5	0.5	0.5	0.5	0.5	-	-	-	0.2
29/02/2008	0.6	0.7	0.6	0.6	0.7	-	-	-	0.3
16/09/2008	0.7	0.6	0.6	0.5	0.5	0.4	0.5	-	0.2
5/03/2009	0.4	0.4	0.6	0.5	0.6	0.5	0.2	0.3	-
Minimum	0.3	0.2	0.3	0.3	0.3	0.4	0.2	0.3	0.2
Mean	0.5	0.4	0.5	0.5	0.5	0.4	0.3	0.3	0.2
Maximum	0.7	0.7	0.6	0.6	0.7	0.5	0.5	0.3	0.3

Macroinvertebrate Based Biological Indices

Date	Ratio Silt Tolerant Taxa								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	0.1	0.0	0.1	0.1	0.1	-	-	-	-
28/03/2003	0.1	0.1	0.1	0.1	0.2	-	-	-	-
25/09/2003	0.1	0.1	0.1	0.2	0.2	-	-	-	-
19/03/2004	0.2	0.1	0.2	0.2	0.2	-	-	-	0.2
3/06/2004	0.1	0.1	0.1	0.1	-	-	-	-	-
21/09/2004	0.1	0.1	0.2	0.2	0.1	-	-	-	0.2
10/03/2005	0.2	0.2	0.2	0.2	0.2	-	-	-	0.2
15/09/2005	0.1	0.2	0.2	0.1	0.1	-	-	-	0.1
7/04/2006	0.2	0.2	0.2	0.2	0.2	-	-	-	0.2
19/09/2006	0.2	0.3	0.3	0.2	0.1	-	-	-	0.1
7/03/2007	0.2	0.2	0.1	0.2	0.2	-	-	-	0.2
12/09/2007	0.1	0.1	0.1	0.2	0.2	-	-	-	0.2
29/02/2008	0.2	0.1	0.1	0.1	0.1	-	-	-	0.2
16/09/2008	0.2	0.1	0.1	0.1	0.1	0.2	0.1	-	0.1
5/03/2009	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	-
Minimum	0.1	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Mean	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2
Maximum	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2

Date	Number of Silt Tolerant Taxa								
	Sampling Locations								
	1	2	3	4	5	6	7	8	9
3/09/2002	5	1	2	4	5	-	-	-	-
28/03/2003	2	3	2	6	7	-	-	-	-
25/09/2003	5	5	4	5	6	-	-	-	-
19/03/2004	5	6	5	5	6	-	-	-	3
3/06/2004	4	5	4	2	-	-	-	-	-
21/09/2004	4	4	5	6	6	-	-	-	4
10/03/2005	7	7	5	7	5	-	-	-	5
15/09/2005	3	6	5	5	2	-	-	-	2
7/04/2006	5	9	7	7	6	-	-	-	5
19/09/2006	8	8	9	8	3	-	-	-	3
7/03/2007	6	7	4	8	5	-	-	-	5
12/09/2007	4	5	3	6	5	-	-	-	5
29/02/2008	7	2	2	4	4	-	-	-	5
16/09/2008	6	3	4	4	6	5	4	-	2
5/03/2009	4	2	4	4	2	4	1	2	-
Minimum	2	1	2	2	2	4	1	2	2
Mean	5	5	4	5	5	5	3	2	4
Maximum	8	9	9	8	7	5	4	2	5