Appendix 6*

Macroinvertebrate Monitoring Reports

*This appendix is presented on the CD included on the inside back cover of this report

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Report for
Donaldson Coal Pty Ltd

Tasman Coal Mine
Macroinvertebrate Sampling Program
Stream Survey: Spring 2011

2nd December, 2011

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TASMAN COAL MINE: MACROINVERTEBRATE STREAM SURVEY

TABLE OF CONTENTS

TASMAN COAL MINE: MACROINVERTEBRATE STREAM SURVEY

1 INTRODUCTION

As part of environmental monitoring for the Tasman Coal mine, two sites on Blue Gum Creek were investigated for aquatic ecological health, using the indicator macroinvertebrate fauna.

2 STUDY AREA

2.1 CATCHMENT

Blue Gum Creek has its source at Mount Sugarloaf. Prior to Pambalong Nature Reserve, it drains a catchment area of approximately 16km^2. Catchment landuse at the upstream site at George Booth Drive is predominantly bushland as well as underground mining and associated surface infrastructure. By the second site (Dog Hole Road crossing), the catchment also includes grazing activity.

2.2 STREAM SAMPLING

Site Locations

The streams were sampled at two locations:

Blue Gum Creek at Stockrington Road (6.5 km from stream source) Grid Reference: Beresfield 1:25,000 AMG 680 621

Blue Gum Creek at Dog Hole Road (8 km from stream source) Grid Reference: Beresfield 1:25,000 AMG 693 635

Sampling Event

The stream was sampled in spring (18th October, 2011) under essentially dry weather conditions, with the last substantial rainfall occurring three weeks prior to sampling.

3 METHODS

3.1 PARAMETERS

Water Quality Parameters

Water quality parameters can be classified into three categories, physical, chemical and biological. All three types of parameters are needed to give a complete picture of stream health and to determine possible influences.

Some results are able to be compared against the National Water Quality guidelines (ANZECC/ ARMCANZ, 2000), a set of water quality values which have been formulated for specific objectives, such as the protection of aquatic ecosystems or recreational usage. Each objective lists a set of parameters with corresponding trigger values which should ensure the sustenance

of the particular environmental or human value. It should be recognised that ANZEC/ARMCANZ criteria are recommended guidelines only and each stream will have its own unique physico-chemistry and biology. ANZECC/ARMCANZ recommends that where possible, site specific studies be undertaken to test the validity of the guidelines and if possible to formulate relevant values for that stream. Due to the paucity of site specific data for the streams, this program has compared results against the ANZECC/ARMCANZ guidelines for the Protection of Aquatic Ecosystems as well as previous monitoring data for the specific sites.

Probe measurements were taken for temperature, dissolved oxygen, pH, conductivity and redox potential. Samples were subsequently analysed for total dissolved solids, alkalinity and sulphate.

Biological Parameters

Assessment of stream fauna can be used to assess areas of environmental stress through the diversity of the macroinvertebrate population and the presence of pollutant-sensitive or pollutant tolerant animals. Healthy systems are usually characterised by a high diversity but relatively low abundance. Conversely, stressed systems favour the growth of only a few pollution-tolerant organisms, which results in a lower diversity but often higher abundance. Also, as animal diversity and abundance are relatively slow to change when compared to chemical parameters, biological data has the advantage of reflecting the long-term average condition of a system rather than at a single point in time.

Macroinvertebrates are aquatic animals including insect larvae, snails and worms which live amongst aquatic vegetation, wood debris and bed material. They can provide an indication of water quality as well as a measure of the diversity and sensitivity of the aquatic ecosystem. Data was collected on the number of families present as well as the abundance of each family. Two biotic indices are available for macroinvertebrates within Australia. The first, the SIGNAL index has been especially developed for freshwaters of South Eastern Australia. The second, AusRIVAS is an Australia wide index using reference sites for specific regions.

The edge/pool habitat of the streams were sampled at each of the sites using a fine net for a period of 10 minutes. The complete sample was assessed for the abundance of each family as a percentage. Specimens of each discrete taxa were then transferred to a 100 mL phial and preserved with ethanol. Specimens were identified to family using a dissecting microscope, except for Chironomids which were identified to subfamily.

AusRivAS Index

The AusRivAS biotic index is a modelled index which enables comparison between the macroinvertebrate community at a particular site and a relevant reference site. The resultant score, the Observed/Expected or O/E, allows an easy comparison to a reference stream, with values close to 1 being more pristine. The site is then placed into one of five bands depending on the variance of the site community from the reference condition.

These are

- Band X = richer than reference = mild organic enrichment/biodiversity hotspot
- Band A = similar to reference = good water quality & habitat
- Band B = below reference = potential impacts on water quality & habitat
- Band C = well below reference = substantial impairment by water/habitat quality
- Band D = impoverished = severe impairment

AusRivAS also provides a comparison with expected SIGNAL scores, termed an O/E SIGNAL. These have not been included in this report as the AusRivAS generated O/E SIGNAL scores do not take into account abundances, which form part of the true SIGNAL calculation (see below).

AusRivAS uses a standard pro-forma sheet which contains all the data needed as input for the computer model. This includes geographical location, catchment area, distance from source, stream slope, elevation, stream substrate, rainfall and water quality alkalinity as well as the presence or absence of macroinvertebrate families (University of Canberra website, 2001).

SIGNAL Index

The SIGNAL index (Chessman, 1995) is a measure of water quality using the factors of indicator animals and abundance. The animals are identified to family level classification, with each family assigned a sensitivity grade between 1 and 10 depending on the tolerance to common pollutants (higher values represent lower levels of tolerance). Each species is then assessed for abundance on a 5 point scale. Scores for each type are calculated from the product of grade and abundance. The Index is derived from the sum of scores divided by the sum of abundances. This provides a comprehensive ecological indicator that takes into account the number and abundance of pollutant sensitive animals.

SIGNAL indices are classified into 5 levels:

• less than 4	= severely impaired	= very poor water quality
• 4-5	= moderately impaired	= poor water quality
• 5-6	= mildly impaired	= fair water quality
• 6-7	= unimpaired	= good water quality
• 7	= unimpaired & rich in sensitive taxa	= excellent water quality

The percentage of sensitive organisms at each site can be calculated using the SIGNAL rankings, with sensitive animals rating a 7 or more. This allows a more detailed picture of the macroinvertebrate community to be ascertained and thus a greater understanding of the degree of impairment of a site.

Riparian Channel Inventory (RCE)

At each site a detailed field observation sheet was completed covering riparian (stream bank) vegetation and stream geomorphology to provide a Riparian-Channel-Environmental Inventory (RCE).

This assessment was developed by Peterson (1992) and evaluates the condition of:

- adjacent land
- banks
- channel & bed (includes instream vegetation and algae)
- riparian vegetation

Each attribute is assigned a value of 1 to 4 depending on the state of impact. A total score is derived from the sum of the component values which indicates the degree of impairment of the stream geomorphology, riparian zone and stream habitat. A rating from very poor to excellent has been developed by Robyn Tuft & Associates for stream bank, stream bed and the total stream condition (RCE) score. The score ranges between 13 to 52, with poor sites generally scoring below 20 and very good to excellent sites above 45. Sites near or over 40 are generally in good condition.

4 RESULTS

4.1 SITE OBSERVATIONS

Blue Gum Creek at Stockrington Road: This site was sampled upstream of the road. The stream was a 2m to 4m wide and approximately 0.2 to 1m deep pool, flowing over mostly sand and silt substrate with some organic detritus and submerged logs. Water clarity was murky. The riparian vegetation consisted of Crofton, Willow, Lantana and Eucalypts with an understory of mixed natives and exotics. Much of the stream was vegetated with macrophytes, incuding Duckweed, Typha and Phagmites.

Blue Gum Creek at Dog Hole Road: This site was sampled upstream of the road. The stream was a 0.5 to 8m wide and approximately 0.1 to 1m deep pool, flowing over mostly sand and silt substrate with some organic detritus. Water clarity was fair and a mild sulphur odour present. The riparian vegetation consisted of Blue Gum Eucalypts with an understory of mixed natives and exotics, incuding Lantana and Cassia.

4.2 RCE RANKING

Results for the Riparian, Catchment and Environment score are given in Table 1. RCE scores were relatively unchanged at both sites.

Table 1 RCE Ranking

Site	Date	Bank Condition Score	Bank Condition Rating	Bed Condition Score	Bed Condition Rating	Stream Condition (RCE)	RCE Rating
Blue Gum Ck @ Stockrington Rd	20/5/09	14	Good	11	Excellent	40	Good
	16/11/09	14	Good	6	Poor	36	Fair
	14/12/10	15	Good	5	Poor	32	Fair
	1/4/11	15	Good	5	Poor	32	Fair
	18/10/11	**14**	**Good**	**6**	**Poor**	**33**	**Fair**
Blue Gum Creek @ Dog Hole Rd	1/8/08	15	Good	8	Fair	37	Good
	20/5/09	13	Good	11	Excellent	39	Good
	16/11/09	12	Fair	7	Fair	31	Fair
	27/4/10	15	Good	12	Excellent	38	Good
	14/12/10	15	Good	11	Excellent	41	Good
	1/4/11	16	Good	7	Fair	36	Fair
	18/10/11	**15**	**Good**	**8**	**Fair**	**38**	**Good**

4.3 WATER QUALITY

The results are shown in Table 2. In water quality studies it is usual to compare parameter concentrations against guidelines values, such as the ANZECC guidelines for the Protection of Aquatic Ecosystems (ANZECC/ARMCANZ, 2000). Dissolved oxygen levels at the upstream site were within the ANZECC/ARMCANZ guideline, and substantially increased since the last survey. Levels at the downstream site had also increased substantially but were still moderately low. Conductivities were elevated, particularly at the downstream site, and above guidelines for aquatic ecosystem protection (ANZECC/ARMCANZ, 2000). The pH at both sites was close to neutral.

Table 2 Chemical Characteristics

Site	Date	Time of Collection	Dissolved Oxygen (%)	Water Clarity	Conductivity µS/cm	pH	Total Alkalinity $CaCO_3$ mg/L
Guideline		-	85-110[1]	-	200-300[1] 1500[2]	6.5 – 8.0	
Blue Gum Ck @ Stockrington Rd	20/5/09	0915	35	Good	110	6.8	230
	16/11/09	0900	16	Poor	1540	7.5	400
	14/12/10	1000	4	Poor	614	12.1	79
	1/4/11	0945	3	Murky	473	-	75
	18/10/11	**0900**	**92**	**Murky**	**890**	**7.3**	**240**
Blue Gum Creek @ Dog Hole Ck	1/8/08	1015	61	Fair	90	7.2	190
	20/5/09	1100	33	Poor	80	7.1	180
	16/11/09	0800	12	Poor	1978	7.6	280
	27/4/10	1530	8	Good	1578	8.2	260
	14/12/10	0800	4	Good	1254	11.8	180
	1/4/11	0815	8	Murky	1221	7.2	170
	18/10/11	**0800**	**67**	**Fair**	**1071**	**7.1**	**140**

1 ANZECC/ARMCANZ (2000)
2 ANZECC (1992)
3 ANZECC/ARMCANZ (2000) – Livestock watering

4.4 AQUATIC ECOLOGY

Biological characteristics are summarised in Table 4 and 5. The aquatic ecosystem consisted of a moderately diverse assemblage of fauna but with the downstream site showing less taxa than was recorded in autumn 2011. The SIGNAL index for both sites had increased since the last survey, placing both sites in the mildly impaired category. AUSRIVAS results for Stockrington Rd supported the SIGNAL index, suggesting poor water quality. AUSRIVAS was unable to produce a score for the downstream site but the SIGNAL index indicated poor ecological health. However, pollution sensitive Leptophlebiidae (mayfly nymphs) were present at both sites.

No vertebrate fauna were observed in this survey, in contrast with the last survey where Gambusia were observed at both sites.

The macrophytes Typha and duckweed covered a large proportion of the surface at the upper site.

Table 4: Biological Characteristics (Macroinvertebrates)

Parameter	Date	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
DIVERSITY	1/8/08	-	22
	20/5/09	29	25
	16/11/09	20	22
	27/4/10	-	11
	14/12/10	33	35
	1/4/11	24	20
	18/10/11	**24**	**16**

Parameter	Date	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
SIGNAL INDEX	1/8/08		5.1
	20/5/09	5.7	5.8
	16/11/09	4.6	4.6
	27/4/10	-	3.4
	14/12/10	4.7	4.7
	1/4/11	4.7	4.4
	18/10/11	**5.0**	**5.3**
AUSRIVAS Observed/ Expected {Band}	1/8/08	--	0.67(Band B)
	20/5/09	--	--
	16/11/09	Outside the model	Outside the model
	27/410		
	14/12/10		
	1/4/11	0.92 (Band A)	0.69 (Band B)
	18/10/11	**0.58 (Band B)**	**Outside the model**
PREDOMINANT TYPES	**18/10/11**	Chironomidae (midge larvae) Corixidae (water boatmen) Leptophlebiidae (mayfly nymphs)	Chironomidae (midge larvae) Leptophlebiidae (mayfly nymphs) Notonectidae (back swimmers)

Table 5: Biological Characteristics (Non Macroinvertebrates)

Biota	Parameter	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
Vertebrates	Predominant types		
Macrophytes	Coverage	50%	
	Predominant types	Typha, Phragmites, duckweed	
Algae	Coverage	20%	-
	Predominant types	Green filamentous	-

5 CONCLUSIONS

The stream's ecology showed some deterioration since last spring. There was a predominance of pollutant tolerant invertebrate communities, but both the SIGNAL and AUSRIVAS scores indicated a deterioration in ecological health.

Dissolved oxygen was substantially elevated compared to the last survey, but conductivity was above recommendations for healthy ecosystems. Historical monitoring data for Blue Gum Creek showed that conductivity, pH and suspended solids can be highly variable.

6 REFERENCES

Australian and New Zealand Environment and Conservation Council (1992) Australian Water Quality Guidelines for Fresh and Marine Waters. National Water Quality Management Strategy November 1992.

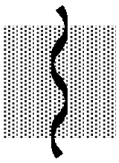
Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, October 2000.

Chessman B. C., Growns J.E and Kotlash A.R. (1997) Objective derivation of macroinvertebrate family sensitivity grade numbers for the SIGNAL biotic index: allocation to the Hunter River system, New South Wales. Mar. Freshwater Res. 48, 159-172.

Connell D.W., (1983) Water Pollution, Causes and Effects in Australia and New Zealand, third Edition, University of Queensland Press.

Peterson R.C. Jr (1992) The RCE: a riparian, channel and environmental inventory for small streams in the agricultural landscape. Freshwater Biology 27, 295-306

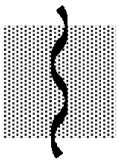
APPENDIX 1 – BIOLOGICAL DATA



ROBYN TUFT & ASSOCIATES RT301

SIGNAL INDEX SUMMARY

		SIGNAL Index
Blue Gum Creek @ Strockrington Rd	18 Oct 2011	5.0
Blue Gum Creek @ Dog Hoe Rd	18 Oct 2011	5.3



ROBYN TUFT & ASSOCIATES

MACROINVERTEBRATE SAMPLING RESULTS

Blue Gum Creek @ Strockrington Rd **18 Oct 2011**

Total Number of Taxa 24

Taxon ID	Number of Taxa	Abundance	Score
Atyidae	1	1	6
Baetidae	1	1	7
Belostomatidae	1	1	5
Chironomidae	3	3	9
Copepoda	1	2	0
Corixidae	1	3	9
Dugesiidae	1	2	6
Dytiscidae	3	2	4
Eusiridae	1	2	16
Hydrophilidae	1	2	8
Leptophlebiidae	3	4	40
Megapodagrionidae	1	2	12
Moinidae	1	2	0
Naididae	1	2	8
Ostracoda	1	2	0
Oxidae	1	2	14
Physidae	1	2	2
Simuliidae	1	1	5

Blue Gum Creek @ Dog Hoe Rd **18 Oct 2011**

Total Number of Taxa 16

Taxon ID	Number of Taxa	Abundance	Score
Baetidae	1	2	14
Chironomidae	3	3	9
Dytiscidae	2	3	6
Hydracarina	1	1	5
Hydrophilidae	1	1	4
Leptoceridae	1	1	7

Printed 2 Dec 2011 Page 1

Report for
Donaldson Coal Pty Ltd

Tasman Coal Mine
Macroinvertebrate Sampling Program
Stream Survey: Autumn 2012

10th June, 2012

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TASMAN COAL MINE: MACROINVERTEBRATE STREAM SURVEY

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2.1 CATCHMENT

Blue Gum Creek has its source at Mount Sugarloaf. Prior to Pambalong Nature Reserve, it drains a catchment area of approximately 16km^2. Catchment landuse at the upstream site at George Booth Drive is predominantly bushland as well as underground mining and associated surface infrastructure. By the second site (Dog Hole Road crossing), the catchment also includes grazing activity.

2.2 STREAM SAMPLING

Site Locations

The stream was sampled at only one location this occasion, due to access difficulties at Stockrington Rd:

Blue Gum Creek at Dog Hole Road (8 km from stream source)
Grid Reference: Beresfield 1:25,000 AMG 693 635

Sampling Event

The stream was sampled in autumn (12th April, 2012) following moderate rainfall the day before (16.1mm).

3 METHODS

3.1 PARAMETERS

Water Quality Parameters

Water quality parameters can be classified into three categories, physical, chemical and biological. All three types of parameters are needed to give a complete picture of stream health and to determine possible influences.

Some results are able to be compared against the National Water Quality guidelines (ANZECC/ ARMCANZ, 2000), a set of water quality values which have been formulated for specific objectives, such as the protection of aquatic ecosystems or recreational usage. Each objective lists a set of parameters with corresponding trigger values which should ensure the sustenance of the particular environmental or human value. It should be recognised that ANZEC/ARMCANZ

criteria are recommended guidelines only and each stream will have its own unique physico-chemistry and biology. ANZECC/ARMCANZ recommends that where possible, site specific studies be undertaken to test the validity of the guidelines and if possible to formulate relevant values for that stream. Due to the paucity of site specific data for the streams, this program has compared results against the ANZECC/ARMCANZ guidelines for the Protection of Aquatic Ecosystems as well as previous monitoring data for the specific sites.

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These are

- Band X = richer than reference = mild organic enrichment/biodiversity hotspot
- Band A = similar to reference = good water quality & habitat
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- Band C = well below reference = substantial impairment by water/habitat quality
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computer model. This includes geographical location, catchment area, distance from source, stream slope, elevation, stream substrate, rainfall and water quality alkalinity as well as the presence or absence of macroinvertebrate families (University of Canberra website, 2001).

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SIGNAL indices are classified into 5 levels:

• less than 4	= severely impaired	= very poor water quality
• 4-5	= moderately impaired	= poor water quality
• 5-6	= mildly impaired	= fair water quality
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• 7	= unimpaired & rich in sensitive taxa	= excellent water quality

The percentage of sensitive organisms at each site can be calculated using the SIGNAL rankings, with sensitive animals rating a 7 or more. This allows a more detailed picture of the macroinvertebrate community to be ascertained and thus a greater understanding of the degree of impairment of a site.

Riparian Channel Inventory (RCE)

At each site a detailed field observation sheet was completed covering riparian (stream bank) vegetation and stream geomorphology to provide a Riparian-Channel-Environmental Inventory (RCE).

This assessment was developed by Peterson (1992) and evaluates the condition of:

- adjacent land
- banks
- channel & bed (includes instream vegetation and algae)
- riparian vegetation

Each attribute is assigned a value of 1 to 4 depending on the state of impact. A total score is derived from the sum of the component values which indicates the degree of impairment of the stream geomorphology, riparian zone and stream habitat. A rating from very poor to excellent has been developed by Robyn Tuft & Associates for stream bank, stream bed and the total stream condition (RCE) score. The score ranges between 13 to 52, with poor sites generally scoring below 20 and very good to excellent sites above 45. Sites near or over 40 are generally in good condition.

4 RESULTS

4.1 SITE OBSERVATIONS

Blue Gum Creek at Dog Hole Road: This site was sampled upstream of the road. The stream was a 1 to 3m wide and approximately 0.3 to 1m deep channel, flowing over a cobble, gravel and clay substrate with some organic detritus and submerged logs. Water clarity was poor. The riparian vegetation consisted of Blue Gum Eucalypts with an understory of mixed natives and exotics, incuding Lantana and Cassia.

4.2 RCE RANKING

Results for the Riparian, Catchment and Environment score are given in Table 1. RCE scores reflect a slight deterioration in bank and total stream condition.

Table 1 RCE Ranking

Site	Date	Bank Condition Score	Bank Condition Rating	Bed Condition Score	Bed Condition Rating	Stream Condition (RCE)	RCE Rating
Blue Gum Ck @ Stockrington Rd	20/5/09	14	Good	11	Excellent	40	Good
	16/11/09	14	Good	6	Poor	36	Fair
	14/12/10	15	Good	5	Poor	32	Fair
	1/4/11	15	Good	5	Poor	32	Fair
	18/10/11	14	Good	6	Poor	33	Fair
Blue Gum Creek @ Dog Hole Rd	1/8/08	15	Good	8	Fair	37	Good
	20/5/09	13	Good	11	Excellent	39	Good
	16/11/09	12	Fair	7	Fair	31	Fair
	27/4/10	15	Good	12	Excellent	38	Good
	14/12/10	15	Good	11	Excellent	41	Good
	1/4/11	16	Good	7	Fair	36	Fair
	18/10/11	15	Good	8	Fair	38	Good
	12/4/12	**12**	**Fair**	**9**	**Good**	**36**	**Fair**

4.3 WATER QUALITY

The results are shown in Table 2. In water quality studies it is usual to compare parameter concentrations against guidelines values, such as the ANZECC guidelines for the Protection of Aquatic Ecosystems (ANZECC/ARMCANZ, 2000). Dissolved oxygen levels at the downstream site were within the ANZECC/ARMCANZ guideline, and increased since the last survey. Conductivity at the downstream site was elevated, and above guidelines for aquatic ecosystem protection (ANZECC/ARMCANZ, 2000). The pH measurements were not taken due to a malfunction of the probe.

Table 2 Chemical Characteristics

Site	Date	Time of Collection	Dissolved Oxygen (%)	Water Clarity	Conductivity µS/cm	pH	Total Alkalinity $CaCO_3$ mg/L
Guideline		-	85-110[1]	-	200-300[1] 1500[2]	6.5 – 8.0	
Blue Gum Ck @ Stockrington Rd	20/5/09	0915	35	Good	110	6.8	230
	16/11/09	0900	16	Poor	1540	7.5	400
	14/12/10	1000	4	Poor	614	12.1	79
	1/4/11	0945	3	Murky	473	-	75
	18/10/11	0900	92	Murky	890	7.3	240
Blue Gum Creek @ Dog Hole Ck	1/8/08	1015	61	Fair	90	7.2	190
	20/5/09	1100	33	Poor	80	7.1	180
	16/11/09	0800	12	Poor	1978	7.6	280
	27/4/10	1530	8	Good	1578	8.2	260
	14/12/10	0800	4	Good	1254	11.8	180
	1/4/11	0815	8	Murky	1221	7.2	170
	18/10/11	0800	67	Fair	1071	7.1	140
	12/4/12	**0745**	**94**	**Poor**	**1050**	-	-

1 ANZECC/ARMCANZ (2000)
2 ANZECC (1992)
3 ANZECC/ARMCANZ (2000) – Livestock watering

4.4 AQUATIC ECOLOGY

Biological characteristics are summarised in Table 4 and 5. The aquatic ecosystem consisted of a diverse assemblage of fauna but with the downstream site showing a substantial increase in taxa than was recorded in spring 2011. The SIGNAL index for the site has increased since the last survey, placing it in the mildly impaired category. No AUSRIVAS analysis was performed. Pollution sensitive Leptophlebiidae (mayfly nymphs), and Leptoceridae (caddis fly nymphs) were present at both sites.

No vertebrate fauna were observed in this survey.

Table 4: Biological Characteristics (Macroinvertebrates)

Parameter	Date	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
DIVERSITY	1/8/08	-	22
	20/5/09	29	25
	16/11/09	20	22
	27/4/10	-	11
	14/12/10	33	35
	1/4/11	24	20
	18/10/11	24	16
	12/4/12	-	**23**
SIGNAL INDEX	1/8/08		5.1
	20/5/09	5.7	5.8
	16/11/09	4.6	4.6
	27/4/10	-	3.4
	14/12/10	4.7	4.7
	1/4/11	4.7	4.4
	18/10/11	5.0	5.3
	12/4/12	-	**5.6**

Parameter	Date	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
AUSRIVAS Observed/ Expected {Band}	1/8/08 20/5/09 16/11/09 27/410 14/12/10 1/4/11 18/10/11	-- -- Outside the model 0.92 (Band A) 0.58 (Band B)	0.67(Band B) -- Outside the model 0.69 (Band B) Outside the model
PREDOMINANT TYPES	**12/4/12**	-	Chironomidae (midge larvae) Dytiscidae (water boatmen) Leptophlebiidae (mayfly nymphs) Simuliidae (black fly larvae)

Table 5: Biological Characteristics (Non Macroinvertebrates)

Biota	Parameter	Blue Gum Ck at Stockrington Rd	Blue Gum Creek at Dog Hole Rd
Vertebrates	Predominant types	-	-
Macrophytes	Coverage	-	<2%
	Predominant types	-	-
Algae	Coverage	-	<2%
	Predominant types	-	-

5 CONCLUSIONS

The stream's ecology showed some improvement since last spring. There was a mixture of pollutant tolerant and sensitive invertebrate families, and the SIGNAL scores mirrored the improvement in ecological health.

Dissolved oxygen was elevated compared to the last survey, but conductivity was above recommendations for healthy ecosystems. Historical monitoring data for Blue Gum Creek showed that conductivity, pH and suspended solids can be highly variable.

6 REFERENCES

Australian and New Zealand Environment and Conservation Council (1992) Australian Water Quality Guidelines for Fresh and Marine Waters. National Water Quality Management Strategy November 1992.

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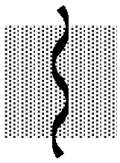
Connell D.W., (1983) Water Pollution, Causes and Effects in Australia and New Zealand, third Edition, University of Queensland Press.

Peterson R.C. Jr (1992) The RCE: a riparian, channel and environmental inventory for small streams in the agricultural landscape. Freshwater Biology 27, 295-306

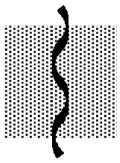
APPENDIX 1 – BIOLOGICAL DATA



ROBYN TUFT & ASSOCIATES RT301

SIGNAL INDEX SUMMARY

		SIGNAL Index
Blue Gum Creek @ Dog Hole Rd	12 Apr 2012	5.6



ROBYN TUFT & ASSOCIATES

MACROINVERTEBRATE SAMPLING RESULTS

Total Number of Taxa

Taxon ID	Number of Taxa	Abundance	Score
?	?	?	

Blue Gum Creek @ Dog Hole Rd **12 Apr 2012**

Total Number of Taxa 23

Taxon ID	Number of Taxa	Abundance	Score
Baetidae	2	1	7
Chironomidae	5	3	9
Corixidae	1	1	3
Dytiscidae	2	3	6
Gerridae	1	1	7
Hydrochidae	1	1	4
Hydropsychidae	1	2	12
Leptoceridae	1	2	14
Leptophlebiidae	2	3	30
Moinidae	1	2	0
Notonectidae	1	2	12
Parastacidae	1	1	7
Physidae	1	1	1
Polycentropodidae	1	2	18
Simuliidae	1	4	20
Veliidae	1	1	6

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