



Springvale Coal Pty Ltd

Springvale EPA Water Quality and Toxicity Assessment Interpretive Report

August 2014

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1. Introduction

1.1 Introduction

GHD understands that the NSW EPA require Centennial Coal to identify and implement a solution to manage mine water quality from Springvale Colliery. Management options include redirection of discharge water to old underground mine workings or treatment options. In order to proceed with these requirements, Centennial Coal must better understand the chemistry and toxicity of the current discharge from the licenced discharge point LDP009 and also take into account the understanding that the water quality may vary in the future with additional mining activities (this work is currently being undertaken). This report will provide information on the potential environmental impacts of the current discharge on the receiving ecosystem and determine potential chemicals of concern.

1.2 Purpose of this report

The purpose of this report is to use information provided on the chemistry of LDP009 and the ecotoxicology conducted by the NSW EPA to determine impacts on the receiving environment and, if possible, to determine the need for water treatment.

1.3 Scope and limitations

GHD completed the following Scope of Works to provide information to Centennial Coal in relation to water quality concerns from the LDP009 discharge;

- Review and interpret the toxicology results and chemistry results provided by NSW EPA to Centennial Coal.
- Determine contaminants of concern from the NSW EPA sampling using a multivariate analysis.
- Compare the results from the NSW EPA sampling with the current and historical data from the Centennial Coal – Springvale discharge point LDP009 and Cocks River.
- Include recommendations for additional investigations required to provide an accurate indication of the environmental effects from increased concentrations of the parameters of concern and/or recommendations for treatment options.

1.3.1 Limitations

This report: has been prepared by GHD for Centennial Coal Company Limited and may only be used and relied on by Centennial Coal Company Limited for the purpose agreed between GHD and the Centennial Coal Company Limited as set out in Section 1.3 of this report.

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

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Centennial Coal Company Limited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4 Assumptions

The following assumptions have been made on the results provided by the NSW EPA:

- Transport and storage has maintained the integrity of the samples and has not been compromised.
- That samples reached the laboratory and testing commenced within holding times.
- Trained samplers took the samples.
- That ecotoxicology samples remained at 4 degrees prior to testing.

2. EPA Results and Discussion

2.1 Sample locations

The NSW EPA collected water samples on the 8 May 2014 at the locations shown in Table 1 and Figure 1. A chain of custody form was provided by the NSW EPA for quality control (Appendix C). However a field data sheet was not provided.

Table 1 NSW EPA Sample Locations

Sample	Easting	Northing	Location
LDP SP1	Not provided	Not provided	Sampled at Springvale DLP009 discharge to Sawyer Swamp Creek next to SDWTS treatment ponds
LDP SP2	Not provided	Not provided	Duplicate of LDP SP1
Coxs River	229625	6310850	Road crossing Coxs River south east of Gardiners Gap
Kangaroo Creek	Not provided	Not provided	Western side of Wolgan Road at Angus Place



EPA Sample Location

EPA Sample Location

Angus Place
Pit Top

LDP009 Cocks River (Haul Road)

LDP009 Mixing Zone Sawyers Swamp (Off Wogan Rd)

LDP009

LDP009 Cocks River (Wang Bridge)

LDP009 Cocks River (Delta Site)

Springvale
Pit Top

SCALE

0 0.5 1 2 3 Km

LEGEND:

- LDP009 Water Quality Sampling Points
- EPA Water Quality Sampling Points

NOTES:

Locations of Water
Quality Sampling Points
Provided by Environment and Community
Coordinator Tony Nolan.

DRAWN:

Zac Burley

DATE:

21-07-2014

PLAN No:

SVY02405

COMPUTER PATH:

N:\Z_Plans

INFORMATION SUPPLIED BY:

Tony Nolan

SCALE:

SCALE 1:50000

A4V
Sheet
1 of 1

SPRINGVALE MINE

TITLE:

**EPA Water Sampling
Locations**



Springvale Coal

SPRINGVALE MINE
Castlereagh HWY
Lidsdale NSW 2790
PO Box 198
Wallerawang NSW 2845
Phone: 02-63501600
Fax: 02-63551052

2.2 Ecotoxicology Bioassays

The acute bioassays listed in Table 2 were conducted by the NSW EPA's Environmental Forensics Section.

Table 2 Bioassays

Species	Endpoint	NATA Accredited
Marine bacteria (<i>Vibrio fischeri</i>)	30 minute luminescence reduction – 30 minute EC50	Yes
Cladoceran (<i>Ceriodaphnia dubia</i>)	48 hour immobility – 48 hour EC50	Yes
Fish larvae (<i>Melanotaenia duboulayi</i>)	48 hour imbalance – 48 hour EC50	No

The marine bacteria is not an ecologically relevant species to be used to detect impacts in a freshwater ecosystem. However, this test is useful for comparative purposes such as determining changes in toxicity over time or changes on operational procedures such as a water treatment.

Both the cladoceran and larval rainbowfish are representative of a NSW freshwater ecosystem. The crimson spotted rainbowfish are distributed throughout northern NSW and south-east Queensland and provide a suitable surrogate species for the Coxes River. The cladoceran are commonly found in temperate freshwater systems worldwide and this is a recognised species for assessing impacts in temperate Australian freshwater ecosystems.

2.3 Concentrations Tested

Usually, receiving water is used as the bioassay diluent for all dilutions and controls to mimic site specific conditions. However, in some cases the receiving water has shown toxicity which masks the toxicity of the discharge. Therefore, the NSW EPA used laboratory water as the dilution water for the larval fish and cladoceran test as shown in Table 3 to provide information on the toxicity of the discharge without potential confounding factors. It must be noted that, in many cases, depending on the chemistry of the receiving water, i.e. high DOC and pH, toxicity can be ameliorated. The marine bacteria bioassay used recommended diluent as shown in Table 3. A laboratory control was run concurrently with all tests. All samples were serially diluted with the diluent to achieve the required test concentrations.

Table 3 Diluent types and test concentrations

Bioassay	Diluent	Concentrations	Replicates per Concentration
Marine bacteria	Microbics diluent	Control LDP SP1: 0.625 %, 1.25 %, 2.5 % 5.0 %, 10 %, 20 %, 40 % and 80 % Others: 10 %, 20 %, 40 % and 80 %	4 control 2 replicates per treatment
Cladoceran	Filtered thiosulphate-treated Sydney mains water with 5 % mineral water and conductivity adjusted to 500 μ S/cm with filtered seawater	Control: 25 %, 50 % and 100 %	4 control 2 replicates per treatment 5 animals/replicate
Larval fish	Filtered Sydney mains water with conductivity adjusted to 500 μ S/cm with filtered seawater	Control: 25 %, 50 % and 100 %	4 control 2 replicates per treatment 5 animals/replicate

2.4 Bioassay Results

All bioassays met the appropriate reference toxicant criteria and test validity criteria. Testing commenced within five days of sampling. It is assumed that the samples were maintained at <4°C until testing commenced.

Table 4 Bioassay results

Test Endpoint	LDP SP1 % (95 % CL)	LDP SP2 % (95 % CL)	Coxs River %	Kangaroo Creek %
Marine bacteria				
30 min inhibition at 80 %	24	<5	12	<5
Cladoceran				
NOEC	50	50	100	100
LOEC	100	100	100	100
EC50	71 (53-100)	79 (47-100)	-	-
Larval Fish				
NOEC	100	100	100	100
LOEC	100	100	100	100

It should be noted that the results presented in Table 4 must be treated with caution as insufficient data is available for statistical analysis as only two replicates were used for each treatment. Standard methodology (USEPA 2002) would use four replicates to improve statistical analysis. The methodology used by the NSW EPA has been compared with the US EPA methods as ANZECC (2000) does not provide information on the accepted use of screening bioassays. ANZECC recommends the use of a suite of bioassays representative of the receiving environment with a minimum of five species from four taxonomic groups for the calculation of a species sensitivity distribution (SSD) which can be used to determine safe dilution factors of the mine water for the protection of the receiving environment. This ANZECC (2000) methodology is current accepted practice for environmental protection in Australia.

2.4.1 Marine Bacteria

The results provided in Ecotox 4 Report No. 201400181 marine bacteria bioassay are reported as percent luminescence inhibition at 80 percent sample concentration. The table also reports the results as percent sample concentration. It is unclear what is being reported, therefore, the results are recorded in Table 4 as reported in the NSW EPA report with the assumption that the results show percent sample concentration.

The marine bacteria samples show that the duplicate samples LDP SP1 and LDP SP2 are different with no decrease in luminescence observed in the LDP SP2 sample. The LDP SP2 result is the same as that of the Kangaroo Creek sample where no toxicity was detected. The far upstream sample shows reduction in luminescence that is greater than the LDP SP2 sample indicating greater toxicity in the Cocks River sample. As the marine bacteria are not representative of the LDP009 receiving environment and the results are inconsistent, the marine bacteria results will not be included in discussions in this report.

2.4.2 Cladoceran

The NSW EPA reports EC50 results for the cladoceran test, however, there is insufficient data to provide the EC50 result with any confidence as shown by the large 95 percent confidence limits. Therefore, the cladoceran EC50 results will not be discussed in this report. The LDP SP1 and duplicate LDP SP2 showed similar results for the cladoceran test.

2.4.3 Larval fish

The larval fish were not adversely affected by exposure to the LDP009 discharge, the Cocks River or Kangaroo Creek waters at 100 percent concentration.

2.4.4 Discussion

There is insufficient confidence in the ecotoxicity test results due to the low number of replicates for each treatment. Further, insufficient treatments were tested to calculate the EC50 results with confidence as reported in Test Report No. 201400181. The USEPA (2002) standard methods state that the recommended toxicity test consists of a control and five or more concentrations of effluent. Therefore, the results from the cladoceran test do not meet the requirements for a standard toxicity test.

Toxicity tests can be used to determine the toxicity of the receiving water with a paired test. The results presented by the NSW EPA better fit this model of analysis, however, the US EPA recommends four replicates to be used to enable hypothesis testing. As only two replicates were used in this series of bioassays, the testing conducted by the NSW EPA does not meet the requirements for a standard receiving water bioassay and the results are of low confidence. Further, the NSW EPA do not report the results of each replicate and it is not possible to interpret the data to determine the variability between replicates. The variability between replicates is very important in the interpretation of bioassay data as inconsistent data will skew

the results. By testing only two replicates the influence of any inconsistent data cannot be determined and, if present, will unduly influence any statistical analysis.

An example, the cladoceran LDP SP2 (Sample Number 201401004) results at 100 percent concentration where the percentage of animals immobilised after 48 hour exposure was reported at 60 percent could mean that three animals were immobile in each replicate or that one replicate had five animals immobilised while the other only had one animal immobilised. This latter scenario may indicate that there was another issue present that may have adversely impacted on the replicate with 100 percent immobilisation, such as laboratory error or contamination within the treatment (unclean glassware).

Without the presence of the replicate data, it is not possible to have confidence in the results as they are presented by the NSW EPA in Report No 201400181.

Further, the NSW EPA do not supply downstream ecotoxicity data to determine any impacts the discharge may be having on the receiving ecosystem.

2.5 Chemistry

The samples taken on 8 May 2014 were tested for the analytes listed in Table 5 using a non-NATA accredited laboratory.

Table 5 Chemical analytes

	Analytes
General	pH, electrical conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS), dissolved organic carbon (DOC), hardness
Organics	TPH, BTEX, pesticides and herbicides
Metals Total and 0.45 µm filtered	Aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, molybdenum, mercury, nickel, selenium, silver, silicon, strontium, sulphur, thallium, tin, titanium, vanadium and zinc
Anions	Alkalinity (bicarbonate, carbonate, hydroxide, total), chloride, fluoride, sulfate
Cations	Sodium, calcium, potassium, magnesium, phosphorous
Nutrients	Ammonia, free reactive phosphorous, NOx, TKN, total nitrogen, total phosphorous

2.6 NSW EPA Chemistry Results

Table 6 shows the chemistry results of the samples used in the bioassays sampled on the 8 May 2014. The date the chemistry was conducted is not reported. It is assumed that the testing of all analytes took place within the required holding times.

Toxic units were calculated for analytes identified as contributing to toxicity. Toxic units were calculated by dividing the concentration of the analyte by the ANZECC (2000) 95% trigger value. The larger the TU the greater contribution to toxicity.

Table 6 NSW EPA Chemistry results

Analyte	95% Trigger Values	LDP SP1	LDP SP2	Average LPD SP1 and SP2	LDP009 TU	Coxs River	Coxs River TU	Kangaroo Creek	Kangaroo Creek TU
pH	8.0	8.0	8.0	8.0	1	6.1	<1	8.4	1.05
EC µS/cm	2,000*	1200	1100	1150	0.58	100	0.05	820	0.41
Hardness mg/L CaCO ₃	-	21	21	21		27		100	
TDS mg/L	1,340**	870	970	921	0.69	72	0.05	550	0.41
Chloride mg/L	-	5.1	5.1	5.1		6.4		8.2	
Fluoride mg/L	-	1.0	1.0	1.0		<0.3		0.6	
Sulfate mg/L	129***	30	31	30.5	0.24	21	0.16	20	0.16
Calcium mg/L	-	3.9	4.0	3.95		6.1		17	
Manganese µg/L	-	8.3	9.7	9.0		74		9.8	
Potassium mg/L	-	13	13	13		3.1		32	
Sodium mg/L	-	280	250	265		5.2		130	
Total alkalinity mg/L CaCO ₃	-	580	580	580		14		420	
Ammonia mg/L	-	0.49	0.49	0.49		<0.01		<0.01	
NOx mg/L	2.4 ^{##}	0.32	0.31	0.315	0.13	0.02	0.01	0.26	0.11
TKN mg/L	-	0.7	0.6	0.65		0.4		<0.2	
TN mg/L	-	1.0	0.9	0.95		0.4		0.4	
TP mg/L	-	0.019	0.019	0.019		<0.015		<0.015	
Dissolved Metals									
Antimony µg/L	9 [#]	0.7	0.71	0.705	0.08	<0.5	-	<0.5	-
Arsenic µg/L	13	20	19	19.5	1.5	<1.0	-	<1.0	-
Barium µg/L	-	24	25	24.5		22		110	
Cobalt µg/L	1.4 [#]	1.4	1.4	1.4	1	1.3	0.93	0.15	0.11
Copper µg/L	1.4	<0.5	0.53	0.515	0.37	0.63	0.45	0.76	0.54

Analyte	95% Trigger Values	LDP SP1	LDP SP2	Average LPD SP1 and SP2	LDP009 TU	Coxs River	Coxs River TU	Kangaroo Creek	Kangaroo Creek TU
Iron mg/L	0.3 [#]	<0.03	<0.03	<0.03	<0.1	0.58	1.93	0.05	0.17
Lead µg/L	3.4	0.34	0.43	0.385	0.11	0.13	0.03	<0.1	
Lithium mg/L	-	0.18	0.19	0.185		2.4 µg/L		0.25	
Magnesium mg/L	2.5 [^]	2.7	2.7	2.7	1.1	2.8	1.12	15	6
Molybdenum µg/L	34 [#]	37	37	37	1.1	<0.5		10	0.29
Nickel µg/L	11	3.8	3.9	3.85		0.61		2.2	
Silicon mg/L	-	3.6	3.6	3.6		4.3		3.9	
Strontium µg/L	-	17	18	17.5		26		93	
Sulfur mg/L	-	10	10	10		6.1		6.3	
Vanadium µg/L	6 [#]	<0.2	0.25	0.225	0.04	0.29	0.05	<0.2	
Zinc µg/L	8	7.2	11	9.1	1.1	3.6	0.45	5.2	0.65
Total TU					9.04		5.23		9.9

The following analytes were below detection limits and were not included in Table 6:

TSS, FRP, TPH, BTEX, herbicides and pesticides, aluminium, boron, titanium, beryllium, cadmium, chromium, mercury, selenium, silver, thallium and tin.

* The ANZECC (2000) EC 95% trigger value is based on EC naturally occurring in the waterways, it is not based on toxicity testing. Therefore, using the ANZECC (2000) TV (350 µS/cm) will result in an overestimation of toxicity i.e. indicating toxicity when there is none. Dr R. Krassoi (Ecotox Services Australia, Pers. Comm.) has indicated that Ceriodaphnia does not detect adverse impacts related to conductivity at concentrations less than 3,500 µS/cm. Kunz *et al.* (2013) states that conductivity at sites across North America above 2,000 µS/cm represents conditions that may adversely impact freshwater organisms based on ecotoxicology results. Therefore, a trigger value of 2,000 µS/cm has been used in this assessment to provide a more accurate and conservative determination of toxic impacts on receiving organisms.

** Similarly to the conductivity Kunz *et al.* (2013) states that a TDS concentration of 1340 mg/L represents conditions that may adversely impact freshwater organisms.

*** The sulfate trigger value has been calculated by Elphick *et al.* (2011) using the ANZECC (2000) SSD methodology. The trigger value for soft water has been calculated at 129 mg/L. This value has been used in this calculation.

Low reliability trigger value.

[^] Magnesium trigger value: van Dam *et al.* 2010.

Revised ANZECC guideline based on toxicity tests

2.6.1 Centennial Coal Chemistry results

Centennial Coal takes weekly samples LDP009 and associated upstream and downstream locations. Table 7 shows that LDP009 water quality sampled on the 8 May 2014 compared with the water quality of that used in the ecotox tests and long term water quality data from LDP009 to determine if the sample used in the May 2014 toxicity tests was representative of the water quality discharged from LDP009.

Table 7 Centennial Coal Chemistry results

Analyte	LDP009 5/8 May 2014	LDP009 Long Term 18 months	NSW EP 8 May 2014	ANZECC Trigger Values
pH	7.72	8.10	8.0	7.5**
EC µS/cm	1190	1025	1150	350**
Hardness mg/L CaCO ₃	9.0	-	21	-
Chloride mg/L	5.0	-	5.1	-
Fluoride mg/L	1.3	0.8	1.0	-
Sulfate mg/L	37	-	30.5	-
Calcium mg/L	2.0	-	3.95	-
Magnesium mg/L	1.0	-	2.7	-
Potassium mg/L	10	-	13	-
Sodium mg/L	222	-	265	-
Total alkalinity mg/L CaCO ₃	627	-	580	-
Ammonia mg/L	0.54	-	0.49	0.013**
NOx mg/L	0.31	-	0.315	0.015**
TKN mg/L	0.6	-	0.65	-
TN mg/L	0.9	-	0.95	0.250**
TP mg/L	0.01	-	0.019	0.020**
Dissolved Metals				
Antimony µg/L	1.0	-	0.705	-
Arsenic µg/L	17	19	19.5	13-24
Barium µg/L	24	-	24.5	-
Copper µg/L	2.0*	1.0	0.515	1.4
Iron mg/L	<0.05	0.05	<0.03	-
Lead µg/L	<1.0	-	0.385	3.4
Lithium mg/L	0.145	-	0.185	-
Manganese µg/L	8.0	-	9.0	1900
Molybdenum µg/L	35	-	37	-
Nickel µg/L	4.0	4.0	3.85	11
Strontium µg/L	18	-	17.5	-
Zinc µg/L	14	12	9.1	8.0

* Copper concentrations for May 2014 with the exception of 8 May 2014 were <1.0 µg/L.

** Note that these concentrations have not been calculated from toxicity tests and are representative of background levels.

The LDP009 sample taken by Centennial Coal on the 8 May 2014 showed similar chemistry to that of the two LDP009 samples taken by the NSW EPA (Table 7) with the exception of copper and zinc being slightly higher in the Centennial Coal sample. Results from LDP009 from the last 18 months (January 2013 to June 2014) shows that the sample taken on 8 May 2014 was representative of the long term water quality discharged from LDP009.

2.6.2 Discussion

The chemistry results for the NSW EPA sample taken on the 8 May 2014 show that the LDP009 chemistry was representative of the LDP009 quality since January 2013. Therefore, the toxicity tests would have provided a good indication of the potential toxic impacts to the receiving water. However, due to the poor quality of the bioassay results it is not possible to provide a confident interpretation of the chemistry related to the toxicity. The toxicity observed in the cladoceran bioassays cannot be attributed to a specific analyte in the LDP009 samples. The chemistry of the upstream samples, particularly Kangaroo Creek that showed no toxicity, were only slightly different from the LDP009 samples. Kangaroo Creek showed lower concentrations of hardness, calcium, potassium, barium, copper, lithium and strontium and higher concentrations of ammonia, lead, magnesium and molybdenum.

The toxic unit (TU) results at LDP009 (TU = 9.04) and Kangaroo Creek (TU = 9.9) show similar total toxicity units, however, no toxicity was observed in Kangaroo Creek even though magnesium was present at 6 TUs. The toxicity units show that no one chemical was present in sufficient concentrations to determine the contributors to the slight toxicity observed in the cladoceran bioassay at LDP009.

2.7 Multivariate Analysis

A principal component analysis (PCA) multivariate analysis was conducted on the chemistry data from the EPA samples. The results are shown in Figure 2. The PCA multivariate analysis indicates the main parameters at LDP009 that are most different to Kangaroo Creek and Cox's River:

- Nickel, molybdenum, lead, arsenic, zinc, antimony, ammonia/NO_x, fluoride, EC/TDS (all higher concentrations at LDP009, although not sufficient to cause toxicity as evidenced by the toxicity results).
- At the same time, LDP009 also has the lowest calcium, magnesium and hardness. All of these analytes have the potential to ameliorate toxicity at higher concentrations.

These results indicate that no potential chemicals of concern can be identified in the LDP009 discharge.

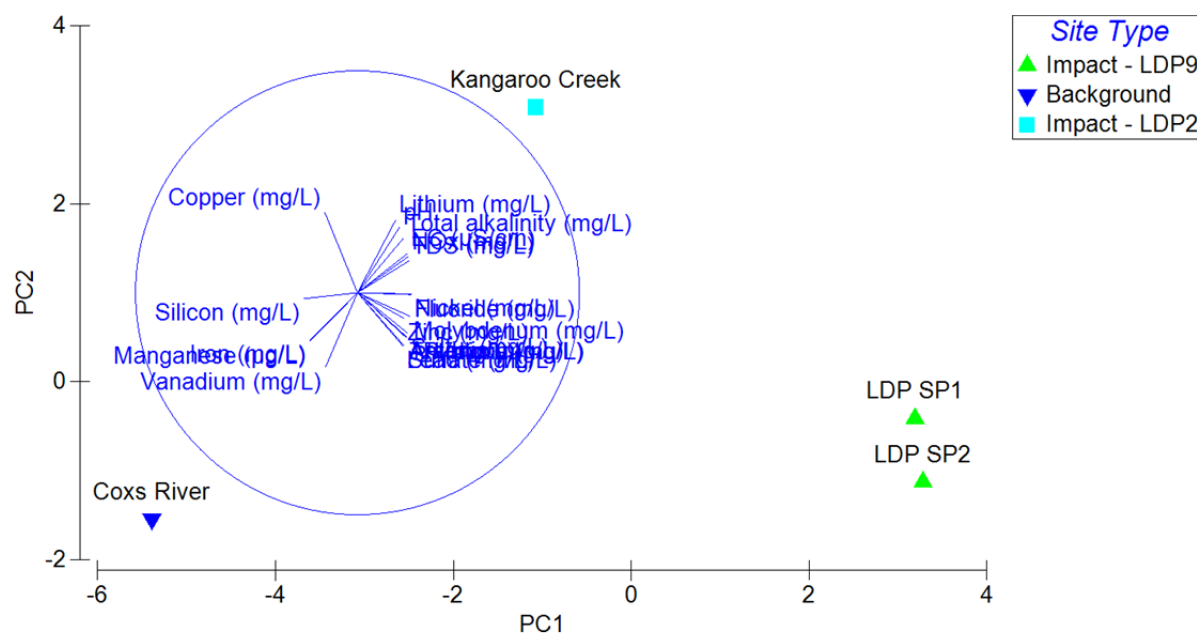


Figure 2 Multivariate Results

2.8 Macroinvertebrate Study Results

The 2013 Spring Aquatic Ecology Monitoring Report (MPR 2014) was reviewed to obtain an understanding of the long term health of the receiving environment (Sawyers Swamp and Coxs River) from exposure to LDP009 discharge. The report concluded that the relative abundance of most of the macrophyte taxa throughout the study area sites were unchanged for this survey.

The MPR (2014) report did not provide interpretation of the macroinvertebrate data that could be used to determine the impacts of the LDP009 discharge. Insufficient information was provided for this sampling period for interpretation and no historical data was provided to enable long term trends to be derived.

Unfortunately the MPR (2014) report is not written in a way that can be used to provide supporting documentation that LDP009 is/is not having an adverse impact on the receiving environment. The data needs to be analysed and interpreted at the individual site level to ascertain differences between upstream and downstream sites. Comparison between upstream and downstream sites is imperative in order to determine the impact of LDP009. The MPR (2014) report only reports site averages from each waterway which cannot be used to determine upstream and downstream impact.

3. Conclusions

The quality of the cladoceran ecotox bioassay results do not follow standard methodology (USEPA 2002) and the results cannot be relied upon, therefore the determination of chemicals of concern potentially causing the observed toxicity cannot be determined. The water quality results show that there are no analytes present in concentrations high enough to cause toxicity. This is supported by the calculation of toxic units for each potential chemical of concern. As the cause of this potential toxicity is unable to be identified, it is not possible to recommend treatment of the discharge water at this time. Further, as the toxicity is marginal in the 100 percent LDP009 sample, a toxicity identification evaluation (TIE) would not be possible to identify the cause of the observed toxicity.

Even though the quality of the cladoceran ecotox results is poor, there is an indication of a slight acute toxicity at the end of pipe (LDP009 discharge). Further investigations are required to determine the toxicity of the discharge at the end of the mixing zone in the Cocks River. If the water quality at this point shows no chronic toxicity, then treatment of the LDP009 discharge water for environmental protection may not be required.

However, the NSW EPA has stated (Letter from Gary Whytcross (EPA) to Mick Cairney (Centennial Coal) not dated) that it will apply a discharge limit to conductivity of 350 $\mu\text{S}/\text{cm}$. This conductivity level is to enable the NSW EPA to improve the water quality in the upper Cocks River. It is important to note that currently the conductivity of the discharge has no adverse impact on aquatic ecosystems downstream of LDP009 and does not contribute to the observed toxicity in the cladoceran bioassay. Further the conductivity of the upstream Kangaroo Creek site was measured at 820 $\mu\text{S}/\text{cm}$, which will influence conductivity within the catchment, indicating that 350 $\mu\text{S}/\text{cm}$ may not be an appropriate guideline. This requires additional investigation.

4. Recommendations

4.1 Assessment of Environmental Impacts

To obtain more confidence that the LDP009 discharge is not having an adverse impacts on the receiving water in Cocks River it is recommended that a freshwater ecologist review and interpret the raw data used in the MPR reports (2010 to 2014).

4.2 Chronic Toxicity of LDP009

To meet the requirements of the NSW EPA as listed in the Notice of Licence Variation date 31 July 2014, Centennial Coal should conduct a full suite of chronic bioassays conducted on a sample from LDP009 to obtain EC10 concentrations to calculate a species sensitivity distribution for a dilution factor that can be incorporated into an environmental management plan.

As discussed previously, there is insufficient toxicity in the sample to allow a TIE to be conducted.

5. References

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Appendices

Appendix A – Ecotoxicity Results

Report on the Acute Toxicity of Samples from Cox River Coal Mine to Larvae of the Rainbowfish, *Melanotaenia duboulayi* (Castelnau, 1878)

Office of Environment and Heritage

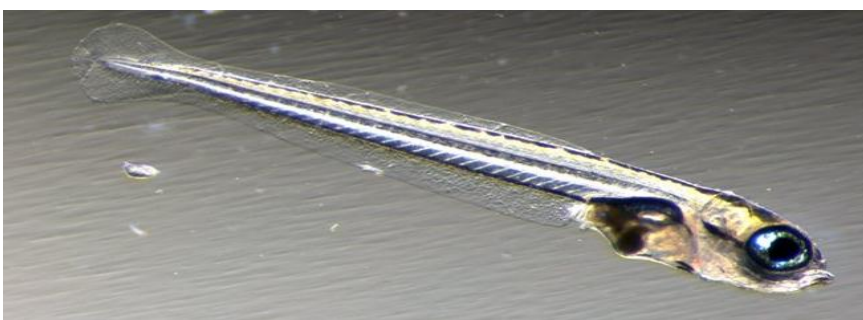
Ecotoxicology Team, Environmental Forensics, Environment Protection Science

480 Weeroona Road, Lidcombe NSW 2141

Date of Issue of Report: **12 June 2014**

Test Outline

The test was conducted to assess the potentially harmful effects of the samples to larvae of the native freshwater fish species *Melanotaenia duboulayi*. In this test the loss of balance (imbalance) is used as the endpoint as



opposed to mortality, i.e. where possible, fish are removed from the test solution once they lose the ability to remain normally positioned.

Following exposure for 48 hours to various concentrations of the samples, the number of *M. duboulayi* affected was counted. This data is statistically analysed to determine sample concentrations causing a significant adverse effect to *M. duboulayi* relative to a control group

If more than 50% of exposed animals are imbalanced in any of the tested sample concentrations, a 48-hour EC50 (imbalance) value is calculated, which is the Effective Concentration of the sample which causes imbalance in 50% of exposed *M. duboulayi*.

The lower the concentration causing a significant adverse effect, or the lower the EC50 value, the greater the observed toxicity.

Results Summary

Samples 201401003, 201401004, 2014001005 and 201401006 had no observable acute effect on *M. duboulayi*, in that no immobilisation occurred in any in *M. duboulayi* exposed to the undiluted samples.

Sample Information

EF Submission Number	EF Sample Number
201400181	201401003
	201401004
	201401005
	201401006

Laboratory Accreditation does not extend to sample collection

Test Methods and Conditions

Test Commencement Date: **12 May 2014**

Test Method Protocol No **ECOTOX 3**. The test method is based on procedures published by the USEPA (2002), Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 5th Edition. EPA-821-R-02-012. It differs from this guideline in that Australian fish species are used, and animals are cultured and bred in the OEH laboratory. The current animal research authority is (OEH AEC approval number 110620/02)

Deviations from Protocol: **Two replicates per sample treatment**

Test Type: Fish, **Acute, Static** Duration of test: **48** hours

Test Species: *Melanotaenia duboulayi* Age: **2 weeks**

Source: **Tank B 3**

Test Location: **Room No. F 27**

Test Room No.: **F. 29**

Test Vessel Type : **100 mL beaker**

Test Volume: **50 mL**

Test Temperature: **25 °C**

Test Photoperiod: **16 h L: 8 h D**

Light intensity at surface of Test Vessels: **<800 Lux**

Dilution Water Source: **Filtered Sydney mains water with conductivity adjusted to 500 µS/cm with filtered seawater.**

Conductivity: **513 µS/cm**

pH: **7.9**

Hardness: **75 mg/L as CaCO₃**

Alkalinity: **38 mg/L as CaCO₃**

Test Design

Concentrations tested: **25, 50 and 100%**

Test Concentrations: **Nominal**

Number of replicate test vessels per concentration and control/s: **Two for sample treatments,
Four for Control**

Number of animals per replicate: **5**

Statistical Method

Statistical Analysis Method: **Trimmed Spearman-Kärber for EC50 for reference toxicant**

Results

Table 1. Imbalance of *Melanotaenia duboulayi* in test solutions

EF Sample Number	Nominal Test Concentration (% sample)	Percentage of animals imbalanced after 24 hours exposure	Percentage of animals imbalanced after 48 hours exposure
Control	Diluent	0	0
201401003	25	0	0
	50	0	0
	100	0	0
201401004	25	0	0
	50	0	0
	100	0	0
201401005	25	0	0
	50	0	0
	100	0	0
20140101006	25	0	0
	50	0	0
	100	0	0

A test validity criterion of Control group survival (greater than 90%) was met.

Table 2. Physico-chemical Variables in Test Solutions

Test Conc.	Temperature (°C)		pH		Conductivity (µS/cm)		Dissolved Oxygen (% saturation)	
	0 hr	48 hr	0 hr	48 hr	0 hr	48 hr	0 hr	48 hr
Control								
Diluent	24.0	24.7	7.9	7.8	513	525	97	95
Sample 201401003								
25	25.7	24.7	7.8	8.8	707	808	103	98
50	25.2	24.8	8.2	8.9	821	844	107	97
100	25.1	24.8	8.5	9.1	1166	1190	116	98
Sample 201401004								
25	25.9	24.7	8.3	8.5	650	662	108	100
50	25.1	24.8	8.3	8.8	823	835	117	99
100	25.3	24.8	8.5	9.1	1156	1276	106	98
Sample 201401005								
25	25.2	24.7	8.0	7.9	420	442	100	95
50	25.7	24.8	8.0	8.0	305	317	100	96
100	26.0	24.8	7.9	8.0	118	137	105	99
Sample 201401006								
25	25.7	24.7	7.7	8.4	577	573	101	96
50	25.8	24.8	8.0	8.6	674	673	98	94
100	25.7	24.7	8.0	8.9	823	819	102	98

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M Julli

Team Leader Ecotoxicology

12 June 2014

Report on the Acute Toxicity of Samples from Cox River Coal Mine to the Cladoceran, *Ceriodaphnia dubia* Richard 1894

Office of Environment and Heritage
Ecotoxicology Team, Environmental Forensics, Environment Protection Science
480 Weeroona Road, Lidcombe NSW 2141

Date of Issue of Report: **12 June 2014**

Test Outline

The test was conducted to assess the potentially harmful effects of the samples to juveniles of the freshwater crustacean zooplankton species *Ceriodaphnia dubia*.

Following exposure for 48 hours to various concentrations of the samples, the number of *C. dubia* immobilised was counted. In this test immobilisation is considered similar to lethality.

Immobilisation data is statistically analysed to determine sample concentrations causing a significant adverse effect to *C. dubia* relative to a control group of animals.

If more than 50% of exposed animals are immobilised in any of the tested sample concentrations, a 48-hour EC50 (immobilisation) value is calculated, which is the Effective Concentration of the sample which causes immobilisation in 50% of exposed *C. dubia*.

The lower the concentration causing a significant adverse effect, or the lower the EC50 value, the greater the observed toxicity.



Results Summary

Sample 201401003 caused significant immobilisation in exposed *C. dubia* at a concentration of **100%**. The sample would need to be diluted approximately 2 times to avoid these acute toxic effects on *C. dubia* (based on the tested concentrations). The 48-hour EC50 (immobilisation) concentration was calculated to be **71%** sample.

Sample 201401004 caused significant immobilisation in exposed *C. dubia* at a concentration of **100%**. The sample would need to be diluted approximately 2 times to avoid these acute toxic effects on *C. dubia* (based on the tested concentrations). The 48-hour EC50 (immobilisation) concentration was calculated to be **79%** sample.

Samples 201401005 and 201401006 had no observable acute effect on *C. dubia*, in that no immobilisation occurred in any *C. dubia* exposed to the undiluted samples.

Sample Information

EF Submission Number	EF Sample Number
201400181	201401003
	201401004
	201401005
	201401006

Laboratory Accreditation does not extend to sample collection

Test Methods and Conditions

Test Commencement Date: **13 May 2014**

Test Method Protocol No.: Test Method Protocol No.: **ECOTOX 1**. The test method is based on procedures published by the USEPA (2002), Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 5th Edition. EPA-821-R-02-012. It differs from this guideline in that an Australian cladoceran species is used.

Deviations from Protocol: **Two replicates per treatment**

Test Type: **Cladoceran, Acute, Static**

Duration of test: **48 Hours**

Test Species: ***Ceriodaphnia dubia*** Age: **<24 hours**

Source: **In-house Culture**

Location: **Room No F.27**

Constant Temperature Room No.: **F29**

Test Vessel Type : **100 mL beaker**

Test Volume: **50 mL**

Test Temperature: **25 °C**

Test Photoperiod: **16 h L: 8 h D**

Light intensity at surface of Test Vessels: **<800 Lux**

Dilution Water Source: **Filtered thiosulphate-treated Sydney mains water with 5% mineral water and conductivity adjusted to 500µS/cm with filtered seawater**

Conductivity: **509 µS/cm**

pH: **8.1**

Hardness: **87 mg/L as CaCO₃**

Alkalinity: **48 mg/L as CaCO₃**

Test Design

Concentrations tested: **25, 50 and 100%**

Test Concentrations: **Nominal**

Number of replicate test vessels per concentration and control: **2 per treatment, 4 per control**

Number of animals per replicate: **5**

Statistical Methods

Data Transformation for Lowest Observed Effect Concentration (LOEC): **Angular Uncorrected**

Statistical Analysis Method: **Probit or Spearman-Kärber for EC50**

Fisher Exact/Bonferroni-Hommel Test for LOEC

Results

Table 1. Immobilisation of *Ceriodaphnia dubia* in test solutions

EF Sample Number	Nominal Test Concentration (% sample)	Percentage of animals immobilised after 24 hours exposure	Percentage of animals immobilised after 48 hours exposure	Percent Minimum Significant Difference # (PMSD)
Control		0	0	
201401003	25	0	0	NC
	50	0	20	
	100	0	80*	
201401004	25	0	20	NC
	50	0	30	
	100	0	60*	
201401005	25	0	0	NC
	50	0	0	
	100	0	0	
201401006	25	0	0	NC
	50	0	0	
	100	0	0	

*Significantly different from the control ($p \leq 0.05$). 48-h data only analysed.

NC = Not calculable due to statistical test required for analysis

PMSD is an estimation of the smallest percentage increase in immobilisation (relative to the control), that could be determined as statistically significant for this test.

A test validity criterion of Control group survival (greater than 90%) was met.

Sample 201401003

The Lowest Observed effect concentration (LOEC) of sample 201401003 was 100 % solution.

The No Observed Effect Concentration (NOEC) was 50 % solution.

48-Hour EC50 (Immobilisation) for sample 201401003 was 71 % (95% CL= 53-100%).

Sample 201401004

The Lowest Observed effect concentration (LOEC) of sample 201401004 was 100 % solution.

The No Observed Effect Concentration (NOEC) was 50 % solution.

48-Hour EC50 (Immobilisation) for sample 201401004 was 79 % (95% CL 47-100 %).

Table 2. Physico-chemical Variables in Test Solutions

Laboratory Accreditation does not extend to measurements of pH, conductivity or dissolved oxygen.

Test Conc.	Temperature (°C)		pH		Conductivity (µS/cm)		Dissolved Oxygen (% saturation)	
	0 hr	48 hr	0 hr	48 hr	0 hr	48 hr	0 hr	48 hr
Control								
Diluent	24.6	24.6	8.1	8.2	509	547	96	90
Sample 201401003								
25	24.3	24.7	8.2	8.6	658	656	88	87
50	24.4	24.8	8.4	8.9	823	814	93	89
100	24.7	24.6	8.5	9.1	1137	1155	97	89
Sample 201401004								
25	24.4	24.7	8.4	8.7	665	681	88	87
50	24.4	24.7	8.4	8.9	834	825	85	87
100	24.7	24.6	8.5	9.1	1145	1155	98	86
Sample 201401005								
25	24.6	24.7	8.1	8.1	408	430	91	87
50	25.0	24.7	8.1	8.1	322	381	90	86
100	25.0	24.6	8.1	8.0	119	142	98	86
Sample 201401006								
25	24.7	24.7	8.1	8.2	580	590	82	88
50	24.7	24.7	8.4	8.7	667	669	91	88
100	24.8	24.6	8.6	8.9	830	825	94	88

Reference toxicant test No. 318

A reference toxicity test using Cr (VI) run in parallel with the above test resulted in 48-h EC50 (immobilisation) value of **220 µg/L** (190 µg/L lower and 260 µg/L upper 95% CL). This value is within the 95% confidence limits of previous reference toxicity test results conducted at this laboratory, and indicates that the test animals used in the current tests were of typical sensitivity. The current percentage coefficient of variation of the reference toxicity data is **3.1%**

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M Julli**Team Leader Ecotoxicology****12 June 2014**

Accreditation No. 3040

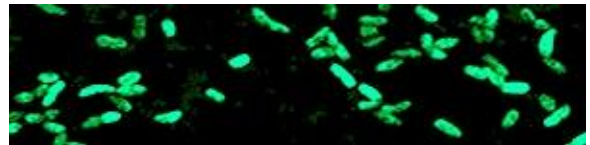
Report on the acute toxicity of samples from Cox River Coal Mine to *Vibrio fischeri* (Microtox®)

Office of Environment and Heritage
Ecotoxicology Team, Environmental Forensics, Environment Protection Science
480 Weeroona Road, Lidcombe NSW 2141

Date of Issue of Report: **12 June 2014**

Test Outline

The Microtox® test was conducted to assess the potential harmful effects of the samples to the photoluminescent marine bacterium (*Vibrio fischeri*). Freshwater samples are salinity adjusted prior to testing.



Following exposure of up to 30 minutes to various concentrations of the sample/s, the light emitted by the bacteria is measured. Significant reduction in light output is considered to indicate an adverse effect on the bacteria.

If light output is reduced by more than 50% in any of the tested samples concentrations, an EC50 (luminescence inhibition) value is calculated which is the Effective Concentration of the sample which causes a 50% reduction in luminescence. The time period quoted with the EC50 indicates the exposure period of the bacteria to the sample.

The lower the EC50 value, the greater the observed toxicity, and the greater the amount of dilution required to eliminate the observed toxicity.

Results Summary

Sample 201401103 caused some reduction in luminescence in the exposed bacteria at the highest tested concentration, but this effect was limited to a **24%** reduction in light output at **80%** sample concentration after 30-minute exposure.

Sample 201401004 had minimal effect on bacterial luminescence, that is, it did not cause a detectable adverse response in exposed bacteria

Sample 201401005 caused some reduction in luminescence in the exposed bacteria at the highest tested concentration, but this effect was limited to a **15%** reduction in light output at **80%** sample concentration after 5-minute exposure.

Sample 201401006 had minimal effect on bacterial luminescence, that is, it did not cause a detectable adverse response in exposed bacteria

Sample Information

EF Submission Number	EF Sample Number
201400181	201401003
	201401004
	201401005
	201401006

Laboratory Accreditation does not extend to sample collection

Test Methods and Conditions

Test Commencement Date: **12 May 2014**

Test Method Protocol No.: **ECOTOX4** - The test procedure is based on the recommended tests described in the Microbics manual (1995) 'Microtox® Acute Toxicity Basic Test Procedures'. The test conducted here has been modified in the aspects of: increased upper limit of sample concentration, maximized volume of test solutions used, and additional dilution of reconstituted bacteria to increase the accuracy & precision of bacterial transfer. These modifications result in greater accuracy and precision of the calculated EC50 values.

Test Type: **Microtox® Acute, Basic**

Readings taken: **5, 15, 30 Minutes**

Test Species: ***Vibrio fischeri***

Test Vessel Type : **4 mL test tubes**

Test Volume: **1.0 mL**

Test Temperature: **15.0°C**

Dilution Water: **Microbics diluent**

Salinity: **20‰**

Sample Treatment

Salinity adjustment: **Samples were adjusted to salinity of the diluent using solid NaCl.**

Filtration: **Not filtered**

Colour correction required: **No**

Test Design

Concentrations tested: **Sample 201401003 – 0.625, 1.25, 2.5, 5.0, 10, 20, 40 and 80%;**

Samples 201401004, 201401005 and 201401006 – 10, 20, 40 and 80%

Test Concentrations: **Nominal**

Number of replicate test vessels per concentration and control/s: **2 for samples;**

4 for controls

Volume of stock organism per test solution: **0.2 mL (containing approx. 1×10^6 cells)**

Results

Laboratory Accreditation does not extend to measurements of pH, conductivity or dissolved oxygen.

EF Sample No.	pH	Conductivity $\mu\text{S}/\text{cm}\#$	Dissolved oxygen (mg/L)	% luminescence inhibition at highest Test Concentration of 80%		
				5-min	15-min	30-min
				% sample concentration		
201401003	8.3	1055	7.74	12	16	24
201401004	8.3	1112	7.75	<5	<5	<5
201401005	7.2	102	7.75	15	13	12
201401006	8.2	773	7.75	<5	<5	<5

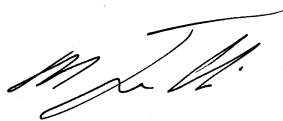
conductivity of sample prior to salinity adjustment

Reference Toxicant Test No. 239

A reference toxicant (Phenol) test conducted with the same batch of organisms used for the tests gave 5min-EC50 value of 21 mg/L (20 mg/L lower and 23 mg/L upper 95% CL). This value is within the 95% confidence limits of previous reference toxicity test results conducted at this laboratory, indicating that the organisms used in the current test were of typical sensitivity. The percent coefficient of variation (% CV) for the previous twenty reference toxicant tests was 5.6%.

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M Julli

Team Leader Ecotoxicology

12 June 2014

Appendix B – Chemistry Results



Environmental Forensics

Report of Analysis

Report 201400181

25 June 2014

Sample source: **Cox River Coal Mine**

Submitted by: **Martin Krogh**
Office of Environment and Heritage
PO Box A290
South Sydney NSW 1232

Date received: **8-May-2014**

Environmental Forensics

Report of Analysis

Report number: 201400181
Report date: 25-Jun-2014
Date received: 08-May-2014 16:00
Sample source: Cox River Coal Mine

Sample details

Lab number	Client reference	Sample type	Date sampled	Sample description
201401003	LDP SP1	LIQUID	08-May-2014 11:02	
201401004	LDP SP2	LIQUID	08-May-2014 11:07	
201401005	Coxs River	LIQUID	08-May-2014 13:25	
201401006	Kangaroo Ck	LIQUID	08-May-2014 13:15	

Report comments: Please see the attached Ecotox reports report no: 201400181 (Ecotox 1, Ecotox 3, Ecotox 4) dated 12 June 2014.

Organics by GC-MS

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	OMSTPH	OMSTPH	OMSTPH	OMSTPH

C10 - C14	<0.5 mg/L	<0.5 mg/L	<0.5 mg/L	<0.5 mg/L
C15 - C28	<1.5 mg/L	<1.5 mg/L	<1.5 mg/L	<1.5 mg/L
C29 - C36	<20 mg/L	<20 mg/L	<20 mg/L	<20 mg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	19/05/2014	19/05/2014	19/05/2014	19/05/2014
Method used	OMSVOC	OMSVOC	OMSVOC	OMSVOC

(p+m) Xylene	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L
Benzene	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L
C6 - C9	<1 mg/L	<1 mg/L	<1 mg/L	<1 mg/L
Ethylbenzene	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L
o-Xylene	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L
Toluene	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	OMSWASTE	OMSWASTE	OMSWASTE	OMSWASTE

1,2,4,5-Tetrachlorobenzene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
1,2,4-Trichlorobenzene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
1,2-Dichlorobenzene	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
1,4-Dichlorobenzene	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
2,3,4,6-Tetrachlorophenol	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
2,4,5-Trichlorophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2,4,6-Trichlorophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2,4-Dichlorophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2,4-Dimethylphenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2,4-Dinitrophenol	<0.2 mg/L	<0.2 mg/L	<0.2 mg/L	<0.2 mg/L
2,4-Dinitrotoluene	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
2,6-Dichlorophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2-Chlorophenol	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
2-Methyl-4,6-dinitrophenol	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L
2-Methylphenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
2-Nitrophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
3+4-Methylphenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
4-Chloro-3-methylphenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
4-Nitrophenol	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L	<0.03 mg/L
Acenaphthene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Acenaphthylene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Aldrin	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
alpha-BHC	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
alpha-Chlordane	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Anthracene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Aroclor 1016 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Aroclor 1221 (Screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Aroclor 1232 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L

Codes: NR = Not Required
SN = Sample Note

IS = Insufficient Sample
RN = Result Note

E = Estimated Result
RC = Report Comment

	201401003 LDP SP1 LIQUID 13/05/2014 OMSWASTE	201401004 LDP SP2 LIQUID 13/05/2014 OMSWASTE	201401005 Coxs River LIQUID 13/05/2014 OMSWASTE	201401006 Kangaroo Ck LIQUID 13/05/2014 OMSWASTE
Aroclor 1242 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Aroclor 1248 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Aroclor 1254 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Aroclor 1260 (screen)	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L
Benzo (a) anthracene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Benzo (a) pyrene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Benzo (b) fluoranthene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Benzo (ghi) perylene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Benzo (k) fluoranthene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
beta-BHC	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Bis-2-ethyl hexyl adipate	<0.12 mg/L	<0.12 mg/L	<0.12 mg/L	<0.12 mg/L
Bis-2-ethyl hexyl phthalate	<0.060 mg/L	<0.060 mg/L	<0.060 mg/L	<0.060 mg/L
Chlorpyrifos	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Chrysene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
delta-BHC	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Dibenzo (ah) anthracene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Dibutyl phthalate	<0.020 mg/L	<0.020 mg/L	<0.020 mg/L	<0.020 mg/L
Dieldrin	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
Endosulfan I	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Endosulfan II	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Endosulfan sulfate	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Endrin	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Endrin aldehyde	<0.035 mg/L	<0.035 mg/L	<0.035 mg/L	<0.035 mg/L
Endrin ketone	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Fluoranthene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Fluorene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
gamma-BHC	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
gamma-Chlordane	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Heptachlor	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Heptachlor epoxide	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Hexachlorobenzene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Indeno (123cd) pyrene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Isodrin	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Methoxychlor	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
Naphthalene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Nitrobenzene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Pentachlorobenzene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Pentachloronitrobenzene	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Pentachlorophenol	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Perylene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Phenanthrene	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Phenol	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
pp'-DDD	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
pp'-DDE	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
pp'-DDT	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
Pyrene	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L

Metals by ICP-AES

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	30/05/2014	30/05/2014	30/05/2014	30/05/2014
Method used	ICPAES	ICPAES	ICPAES	ICPAES
Aluminium (acid extractable)	0.05 mg/L	<0.04 mg/L	0.07 mg/L	<0.04 mg/L
Barium (acid extractable)				0.13 mg/L
Boron (acid extractable)	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Calcium (acid extractable)	4.5 mg/L	4.4 mg/L	6.7 mg/L	21 mg/L
Iron (acid extractable)	0.12 mg/L	0.1 mg/L	0.82 mg/L	0.16 mg/L
Lithium (acid extractable)	0.22 mg/L	0.2 mg/L		0.26 mg/L
Magnesium (acid extractable)	3.3 mg/L	3.1 mg/L	3.2 mg/L	19 mg/L
Phosphorus (acid extractable)	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L
Potassium (acid extractable)	16 mg/L	14 mg/L	3.4 mg/L	34 mg/L
Silicon (acid extractable)	4.4 mg/L	4.1 mg/L	4.7 mg/L	4.4 mg/L
Sodium (acid extractable)	300 mg/L	300 mg/L	5.4 mg/L	150 mg/L
Strontium (acid extractable)				0.1 mg/L
Sulfur (acid extractable)	14 mg/L	13 mg/L	6.8 mg/L	7.4 mg/L
Titanium (acid extractable)	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	30/05/2014	30/05/2014	30/05/2014	30/05/2014
Method used	ICPAES	ICPAES	ICPAES	ICPAES
Aluminium (Lab. filtered)	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L
Barium (Lab. filtered)				0.11 mg/L
Boron (Lab. filtered)	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Calcium (Lab. filtered)	3.9 mg/L	4.0 mg/L	6.1 mg/L	17 mg/L
Iron (Lab. filtered)	<0.03 mg/L	<0.03 mg/L	0.58 mg/L	0.05 mg/L
Lithium (Lab. filtered)	0.18 mg/L	0.19 mg/L		0.25 mg/L
Magnesium (Lab. filtered)	2.7 mg/L	2.7 mg/L	2.8 mg/L	15 mg/L
Phosphorus (Lab. filtered)	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L
Potassium (Lab. filtered)	13 mg/L	13 mg/L	3.1 mg/L	32 mg/L
Silicon (Lab. filtered)	3.6 mg/L	3.6 mg/L	4.3 mg/L	3.9 mg/L
Sodium (Lab. filtered)	280 mg/L	250 mg/L	5.2 mg/L	130 mg/L
Sulfur (Lab. filtered)	10 mg/L	10 mg/L	6.1 mg/L	6.3 mg/L
Titanium (Lab. filtered)	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L

Metals by ICP-MS

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	21/05/2014	21/05/2014	21/05/2014	21/05/2014
Method used	ICPMS	ICPMS	ICPMS	ICPMS
Antimony (acid extractable)	0.77 µg/L	0.78 µg/L	<0.5 µg/L	<0.5 µg/L
Arsenic (acid extractable)	21 µg/L	24 µg/L	<1.0 µg/L	<1.0 µg/L
Barium (acid extractable)	26 µg/L	27 µg/L	23 µg/L	
Beryllium (acid extractable)	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L
Cadmium (acid extractable)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Chromium (acid extractable)	<1.0 µg/L	<1.0 µg/L	<1.0 µg/L	<1.0 µg/L
Cobalt (acid extractable)	1.7 µg/L	1.6 µg/L	1.3 µg/L	0.17 µg/L
Copper (acid extractable)	<0.5 µg/L	0.51 µg/L	0.59 µg/L	<0.5 µg/L
Lead (acid extractable)	0.56 µg/L	0.55 µg/L	0.1 µg/L	<0.1 µg/L
Lithium (acid extractable)			2.5 µg/L	
Manganese (acid extractable)	10 µg/L	9.6 µg/L	76 µg/L	12 µg/L
Molybdenum (acid extractable)	36 µg/L	36 µg/L	<0.5 µg/L	10 µg/L
Nickel (acid extractable)	4.1 µg/L	4.3 µg/L	0.61 µg/L	1.9 µg/L
Selenium (acid extractable)	<2.0 µg/L	<2.0 µg/L	<2.0 µg/L	<2.0 µg/L
Silver (acid extractable)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Strontium (acid extractable)	17 µg/L	17 µg/L	25 µg/L	94 µg/L
Thallium (acid extractable)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Tin (acid extractable)	<0.2 µg/L	<0.2 µg/L	<0.2 µg/L	<0.2 µg/L
Vanadium (acid extractable)	0.34 µg/L	<0.2 µg/L	0.57 µg/L	0.68 µg/L
Zinc (acid extractable)	10 µg/L	11 µg/L	4.2 µg/L	29 µg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	21/05/2014	21/05/2014	21/05/2014	21/05/2014
Method used	ICPMS	ICPMS	ICPMS	ICPMS
Antimony (lab. filtered)	0.7 µg/L	0.71 µg/L	<0.5 µg/L	<0.5 µg/L
Arsenic (lab. filtered)	20 µg/L	19 µg/L	<1.0 µg/L	<1.0 µg/L
Barium (lab. filtered)	24 µg/L	25 µg/L	22 µg/L	
Beryllium (lab. filtered)	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L
Cadmium (lab. filtered)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Chromium (lab. filtered)	<1.0 µg/L	<1.0 µg/L	<1.0 µg/L	<1.0 µg/L
Cobalt (lab. filtered)	1.4 µg/L	1.4 µg/L	1.3 µg/L	0.15 µg/L
Copper (lab. filtered)	<0.5 µg/L	0.53 µg/L	0.63 µg/L	0.76 µg/L
Lead (lab. filtered)	0.34 µg/L	0.43 µg/L	0.13 µg/L	<0.1 µg/L
Lithium (lab. filtered)			2.4 µg/L	
Manganese (lab. filtered)	8.3 µg/L	9.7 µg/L	74 µg/L	9.8 µg/L
Molybdenum (lab. filtered)	37 µg/L	37 µg/L	<0.5 µg/L	10 µg/L
Nickel (lab. filtered)	3.8 µg/L	3.9 µg/L	0.61 µg/L	2.2 µg/L
Selenium (lab. filtered)	<2.0 µg/L	<2.0 µg/L	<2.0 µg/L	<2.0 µg/L
Silver (lab. filtered)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Strontium (lab. filtered)	17 µg/L	18 µg/L	26 µg/L	93 µg/L
Thallium (lab. filtered)	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L	<0.1 µg/L
Tin (lab. filtered)	<0.2 µg/L	<0.2 µg/L	<0.2 µg/L	<0.2 µg/L
Vanadium (lab. filtered)	<0.2 µg/L	0.25 µg/L	0.29 µg/L	<0.2 µg/L
Zinc (lab. filtered)	7.2 µg/L	11 µg/L	3.6 µg/L	5.2 µg/L

Metals by FIMS

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	19/05/2014	19/05/2014	19/05/2014	19/05/2014
Method used	ICVAASW	ICVAASW	ICVAASW	ICVAASW
Mercury (dissolved)	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	19/05/2014	19/05/2014	19/05/2014	19/05/2014
Method used	ICVAASW	ICVAASW	ICVAASW	ICVAASW
Mercury	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L	<0.05 µg/L

Inorganics

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	30/05/2014	30/05/2014	30/05/2014	30/05/2014
Method used	CALCULATION	CALCULATION	CALCULATION	CALCULATION

Hardness	21 mg/L CaCO ₃	21 mg/L CaCO ₃	27 mg/L CaCO ₃	100 mg/L CaCO ₃
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	IGR_TDS	IGR_TDS	IGR_TDS	IGR_TDS

Total Dissolved Solids	870 mg/L	970 mg/L	72 mg/L	550 mg/L
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	IGRTSS	IGRTSS	IGRTSS	IGRTSS

Total Suspended Solids	<15 mg/L	<15 mg/L	<15 mg/L	<15 mg/L
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	HCAO1	HCAO1	HCAO1	HCAO1

Chloride	5.1 mg/L	5.1 mg/L	6.4 mg/L	8.2 mg/L
Fluoride	1.0 mg/L	1.0 mg/L	<0.3 mg/L	0.6 mg/L
Sulfate	30 mg/L	31 mg/L	21 mg/L	20 mg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	9/05/2014	9/05/2014	9/05/2014	9/05/2014
Method used	HSECON	HSECON	HSECON	HSECON

Conductivity	1200 µS/cm	1100 µS/cm	100 µS/cm	820 µS/cm
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	8/05/2014	8/05/2014	8/05/2014	8/05/2014
Method used	IISEPH	IISEPH	IISEPH	IISEPH
pH	8.0 pH units	8.0 pH units	6.1 pH units	8.4 pH units
Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	ITIALKA	ITIALKA	ITIALKA	ITIALKA
Bicarbonate Alkalinity	580 mg/L CaCO ₃	580 mg/L CaCO ₃	14 mg/L CaCO ₃	410 mg/L CaCO ₃
Carbonate Alkalinity	<6 mg/L CaCO ₃	<6 mg/L CaCO ₃	<6 mg/L CaCO ₃	10 mg/L CaCO ₃
Hydroxide Alkalinity	<6 mg/L CaCO ₃	<6 mg/L CaCO ₃	<6 mg/L CaCO ₃	<6 mg/L CaCO ₃
Total Alkalinity	580 mg/L CaCO ₃	580 mg/L CaCO ₃	14 mg/L CaCO ₃	420 mg/L CaCO ₃

Nutrients by FIA

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	21/05/2014	21/05/2014	21/05/2014	21/05/2014
Method used	IFIAFRE	IFIAFRE	IFIAFRE	IFIAFRE
Ammonia - N	0.49 mg/L	0.49 mg/L	<0.01 mg/L	<0.01 mg/L
Free Reactive Phosphorus	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L	<0.003 mg/L
NO _x - N	0.32 mg/L	0.31 mg/L	0.02 mg/L	0.26 mg/L

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	IFIAKNP	IFIAKNP	IFIAKNP	IFIAKNP
TKN	0.7 mg/L	0.6 mg/L	0.4 mg/L	<0.2 mg/L
Total Nitrogen	1.0 mg/L	0.9 mg/L	0.4 mg/L	0.4 mg/L
Total Phosphorus	0.019 mg/L	0.019 mg/L	<0.015 mg/L	<0.015 mg/L

Toxicity by TOX

Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	13/05/2014	13/05/2014	13/05/2014	13/05/2014
Method used	Ecotox 1	Ecotox 1	Ecotox 1	Ecotox 1

Toxicity 1	RC	RC	RC	RC
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	12/06/2014	12/06/2014	12/06/2014	12/06/2014
Method used	Ecotox 3	Ecotox 3	Ecotox 3	Ecotox 3

Toxicity 3	RC	RC	RC	RC
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Laboratory number	201401003	201401004	201401005	201401006
Client sample ID	LDP SP1	LDP SP2	Coxs River	Kangaroo Ck
Sample type	LIQUID	LIQUID	LIQUID	LIQUID
Date started	12/05/2014	12/05/2014	12/05/2014	12/05/2014
Method used	Ecotox 4	Ecotox 4	Ecotox 4	Ecotox 4

Toxicity 4	RC	RC	RC	RC
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Released by:

Stephen Fuller - Senior Scientist

Anil Gautam - Senior Scientist

Moreno Julli - Team leader Ecotoxicology

Date: 25/06/2014

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Samples analysed as received and non-legal samples will be discarded one month from report date.

Soil samples are reported on a dry weight basis, except when analysed in accordance with the NSW EPA Waste Guidelines.

Appendix C – Chain of Custody Form

24/5/14

NSW ENVIRONMENT PROTECTION AUTHORITY/OFFICE of ENVIRONMENT and HERITAGE SAMPLE SUBMISSION/PROJECT FORM

Site reference or address of event: **Cox River coal mine**

Report to: **Martin Krogh**
 Submitted by: **M. Krogh**
 Section: **OEH Waters**

Waste: **Contaminated sites:**
 Chemicals/pesticides: ☒
 Submissions/Project Number: **201400151**
 Delivered by: **M. Krogh**
 Date required: **5/5/14**

Received by: **K. Edge**
 Study:

Grey Areas - LAB USE ONLY

Client Sample ID / Point: **LAP 511**

Sample Type*: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:02**

For identification and comparative testing laboratory staff must nominate all screening tests and sample preparation steps

Laboratory No: **201401003**

Sample Type: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:07**

Client Sample ID / Point: **LAP 512**

Sample Type*: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:25**

Laboratory No: **201401004**

Sample Type: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:15**

Client Sample ID / Point: **LAP 513**

Sample Type*: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:15**

Laboratory No: **201401005**

Sample Type: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:15**

Client Sample ID / Point: **LAP 514**

Sample Type*: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:15**

Laboratory No: **201401006**

Sample Type: **water**

Date Sampled: **8/5/14**

Time Sampled: **11:15**

Specific Tests or test groups requested	Test Method	201401003	201401004	201401005	201401006
pH	11SEPH	✓	✓	✓	✓
TSS	1QRTSS	✓	✓	✓	✓
TDS	1QRTDS	✓	✓	✓	✓
11SECON - conductivity	11SECON	✓	✓	✓	✓
Hardness	1CPAESHAD	✓	✓	✓	✓
Total + Free nutrients	1FIA FRE-C 1FIA KNP-C	✓	✓	✓	✓
Total Metals + Dissolved	1CPMSW-T 1CPASW-T	✓	✓	✓	✓
Mercury + Dissolved	1CVASW-	✓	✓	✓	✓
IC Cl⁻ SO₄	1ICA01	✓	✓	✓	✓
Alkalinity	1ITAK	✓	✓	✓	✓
Fluoride	1X-INORGANIC	✓	✓	✓	✓
LIMS line number					

3rd deaths: Number: _____ Species: _____

Comments: **To support EIS assessment of coal mine**
Cox's river - upstream.

**ENVIRONMENT PROTECTION AUTHORITY/OFFICE OF ENVIRONMENT AND HERITAGE
CHAIN OF CUSTODY**

KE9/5/1

SUBMISSION/PROJECT No. <u>201400181</u>		Page <u>2</u> of <u>73</u>
<u>Shipping container</u>		<u>Sample bottles</u>
Type of container	Type of seal	Type of bottle
<input type="checkbox"/> White Plastic Box	<input type="checkbox"/> EPA	<input checked="" type="checkbox"/> EPA
<input checked="" type="checkbox"/> Esky	<input checked="" type="checkbox"/> Other <u>no</u>	<input type="checkbox"/> Other
<input type="checkbox"/> Other	<input type="checkbox"/> Signed or Initialed	<input type="checkbox"/> Sealed
Condition: on arrival: Cooled..... Frozen..... Ambient..... Alkali..... Acid..... Other.....		Type of seal <input type="checkbox"/> EPA <input type="checkbox"/> Other

☒ If seal is intact place a tick in the appropriate box
 ☒ If seal is missing or broken place a cross in the appropriate box

Details if seals not intact or missing: _____

Sample Collector <u>M. KROGH</u>		Mobile contact: <u>0427 867 330</u>	
Shipping container	Sample bottle/s	Representative's name (Print & sign)	Organisation/Employer
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Print <u>MARTIN KROGH</u> Sign <u>[Signature]</u>	Date <u>8/5/14</u> Time <u>11:00</u>
		Contact phone no.	<u>9995 5619</u>
Submitter/Sender/Handler/Analyst			

Shipping container	Sample bottle/s	Representative's name (Print & sign)	Organisation/Employer	Received Date	Time	Contact phone no.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Print <u>MARTIN KROGH</u> Sign <u>[Signature]</u>	<u>OE H</u>	<u>8/5/14</u>	<u>11:00</u>	<u>9995 5619</u>
<input type="checkbox"/>	<input type="checkbox"/>	Print <u>Katelyn Edge</u> Sign <u>[Signature]</u>	<u>OE H</u>	<u>8/5/14</u>	<u>16:00</u>	<u>75094</u>
<input type="checkbox"/>	<input type="checkbox"/>	Print _____ Sign _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Print _____ Sign _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Print _____ Sign _____	_____	_____	_____	_____

NSW ENVIRONMENT PROTECTION AUTHORITY/OFFICE of ENVIRONMENT and HERITAGE SAMPLE SUBMISSION/PROJECT FORM

Page 3 of 3

Site reference or address of event:

Legal / Legal (Pest) / Non Legal	Waste:	Contaminated sites:	Report to:	Submitted by:	Section:
	Chemicals/pesticides:		Submission/Project Number:	Delivered by:	Date required:
Grey Areas - LAB USE ONLY	Client Sample ID / Point	LDP SP1	LDP SP2	Received by:	Study:
For identification and comparative testing laboratory staff must nominate all screening tests and sample preparation steps	Sample Type*	Liquid	COXS RIVER		
	Date Sampled		Liquid		
	Time Sampled				
	Laboratory No	201401003	201401004	201401005	201401006
Specific Tests or test groups requested	Test Method	Please tick the tests required below and if applicable note the sub-sample Id and any preservatives used.			
TPH	OMSTPH	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
BTEX	OMSVOC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
PAHS	OMSWASTE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
C. dubia	ECOTOX1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Fish	ECOTOX3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Microtox	ECOTOX4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Bird deaths: Number:	Species:				
Comments					

145 9/15/14

ENVIRONMENT PROTECTION AUTHORITY/OFFICE OF ENVIRONMENT AND HERITAGE
CHAIN OF CUSTODY

SUBMISSION/PROJECT No.		Page of	
<u>Shipping container</u>		<u>Sample bottles</u>	
Type of container	Type of seal	Type of bottle	Type of seal
<input type="checkbox"/> White Plastic Box	<input type="checkbox"/> EPA	<input type="checkbox"/> EPA	<input type="checkbox"/> EPA
<input type="checkbox"/> Esky	<input type="checkbox"/> Other	<input type="checkbox"/> Other	<input type="checkbox"/> Other
<input type="checkbox"/> Other	<input type="checkbox"/> Signed or Initialed	<input type="checkbox"/> Sealed	<input type="checkbox"/> Signed
Condition: on arrival: Cooled..... Frozen.....		Ambient..... Alkali..... Acid..... Other.....	

☒ If seal is intact place a tick in the appropriate box ☒ If seal is missing or broken place a cross in the appropriate box

Details if seals not intact or missing: _____

Sample Collector

Mobile contact:

Shipping container	Sample bottle/s	Representative's name (Print & sign)	Organisation/Employer	Collected Date	Time	Contact phone no.
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____

Submitter/Sender/Handler/Analyst

Shipping container	Sample bottle/s	Representative's name (Print & sign)	Organisation/Employer	Received Date	Time	Contact phone no.
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	<u>Print</u> _____ <u>Sign</u> _____	_____	_____	_____	_____

GHD

72 McNamara St, Orange, NSW 2800

PO BOX 950, Orange, NSW 2800



T: (02) 6393 6400 F: (02) 6393 6401 E: oagmail@ghd.com

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J.Woodworth	G.Metcalf		G.Metcalf		07/08/14

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