



Vista Gold Australia Pty Ltd

2019 Ecotoxicology Program Report

October 2019

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1. Introduction

1.1 Background

As a requirement of Vista Gold's Waste Discharge Licence (WDL 178-06) for the Mt Todd Project Area (MTPA) and the approved Mt Todd Ecotoxicological Plan Chapter 6 – WDL 178-05 Annual Report, Vista Gold has conducted the required ecotoxicological testing. This report presents the results of ecotoxicological assessment of water discharged from the MTPA. Ecotoxicological assessment of treated mine water from the MTPA is conducted to assess the potential impacts of mine water discharged to the Edith River and to meet the following conditions of WDL 178-06:

Northern Territory (NT) Environmental Protection Authority (EPA) in accordance with Condition 35 and Condition 36 of Waste Discharge Licence (WDL) 178-06.

- Condition 35: The licensee must implement, maintain and follow the Ecotoxicology Plan as specified in Table 1 for the life of this licence.
- Condition 36: The licensee must revert back to the previously approved Ecotoxicology Plan if the results of the current Ecotoxicological Plan confirm the presence of toxicity at SW4.

1.2 Scope of work

To meet the requirements of WDL 178-06 the following work was conducted:

- Review and assessment of ecotoxicity testing results
- Review and assess water chemistry results
- Interpretation of ecotoxicity and chemistry results
- Reporting ecotoxicity to meet the WDL requirements

1.3 Objectives and limitations

This report has been developed to meet the specific requirements of WDL 178-06 as listed above and to comply with the approved Mt Todd Ecotoxicological Plan Chapter 6 – WDL 178-05 Annual Report.

1.3.1 Limitations

This report has been prepared by GHD for Vista Gold Australia Pty Ltd (Vista Gold) and may only be used and relied on by Vista Gold, NT EPA and DPIR for the purpose agreed between GHD and Vista Gold as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Vista Gold 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 to Section 1.4). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Vista Gold and others (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

In assessment of the ecotoxicological results GHD assumes the following:

All samples collected by Vista Gold are representative of each of the specified sample sites and handled according to specified sample management detailed in the analysis laboratory quotation and sample requirements.

2. Methodology

2.1.1 Collection of samples

Vista Gold collected samples for ecotoxicity and water quality analysis on 21 January 2019, following standard methods for water sampling with all sample containers filled to the top (i.e. no air spaces). Ecotoxicity samples were collected from the Edith River at compliance point (SW4) during discharge of treated water from Batman Pit and at the Edith River upstream site at SW2 for screening bioassays and chemistry assessment. All samples were immediately chilled on ice then maintained at 4°C prior to transport to Ecotoxicology Services Australasia (ESA) where the samples were received on 22 January 2019.

2.1.2 Water quality analysis

All water samples for ecotox testing were analysed for the suite of analytes listed in Appendix 1 of WDL 178-06. Analysis were conducted by a NATA accredited laboratory and sampled according to Australian Standards for water quality sampling:

AS/NZS 5667.1:1998 – Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

2.1.3 Screening bioassays

Screening bioassays are used to assess the toxicity of natural waterways where the water quality is not expected to show toxicity. The screening bioassays use an undiluted water sample from each site for the assessment. The results of the screening bioassay are compared to an upstream sample and a laboratory control water sample. A result of >80% when compared to controls indicates that the water quality shows no significant toxicity. The screening results can also be used to compare water chemistry and toxicity spatially across a site and temporally if historical results are available. The 7 day *Ceriodaphnia dubia* reproduction bioassay (this is the most sensitive species as determined by previous studies) was used as the screening bioassays. The *C. dubia* were exposed to 100% of SW4 water only (sampled during Batman Pit discharge) and 100% SW2 water. The screening bioassays were run concurrently with a laboratory control sample. Toxicity is observed if the difference between the test and the controls is >20%.

Species used in the DTA program

The following freshwater species and test protocol was used to test the SW2 and SW4 samples:

- 7 day reproductive impairment test using the freshwater cladoceran *Ceriodaphnia dubia* (based on USEPA 2002 and Bailey et al. 2000).

2.1.4 Laboratory controls

Previous monitoring has shown that upstream water (SW2) may adversely impact on *cladoceran* reproduction. To identify any confounding influence from SW2 on the results obtained from SW4, the *C. dubia* bioassay was conducted using SW2 to assist in interpreting the SW4 results. Laboratory dilution water was used as the control.

2.1.5 Quality assurance

The bioassays used in this study are NATA accredited and, as such, are regulated as to quality assurance. Each bioassay was conducted with a laboratory control (the water in which the organisms are grown) and a reference toxicant. All bioassays met the laboratory QA parameters.

3. Results and discussion

3.1 Water quality

The water quality results are presented in Table 3-1. Field parameters indicate that the background reference water at SW2 is very soft with a conductivity of only 24 µS/cm. Water quality of the treated Batman Pit discharge is characterised by high conductivity and sulfate with elevated concentrations of dissolved metals, including cadmium, copper, nickel and, particularly, zinc. Chemistry results are located in Appendix B.

Water quality at the compliance point at SW4 contains considerably lower metal concentrations when compared to Batman Pit. The concentrations of metals at SW4 are compliant with the site specific trigger values (SSTVs) listed in WDL 178-06, with one exception. The only metal exceedance is for zinc. Magnesium also recorded an exceedance. However, the screening toxicity tests using the cladoceran reproduction bioassay shows that there is no toxicity in the sample when compared to laboratory controls, even with the elevated zinc and magnesium concentrations.

Table 3-1 Summary of water quality results

Analytes	Batman Pit		SW2		SW4		SSTV ¹
	This study	long-term median	This study	long-term median	This study	long-term median	
Physiochemical							
EC (µS/cm)	2,782	2,818	24	17	180	83	250
pH	7.1	7.2	7.1	6.2	6.7	6.2	6.0-8.0
Bicarbonate (mg/L)	9	34	9	8	9	9	319
Chloride (mg/L)	NT	7	NT	1	NT	2	64
Magnesium (mg/L)	217	190	0.7	0.6	6.7	3.4	2.5
Sulphate (mg/L)	1,960	1,800	<0.1	0.5	53	16	129
Total cyanide (mg/L)	<0.005	0.002	<0.005	0.002	NT	<0.004	7
Dissolved metals (µg/L)							
Aluminium	39	110	38	29	6.5	12	150
Boron	46	ND	5.5	ND	4.5	ND	
Arsenic	NT	<1	NT	<1	NT	1	140
Cadmium	22	23	<0.02	<0.1	0.48	0.1	0.8
Chromium	<0.5	<1	0.2	<1	<0.1	<1	
Cobalt	18	83	0.11	<1	0.79	1	13
Copper	30	9	0.3	<1	0.89	1	2.5
Fluoride (mg/L)	1.3	ND	<0.1	ND	<0.1	ND	
Iron	<10	5	216	220	68	150	350
Lead	0.1	<1	0.01	<1	<0.01	<1	9.4
Lithium	195	ND	0.6	ND	4.5	ND	
Manganese	241	700	5.8	7	44	40	3,600
Nickel	146	200	0.22	<1	3.6	2	17
Zinc	1,720	480	0.5	1	44	10	31

¹ Based on WDL 178-06: NT = Not tested; ND = No data

Bold text denotes exceedances of the SSTV

3.2 Ecotoxicology results

The 2019 ecotoxicity assessment has been summarized together with the results from the 2015 and 2018 ecotoxicity studies in Table 3-2. Results from the 2015 DTA (GHD 2015) and 2018 Ecotox Report (GHD 2018) have been included for comparative purposes. The ESA ecotoxicity report is located in Appendix A.

Table 3-2 shows the screening results for SW2 and SW4 for 2015, 2018 and 2019. These results show that the SW2 was more toxic in 2019 than in 2015 and 2018. This may be due to the low ionic strength of the SW2 water as no other analytes exceeded trigger values. The 2015, 2018 and 2019 screening bioassays conducted on SW4 show that there is no toxicity during the treated mine water discharge at the compliance site even though zinc and magnesium were elevated.

Table 3-2 Edith River screening results % of control

Bioassay	SW2	SW4	SW2	SW4	SW2	SW4
	2015	2015	2018	2018	2019	2019
<i>Ceriodaphnia dubia</i> reproduction	50%	102%	6%	98%	0%	92%
<i>Ceriodaphnia dubia</i> survival	90%	100%	0%	100%	0%	100%

4. Conclusions and recommendations

4.1 Conclusions

The current ecotoxicological investigation has demonstrated that the treated mine water discharged from Batman Pit is not toxic for the sensitive species tested at the compliance point, SW4. The dilution of the treated mine water is managed using a dilution ratio based on Batman Pit water quality and the Edith River flow. The dilution ratio is usually in the order of 1:33 (as a minimum), However, during the 21 January 2019 sampling the dilution ratio was 1:45 based on operating data provided by Vista Gold. This indicates that the current dilution is averting any environmental harm in the receiving waters of Edith River. The chemistry results and the screening tests conducted on the SW4 water during discharge have confirmed the absence of toxicity. Jointly, these results validate the safety of the current dilution rate and treated mine water management for the protection of the receiving environment.

The current investigation suggests that the low conductivity observed at the upstream site (SW2), may be affecting the results of the cladoceran screening test conducted on the SW2 water. This species has been reported to be sensitive to low conductivity.

The comparison with historic chemistry results confirms the decreasing trend in both the metal concentrations (except zinc and magnesium) and the stability of the toxicity of the discharge effluent at SW4, indicating that the current treatment of the mine water is successfully reducing the metal concentrations and the associated toxicity.

Magnesium and zinc are the only chemicals that exceed the SSTV and the long-term median at SW4. These exceedances are not associated with any risk of detrimental effects in the receiving environment as has been validated by the absence of toxicity in the receiving water at SW4.

In conclusion, the ecotoxicological assessment, undertaken according to the WDL 178-06 requirements and the approved Ecotoxicological Plan, has shown that discharge of treated mine water from Batman Pit at the current dilution method does not pose any risk for the aquatic communities living in Edith River downstream the discharge point.

4.2 Recommendations

It is recommended to maintain the ecotoxicology testing as per the current approved Plan.

It is recommended to review the SSTV of the magnesium to reflect more realistically the potential concentration that might be harmful for the environment.

Appendices

Appendix A – Ecotox Laboratory Report

Toxicity Assessment of SW-2 and SW-4 Wastewater Samples

GHD for Vista Gold

Test Report

February 2019

Toxicity Test Report: TR1804/1

(Page 1 of 2)

Accredited for compliance with ISO/IEC 17025

Client:	GHD Pty Ltd Level 2, 102 Cameron Street Launceston TAS 7250	ESA Job #:	PR1804
Attention:	Jill Woolworth	Date Sampled:	21 January 2019
Client Ref:	Not Supplied	Date Received:	22 January 2019
		Sampled By:	Client
		ESA Quote #:	PL1804_q01

Lab ID No.:	Sample Name:	Sample Description:
8927	SW2	Aqueous sample, 7.1 pH*, conductivity 24.0 $\mu\text{S}/\text{cm}^*$, total ammonia <2.0mg/L*. Sample received at 14°C* in apparent good condition.
8928	SW4	Aqueous sample, 7.0 pH*, conductivity 191 $\mu\text{S}/\text{cm}^*$, total ammonia <2.0mg/L*. Sample received at 14°C* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	Partial life-cycle toxicity test using the freshwater cladoceran <i>Ceriodaphnia cf dubia</i>
Test Protocol:	ESA SOP 102 (ESA 2016), based on USEPA (2002) and Bailey <i>et al.</i> (2000)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The samples were tested undiluted. A Dilute Mineral Water (DMW) control was tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	23 January 2019 at 1700h

Sample 8927 and 8928: SW2 and SW4		Sample 8927 and 8928: SW2 and SW4	
Concentration (%)	% Unaffected at 7 days (Mean ± SD)	Concentration (%)	Number of Young (Mean ± SD)
DMW Control	100 ± 0.0	DMW Control	15.4 ± 1.6
SW2	0.0 ± 0.0	SW2	0.0 ± 0.0
SW4	100 ± 0.0	SW4	14.2 ± 3.4

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % unaffected	≥80.0%	100%	Yes
Control mean number of young per surviving adult	≥15.0	15.4	Yes
Reference Toxicant within cusum chart limits	183.4-240.5KCl/L	192.5KCl/L	Yes

Toxicity Test Report: TR1804/1

(Page 2 of 2)

Test Report Authorised by:  Dr Rick Krassoi, Director on 18 February 2019

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

This document shall not be reproduced except in full.

Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2016) ESA SOP 102 – *Acute Toxicity Test Using Ceriodaphnia dubia*. Issue No 11. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. 4th Ed. United States Environmental Protection Agency, Office of Water, Washington DC.

Chain-of-Custody Documentation



Sample Receipt Notification

Attention : Jill Woodworth

Client : GHD Pty Ltd
Level 2, 102 Cameron Street
Launceston TAS 7250

Email : jill.woodworth@ghd.com
Telephone : (03) 6332 5532
Facsimile :

Date : 24/01/2019

Re : Receipt of Samples

Pages : 2

ESA Project : PR1804

For Review

Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: YES
Samples received in apparent good condition and correctly bottled: YES
Security seals on sample bottles and esky intact: YES

Date samples received : 23/01/2019
Time samples received : 8:30
No. of samples received : 2
Sample matrix : Aqueous
Sample temperature : 11-15°C

Comments : 2 x 5L samples received at 14oC in apparent good condition.

Contact Details

Projects Manager : Dr Rick Krassoi
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : rkrassoi@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia

ABN 95619426201

Unit 27, 2 Chaplin Drive

Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481

Fax : 61 2 9420 9484

Email : info@ecotox.com.au

Chain-of-Custody / Service Request Form



Datasheet ID: 601.1
Last Revised: 15 July 2014

Customer: GHD Ship To: Ecotox Services
 Contact Name: Sill Woodworth Attention: Dr Rick Krasson
 Phone: 08 8482 0127 Email: jill.woodworth (please provide an email address for sample receipt notification)

Sampled by: _____

Sample Date (day/month/year)	Sample Time	Sample Name (exactly as written on the sample vessel)	Sample Method (eg. Grab, composite etc.)	Number and Volume of Containers (eg 2 x 1L)	Tests Requested (See reverse for guidance)	Comments / Instructions
21/01/19	0851	SW2	Grab	1 x SL	X	Note that testing will be delayed if an incomplete chain of custody is received • Additional treatment of samples (i.e. spiking) • Sub-contracted services (i.e. chemical analyses) • Dilutions required (if different than 100% down to 6.25%) • Sample holding time restriction (if applicable) • Sample used for litigation (if applicable) Note: An MSDS must be attached if Available ESA Project Number: PR 1804
21/01/19	0913	SW4	Grab	1 x SL	X	

1) Released By: <u>R. Chubb</u>	Date: <u>21/01/19</u>	2) Received By: <u>[Signature]</u>	Date: <u>22/1/19</u>	3) Released By:	Date:	4) Received By:	Date:
Of: <u>Vista Gold, Mt Todd</u>	Time: <u>11:15am</u>	Of: <u>ESA</u>	Time: <u>0830</u>	Of:	Time:	Of:	Time:

Note that the chain-of-custody documentation will provide definitive information on the tests to be performed.

**Statistical Printouts for the 3-
brood Partial Life Cycle Test with
*Ceriodaphnia dubia***

Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

Start Date: 23/01/2019 17:00	Test ID: PR1804/2	Sample ID: SW2, SW4
End Date: 30/01/2019 17:00	Lab ID: 8927, 8928	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 102	Test Species: CD-Ceriodaphnia dubia

Comments:

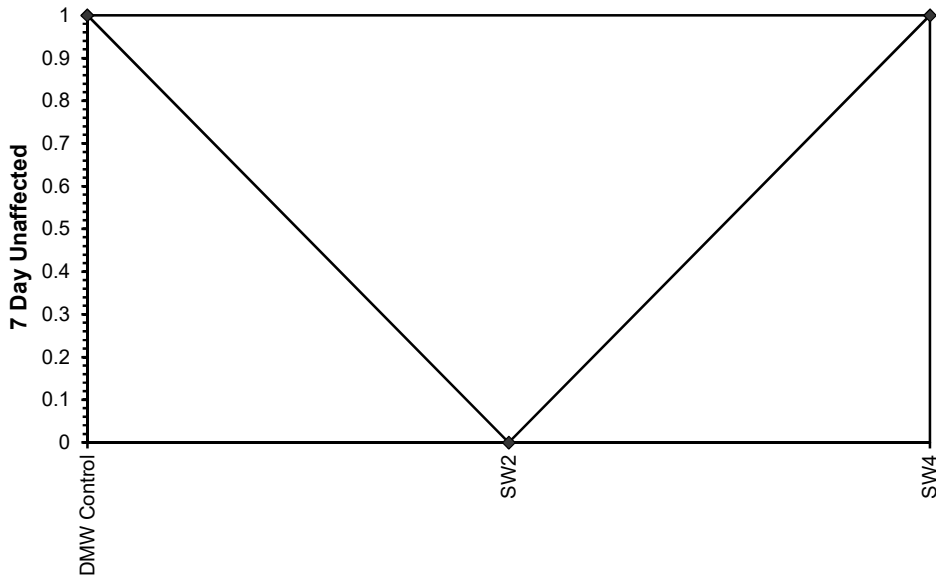
Conc-%	1	2	3	4	5	6	7	8	9	10
DMW Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SW2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SW4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Transform: Arcsin Square Root

Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N
DMW Control	1.0000	1.0000	1.0472	1.0472	1.0472	0.000	10
SW2	0.0000	0.0000	0.5236	0.5236	0.5236	0.000	10
SW4	1.0000	1.0000	1.0472	1.0472	1.0472	0.000	10

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	1	0.905		
Equality of variance cannot be confirmed				

Dose-Response Plot



Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

Start Date: 23/01/2019 17:00 Test ID: PR1804/2 Sample ID: SW2, SW4
End Date: 30/01/2019 17:00 Lab ID: 8927, 8928 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 102 Test Species: CD-Ceriodaphnia dubia
Comments:

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	No of Young	15.40	13.00	18.00	1.58	8.16	10
SW2		0.00	0.00	0.00	0.00		10
SW4		14.22	11.00	22.00	3.38	12.93	9
DMW Control	% unaffected	100.00	100.00	100.00	0.00	0.00	10
SW2		0.00	0.00	0.00	0.00		10
SW4		100.00	100.00	100.00	0.00	0.00	10
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
SW2		7.10	7.10	7.10	0.00	0.00	1
SW4		7.00	7.00	7.00	0.00	0.00	1
DMW Control	DO %	98.90	98.90	98.90	0.00	0.00	1
SW2		100.90	100.90	100.90	0.00	0.00	1
SW4		102.10	102.10	102.10	0.00	0.00	1
DMW Control	Cond uS/cm	174.00	174.00	174.00	0.00	0.00	1
SW2		24.00	24.00	24.00	0.00	0.00	1
SW4		191.00	191.00	191.00	0.00	0.00	1

Ceriodaphnia Partial Life-Cycle Test-Reproduction

Start Date: 23/01/2019 17:00	Test ID: PR1804/2	Sample ID: SW2, SW4
End Date: 30/01/2019 17:00	Lab ID: 8927, 8928	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 102	Test Species: CD-Ceriodaphnia dubia

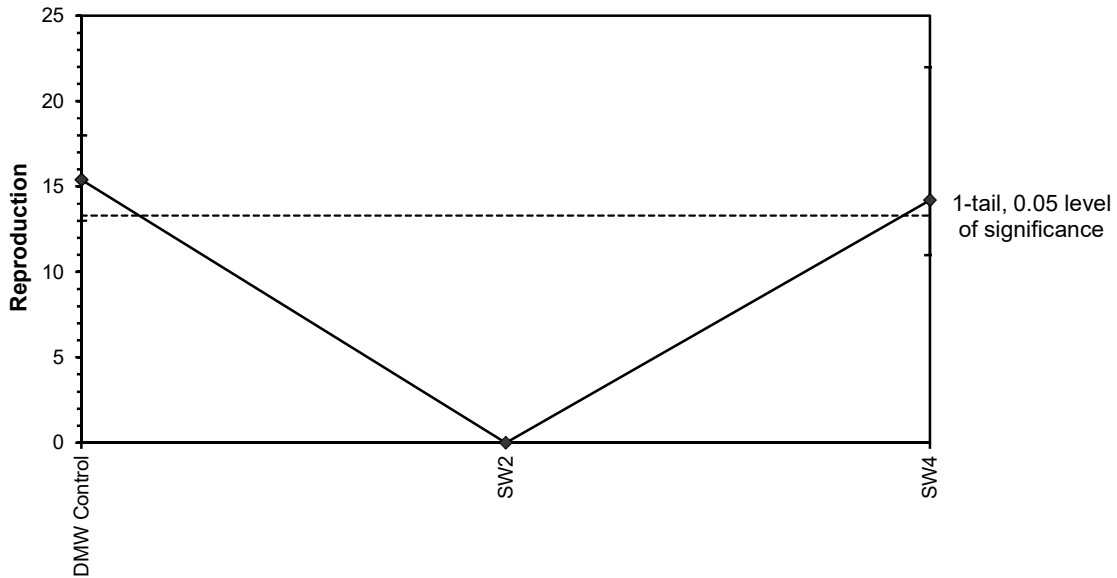
Comments:

Conc-%	1	2	3	4	5	6	7	8	9	10
DMW Control	18.000	15.000	16.000	13.000	15.000	16.000	15.000	17.000	16.000	13.000
SW2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SW4	16.000	11.000	13.000	14.000	12.000	11.000	22.000	14.000	15.000	

Conc-%	Mean	N-Mean	Transform: Untransformed					t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%	N			
DMW Control	15.400	1.0000	15.400	13.000	18.000	10.244	10			
SW2	0.000	0.0000	0.000	0.000	0.000	0.000	10			
SW4	14.222	0.9235	14.222	11.000	22.000	23.786	9	0.990	1.740	2.069

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.868391	0.901	1.525445	4.232777		
F-Test indicates equal variances (p = 0.04)	4.598214	6.6933				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	2.069426	0.134378	6.57076	6.703268	0.336025	1, 17
Treatments vs DMW Control						

Dose-Response Plot



Ceriodaphnia Partial Life-Cycle Test-Reproduction

Start Date: 23/01/2019 17:00 Test ID: PR1804/2 Sample ID: SW2, SW4
End Date: 30/01/2019 17:00 Lab ID: 8927, 8928 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 102 Test Species: CD-Ceriodaphnia dubia
Comments:

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	No of Young	15.40	13.00	18.00	1.58	8.16	10
SW2		0.00	0.00	0.00	0.00		10
SW4		14.22	11.00	22.00	3.38	12.93	9
DMW Control	% unaffected	100.00	100.00	100.00	0.00	0.00	10
SW2		0.00	0.00	0.00	0.00		10
SW4		100.00	100.00	100.00	0.00	0.00	10
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
SW2		7.10	7.10	7.10	0.00	0.00	1
SW4		7.00	7.00	7.00	0.00	0.00	1
DMW Control	DO %	98.90	98.90	98.90	0.00	0.00	1
SW2		100.90	100.90	100.90	0.00	0.00	1
SW4		102.10	102.10	102.10	0.00	0.00	1
DMW Control	Cond uS/cm	174.00	174.00	174.00	0.00	0.00	1
SW2		24.00	24.00	24.00	0.00	0.00	1
SW4		191.00	191.00	191.00	0.00	0.00	1

Appendix B – Chemistry Laboratory Report

ANALYTICAL TEST REPORT



VISTA GOLD AUSTRALIA Pty Ltd

Robert Friel
rfriel@mttodd.com.au
MT TODD MINE
PO Box 1616 KATHERINE NT 0851
AUSTRALIA

JOB NUMBER	NT49858
PO NUMBER	
PROJECT	WDL Water monitoring
CHAIN OF CUSTODY	Mt Todd - 20/01/2019
DATE RECEIVED	21/01/19
DATE REPORTED	11/02/19
NO. SAMPLES	3 Water/Solution(s) for Analysis

COMMENTS

- > Results required for compliance may be compromised by:
 1. Use of non-laboratory supplied sample containers
 2. Holding time breaches
 3. Field related preparation or preservation techniques
 4. Laboratory Measurement Uncertainty

Potentially affected results are coloured.
- > Samples will be discarded one month from final report date.
- > THIS IS THE FINAL REPORT & REPLACES PRELIMINARY REPORT #2 ISSUED ON 29/01/2019.
- > Due to high salt levels some samples have been diluted to reduce matrix effects. The dilution factors (DF) are listed & the detection limits are raised accordingly.
- > I.S.: Insufficient Sample

TESTED BY

Intertek NTEL
55 Export Drive
East Arm NT 0822
AUSTRALIA
P: +61 8 8947 0510
E: ntel@intertek.com



RESULTS AUTHORISED BY

NAME **Fiona Dunbar-Smith**
POSITION Intertek NTEL signatory

Accredited for compliance with ISO/IEC17025 - Testing
Accreditation Number 14610
Report is only valid when reproduced or presented in full.

REPORT CODE: NT49858
Methodology:



Analysis Code	Description	Method Reference	Analytical Scheme	Technique / Instrument	Detection Limit	Data Units
Alkalinity	Total Alkalinity (as CaCO ₃)	WWM08	ALK1	ELECTRODE	1	mg/L
CO ₃	Carbonate Alkalinity (as CaCO ₃)	WWM08	ALK1	ELECTRODE	1	mg/L
HCO ₃	BiCarbonate Alkalinity (as CaCO ₃)	WWM08	ALK1	ELECTRODE	1	mg/L
OH	Hydroxide Alkalinity (as CaCO ₃)	WWM08	ALK1	ELECTRODE	1	mg/L
TSS	Total Suspended Solids	WWM14	TSSTDS	GRAV	10	mg/L
TDS	Total Dissolved Solids	WWM14	TSSTDS	GRAV	10	mg/L
NO ₂ _N	Nitrite as Nitrogen	WWM22	FIAS_4	FIA	0.005	mg/L
NO ₃ _N	Nitrate as Nitrogen	WWM22	FIAS_4	FIA	0.005	mg/L
NH ₃ _N	Ammonium as Nitrogen	WWM22	NH3_N	FIA	0.005	mg/L
Total N	Total Nitrogen	WWM22	N3	FIA	0.01	mg/L
Total P	Total Phosphorous	WWM25	P3	FIA	0.005	mg/L
F	Fluoride	WWM20	FISE1	ELECTRODE	0.1	mg/L
Total CN	Total Cyanide by distillation & FIA	WWM17	CN_TOT	FIA	0.01	mg/L
Hardness	Total Hardness (as CaCO ₃ - calculated)	WWM11	TH1	CALC.	0.1	mg/L
Ca_F	Calcium_Filtered 0.45µm	W108	W108I	ICPOES	0.1	mg/L
K_F	Potassium_Filtered 0.45µm	W108	W108I	ICPOES	0.1	mg/L
Mg_F	Magnesium_Filtered 0.45µm	W108	W108I	ICPOES	0.1	mg/L
Na_F	Sodium_Filtered 0.45µm	W108	W108I	ICPOES	0.1	mg/L
SO ₄ _F	Sulfur as Sulfate_Filtered 0.45µm	W108	W108I	ICPOES	0.1	mg/L
ACBalance	Anion Cation Balance	WWM40	ACB	CALC.	0.1	%
DF	Dilution Factor	W100	W100M	ICPMS	1	--
Al_F	Aluminium_Filtered 0.45µm	W100	W100M	ICPMS	0.1	µg/L
Al_T	Aluminium_Total Recoverable	W200	W200M	ICPMS	0.1	µg/L
B_F	Boron_Filtered 0.45µm	W100	W100M	ICPMS	0.5	µg/L
Cd_F	Cadmium_Filtered 0.45µm	W100	W100M	ICPMS	0.02	µg/L
Cd_T	Cadmium_Total Recoverable	W200	W200M	ICPMS	0.02	µg/L
Co_F	Cobalt_Filtered 0.45µm	W100	W100M	ICPMS	0.01	µg/L
Cr_F	Chromium_Filtered 0.45µm	W100	W100M	ICPMS	0.1	µg/L
Cu_F	Copper_Filtered 0.45µm	W100	W100M	ICPMS	0.01	µg/L
Cu_T	Copper_Total Recoverable	W200	W200M	ICPMS	0.01	µg/L
Fe_F	Iron_Filtered 0.45µm	W100	W100M	ICPMS	2	µg/L
Fe_T	Iron_Total Recoverable	W200	W200M	ICPMS	2	µg/L
Hg_F	Mercury_Filtered 0.45µm - unpreserved	W100	W100M	ICPMS	0.02	µg/L
Li_F	Lithium_Filtered 0.45µm	W100	W100M	ICPMS	0.05	µg/L
Mn_F	Manganese_Filtered 0.45µm	W100	W100M	ICPMS	0.01	µg/L
Ni_F	Nickel_Filtered 0.45µm	W100	W100M	ICPMS	0.01	µg/L
Pb_F	Lead_Filtered 0.45µm	W100	W100M	ICPMS	0.01	µg/L
Zn_F	Zinc_Filtered 0.45µm	W100	W100M	ICPMS	0.1	µg/L



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COC

Mt Todd - 20/01/2019

Element:	Alkalinity	CO3	HCO3	OH	TSS	TDS	NO2_N	NO3_N	NH3_N
Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Method:	ALK1	ALK1	ALK1	ALK1	TSSTDS	TSSTDS	FIAS_4	FIAS_4	NH3_N
Detection Limit	1	1	1	1	10	10	0.005	0.005	0.005
Analysis Date:	21/01/19	21/01/19	21/01/19	21/01/19	21/01/19	21/01/19	22/01/19	22/01/19	22/01/19
Sample ID									
RP3 20/01/19	9	<1	9	<1	10	3010	0.055	2.74	<0.005
SW2 20/01/19	9	<1	9	<1	30	50	0.005	<0.005	0.005
SW4 20/01/19	9	<1	9	<1	30	120	0.005	0.070	0.020

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Element:	Total N	Total P	F	Total CN	Hardness	Ca_F	K_F	Mg_F	Na_F
Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Method:	N3	P3	FISE1	CN_TOT	TH1	W108I	W108I	W108I	W108I
Detection Limit:	0.01	0.005	0.1	0.01	0.1	0.1	0.1	0.1	0.1
Analysis Date:	22/01/19	22/01/19	22/01/19	1/02/19	23/01/19	22/01/19	22/01/19	22/01/19	22/01/19
Sample ID									
RP3 20/01/19	2.74	0.040	1.3	<0.005	1940	420	8.5	217	51.9
SW2 20/01/19	0.17	0.055	<0.1	<0.005	4.3	0.6	0.9	0.7	1.5
SW4 20/01/19	0.23	0.040	<0.1	I.S.	56.3	11.4	1.3	6.7	3.7

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Element:	SO4_F	AC Balance	DF	Al_F	Al_T	B_F	Cd_F	Cd_T	Co_F
Units:	mg/L	%	--	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Method:	W108I	ACB	W100M	W100M	W200M	W100M	W100M	W200M	W100M
Detection Limit	0.1	0.1	1	0.1	0.1	0.5	0.02	0.02	0.01
Analysis Date:	22/01/19	23/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19
Sample ID									
RP3 20/01/19	1960	<0.1	5	38.5	134	45.5	22.2	22.4	17.5
SW2 20/01/19	<0.1	PASS	--	38.1	1670	5.5	<0.02	<0.02	0.11
SW4 20/01/19	53.1	PASS	--	6.5	1560	4.5	0.48	0.46	0.79

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Element:	Cr_F	Cu_F	Cu_T	Fe_F	Fe_T	Hg_F	Li_F	Mn_F	Ni_F
Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Method:	W100M	W100M	W200M	W100M	W200M	W100M	W100M	W100M	W100M
Detection Limit:	0.1	0.01	0.01	2	2	0.02	0.05	0.01	0.01
Analysis Date:	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19	22/01/19
Sample ID									
RP3 20/01/19	<0.5	29.5	44.9	<10	180	<0.1	195	241	146
SW2 20/01/19	0.2	0.30	0.60	216	1330	<0.02	0.60	5.78	0.22
SW4 20/01/19	<0.1	0.89	1.75	68	1160	<0.02	4.50	44.2	3.63

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Element:	Pb_F	Zn_F							
Units:	µg/L	µg/L							
Method:	W100M	W100M							
Detection Limit	0.01	0.1							
Analysis Date:	22/01/19	22/01/19							
Sample ID									
RP3 20/01/19	0.10	1720							
SW2 20/01/19	0.01	0.5							
SW4 20/01/19	<0.01	43.7							

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Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J. Woodworth	V.Perez-Landa		J.Woodworth		01/03/2019

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