Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1402602**	Page	: 1 of 7
Client	: **WOLLONGONG CITY COUNCIL**	Laboratory	: Environmental Division NSW South Coast
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Project	: Whytes Gully Stage 3 Quarterly Bores & Surface Waters	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 3030159		
C-O-C number	: ----	Date Samples Received	: 28-AUG-2014
Sampler	: Craig Wilson	Issue Date	: 05-SEP-2014
Site	: ----		
		No. of samples received	: 23
Quote number	: WL/090/11 Stage 3	No. of samples analysed	: 23

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
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Glenn Davies	Environmental Services Representative	Laboratory - Wollongong

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Ionic Balance out of acceptable limits due to analytes not quantified in this report.**
- **Sampling and sample data supplied by ALS Wollongong.**
- **Site GMW102 - No Access site too wet at time of sampling.**
  Site GMW106 - Dry at time of sampling.
  Site GABH01 - Found destroyed at time of sampling.
- **TDS by method EA-015 may bias high for sample ID 'Surface Water 2' due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Unit	Client sample ID: GMW102 (Point 9)	GMW103 (Point 10)	GMW104 (Point 11)	GMW105 (Point 12)	GMW106 (Point 13)
Client sampling date / time				28-AUG-2014 10:55	28-AUG-2014 11:15	28-AUG-2014 10:45	28-AUG-2014 11:25	28-AUG-2014 11:30
				EW1402602-001	EW1402602-002	EW1402602-003	EW1402602-004	EW1402602-005
EA005FD: Field pH								
pH	----	0.1	pH Unit	----	7.1	7.1	5.6	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	----	2160	520	283	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	----	1180	280	192	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	389	145	17	----
Total Alkalinity as CaCO3	----	1	mg/L	----	389	145	17	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	122	32	13	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	----	349	42	58	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	156	20	5	----
Magnesium	7439-95-4	1	mg/L	----	60	14	3	----
Sodium	7440-23-5	1	mg/L	----	160	48	35	----
Potassium	7440-09-7	1	mg/L	----	<1	<1	<1	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	0.02	0.01	0.02	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	----	20.2	4.75	2.25	----
Total Cations	----	0.01	meq/L	----	19.7	4.24	2.02	----
Ionic Balance	----	0.01	%	----	1.18	5.70	----	----
EN67 PK: Field Tests								
Field Observations	----	0.01	--	NO ACCESS	----	----	----	DRY
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	----	2	2	4	----
FWI-EN/001: Groundwater Sampling - Depth								
Depth	----	0.01	m	----	7.36	7.41	7.46	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: GMW108S (Point 14)	GMW108D (Point 15)	GMW109S (Point 16)	GMW109D (Point 19)	GMW110 (Point 17)
			Client sampling date / time	28-AUG-2014 11:45	28-AUG-2014 11:50	28-AUG-2014 08:45	28-AUG-2014 08:50	28-AUG-2014 09:20
				EW1402602-006	EW1402602-007	EW1402602-008	EW1402602-009	EW1402602-010
EA005FD: Field pH								
pH	----	0.1	pH Unit	7.3	6.8	6.5	7.4	6.7
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	508	3200	2140	1660	4070
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	320	1810	1430	904	2430
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	183	429	503	246	627
Total Alkalinity as CaCO3	----	1	mg/L	183	429	503	246	627
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	18	202	398	24	294
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	36	616	238	407	902
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	25	118	216	83	208
Magnesium	7439-95-4	1	mg/L	11	87	66	46	165
Sodium	7440-23-5	1	mg/L	53	401	202	194	520
Potassium	7440-09-7	1	mg/L	3	<1	5	2	2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.01	0.78	0.01	0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	5.05	30.2	25.0	16.9	44.1
Total Cations	----	0.01	meq/L	4.53	30.5	25.1	16.4	46.6
Ionic Balance	----	0.01	%	5.36	0.54	0.15	1.44	2.79
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	11	2	2	<1	2
FWI-EN/001: Groundwater Sampling - Depth								
Depth	----	0.01	m	2.66	2.26	2.70	2.74	4.05

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	GMW111 (Point 18)	GABH01 (Point 2)	GABH02 (Point 5)	GABH03 (Point 6)	GABH06S (Point 7)
Client sample ID								
Client sampling date / time				28-AUG-2014 09:00	28-AUG-2014 11:05	28-AUG-2014 10:10	28-AUG-2014 09:55	28-AUG-2014 10:25
				EW1402602-011	EW1402602-012	EW1402602-013	EW1402602-014	EW1402602-015
EA005FD: Field pH								
pH	----	0.1	pH Unit	**7.0**	----	**6.7**	**6.6**	**7.2**
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	**2510**	----	**5330**	**5490**	**3140**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**1340**	----	**3040**	**3540**	**1770**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**480**	----	**1100**	**756**	**454**
Total Alkalinity as CaCO3	----	1	mg/L	**480**	----	**1100**	**756**	**454**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**111**	----	**174**	**201**	**227**
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**531**	----	**1220**	**1370**	**697**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**101**	----	**349**	**396**	**92**
Magnesium	7439-95-4	1	mg/L	**80**	----	**212**	**222**	**83**
Sodium	7440-23-5	1	mg/L	**412**	----	**682**	**544**	**502**
Potassium	7440-09-7	1	mg/L	**1**	----	**3**	**2**	<1
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.02**	----	**0.02**	**0.02**	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**26.9**	----	**60.0**	**57.9**	**33.5**
Total Cations	----	0.01	meq/L	**29.6**	----	**64.6**	**61.8**	**33.3**
Ionic Balance	----	0.01	%	**4.75**	----	**3.68**	**3.19**	**0.32**
EN67 PK: Field Tests								
Field Observations	----	0.01	--	----	**DESTROYED**	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	----	**6**	**5**	**1**
FWI-EN/001: Groundwater Sampling - Depth								
Depth	----	0.01	m	**6.36**	----	**5.12**	**0.65**	**2.50**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	GABH06D (Point 8)	BH6 (Point 20)	Surface Water 1 (Point 1)	Surface Water 2 (Point 35)	Surface Water 3 (Point 36)
Client sample ID								
Client sampling date / time				28-AUG-2014 10:35	28-AUG-2014 09:30	28-AUG-2014 08:30	28-AUG-2014 12:40	28-AUG-2014 12:30
				EW1402602-016	EW1402602-017	EW1402602-018	EW1402602-019	EW1402602-020
EA005FD: Field pH								
pH	----	0.1	pH Unit	**7.1**	**6.9**	**7.8**	**7.7**	**7.6**
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	**2960**	**5040**	**470**	**435**	**244**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**1710**	**2820**	**338**	**389**	**152**
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	----	----	**44**	**37**	**6**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**365**	**779**	**135**	**120**	**56**
Total Alkalinity as CaCO3	----	1	mg/L	**365**	**779**	**135**	**120**	**56**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**209**	**315**	**28**	**25**	**12**
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**708**	**1120**	**40**	**37**	**23**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**109**	**123**	**20**	**17**	**11**
Magnesium	7439-95-4	1	mg/L	**69**	**135**	**10**	**9**	**6**
Sodium	7440-23-5	1	mg/L	**445**	**825**	**52**	**49**	**21**
Potassium	7440-09-7	1	mg/L	<1	<1	**7**	**7**	**2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	**0.13**	**1.02**	**0.62**	**0.02**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**31.6**	**53.7**	**4.41**	**3.96**	**2.02**
Total Cations	----	0.01	meq/L	**30.5**	**53.1**	**4.26**	**3.90**	**2.01**
Ionic Balance	----	0.01	%	**1.85**	**0.57**	**1.71**	**0.81**	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**1**	**5**	**13**	**12**	**6**
FWI-EN/001: Groundwater Sampling - Depth								
Depth	----	0.01	m	**2.02**	**1.56**	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: Surface Water 4 (Point 33)	Surface Water 5 (Point 37)	Surface Water 6 (Point 34)	----	----
Client sampling date / time				28-AUG-2014 12:15	28-AUG-2014 12:10	28-AUG-2014 09:10	----	----
				EW1402602-021	**EW1402602-022**	**EW1402602-023**	**----**	**----**
EA005FD: Field pH								
pH	----	0.1	pH Unit	**7.6**	**7.6**	**7.9**	----	----
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	**293**	**290**	**254**	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**196**	**182**	**150**	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	**14**	**15**	**12**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**71**	**70**	**59**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**71**	**70**	**59**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**18**	**19**	**16**	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**26**	**27**	**24**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**12**	**12**	**12**	----	----
Magnesium	7439-95-4	1	mg/L	**7**	**7**	**7**	----	----
Sodium	7440-23-5	1	mg/L	**28**	**29**	**21**	----	----
Potassium	7440-09-7	1	mg/L	**3**	**3**	**2**	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.15**	**0.13**	**0.01**	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**2.53**	**2.56**	**2.19**	----	----
Total Cations	----	0.01	meq/L	**2.47**	**2.51**	**2.14**	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**8**	**7**	**6**	----	----