

CERTIFICATE OF ANALYSIS

Work Order : **EW1903709**
Client : **KIAMA COUNCIL**
Contact : **MS JULIE MILEVSKI**
Address : **11 MANNING STREET**
KIAMA NSW, AUSTRALIA 2533

Telephone : **+61 02 4232 0557**
Project : **Minnamurra Landfill**
Order number : **126589**
C-O-C number : **----**
Sampler : **Robert DaLio**
Site : **Minnamurra Landfill**
Quote number : **WO/017/18**
No. of samples received : **20**
No. of samples analysed : **20**

Page : 1 of 10
Laboratory : Environmental Division NSW South Coast
Contact : Glenn Davies
Address : 1/19 Ralph Black Dr, North Wollongong 2500
 4/13 Geary Pl, North Nowra 2541
 Australia NSW Australia

Telephone : 02 42253125
Date Samples Received : 28-Aug-2019 14:44
Date Analysis Commenced : 28-Aug-2019
Issue Date : 05-Sep-2019 14:09



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, NSW



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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED041G: LOR raised for Sulfate on samples 13 and 16 due to sample matrix.
- EG020: Some samples were diluted and rerun due to matrix interference and LOR's have been raised accordingly. (High Total Dissolved Solids)
- EP002: It has been noted that DOC is greater than TOC for various samples, however this difference is within the limits of experimental variation.
- Sampling and sample data supplied by ALS Wollongong.
- Sampling completed as per EN/67.11 Sampling of Groundwater
- Sampling completed as per EN/67.6 Sampling from Rivers and Streams
- Field tests completed on day of sampling/receipt.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 1A	MD 1B	MD 2A	MD 2B	MD 2C
Client sampling date / time				28-Aug-2019 13:30	28-Aug-2019 13:35	28-Aug-2019 12:00	28-Aug-2019 12:10	28-Aug-2019 12:25	
Compound	CAS Number	LOR	Unit	EW1903709-001	EW1903709-002	EW1903709-003	EW1903709-004	EW1903709-005	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	----	7.5	7.6	6.9	7.0	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	----	604	20700	36400	47900	
EA020FD: Field Salinity									
Salinity	----	0.2	g/L	----	0.3	15.0	27.6	36.2	
EA116: Temperature									
Temperature	----	0.1	°C	----	21.0	16.7	17.2	18.6	
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	----	189	587	650	490	
Total Alkalinity as CaCO3	----	1	mg/L	----	189	587	650	490	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	17	752	1720	2350	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	----	42	6710	11800	15400	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	----	47	280	423	471	
Magnesium	7439-95-4	1	mg/L	----	8	439	860	1090	
Sodium	7440-23-5	1	mg/L	----	32	3330	6680	8760	
Potassium	7440-09-7	1	mg/L	----	13	175	262	327	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	----	0.044	0.059	0.146	0.158	
Iron	7439-89-6	0.05	mg/L	----	0.42	0.24	1.42	1.74	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	----	0.2	0.9	0.7	0.8	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	----	13.4	15.9	9.64	5.09	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	----	<0.01	0.11	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	----	0.70	7.42	0.02	<0.01	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 1A	MD 1B	MD 2A	MD 2B	MD 2C
Client sampling date / time					28-Aug-2019 13:30	28-Aug-2019 13:35	28-Aug-2019 12:00	28-Aug-2019 12:10	28-Aug-2019 12:25
Compound	CAS Number	LOR	Unit		EW1903709-001	EW1903709-002	EW1903709-003	EW1903709-004	EW1903709-005
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	0.70	7.53	0.02	<0.01
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		----	5.31	217	382	493
∅ Total Cations	----	0.01	meq/L		----	5.69	----	----	----
∅ Total Cations	----	0.01	meq/L		----	----	199	389	503
∅ Ionic Balance	----	0.01	%		----	3.33	----	----	----
∅ Ionic Balance	----	0.01	%		----	----	4.14	0.97	0.95
EN67 PK: Field Tests									
Field Observations	----	0.01	--		destroyed	----	----	----	----
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		----	6	47	36	21
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		----	6	48	36	21
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		----	0.93	3.76	1.15	1.44
Dissolved Oxygen - % Saturation	----	0.1	% saturation		----	10.5	38.7	12.0	15.2
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		----	<0.05	<0.05	<0.05	0.76
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		----	1.60	0.57	0.74	0.77



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 4A	MD 4B	MD 4C	MD 6A	MD 6B
Client sampling date / time				28-Aug-2019 11:10	28-Aug-2019 11:15	28-Aug-2019 11:30	28-Aug-2019 12:30	28-Aug-2019 13:00	
Compound	CAS Number	LOR	Unit	EW1903709-006	EW1903709-007	EW1903709-008	EW1903709-009	EW1903709-010	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	----	6.9	7.0	7.6	7.1	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	----	23000	48800	1650	1620	
EA020FD: Field Salinity									
Salinity	----	0.2	g/L	----	16.2	38.0	1.0	0.9	
EA116: Temperature									
Temperature	----	0.1	°C	----	18.2	17.5	18.5	19.0	
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	----	758	492	477	575	
Total Alkalinity as CaCO3	----	1	mg/L	----	758	492	477	575	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	927	2320	44	43	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	----	7440	14900	146	82	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	----	402	472	118	106	
Magnesium	7439-95-4	1	mg/L	----	490	1130	43	46	
Sodium	7440-23-5	1	mg/L	----	3740	9220	119	101	
Potassium	7440-09-7	1	mg/L	----	176	338	41	45	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	----	0.124	0.170	0.025	0.106	
Iron	7439-89-6	0.05	mg/L	----	2.01	1.54	0.12	0.18	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	----	0.6	1.1	0.8	0.5	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	----	29.6	1.60	12.4	33.6	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	----	<0.01	<0.01	0.28	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	----	0.03	<0.01	10.6	0.06	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 4A	MD 4B	MD 4C	MD 6A	MD 6B
Client sampling date / time				28-Aug-2019 11:10	28-Aug-2019 11:15	28-Aug-2019 11:30	28-Aug-2019 12:30	28-Aug-2019 13:00	
Compound	CAS Number	LOR	Unit	EW1903709-006	EW1903709-007	EW1903709-008	EW1903709-009	EW1903709-010	
				Result	Result	Result	Result	Result	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	----	0.03	<0.01	10.9	0.06	
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	----	244	478	14.6	14.7	
∅ Total Cations	----	0.01	meq/L	----	228	526	15.6	14.6	
∅ Ionic Balance	----	0.01	%	----	3.55	4.76	3.60	0.26	
EN67 PK: Field Tests									
Field Observations	----	0.01	--	destroyed	----	----	----	----	
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L	----	38	17	32	34	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	----	39	18	32	35	
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	----	3.27	0.73	3.86	0.88	
Dissolved Oxygen - % Saturation	----	0.1	% saturation	----	34.2	7.6	40.5	9.4	
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L	----	<0.05	0.97	<0.05	<0.05	
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m	----	1.17	1.15	1.28	1.28	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 6C	MD 9A	MD 9B	MD 9C	MD 10A
Client sampling date / time				28-Aug-2019 13:10	28-Aug-2019 10:30	28-Aug-2019 10:45	28-Aug-2019 10:55	28-Aug-2019 09:50	
Compound	CAS Number	LOR	Unit	EW1903709-011	EW1903709-012	EW1903709-013	EW1903709-014	EW1903709-015	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.3	7.5	7.1	7.0	7.4	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	38100	6580	3460	10100	41100	
EA020FD: Field Salinity									
Salinity	----	0.2	g/L	27.6	4.2	2.1	6.5	32.8	
EA116: Temperature									
Temperature	----	0.1	°C	19.2	18.1	18.7	18.8	15.7	
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	354	366	1040	812	285	
Total Alkalinity as CaCO3	----	1	mg/L	354	366	1040	812	285	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1910	267	<10	158	2150	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	12400	1880	390	2920	13200	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	372	81	107	193	866	
Magnesium	7439-95-4	1	mg/L	925	130	52	162	997	
Sodium	7440-23-5	1	mg/L	7120	982	292	1380	7370	
Potassium	7440-09-7	1	mg/L	238	69	131	132	165	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.085	0.021	0.150	0.201	0.315	
Iron	7439-89-6	0.05	mg/L	19.7	<0.05	2.08	4.15	<0.10	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.5	0.1	0.7	0.6	0.6	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	44.0	0.12	127	94.4	0.55	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	6.90	<0.01	0.12	0.33	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 6C	MD 9A	MD 9B	MD 9C	MD 10A
Client sampling date / time					28-Aug-2019 13:10	28-Aug-2019 10:30	28-Aug-2019 10:45	28-Aug-2019 10:55	28-Aug-2019 09:50
Compound	CAS Number	LOR	Unit		EW1903709-011	EW1903709-012	EW1903709-013	EW1903709-014	EW1903709-015
					Result	Result	Result	Result	Result
EPK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	6.90	<0.01	0.13	0.33
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		397	65.9	31.8	102	423
∅ Total Cations	----	0.01	meq/L		----	----	34.7	----	----
∅ Total Cations	----	0.01	meq/L		410	59.2	----	86.4	450
∅ Ionic Balance	----	0.01	%		----	----	4.42	----	----
∅ Ionic Balance	----	0.01	%		1.72	5.34	----	8.24	3.12
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		11	49	67	61	50
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		10	50	65	66	51
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		1.80	3.83	0.59	1.61	7.14
Dissolved Oxygen - % Saturation	----	0.1	% saturation		19.4	39.3	6.3	17.2	71.4
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		1.51	0.63	0.77	0.83	0.81



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 10B	Rocklow Down	Rocklow Middle	Rocklow Up	BLANK
Client sampling date / time				28-Aug-2019 10:00	28-Aug-2019 08:20	28-Aug-2019 09:40	28-Aug-2019 08:40	28-Aug-2019 08:15	
Compound	CAS Number	LOR	Unit	EW1903709-016	EW1903709-017	EW1903709-018	EW1903709-019	EW1903709-020	
				Result	Result	Result	Result	Result	
EA005FD: Field pH									
pH	----	0.1	pH Unit	7.0	7.3	7.1	7.6	----	
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	2010	38900	40400	31500	----	
EA020FD: Field Salinity									
Salinity	----	0.2	g/L	1.2	32.3	32.7	25.3	----	
EA116: Temperature									
Temperature	----	0.1	°C	18.8	13.9	15.0	14.3	----	
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	666	170	182	136	----	
Total Alkalinity as CaCO3	----	1	mg/L	666	170	182	136	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	2050	2050	1680	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	179	13300	13400	10700	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	97	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	38	----	----	----	----	
Sodium	7440-23-5	1	mg/L	109	----	----	----	----	
Potassium	7440-09-7	1	mg/L	68	----	----	----	----	
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L	----	409	414	263	----	
Magnesium	7439-95-4	1	mg/L	----	1070	1060	752	----	
Sodium	7440-23-5	1	mg/L	----	8530	8570	6040	----	
Potassium	7440-09-7	1	mg/L	----	312	312	210	----	
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	0.345	----	----	----	<0.001	
Iron	7439-89-6	0.05	mg/L	0.69	----	----	----	<0.05	
EG020T: Total Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L	----	0.067	0.110	0.098	----	
Iron	7439-89-6	0.05	mg/L	----	0.20	0.33	0.27	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 10B	Rocklow Down	Rocklow Middle	Rocklow Up	BLANK
Client sampling date / time				28-Aug-2019 10:00	28-Aug-2019 08:20	28-Aug-2019 09:40	28-Aug-2019 08:40	28-Aug-2019 08:15	
Compound	CAS Number	LOR	Unit	EW1903709-016	EW1903709-017	EW1903709-018	EW1903709-019	EW1903709-020	
				Result	Result	Result	Result	Result	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.8	1.0	1.0	1.0	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	77.0	1.49	1.19	0.02	----	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.02	0.01	<0.01	----	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.02	<0.01	<0.01	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.04	0.01	<0.01	----	
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	18.4	----	----	----	----	
∅ Total Cations	----	0.01	meq/L	20.0	----	----	----	----	
∅ Ionic Balance	----	0.01	%	4.12	----	----	----	----	
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L	49	5	6	6	<1	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	47	7	7	6	----	
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L	1.20	6.10	2.93	7.27	----	
Dissolved Oxygen - % Saturation	----	0.1	% saturation	12.7	59.7	28.8	75.3	----	
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L	<0.05	0.77	<0.05	<0.05	----	
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m	0.87	----	----	----	----	