

Report:
MSA241R06

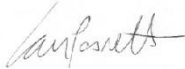
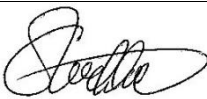
OCEAN GROWN ABALONE: WINTER SEDIMENT SAMPLING REPORT – AUGUST 2018

Prepared for Ocean Grown Abalone Pty Ltd • 13 September 2018

Document Information

REPORT NO.	MSA241R06
TITLE	Ocean Grown Abalone: Winter Sediment Sampling Report - August 2018
DATE	13 September 2018
JOB	MSA241
CLIENT	Ocean Grown Abalone Pty Ltd
USAGE	This report describes the results of the sediment sampling survey undertaken by OGA in August 2018 in accordance with their Management and Environmental Monitoring Plan.
PRECIS	Results from the August 2018 sediment survey in Flinders Bay, Western Australia, showed there was no evidence of eutrophication in sediments directly attributable to the aquaculture operation. No sites reported median concentrations of TP, TKN and TOC above the 80 th percentile trigger values derived from long term monitoring of reference sites. There was no spatial relationship between distance from the lease and concentration of analytes in sediments. A redox discontinuity layer was not identified in any photos of the sediment samples.
KEYWORDS	Sediments, abalone, nutrients

Document Control

	Name	Signature	Date
Prepared	Justin Q Welsh		13/09/2018
Technical Review Completed	Chris Stoddart		13/09/2018
Editorial (QC) Review Completed	Iain Posnett		13/09/2018
Approved	Chris Stoddart		13/09/2018

Revision Approvals

Version	Date	Description	Prepared	Checked	Approved
A.	13.09.18	Issued for client review	JQW	CWS	CWS

Quality Assurance

Level	Description	Status
1: Full	Full review of technical and quality aspects of the document, including where relevant data, calculations and format of contents	☒
2: Minimal	Prima facie check undertaken for completeness and sense	☐
3: None	MScience has not reviewed the document	☐

Table of Contents

1	INTRODUCTION.....	1
2	METHODOLOGY.....	2
2.1	FIELD METHODS.....	2
2.2	SAMPLING DESIGN.....	2
2.3	DATA ANALYSIS - COMPLIANCE WITH MEMP.....	4
3	RESULTS	5
3.1	REDOX LAYER AND ODOUR	5
3.2	SEDIMENT NUTRIENTS.....	6
3.2.1	Total Nitrogen	6
3.2.2	Total Phosphorous.....	7
3.2.3	Total Organic Carbon.....	8
4	DISCUSSION.....	10
5	REFERENCES	11

List of Tables

Table 1. Median nutrient concentrations recorded at lease areas and reference sites. Bold values exceed the 80 th percentile of the pooled winter 2016, 2017 and 2018 reference sites.....	6
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List of Figures

Figure 1. OGA leases in Flinders Bay, Western Australia; insets show the indicative position of samples taken at 1, 5, and 10 m distances from the densely colonised artificial structure within each lease area and the sampling at reference sites.	3
Figure 2. Examples of sediment cores used to evaluate the presence or absence of a redox layer.	5
Figure 3. Total Kjeldahl Nitrogen detected down current of each lease area. The red line represents the 80 th percentile of pooled reference sites (0.41 mg/g).	7
Figure 4. Total Phosphorous detected down current of each lease area. The red line represents the 80 th percentile of pooled reference sites (0.43 mg/g).	8
Figure 5. Total Organic Carbon detected down current of each lease area. The red line represents the 80 th percentile of pooled reference sites (0.10 mg/g).	9

Acronyms and Abbreviations

Abbreviation	Definition
DPIRD	Department of Primary Industry and Resource Development
LoR	Limit of Reporting
MEMP	Management and environmental monitoring plan
OGA	Ocean Grown Abalone Pty. Ltd.
SAP	Sampling and Analysis Plan
SSSR	Summer Sediment Sampling Report
WSSR	Winter Sediment Sampling Report
TKH	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorous

1 Introduction

Ocean Grown Abalone Pty Ltd (OGA) raise greenlip abalone (*Haliotis laevis*) on artificial substrate (known as ABITATs) in Flinders Bay, Augusta, Western Australia under licence number 1630 issued under the *Fish Resources Management Act 1994* from the Western Australian Department of Fisheries (now Department of Primary Industry and Resource Development – DPIRD). Hatchery-reared larvae, grown from broodstock taken within Flinders Bay, Western Australia, are placed on ABITAT modules within the bay and are allowed to feed on naturally occurring algae until harvest. The first hatchery-reared juvenile abalone were transferred to blocks within sandy substrates in August 2014.

In 2017, OGA applied for and were granted, a variation to their operation within Flinders Bay. The variation amalgamated three disjointed leases into a single, larger region (MScience 2016a).

As a condition of approval for this operation, OGA has developed a Management and Environmental Monitoring Plan (MEMP; MScience 2016) which has been approved by DPIRD. Under Section 3.1.5 of the MEMP, OGA is required to conduct biannual monitoring of the quality of sediments in and around the aquaculture leases in summer and winter, with the sampling effort dictated by the number of ABITATs within the lease (MScience 2016). Sampling is conducted by OGA divers and sediment samples are assessed for nutrients, total organic carbon, and the depth of any redox discontinuity (by colour and odour).

The results of the August 2018 sampling event are presented in this report consistent with the MEMP.

2 Methodology

2.1 Field Methods

This report describes the results of the Winter Sediment Sampling Program 2018 (WSSR) undertaken by OGA divers on the 28th of August 2018. All methods relating to sediment collection, sample handling, QAQC practices and laboratory procedures were followed as per the Sampling Analysis Plan (SAP; BMT Oceanica 2015) with sample locations and numbers modified under the licence variation MEMP (MScience 2016).

2.2 Sampling Design

The number of sampling and reference sites are dependent on the number of ABITAT modules deployed in the lease at the time of sampling. For every 2000 modules, samples will be collected along one transect within the lease and one reference site outside the lease, rounding up to an integer value (MScience 2016). For each transect and reference site, 9 samples are collected (see below for details). At the time of the WSSR 2018, roughly 10,000 modules were present in the lease, resulting in the requirement for five sampling transects and five reference sites.

The location of OGA's lease, as well as the sampling and reference sites within the lease for the WSSR 2018, are shown in Figure 1. In total, 90 samples were collected from the lease area for analysis in accordance with OGA's MEMP (MScience 2016a). Of the 90 samples, 45 were from test sites and 45 from reference sites.

Test site sediment samples were collected along three transects, extending down-current from ABITAT modules. Along each transect, samples were collected at distance increments of 1, 5, and 10 m from the module (Figure 1). Where practical, sampling started from modules distributed throughout the lease with a high abalone biomass (or the abalone expected to contribute the greatest volume of fecal waste).

Reference points were located at least 50 m from the nearest lease area boundary. Within a 20 m radius of a reference point, three sites were randomly selected and at each of these sites, three samples were collected for nutrient analyses. In addition to the reference site data collected as part of the 2018 WSSR, additional reference site data collected as part of the 2016 and 2017 WSSR was included to develop the background reference condition. Sample collection was identical between the 2016, 2017 and 2018 surveys. Laboratory methods used to analyse the sediments were all NATA certified.

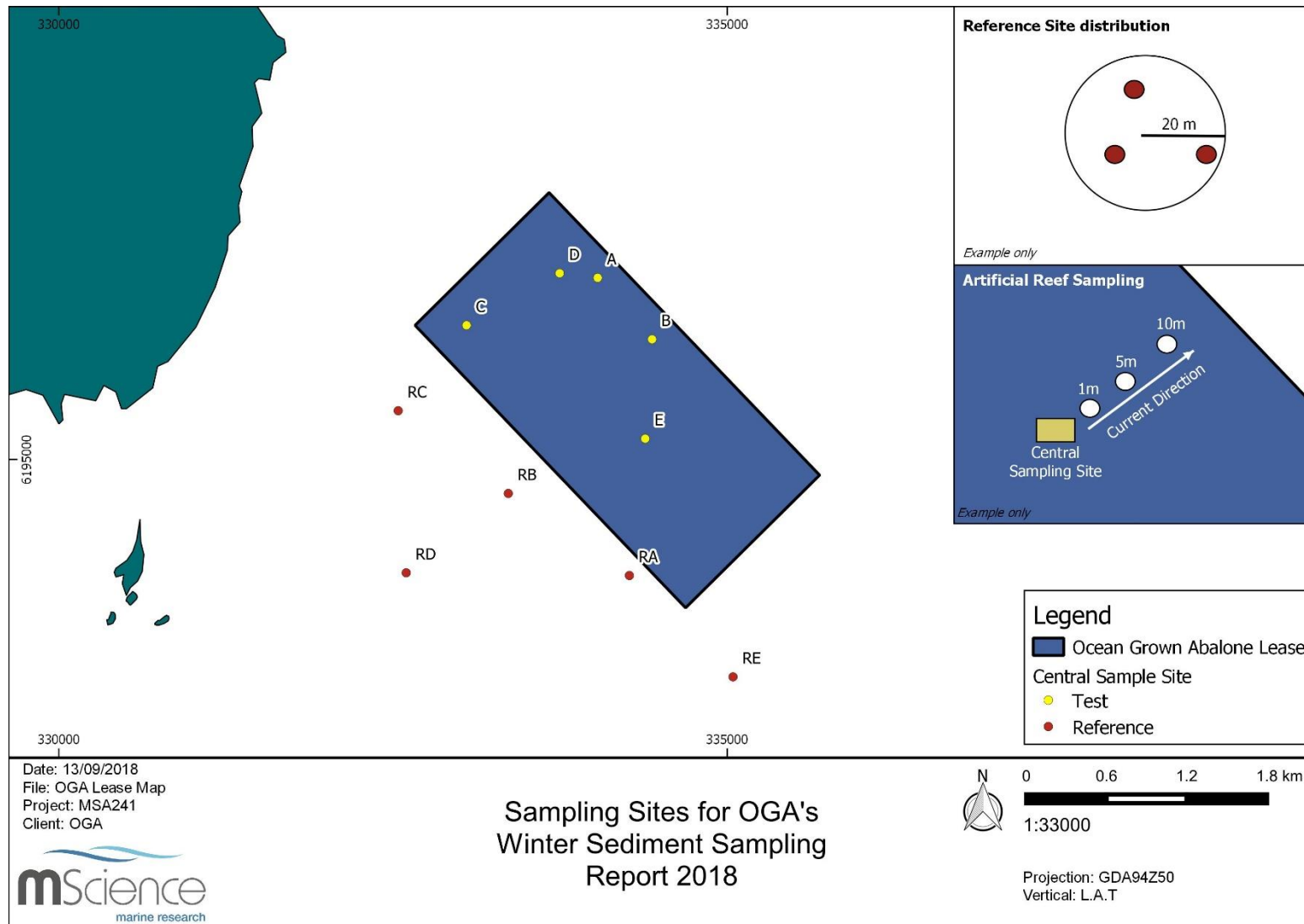


Figure 1. OGA leases in Flinders Bay, Western Australia; insets show the indicative position of samples taken at 1, 5, and 10 m distances from the densely colonised artificial structure within each lease area and the sampling at reference sites.

2.3 Data analysis - Compliance with MEMP

To evaluate the potential influence of ranching abalone in Flinders Bay, median sediment concentrations of Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP) and Total Organic Carbon (TOC) were calculated for each distance (1, 5 and 10 m) down current of the most densely colonised section of artificial substrate from each of the four test transects (resulting in 15 test site medians per analyte). Median values were then compared against the 80th percentile of pooled data from the reference sites. ANZECC & ARMCANZ (2000) states that reference data should be collected over at least two years in order to accurately represent natural variability within an analyte. As such, median values from the aquaculture lease distance increments in the WSSR 2018 survey were compared to pooled reference site data collected over the 2016, 2017 and 2018 winter sediment sampling programs ($n = 125$)¹. In order to be compliant with the MEMP, median concentrations at every test site were required to be below the 80th percentile of reference sites.

Further analysis of the relationship between nutrient concentration and distance of the test site from the artificial substrate was undertaken using an ANOVA of pooled lease area data, to test for a significant difference between distance increments from the artificial structures (1, 5 and 10 m). As the ANOVAs were being performed for multiple tests, a Bonferroni Correction was applied to the *P* value against which the results of each statistical test were compared, resulting in a *P* value of 0.02.

For the purposes of data analysis, any samples returning concentrations lower than the limit of reporting (LoR) were assigned a nominal value of LOR/2 and included in the dataset, as per the guidelines in ANZECC & ARMCANZ (2000).

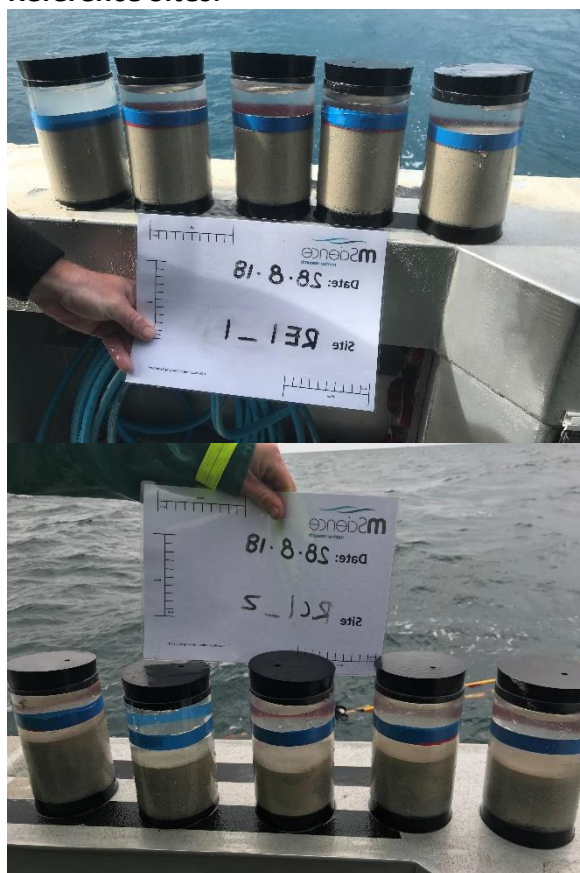
¹ While additional data were available from the summer sediment sampling programs, only winter data were included as part of the pooled reference site data to avoid any potential impacts of seasonality.

3 Results

3.1 Redox layer and odour

Visual inspection of the sediment cores taken at both test and reference sites revealed no visible evidence of a redox discontinuity layer (Figure 2). There was also no reported evidence of sulphurous odour from test site samples (Appendix A). Further visual inspection of core samples did not identify visible abnormal organic material in either test or reference sites.

Reference Sites:



Test Sites:



Figure 2. Examples of sediment cores used to evaluate the presence or absence of a redox layer.

3.2 Sediment nutrients

Chemical analyses of sediments showed that nutrient and TOC concentrations for all samples were above the LORs. The median sediment concentrations of nutrients and TOC are presented in Table 1 for comparison against the 80th percentile reference values obtained from the long-term reference site data set.

Table 1. Median nutrient concentrations recorded at lease areas and reference sites. Bold values exceed the 80th percentile of the pooled winter 2016, 2017 and 2018 reference sites.

Sample Group	Sample Site	TKN (mg/g)	TP (mg/g)	TOC (%)
Sample Site A	1 m	0.23	0.33	0.09
	5 m	0.23	0.31	0.09
	10 m	0.20	0.29	0.09
Sample Site B	1 m	0.25	0.37	0.08
	5 m	0.23	0.36	0.10
	10 m	0.21	0.37	0.10
Sample Site C	1 m	0.24	0.33	0.09
	5 m	0.27	0.35	0.08
	10 m	0.26	0.34	0.09
Sample Site D	1 m	0.32	0.34	0.10
	5 m	0.32	0.32	0.10
	10 m	0.35	0.30	0.10
Sample Site E	1 m	0.36	0.33	0.09
	5 m	0.37	0.32	0.10
	10 m	0.34	0.33	0.10
Reference sites	R1	0.37	0.35	0.10
	R2	0.26	0.38	0.08
	R3	0.25	0.33	0.07
	R4	0.27	0.38	0.06
	R5	0.44	0.37	0.07

3.2.1 Total Nitrogen

TKN concentrations in sediments sampled from impact sites near lease areas varied between 0.16 and 0.41 mg/g (Appendix B). These concentrations were similar to the TKN concentrations of 0.23 to 0.44 mg/g obtained for the 2017 WSSR (MScience 2017). Sediment concentrations of TKN at all sites and all distances were below the 80th percentile from the pooled reference sites (0.41 mg/g) (Figure 3, Table 1).

Statistical comparison of pooled TKN data across test sites at 1, 5 and 10 m from the most densely stocked sections of the artificial structure, found no significant effect of site distance from the lease ($F_{2,42} = 0.057$, $p > 0.05$).

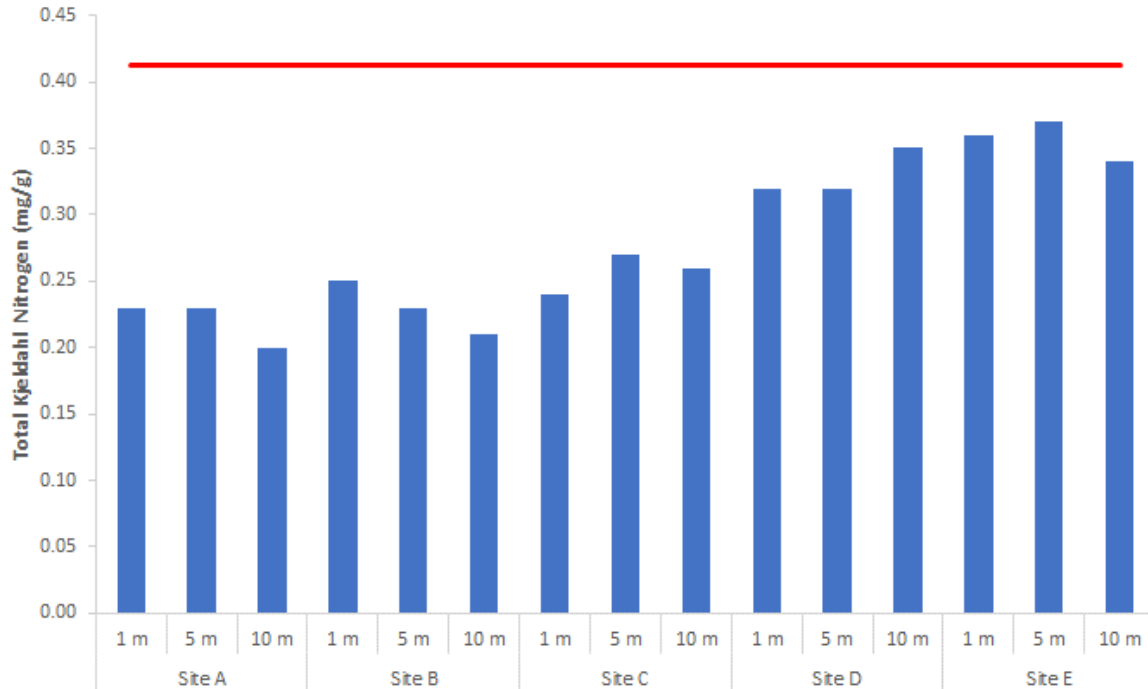


Figure 3. Total Kjeldahl Nitrogen detected down current of each lease area. The red line represents the 80th percentile of pooled reference sites (0.41 mg/g).

3.2.2 Total Phosphorous

TP concentrations in sediments varied from 0.28 to 0.41 mg/g (Table 1; Appendix B), which was similar to the range of concentrations reported in the 2017 WSSR, where TP ranged from 0.32 to 0.45 mg/g (MScience 2017). All test sites were below the 80th percentile of pooled reference sites at all distances from the lease (Figure 4).

When pooled across transects, statistical comparison of TP data between sites at 1, 5 and 10 m from the most densely stocked sections of the artificial structures, found no significant difference between test sites at different distances ($F_{2,42} = 0.42$, $p > 0.05$).

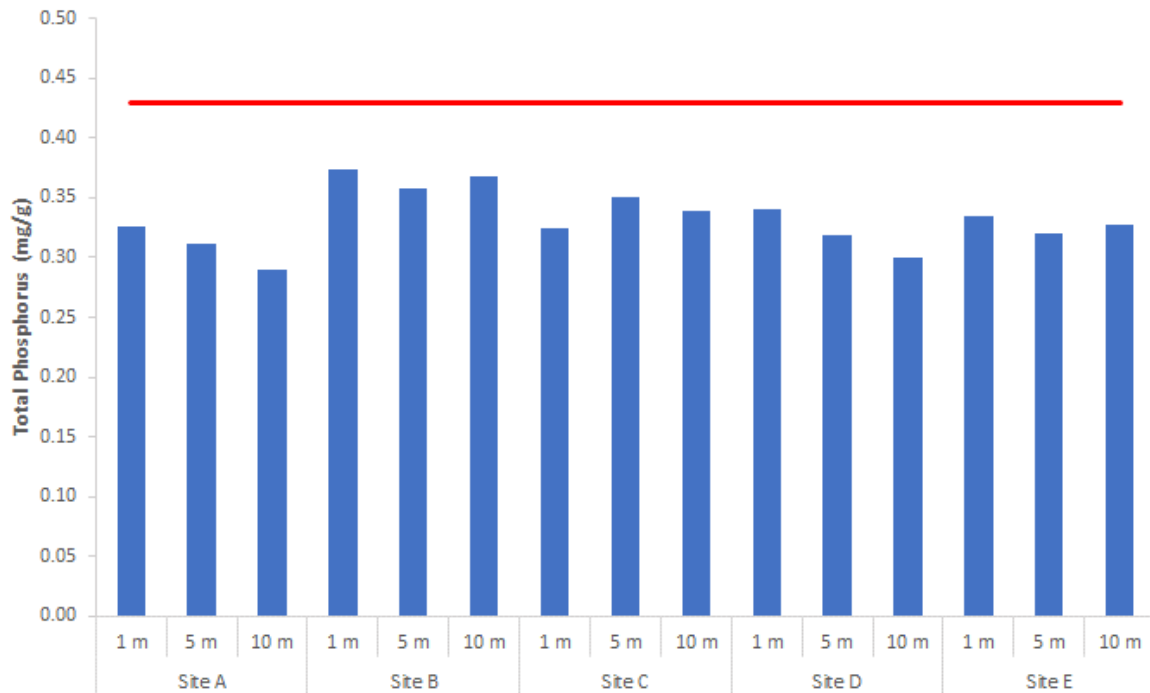


Figure 4. Total Phosphorous detected down current of each lease area. The red line represents the 80th percentile of pooled reference sites (0.43 mg/g).

3.2.3 Total Organic Carbon

TOC concentration in sediment was low, ranging from 0.06 to 0.11%. The TOC results from the present study were similar than those reported for the 2017 WSSR, in which TOC was found to range between 0.06 and 0.14% (MScience 2017). Comparison of median TOC data at test sites with the 80th percentile of pooled reference sites revealed none of the test sites exceeded the reference trigger (Figure 5).

When pooled across transects, statistical comparison of TOC data between sites at 1, 5 and 10 m from the three most densely stocked sections of the artificial structures, found no significant difference between the test sites at different distances ($F_{2,42} = 0.84$, $p > 0.05$).

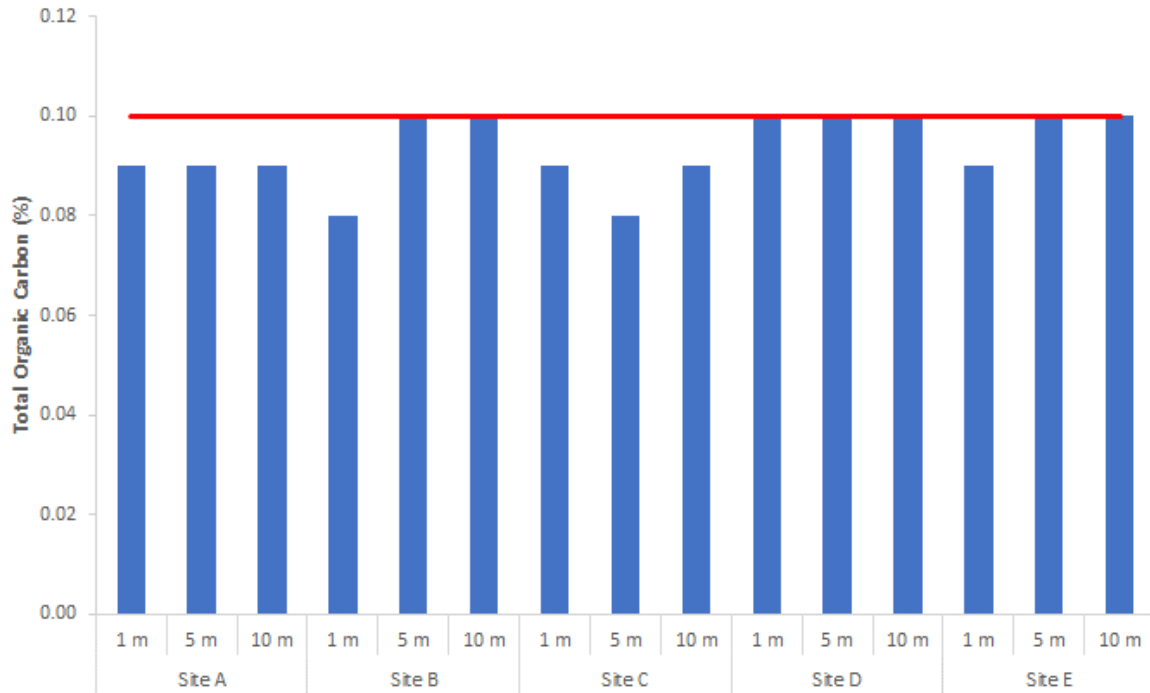


Figure 5. Total Organic Carbon detected down current of each lease area. The red line represents the 80th percentile of pooled reference sites (0.10 mg/g).

4 Discussion

The MEMP (MScience 2016) uses a comparison between the median concentration of analytes at individual test sites and the 80th percentile data from pooled reference sites from all winter sampling programs to evaluate the impact of OGA's aquaculture operations on the marine environment. If there is an exceedance of the 80th percentile trigger value at any of the test sites, the MEMP states that seagrass monitoring within the area of OGA's aquaculture leases may be required. In the present investigation, no sites reported an exceedance of the 80th percentile trigger value for any of the organic contaminants measured. The lines of evidence investigation also concluded that there was no evidence of additional nutrient deposition from the aquaculture operation.

Comparing the results of the 2018 winter survey with previous surveys of the area suggest that nitrogen levels have been consistent over the winter surveys between 2016 to 2018. Similarly, comparison of TP and TOC concentrations between surveys show consistent TP sediment concentrations across winter surveys between 2016 to 2018. These data suggest there have been no cumulative impacts over time from the aquaculture operation on sediment quality.

Given the low levels of nutrients surrounding artificial structures, the lack of a redox discontinuity layer at any of the sites and the spatial relationships with nutrient concentration, there is no evidence to suggest that OGA's aquaculture activities in Flinders Bay are having a significant influence on the nutrient content of the surrounding marine sediments.

5 References

- ANZECC & ARMCANZ (2000) National Water Quality Management Strategy No. 4. Australian and New Zealand Environment and Conservation Council and Agriculture, and Resource Management Council of Australia and New Zealand, Canberra, ACT
- BMT Oceanica (2015) Ocean Grown Abalone – Sediment Sampling and Analysis Plan. Perth, WA
- MScience (2016) Aquaculture Management and Environmental Monitoring Plan (MEMP): Ocean Grown Abalone.
- MScience (2017) Ocean Grown Abalone - Winter Sediment Sampling Report - September 2017. Report Prepared for Ocean Grown Abalone Pty Ltd

Appendix A
Sediment Sample Log and Description

WINTER 2018 SEDIMENT SAMPLING FIELD NOTES

SITE ID	SAMPLE DATE/TIME	GPS TAG	DEPTH	PHOTO ID	JAR FILLED	PSD BAG FILLED	NOTES
A1	8/28/2018	S 34°21.649' E 115°11.714'	16	☒	☒	☒	JBAY # 7 MOORING
A5	8/28/2018			☒	☒	☒	
A10	8/28/2018			☒	☒	☒	
B1	8/28/2018	S 34°21.902' E 115°11.974'	17	☒	☒	☒	P BREAK # 6 MOORING
B5	8/28/2018			☒	☒	☒	
B10	8/28/2018			☒	☒	☒	
C1	8/28/2018	S 34°21.832' E 115°11.070'	15	☒	☒	☒	KIRRA # 2 MOORING
C5	8/28/2018			☒	☒	☒	
C10	8/28/2018			☒	☒	☒	
C1	8/28/2018	S 34°21.832' E 115°11.070'	15	☒	☒	☒	KIRRA # 2 MOORING
C5	8/28/2018			☒	☒	☒	
C10	8/28/2018			☒	☒	☒	
D1	8/28/2018	S 34°21.628' E 115°11.529'	17	☒	☒	☒	AC # 11 MOORING
D5	8/28/2018			☒	☒	☒	
D10	8/28/2018			☒	☒	☒	
E1	8/28/2018	S 34°22.304' E 115°11.932'	18	☒	☒	☒	MAINBREAK # 2 MOORING
E5	8/28/2018			☒	☒	☒	
E10	8/28/2018			☒	☒	☒	
RA1	8/28/2018	S 34°22.857' E 115°11.843'	18	☒	☒	☒	
RA2	8/28/2018			☒	☒	☒	
RA3	8/28/2018			☒	☒	☒	
RB1	8/28/2018	S 34°22.516' E 115°11.259'	15	☒	☒	☒	
RB2	8/28/2018			☒	☒	☒	
RB3	8/28/2018			☒	☒	☒	
RC1	8/28/2018	S 34°22.173' E 115°10.729'	17	☒	☒	☒	
RC2	8/28/2018			☒	☒	☒	
RC3	8/28/2018			☒	☒	☒	
RD1	8/28/2018	S 34°22.830' E 115°10.754'	18	☒	☒	☒	
RD2	8/28/2018			☒	☒	☒	
RD3	8/28/2018			☒	☒	☒	
RE1	8/28/2018	S 34°23.275' E 115°12.340'	17	☒	☒	☒	
RE2	8/28/2018			☒	☒	☒	
RE3	8/28/2018			☒	☒	☒	

Appendix B

Laboratory Reports

CERTIFICATE OF ANALYSIS

Work Order : **EP1810112**
Client : **MSCIENCE PTY LTD**
Contact : JUSTIN WELSH
Address : 322 LORD ST
HIGHGATE WA, AUSTRALIA 6003
Telephone : +61 08 6389 4600
Project : MSA241 OGA WSSR 2018
Order number : MSA241 WSSR18
C-O-C number : ----
Sampler : OCEAN GROWN ABALONE
Site : ----
Quote number : EP/523/18
No. of samples received : 90
No. of samples analysed : 90

Page : 1 of 20
Laboratory : Environmental Division Perth
Contact : Customer Services EP
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : +61-8-9406 1301
Date Samples Received : 31-Aug-2018 12:00
Date Analysis Commenced : 04-Sep-2018
Issue Date : 10-Sep-2018 16:28



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.

Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



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.

- TOC conducted by ALS Brisbane, NATA Site No. 818.



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				A1-1	A1-2	A1-3	A5-1	A5-2
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-001	EP1810112-002	EP1810112-003	EP1810112-004	EP1810112-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	27.4	26.6	29.2	27.2	27.5
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	250	230	220	230	240
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	250	230	220	230	240
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	366	326	278	311	334
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.10	0.08	0.09	0.09	0.10



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				A5-3	A10-1	A10-2	A10-3	B1-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-006	EP1810112-007	EP1810112-008	EP1810112-009	EP1810112-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	28.3	26.7	28.3	26.9	27.6
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	220	200	270	160	240
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	220	200	270	160	240
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	297	290	297	283	413
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.09	0.08	0.09	0.09	0.08



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				B1-2	B1-3	B5-1	B5-2	B5-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-011	EP1810112-012	EP1810112-013	EP1810112-014	EP1810112-015
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	28.0	30.6	27.1	27.3	27.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	250	260	220	230	240
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	250	260	220	230	240
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	373	306	363	324	358
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.08	0.10	0.10	0.10	0.11



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	B10-1	B10-2	B10-3	C1-1	C1-2
Client sampling date / time					[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit		EP1810112-016	EP1810112-017	EP1810112-018	EP1810112-019	EP1810112-020
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		27.0	26.4	27.0	30.8	29.2
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		240	210	210	200	240
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		240	210	210	200	240
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		368	388	333	318	325
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.10	0.10	0.10	0.11	0.09



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				C1-3	C5-1	C5-2	C5-3	C10-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-021	EP1810112-022	EP1810112-023	EP1810112-024	EP1810112-025
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	27.2	32.2	29.8	27.3	28.8
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	240	280	270	260	260
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	240	280	270	260	260
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	366	350	331	409	339
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.06	0.07	0.08	0.08	0.08



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				C10-2	C10-3	D1-1	D1-2	D1-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-026	EP1810112-027	EP1810112-028	EP1810112-029	EP1810112-030
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	29.8	28.8	30.5	32.6	30.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	260	270	330	320	310
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	260	270	330	320	310
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	356	325	340	341	307
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.09	0.09	0.11	0.10	0.09



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				D5-1	D5-2	D5-3	D10-1	D10-2
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-031	EP1810112-032	EP1810112-033	EP1810112-034	EP1810112-035
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	31.4	30.5	31.9	32.2	38.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	0.1	0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	320	340	320	320	350
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	320	340	320	320	350
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	321	319	304	299	300
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.10	0.08	0.10	0.11	0.09



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				D10-3	E1-1	E1-2	E1-3	E5-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-036	EP1810112-037	EP1810112-038	EP1810112-039	EP1810112-040
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	39.4	37.2	38.1	38.7	38.5
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	410	340	360	360	370
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	410	340	360	360	370
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	345	298	350	334	322
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.10	0.09	0.07	0.09	0.10



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				E5-2	E5-3	E10-1	E10-2	E10-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-041	EP1810112-042	EP1810112-043	EP1810112-044	EP1810112-045
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	39.7	37.8	41.2	37.4	37.9
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	0.2	0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	350	370	340	330	360
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	350	370	340	330	360
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	320	319	328	289	345
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.09	0.11	0.11	0.09	0.10



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RA1-1	RA1-2	RA1-3	RA2-1	RA2-2
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-046	EP1810112-047	EP1810112-048	EP1810112-049	EP1810112-050
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	38.7	41.2	38.8	39.3	39.4
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	0.1	0.1	0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	350	380	370	410	370
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	350	380	370	410	370
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	316	348	379	365	352
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.09	0.10	0.10	0.09	0.09



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RA2-3	RA3-1	RA3-2	RA3-3	RB1-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-051	EP1810112-052	EP1810112-053	EP1810112-054	EP1810112-055
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	39.2	37.3	36.9	41.0	34.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	330	360	370	390	260
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	330	360	370	390	260
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	300	360	395	344	347
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.10	0.09	0.10	0.10	0.09



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RB1-2	RB1-3	RB2-1	RB2-2	RB2-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-056	EP1810112-057	EP1810112-058	EP1810112-059	EP1810112-060
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	31.4	32.3	35.6	35.4	34.9
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	250	240	320	360	270
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	250	240	320	360	270
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	424	381	378	430	389
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.07	0.08	0.08	0.11	0.07



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RB3-1	RB3-2	RB3-3	RC1-1	RC1-2
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-061	EP1810112-062	EP1810112-063	EP1810112-064	EP1810112-065
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	34.0	31.3	35.3	32.6	34.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	250	250	320	240	270
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	250	250	320	240	270
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	363	380	353	326	371
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.09	0.07	0.09	0.05	0.07



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RC1-3	RC2-1	RC2-2	RC2-3	RC3-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-066	EP1810112-067	EP1810112-068	EP1810112-069	EP1810112-070
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	31.7	33.1	32.2	33.3	35.0
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	<0.1	0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	260	250	270	230	250
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	260	250	270	230	250
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	330	317	338	404	322
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.07	0.07	0.07	0.06	0.06



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RC3-2	RC3-3	RD1-1	RD1-2	RD1-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-071	EP1810112-072	EP1810112-073	EP1810112-074	EP1810112-075
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	35.6	33.9	32.8	34.8	36.0
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	<0.1	<0.1	0.1	0.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	290	230	280	290	270
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	290	230	280	290	270
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	378	296	413	406	380
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.08	0.08	0.06	0.06	0.06



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	RD2-1	RD2-2	RD2-3	RD3-1	RD3-2
Client sampling date / time					[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit		EP1810112-076	EP1810112-077	EP1810112-078	EP1810112-079	EP1810112-080
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		37.4	35.4	34.2	30.2	35.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.3	0.2	0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		280	300	270	260	240
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		280	300	270	260	240
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		375	379	411	356	455
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.07	0.06	0.08	0.07	0.06



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RD3-3	RE1-1	RE1-2	RE1-3	RE2-1
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-081	EP1810112-082	EP1810112-083	EP1810112-084	EP1810112-085
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	31.9	40.8	39.7	38.0	40.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.1	0.1	0.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	270	380	390	360	460
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	270	380	390	360	460
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	366	386	377	368	396
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.05	0.08	0.07	0.07	0.06



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				RE2-2	RE2-3	RE3-1	RE3-2	RE3-3
Client sampling date / time				[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]	[31-Aug-2018]
Compound	CAS Number	LOR	Unit	EP1810112-086	EP1810112-087	EP1810112-088	EP1810112-089	EP1810112-090
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	38.8	39.6	40.7	38.6	41.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	0.2	<0.1	0.1	0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	480	440	460	440	430
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	480	440	460	440	430
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	354	399	367	343	358
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.07	0.07	0.10	0.08	0.08



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