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Mackay Sugar Limited

Racecourse Mill Effluent Pond Environmental (Odour) Assessment

Environmental Evaluation STAT1122

February 2019

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Glossary

Acronym	Meaning
ALS	Australian Laboratory Services
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CQG	CQG Consulting (CQ Environmental Pty Ltd)
DES	Department of Environment and Science
DW1	Downwind 1 (hydrogen sulfide monitoring point)
DW2	Downwind 2 (hydrogen sulfide monitoring point)
EA	Environmental Authority EPPR00423513
EE	Environmental Evaluation (STAT1122 reference CR70825)
EPP	Environmental Protection Policy
H ₂ S	hydrogen sulfide
km	Kilometre
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
PPB	Parts per billion
PPM	Parts per million
SAP	Sampling and Analysis Plan
t	tonne
UW1	Upwind 1 (Hydrogen Sulfide monitoring point)

Executive Summary

Mackay Sugar Limited (MSL) operates under an Environmental Authority EPPR00423513 (EA) issued and monitored by the Department of Environment and Science (DES) to ensure compliance with the *Environmental Protection Act, 1994*, (Qld). A notice to conduct or commission an environmental evaluation (EE) was issued to MSL on 15 May 2018 (STAT 1122 reference CR70825) by DES in relation to community complaints regarding odour nuisance and perceived potential health effects from Racecourse Mill's effluent treatment ponds.

The Racecourse Mill ponds treat effluent from the Mill, the Racecourse Cogeneration Plant and the Racecourse Refinery during the crushing season (typically June to December each year) and from the Cogeneration Plant and the Refinery only during the non-crush period. The Racecourse Refinery is owned and operated by Sugar Australia.

MSL engaged CQG Consulting (CQG) to assist with the investigation and with the identification of the potential remedial options to reduce the generation of odours from the ponds. CQG's Senior Environmental Scientist and Mackay Manager, Nicola Mylne conducted the monitoring and assessments required for this investigation (refer to **Section 3** for Sampling Methodology) and is deemed a suitably qualified person (refer to **Attachment A** for curriculum vitae and statutory declaration).

A comprehensive monitoring program was undertaken to determine the hydrogen sulfide (H₂S) gas levels upwind and downwind of the Mill effluent ponds with the establishment of three continuous monitors and a weather station along with two sampling events (one during the crush and one non-crush) of pond waters and pond sediments (sludge).

The key findings of the investigation include the following:

- During the investigation period, the H₂S gas levels upwind and downwind of the effluent ponds did not exceed the *Environmental Protection (Air) Policy 2007* health and wellbeing trigger (0.11 ppm for 24 hours);
- Upwind 1 (UW1) reported intermittent readings of H₂S ranging from 0.6 ppm to 1.0 ppm. Measurements were not sustained for longer than 15 minutes and predominately occurred when there was north and/or north-easterly wind conditions;
- H₂S was not detected at all at Downwind 1 (DW1) during the monitoring period;
- H₂S was detected at Downwind 2 (DW2) monitoring site 85% of the days during the crush and 40% of the days during the non-crush, with the highest reading on 18 October 2018 where measurements ranged from 0.011 ppm to 0.018 ppm for up to 20 minutes. These levels were above *Environmental Protection (Air) Policy 2007* aesthetic trigger (0.0049 ppm for 30 mins);
- Operational conditions at Racecourse Mill (including effluent quality and volume) had a direct correlation to the production of H₂S gas at the effluent ponds following a caustic juice loss to effluent and a higher than usual volume of effluent and elevated carbohydrate levels;
- There is insufficient data on the quality and quantity of effluent flows from the three sources (Mill, Cogeneration Plant and Refinery) and for possible sources of sulfur and sulfides in the effluent;
- Effluent produced in the crush has poorer water quality than the effluent produced in the non-crush (as expected);
- Effluent from the boiler ash sluice system could be contributing to the production of sulfide reducing bacteria in the ponds; and
- There are elevated levels of sulfide reducing bacteria present in both the effluent water and sludge within the ponds.

Several recommendations to reduce the risk of odour generation at the ponds have been made by CQG and MSL, refer to **Table 6.1** and to the Remediation Options Assessment Technical Memo (CQG, February 2019). Several of these include proposed capital investments during the 2019 non-crush period, meaning their effect could not be determined until the 2019 crushing season (June to December this year).

1 Introduction

1.1 Background

CQG Consulting (CQG) was commissioned by Mackay Sugar Limited (MSL) to undertake an investigation in response to an environmental evaluation (STAT1122 reference CR70825) (EE) (**Attachment G**) issued in respect to odour complaints associated with Racecourse Mill's effluent treatment ponds.

Wastewater effluent is produced as a result of the sugar milling at Racecourse Mill, generation of electricity from bagasse at the Racecourse Cogeneration Plant and from the refining of sugars at the Racecourse Refinery during the crushing season (typically June to December each year) and from the Cogeneration Plant and the Refinery during the non-crush period. The Racecourse Refinery is owned and operated by Sugar Australia. Crushing of cane and the production of sugar generates wastewaters that typically contain sugars and other materials that have the potential to ferment and generate odours, particularly if there are sulfides in the effluent stream or in treatment systems where there are sediment/sludge build ups.

Effluent (including wash-down waters, overflows from vessels and the ash handling system, excess condensates and contaminated stormwaters) is transported through an underground seven-kilometre network of poly pipes to a series of effluent ponds for treatment located approximately 5.5 kilometres south-west (SW) of Racecourse Mill (see **Figure 1.1**).

When constructed the ponds were approximately 120 x 300 x 5 metres, providing a total capacity of around 450 mega litres (ML). Under normal conditions flow between the ponds is from Pond One (facultative pond where treatment occurs by digestion) to Pond Three and then into to Pond Two for release when discharge release conditions under Environmental Authority (EA) EPPR00423513 are met (Mackay Sugar Limited, Effluent Management Procedure, 2016).

The Department of Environment and Science (DES) has reportedly received several complaints since November 2015 regarding odour nuisance and alleged health effects associated with odours in the vicinity of the effluent ponds.

MSL conducted an air quality monitoring program in August 2016 and submitted a report to DES. The monitoring conducted in that investigation indicated that the levels of H₂S detected had the potential to cause environmental nuisance to sensitive receptors. The investigation was limited by equipment failures and data loss and DES noted that some critical water quality parameters were not included in the monitoring program. DES issued a notice to MSL to conduct another environmental evaluation to address the issue (CR70825).

1.2 Site Description

The street address of the Site (Racecourse Mill the Refinery and the effluent ponds) is Peak Downs Highway, Mackay 4740. Refer to **Figure 1.1** which defines the site boundaries and **Table 1.1** for a site summary.

Table 1.1: Site Summary

Site Identifier	Racecourse Sugar Mill
Real Property Description	Lot 1 & 2 RP703613; Lot 3 & 4 RP704750; Lot 1 RP704739, Lot 1 RP732066, Lot 1 & 2 RP723347, Lot 9 RP749853m Lot 8 RP904457, Lot 2 CP854468, Lot L of Lot 632 on CP859415, Lot M of Lot 632 on CP859415.
Street Address	Peak Downs Highway
Registered Owner	Mackay Sugar Limited
MSL Environmentally Relevant Activities	Environmentally relevant activity (ERA) 28 – sugar milling or refining, consisting of either: a) Crushing or grinding 200 tonne (t) or more of sugar cane in a year; or b) Manufacturing 200t or more of sugar or other sugarcane products in a year.



Figure 1.1

Mackay Sugar Limited

Racecourse Mill

Site Boundaries



180 Quay Street, Rockhampton Q 4700
PO Box 8384, Allenstown 4700
Ph: +61 7 4922 9522 Fax: +61 7 4922 0195

Project No: 18059
22 January 2019

Legend

Cadastral Boundaries

N

Scale 1:24,000 (A3)



Map Projection: Map Grid of Australia 1994 Zone 55

2 Sampling Methodology

2.1 Scope

The investigations, methodologies and recommendations within this Report are aligned to *Air Quality Sampling Manual* (Environmental Protection Agency, 1997) (for H₂S), *DES Monitoring and Sampling Manual 2018*, AS/NZS 5667 – *Water Quality Sampling* and the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 2013* (for sludge sampling).

The scope of the sampling was designed to meet the requirements of the EE and to ensure adequate data to facilitate the H₂S investigation. A sampling and analysis plan (SAP) were developed by CQG (refer to **Attachment B**) and was reviewed and accepted by MSL at project commencement. The monitoring locations are presented in **Figure 2.1**. The scope of the SAP was to identify sources of odours at the effluent ponds and includes the following:

- H₂S monitoring;
- Water quality sampling;
- Sludge sampling; and
- Meteorological data recording.

The sampling program was also designed to compare the H₂S and water quality data during the two different operational conditions at the Mill (i.e. crush and non-crush conditions) to inform influences on effluent quality and the subsequent H₂S production.

2.2 Hydrogen Sulfide

The sampling methodology was developed in accordance with the *Air Quality Sampling Manual* (Environmental Protection Agency, 1997). Three acrologgers were installed within the Study Area (shown in **Figure 2.1**) to provide continuous monitoring of H₂S gas. One was located upwind of the effluent ponds (Upwind 1), and two downwind at sensitive receptors (Downwind 1 and Downwind 2). Upwind 1 (UW1) was positioned approximately 0.27 kilometres south from the central point of the ponds, whereas Downwind 1 (DW1) and Downwind 2 (DW2) were located approximately 1.1 kilometres north-west and 1.25 kilometres north-west respectively. The acrologgers were in place from 11 October 2018 to the 21 December 2018, monitoring for the minimum of 45 days within the crush period and 15 days within the non-crush period as required by DES.

Loggers installed at UW1 and DW1 measured in parts per million (PPM) whereas the logger installed at DW2 measured in parts per billion (PPB).

Data was downloaded weekly using the Acrustat software and observations were recorded against operational conditions at the Mill. Reliability of the acrologgers was a limitation for a small component of the monitoring program, where battery faults occurred with UW1 and DW2 causing data loss for eight and seven days respectively. This was mitigated by extending the end point to ensure that the minimum monitoring requirement was met.

2.3 Pond Water

Pond water sampling was conducted by CQG on two occasions within the monitoring period: The first event on 5 November 2018 during the crushing season and on 3 December 2018 following the end of the Mill washdown (non-crush).

Samples were collected in appropriately prepared laboratory bottles using a decontaminated bucket. Sample bottles were labelled and transferred to an esky on ice with chain of custody documentation and forwarded overnight to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

In-situ parameters of physical chemistry were recorded on field sheets (refer to **Attachment C**).

The pond water samples were taken in the same monitoring locations for both events (refer to **Figure 2.1**).

2.4 Pond Sludge

Pond sludge sampling was also conducted by CQG environmental staff on 5 November 2018 and 3 December 2018 to detect the effects of washdown at the commencement of non-crush conditions on sludge quality. It is acknowledged that the effects may be difficult to detect given the short lag time between the crush and the non-crush period and the legacy contaminants likely to be present in the sludge.

A long reach excavator was used to collect sludge from the base/surface of the ponds. The location and depth of samples were dependant on access and characteristics of the pond. The samples were taken from the centre of the excavator bucket (refer to **Photograph 2.1**) using a trowel and homogenised in a stainless-steel bucket prior to being collected in laboratory supplied jars. All sampling equipment was decontaminated between sludge samples and locations by removing excess soil from the trowel and following the decontamination procedures described in the SAP (refer to **Attachment B**).

Samples were then transferred into appropriately prepared laboratory bottles. Sample bottles were labelled and transferred to an esky on ice with chain of custody documentation and forwarded overnight to a NATA accredited laboratory for analysis.

Observation of physical parameters were recorded on field sheets (refer to **Attachment D**).

The pond sludge samples were taken in the same monitoring locations for both events (refer to **Figure 2.1**).

The Pond One sludge sample was collected at the edge of the bank where material had built up against the outlet pipe (refer to **Photograph 2.2**), whereas Pond Two and Pond Three samples were collected from the base of the ponds at an estimated depth of 3 – 4 metres. All of the sludge when excavated was odorous and had significant bubbling, indicating anaerobic conditions at the time of sampling.



Photograph 2.1: Sludge sample collected using long reach excavator



Photograph 2.2: Pond One sludge sampling point

2.5 Meteorological Data

A real time meteorological station was installed by EnvironData providing real time data for rainfall, temperature, humidity, wind speed and direction.



Legend

-  Hydrogen Sulphide Monitoring Points
-  Water and Sludge Monitoring Points
-  Meteorological Station

N

Scale 1:6,000 (A3)



Map Projection: Map Grid of Australia 1994 Zone 55

Figure 2.1

Mackay Sugar Limited

Racecourse Mill

Effluent Ponds
Monitoring Points



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Project No: 18059
23 January 2019

3 Results

3.1 Hydrogen Sulfide

The results from the H₂S have been compared to the *Environmental Protection (Air) Policy 2007*, where limits are defined for health and wellbeing (0.11 ppm for 24 hours) and aesthetic (0.0049 ppm for 30 mins). Results and comparisons to the EPP limits are summarised in **Table 3.1** and presented in full in **Attachment C**.

Table 3.1: Summary of Hydrogen Sulfide (H₂S) Monitoring Results

Site	Results
Upwind 1 (UW1)	Intermittent readings of H ₂ S ranging from 0.6 ppm to 1.0 ppm were observed. Measurements were not sustained for longer than 15 minutes and predominately occurred when there was north and/or north-easterly wind conditions.
Downwind 1 (DW1)	There were no recorded readings of H ₂ S at DW1 for the duration of the monitoring period.
Downwind 2 (DW2)	A comparison of the readings during the monitoring period indicate that 85% of days during the crush conditions had H₂S readings (characterised as any day with readings above zero), whereas 40% of days during non-crush conditions had H₂S readings. The highest reading obtained at DW2 was 0.079 ppm on 18 October where measurements ranged from 0.011 ppm to 0.018 ppm with a sustained measurement of 20 minutes. This correlates with operational conditions at the Mill including a caustic juice overflow to effluent, higher than usual water outflow of 4,133 m³ and a significant carbohydrate load of 30.56 t. The wind direction on 18 October was south-east whereas other higher readings of H₂S at this monitoring point of >0.05 ppm predominantly were in north-east wind direction. This variant is likely explained by the significant operational conditions experienced at the Mill and the subsequent effect on the effluent ponds.

A summary of the data compared to operational and meteorological conditions is presented in **Figure 3.1**.

Figure 3.1: Comparison of Hydrogen Sulphide Results to Operational and Meteorological Conditions

Figure 3.1: Comparison of Hydrogen Sulphide Results to Operational and Meteorological Conditions																
Date	Upwind 1 (UW1)			Downwind 1 (DW1)			Downwind 2 (DW2)			Operational Conditions	Water Outflow (m3)	Daily Catch Loss (tonnes)	Meteorological Conditions			
	days	Maximum H2S (ppm)	Sustained measurement (ppm)	days	Maximum H2S (ppm)	Sustained measurement (ppm)	days	Maximum H2S (ppm)	Sustained measurement (ppm)				Wind Direction	Average Wind Speed (kilometres/hour)	Maximum Wind Speed (kilometres/hour)	Total Daily Rainfall (millimetres)
11/10/2018	1	1	15	-	-	-	1	-	-	-	1508	1.23	N	7.4	23.6	0
12/10/2018	2	-	-	2	-	-	2	0.031	30	-	1420	1.04	NNE	9.5	26	0
13/10/2018	3	0.8	2	3	-	-	3	0.009	20	-	1564	6.99	NNE	9.3	28.8	7.4
14/10/2018	4	-	-	4	-	-	4	-	-	-	1991	1.69	N	6.9	36.1	15
15/10/2018	5	-	-	5	-	-	5	0.01	70	-	2253	2.78	SE	7.1	24.5	0.2
16/10/2018	6	-	-	6	-	-	6	0.02	20	-	1354	5.56	NE	5.5	20.5	0.2
17/10/2018	7	0.6	6	7	-	-	7	0.024	40	Caustic contaminated juice to effluent	2519	2.53	NE	6	25.8	0
18/10/2018	8	-	-	8	-	-	8	0.079	20	Caustic contaminated juice to effluent	4133	30.56	SE	7.1	24.4	0.4
19/10/2018	9	0.6	6	9	-	-	9	-	-	-	3341	7.94	ESE	9.9	26.2	0
20/10/2018	10	-	-	10	-	-	10	0.003	10	-	2696	3.07	E	9.7	27.4	0
21/10/2018	11	-	-	11	-	-	11	-	-	-	2374	7.02	ENE	6.9	23.4	0.2
22/10/2018	12	0.6	1	12	-	-	12	0.005	10	-	2310	1.10	ENE	7.9	26.7	0
23/10/2018	13	-	-	13	-	-	13	0.015	20	-	2057	2.38	ENE	8.7	24.3	0
24/10/2018	14	-	-	14	-	-	14	0.005	190	-	2648	1.70	E	7.6	23.8	0.2
25/10/2018	15	-	-	15	-	-	15	0.012	110	-	2343	1.77	NE	7	22.2	0
26/10/2018	16	-	-	16	-	-	16	0.005	180	-	2046	1.64	ESE	8.6	26.7	0.2
27/10/2018	17	-	-	17	-	-	17	0.01	90	-	1842	1.48	NW	6.5	22.3	0.2
28/10/2018	18	-	-	18	-	-	18	0.06	30	-	2301	3.03	NNE	8.9	25	0
29/10/2018	19	-	-	19	-	-	19	0.068	80	-	2448	3.49	NNE	9.6	27.6	0
30/10/2018	20	-	-	20	-	-	20	-	-	-	2101	2.24	NE	12.3	26.1	0
31/10/2018	21	-	-	21	-	-	21	0.004	10	Maintenance Day	2117	3.65	ENE	12	30.7	0
1/11/2018	22	-	-	22	-	-	22	0.005	40	-	2078	15.33	ENE	12.2	29.2	1.2
2/11/2018	23	-	-	23	-	-	23	-	-	-	2759	3.27	E	17.6	33.7	1.8
3/11/2018	24	0.6	4	24	-	-	24	0.003	10	-	2340	2.51	SE	14	34.6	1.2
4/11/2018	25	-	-	25	-	-	25	0.006	160	-	2281	3.70	E	9.8	28.8	0.2
5/11/2018	26	-	-	26	-	-	26	0.004	90	-	1730	5.15	N	7.6	23.8	0
6/11/2018	27	-	-	27	-	-	27	0.007	200	-	1805	0.52	N	7.5	24.8	0.2
7/11/2018	28	-	-	28	-	-	28	0.003	40	-	1509	1.43	N	7.9	23.4	0
8/11/2018	29	-	-	29	-	-	29	-	-	-	2008	1.71	N	9	25.7	0
9/11/2018	30	-	-	30	-	-	30	-	-	End of Crush start washdown	2347	3.57	SE	13.7	30.2	0.4
10/11/2018	31	-	-	31	-	-	31	-	-	-	3081	15.84	ESE	17.3	33.1	0.6
11/11/2018	32	-	-	32	-	-	32	-	-	-	2709	22.47	SE	13.9	35.7	0.4
12/11/2018	33	-	-	33	-	-	33	-	-	-	1911	0.96	SE	13.4	31.8	1.2
13/11/2018	34	-	-	34	-	-	34	-	-	-	1881	1.77	SE	11.9	31.1	0
14/11/2018	35	-	-	35	-	-	35	-	-	-	1319	1.17	SE	11.3	35.5	0
15/11/2018	36	-	-	36	-	-	36	-	-	-	1674	2.17	E	9.2	28.3	0
16/11/2018	37	-	-	37	-	-	37	0.01	230	-	1627	2.21	ENE	8.8	26.3	0
17/11/2018	38	-	-	38	-	-	38	0.013	230	-	137	2.19	ENE	7.8	24.2	0
18/11/2018	39	-	-	39	-	-	39	0.003	50	-	1351	1.07	ENE	7.3	22.5	0
19/11/2018	40	-	-	40	-	-	40	0.006	30	-	1244	0.70	E	10.7	26.3	0
20/11/2018	41	-	-	41	-	-	41	0.003	10	-	1596	0.86	E	15.8	28.8	0
21/11/2018	42	-	-	42	-	-	42	0.003	20	-	1898	0.66	ENE	10.1	25.1	0
22/11/2018	43	-	-	43	-	-	43	0.009	110	-	2007	2.33	N	11.6	27.1	0
23/11/2018	44	-	-	44	-	-	44	0.07	220	-	1474	2.58	NW	10.2	29.5	3
24/11/2018	45	-	-	45	-	-	45	0.03	280	-	1732	3.62	NW	7.7	29	0.2
25/11/2018	46	-	-	46	-	-	46	0.06	130	-	1473	2.14	NW	7.7	28.6	0.2
26/11/2018	47	-	-	47	-	-	47	-	-	-	1488	2.95	NW	11.4	32.2	0
27/11/2018	48	-	-	48	-	-	48	0.017	430	-	1897	1.56	W	6.7	28.2	0
28/11/2018	49	-	-	49	-	-	49	0.09	160	-	1851	5.08	NW	6.7	24.1	0
29/11/2018	50	-	-	50	-	-	50	0.07	160	-	1618	1.06	NW	9.6	34.3	0
30/11/2018	51	-	-	51	-	-	51	0.033	480	-	1526	2.61	NNE	7.1	27	0
1/12/2018	52	-	-	52	-	-	52	0.004	40	-	1406	2.24	NE	7.4	23.1	0
2/12/2018	53	-	-	53	-	-	53	-	-	Wash down completed	1402	1.52	N	8.2	23.8	0.2
3/12/2018	54	-	-	54	-	-	54	-	-	-	1240	0.47	N	11	27.9	0
4/12/2018	1	-	-	1	-	-	1	0.007	60	-	1865	0.38	NNE	12.5	40.5	15.8
5/12/2018	2	-	-	2	-	-	2	0.032	80	-	2183	0.89	NE	10.8	32.1	35.8
6/12/2018	3	0.6	1	3	-	-	3	0.009	20	-	2271	1.48	SE	18	32.8	29.2
7/12/2018	4	-	-	4	-	-	4	0.01	110	-	2926	1.48	SSE	15.9	35	89.2
8/12/2018	5	-	-	5	-	-	5	-	-	-	3097	0.99	SSE	18.6	39.7	15.8
9/12/2018	6	-	-	6	-	-	6	-	-	-	2707	0.70	SSE	18.8	36	26.4
10/12/2018	7	-	-	7	-	-	7	-	-	-	2105	0.45	SSE	16.3	35	1.6
11/12/2018	8	-	-	8	-	-	8	-	-	-	2467	0.39	SE	13	32.3	0.2
12/12/2018	9	-	-	9	-	-	9	0.004	20	-	2070	0.18	SE	11.7	24.6	2.6
13/12/2018	10	-	-	10	-	-	10	-	-	-	1749	0.83	E	11.1	30.1	8.4
14/12/2018	11	-	-	11	-	-	11	-	-	-	2040	1.04	N	6.9	25.4	60
15/12/2018	12	-	-	12	-	-	12	-	-	-	1357	0.70	N	6	19.6	5.2
16/12/2018	13	-	-	13	-	-	13	-	-	-	1960	0.66	S	5	23.2	4.6
17/12/2018	14	-	-	14	-	-	14	-	-	-	2799	2.02	SSE	12.5	29.9	46.4
18/12/2018	15	-	-	15	-	-	15	-	-	-	2193	1.64	S	9.5	27.2	0.2
19/12/2018	16	0.6	2	16	-	-	16	0.007	110	-	1620	0.51	SSE	9.9	25.1	0
20/12/2018	17	-	-	17	-	-	17	0.036	200	-	2081	0.88	SSE	12.2	28.3	0
21/12/2018	18	-	-	18	-	-	18	0.004	80	-	2864	2.00	SE	8.3	24.6	0
22/12/2018	19	-	-	19	-	-	19	-	-	-						

Crush conditions at Racecourse Mill

Non-crush conditions at Racecourse Mill

Environmental Protection (Air) Policy 2008: Acoustic: 0.0049 ppm for 30 mins

Environmental Protection (Air) Policy 2008: Health and wellbeing: 0.11 ppm for 24 hours

Equipment failure

* DW2 records data early ten minutes, and has been rounded to 1PM from 1PM

3.2 Effluent characteristics

Characteristics of the effluent is highly variable, including water volumes and carbohydrate content. **Table 3.2** shows a comparison of the effluent characteristics during the monitoring period (information provided by MSL). Effluent outflows (inflows to Pond One) during the monitoring period for the crushing and during the washdown event were similar, and the flows during the crushing were higher than the non-crush. Conversely, the carbohydrate loss per cubic metre per day was higher in the crush than the wash down and non-crush conditions, which is to be expected due to the sugar milling activities.

Table 3.2: Effluent characteristics at Racecourse Mill

Characteristic	Crush Conditions 11/10/2018 – 09/11/2018	Wash Down 10/11/2018 – 02/12/2018	Non-Crush Conditions 03/12/2018 – 21/12/2018
	30 Days	23 Days	19 Days
Average water outflow per day (m ³)	2206.47	1739.21	2189.68
Total water outflow (m ³)	66194	40002	41604
Average carbohydrate loss per day (m ³)	4.34	3.47	0.93
Total carbohydrate loss (m ³)	130.09	79.79	17.69
Rainfall (mm)	29	5.8	341.4

3.3 Pond Water

The results for the pond water sampling from the two events are presented in **Table 3.3** and in **Attachment D** and summarised below:

- High levels of sulfide reducing bacteria were present in the pond water during both monitoring events;
- Total dissolved solids levels were high in all ponds;
- Sulfide was present in all pond samples. A reduction of sulfide levels could be seen between the crush and non-crush in Ponds One and Three;
- pH was elevated in Pond One in the non-crush, probably reflecting the washdown effluent inflows;
- Pond One waters recorded an elevated ammonia reading; and
- Results show the ponds are effective in reducing BOD, TOC and COD between Pond One and Pond Two (the discharge pond).

Carbohydrates as sugar (mg/L) were not detected in the pond waters collected during the crush sampling event however, were present in all three ponds in the non-crush sampling event. This is not supported by the sustained carbohydrate loss data provided by MSL and could be attributed to the timing of the samples taken or potentially a laboratory outlier or error. It does however identify that the washdown water contains high levels of carbohydrates, which would be indicative of vessel washdowns.

The water quality data is limited to two grab samples only and can only be relied upon as indicative.

Table 3.3: Pond Water Data

Parameter	Units	Crush Conditions					Non-Crush Conditions				
		Pond One	Pond Two	Pond Three	Pond One	Pond Two	Pond One	Pond Two	Pond Three	Pond One	Pond Two
		5/11/2018 10:50	5/11/2018 11:15	5/11/2018 12:10	3/12/2018 9:05	3/12/2018 9:45	3/12/2018 9:05	3/12/2018 9:45	3/12/2018 9:25	3/12/2018 9:05	3/12/2018 9:25
Description	Reporting Limit	CE136496.001	CE136496.002	CE136496.003	CE136989.001	CE136989.002	CE136989.001	CE136989.002	CE136989.003	CE136989.001	CE136989.003
FIELD RESULTS											
Dissolved oxygen	%	29%	137%	2.90%	44.90%	91.10%	44.90%	91.10%	4.80%	44.90%	91.10%
Dissolved oxygen	ppm	1.75	11	0.22	3.46	6.86	3.46	6.86	0.35	3.46	6.86
Electrical conductivity (EC)	µS/cm	3157	1768	1993	1887	2003	1887	2003	2161	1887	2161
pH	pH units	7.09	8.36	7.73	9.23	8.18	9.23	8.18	7.95	9.23	7.95
Redox/ORP	mV	-219.5	9.7	-70.5	-210	13	-210	13	-60.7	-210	-60.7
Temperature	C°	37.8	27.7	27	34.7	30	34.7	30	29.2	34.7	29.2
Total Dissolved Solids (TDS)	mg/L	1644.5	1092	1248	-	-	-	-	-	-	-
Comments: colour, odour	-	Highly odorous, sugar smell, black and turbid hot water.	Still turbid, dark particles, slight odour.	Orange/pink colouration, foamy.		odour					
LABORATORY RESULTS											
pH**	pH Units	0.1	8.4	8.0	9.1	8.1	9.1	8.1	8.0	9.1	8.1
Conductivity @ 25 C	µS/cm	5	1900	2200	1600	2000	1600	2000	2200	1600	2000
Total Dissolved Solids (by calculation)	mg/L	10	1100	1300	980	1200	980	1200	1300	980	1200
Total Suspended Solids Dried at 103-105°C	mg/L	5	55	160	230	130	230	130	300	230	300
Total Dissolved Solids Dried at 175-185°C	mg/L	10	1400	1200	1500	1300	1500	1300	1200	1500	1200
Biochemical Oxygen Demand (CBOD ₅)	mg/L	5	43	170	>340	18	>340	18	81	>340	18
Chemical Oxygen Demand	mg/L	10	150	420	610	180	610	180	420	610	180
Carbohydrates as Sugar	mg/L	5	<5	<5	81	40	81	40	27	81	40
Ammonia Nitrogen, NH ₃ as N	mg/L	0.005	0.30	0.73	0.010	0.014	0.010	0.014	0.005	0.010	0.005
Nitrate/Nitrite Nitrogen, NO _x as N	mg/L	0.005	0.013	0.015	0.28	0.009	0.28	0.009	0.056	0.28	0.009
Nitrate Nitrogen, NO ₃ as N	mg/L	0.005	0.012	0.015	0.20	0.009	0.20	0.009	0.056	0.20	0.009
Nitrite Nitrogen, NO ₂ as N	mg/L	0.005	<0.005	<0.005	0.085	<0.005	0.085	<0.005	<0.005	0.085	<0.005
Total Kjeldahl Nitrogen	mg/L	0.05	6.5	14	2.5	8.6	2.5	8.6	16	2.5	8.6
Total Nitrogen (calc)	mg/L	0.05	6.5	14	2.8	8.6	2.8	8.6	16	2.8	8.6
Organic Nitrogen (calc)	mg/L	0.05	6.2	14	2.5	8.6	2.5	8.6	16	2.5	8.6
Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	3.3	7.0	12	2.6	12	2.6	5.8	12	2.6
Filterable Reactive Phosphorus	mg/L	0.005	1.9	4.2	0.092	0.028	0.092	0.028	2.2	0.092	0.028
Sulfide	mg/L	0.5	1.4	4.5	1.4	1.6	1.4	1.6	4.1	1.4	1.6
Total Sulfur, S	mg/L	0.1	13	4.1	160	16	160	16	9.5	160	16
Total Sulphur as Sulfate, SO ₄	mg/L	0.2	40	12	490	47	490	47	28	490	47
Total Organic Carbon as NPOC	mg/L	0.2	40	130	220	43	220	43	110	220	43
Sulphide reducing bacteria	CFU/mL	0	290000	281000	240000	230000	240000	230000	280000	240000	230000

3.4 Pond Sludge

The results for the pond sediment (sludge) sampling from the two events are presented in **Table 3.4** and **Attachment D**.

A summary of results is provided below:

- High levels of sulfur and sulfur as sulfate and sulfide reducing bacteria were present in the sludge during both sampling events;
- In contrast to the pond water quality results, the analysis of the sludge suggests that its quality deteriorated in the non-crush. As noted previously, little reliance can be placed upon sludge quality given the small time-lag between crush and non-crush and legacy contaminants likely to be in the sludge;
- Results for the sludge in all ponds exhibited a decrease in BOD between the sampling events;
- Soluble ammonia nitrogen (NH_3 as N) values in Ponds One and Two were higher during the crush period;
- Ponds One and Three exhibited an increase in nitrite (NO_2 as N in Soil), nitrate/nitrite nitrogen (NO_x as N), and nitrate nitrogen (NO_3 as N), from the crush period to the non-crush period;
- Both total phosphorus (TP) and water-soluble orthophosphorus (P) parameters, across all three ponds, had higher values during the non-crush period;
- Both carbohydrate relevant parameters (carbohydrates as sugar, carbohydrates as sugar in soil), across all ponds, exhibited higher readings during the non-crush period; and
- Total organic carbon (TOC) readings for sludges tested for all Ponds displayed a slight increase between sampling periods.

The sediment quality data is limited to two grab samples only and can only be relied upon as indicative.

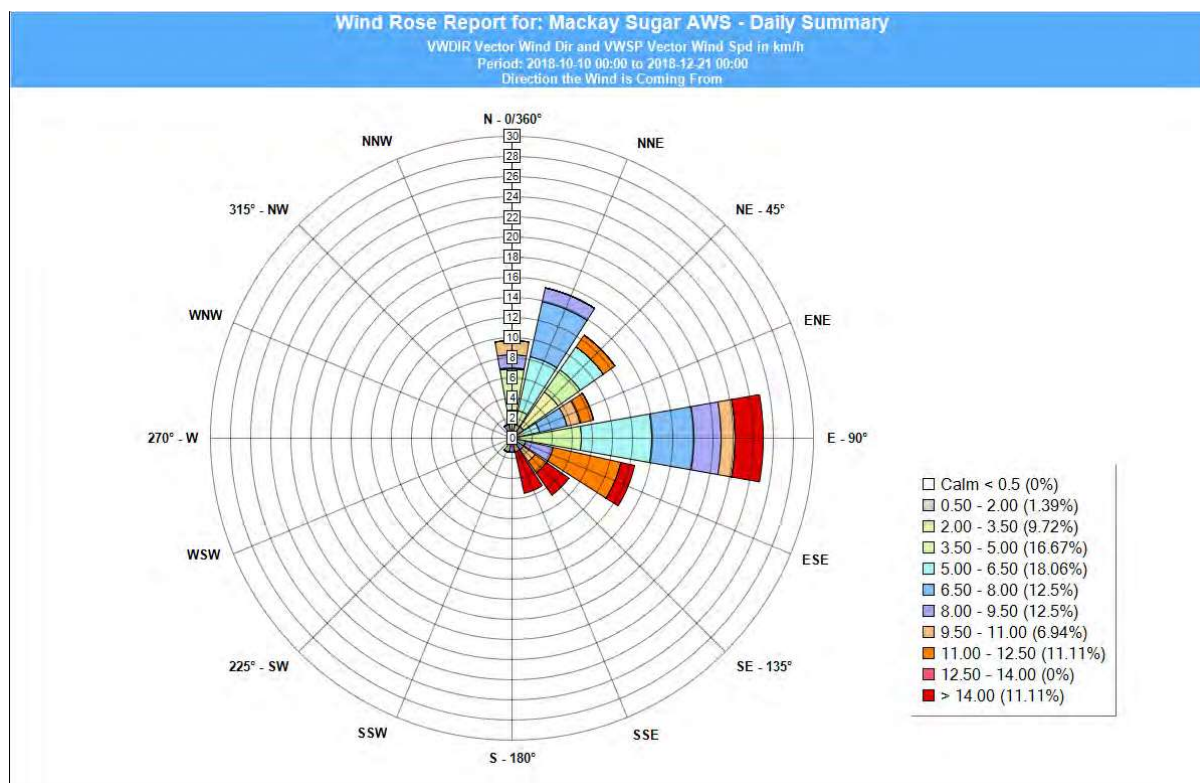
Table 3.4: Pong Sludge Data

Job Number	Analyte Name	Units	Reporting Limit	Sample Name	CE136496A.001	CE136496A.002	CE136496A.003	CE136989A.001	CE136989A.002	CE136989A.003
CE136496A	pH	pH Units	0	Description	Pond 1	Pond 2	Pond 3	Pond 1	Pond 2	Pond 3
CE136496A	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	Sample Date	5/11/2018	5/11/2018	5/11/2018	3/12/2018	3/12/2018	3/12/2018
CE136496A	Chemical Oxygen Demand (Soluble)	mg/L	10	Matrix	Soil	Soil	Soil	Soil	Soil	Soil
CE136496A	Biochemical Oxygen Demand (BOD5)	mg/kg	50							
CE136496A	Soluble Ammonia Nitrogen, NH ₃ as N	mg/kg	0.1							
CE136496A	Nitrite, NO ₂ as N in Soil	mg/kg	0.05							
CE136496A	Nitrate/Nitrite Nitrogen, NO _x as N	mg/kg	0.05							
CE136496A	Nitrate Nitrogen, NO ₃ as N	mg/kg	0.05							
CE136496A	Total Kjeldahl Nitrogen	mg/kg	20							
CE136496A	Organic Nitrogen	mg/kg	20							
CE136496A	Total Nitrogen	mg/kg	20							
CE136496A	Total Phosphorus (Kjeldahl Digestion)	mg/kg	20							
CE136496A	Water Soluble ortho Phosphorus, P	mg/kg	0.05							
CE136496A	Carbohydrates as Sugar	mg/L	5							
CE136496A	Carbohydrates as Sugar in Soil	mg/kg	25							
CE136496A	Sulphur, S	mg/kg	10							
CE136496A	Sulfur, S	mg/kg	1							
CE136496A	Sulphur as Sulfate, SO ₄	mg/kg	3							
CE136496A	Total Organic Carbon	%w/w	0.05							
CE136496A	Total Sulfur	%w/w	0.005							
CE136496A	Acid Soluble Sulfur (SHC)	%w/w	0.005							
CE136496A	Ecoscope Rockhampton	CFU/ml	0							
					8.0	8.0	7.9	9.5	8.7	8.2
					960	420	1100	2000	530	350
					95	250	230	4500	1800	4800
					>6830	510	440	250	120	90
					14	48	25	5.7	29	25
					0.08	<0.05	0.15	1.3	0.10	0.14
					0.73	0.30	0.40	5.4	0.40	0.72
					0.65	0.30	0.25	4.2	0.30	0.58
					2500	2400	12000	3100	4000	11000
					2500	2400	12000	3100	4000	11000
					15000	1300	32000	24000	11000	38000
					4.3	4.7	3.3	90	7.5	5.0
					<5	<5	<5	49	25	50
					<25	<25	<25	250	130	250
					2500	3700	7600	2500	2000	6700
					420	180	340	710	160	530
					1200	540	1000	2100	470	1600
					15	3.4	9.5	16	4.3	9.8
					0.28	0.39	0.80	0.22	0.12	0.40
					0.085	0.081	0.078	0.11	0.051	0.081
					190000	183000	174000	160000	1800	190000

3.5 Meteorological Data

The daily summary of the meteorological conditions at the effluent ponds is presented in **Attachment F**. Refer to **Figure 3.2** for the wind rose from the meteorological station at the effluent ponds. The dominant wind direction for the duration of the monitoring period was east to south-east, with 11 percent of the wind speed above moderate breeze (based on the Beaufort wind force scale).

Figure 3.2 Wind Rose for Monitoring Period



4 Operational Considerations

4.1 Effluent Quality

Effluent quality within the treatment ponds is highly variable and dependant on the operational activities at the Mill, in particular between the crush and non-crush conditions. Effluent produced as a result of the milling process in crush conditions can be characterised by the following:

- High volumes of outflow (including infrequent pulses of flows, including caustic inflows);
- High temperature; and
- Poor quality water quality in the ponds (high sulfides, sulfur, sulfates, carbon and high carbohydrates as sugar) leading to high COD, BOD and low dissolved oxygen.

The effluent produced in the non-crush generally had a reduction of the parameters noted above, however higher levels of nutrients were observed. This is discussed further in **Section 5**.

4.2 Current Management Techniques

As a result of the initial community complaints and DES request for information in 2016, MSL has implemented various improvement initiatives, including those outlined in **Table 4.1** to both manage their effluent and reduce the nuisance odours at the effluent ponds. MSL has also committed to the completion of several capital projects as identified in the “Remedial Options Assessment, CQG 2019”.

Table 4.1: Summary of Improvement Initiatives implemented by MSL since 2016

Improvement Initiative	Summary	Considerations
Aeration	Aerators were installed in Pond Two in late 2016. Additional aerators were installed on Pond Three in October 2018. Refer to Photograph 4.1 .	Reliability is an identified limitation of the current system. The effectiveness of the aerators is unknown.
Inoculant (Vital Resource)	During the crush, inoculant is added to the effluent at a rate of 6,000 L/week. Whereas in the non-crush the dosage is maintained at 3,000 L/week. Dosage occurs at the screen pulse, at the Pond One inlet and weekly surface sprays are applied directly to the surface of Pond One. Application using a helicopter can occur in emergency.	Dosage rate is considered high. It is likely that the temperature of the effluent would be having a detrimental effect on the beneficial bacteria, reducing its effectiveness. Inoculant could also be applied to the surface of Pond Three, if required and MSL could trial different types of inoculants to maximise benefits.



Photograph 4.1: Irrigation style aeration on Pond Three

5 Discussion

From the monitoring data collated and the observations made in this investigation, it is apparent that parameters likely to be contributing to the generation of H₂S include the following:

- Inadequate retention time in the treatment ponds, in particular, Pond One, due to build-up of sludges in the base on the ponds. Previous surveys by MSL indicate 70,000 m³ of sludge needs to be removed from Pond One to achieve the desired retention times;
- Ash sluice waters and caustic overflows being discharged to the ponds elevating the pH and increasing concentration of sulfur, sulfides and sulfates in the sludge and pond waters;
- High nutrient levels (nitrogen, nitrates and phosphorus) observed in the pond water and sludge during the non-crush conditions (a tenfold increase). This may indicate that mill mud, bagasse or similar is entering the effluent waste stream. High nutrients increase eutrophication at the ponds, which could also contribute to nuisance odours through the depletion of oxygen; and
- Lack of adequate aeration at Pond One and Pond Three resulting in low dissolved oxygen levels which can reduce effectiveness of the ponds and trigger odour generation.

6 Recommendations

Key recommendations to reduce the risk of odour generation at the ponds are outlined in **Table 6.1** and should be read in conjunction with "Remedial Options Assessment, CQG Feb 2019". Given the recommendations and the capital investments will be implemented during 2019, their effectiveness may not be determined until the 2019 crush.

Table 6.1: Key recommendations to address contributing factors

Identified Constraint	Recommendation
Insufficient data on effluent inflows to ponds - source, quality and volumes	1. Conduct an investigation during the non-crush to inspect vessels, condensate lines, entrainment arrestors, drains, bunds etc. to identify potential sources & routes for sugar losses, ash & nutrients to effluent; 2. Repair the effluent screen as planned; 3. Replace the ash clarifier as planned; 4. Decommission #2 boiler as planned to reduce effluent flows; 5. Replace the valves & the vacuum pan tubing as planned; 6. Undertake an investigation within the Mill during the crushing season to identify possible sources of contaminants that could contribute to the generation of odours (sampling & analysis of effluent streams and volumetric flows from the Mill, Cogeneration Plant and Refinery); 7. Develop a project plan detailing the actions & strategies to address the key findings of the contamination investigation; 8. Consider diverting high strength effluents e.g. caustic overflows &/or ash sluice waters to surge ponds for pre-treatment prior to discharge into the treatment ponds; 9. Consider installing continuous data collection units on effluent streams to record pH, flows & conductivity; and 10. Assess the capability of the current effluent treatment system to effectively treat effluent from the Mill, the Cogeneration Plant & the Refinery.
Inadequate retention time in the treatment ponds	De-sludge Pond 1 to increase retention & capacity. Previous surveys completed at the effluent ponds indicate that there is approximately 70,000 m³ of material that needs to be removed from Pond One. It is recommended that this is prioritised with appropriate pre-planning including the process to de-sludge, the treatment/disposal of the sludge when removed (stockpiles can be odorous, material cannot be transported from the lots without permits if the lots are on the Queensland Government's Environmental Management Register (EMR), the pond may need to be dosed with a biological agent to reactivate after the sludge has been removed etc.) & a risk assessment to mitigate risks.
Lack of adequate aeration at Pond 1 & Pond 3	Although aerators are installed on Pond Two & Pond Three, reliability is a limitation. The aerators were not in use for the duration of the investigation & is reflected in the low DO results obtained in both sampling events. CQG recommend prioritising the maintenance & use of the aerators at the Ponds & reporting on their performance as a key performance indicator to MSL management on a monthly basis. It is also recommended that based on these results MSL consider either additional aeration or modification of aeration techniques.
Lack of documented procedures to manage odours	Develop an Odour Management Plan that addresses the operational actions to record relevant data, avoid incidents that could cause odorous events, actions to follow should an incident occur (e.g. pH adjustment, aeration and/or inoculation if ash sluice waters enter effluent), training of staff (in Mill, Cogeneration Plant and Refinery) regarding housekeeping and effluent management, training of effluent operators in H₂S exposure risks and how to avoid exposure, engagement with neighbours to encourage them to report odours to the Mill and to update them on initiatives. Plan to include checklists, reference to legislation, the EA & other relevant MSL documentation and procedures.

7 References

Australian & New Zealand Guidelines for Fresh & Marine Water Quality Volume 1. (2000). [PDF] Australian & New Zealand Environment & Conservation Council, Agriculture & Resource Management Council of Australia & New Zealand. Available at: <http://www.waterquality.gov.au/anz-guidelines/Documents/ANZECC-ARMCANZ-2000-guidelines-vol1.pdf>.

Environmental Protection (Water) Policy 2009 Pioneer River & Plane Creek Basins Environmental Values & Water Quality Objectives. (2013). [PDF] Environmental Policy & Planning Division, Department of Environment & Heritage Protection, pp.15-16. Available at: <https://environment.des.qld.gov.au/water/policy/pdf/plans/pioneer-river-plane-creek-ev-wqo.pdf>.

Environmental Protection Agency, Queensland Government., 1997 Air Quality Sampling Manual

McFarland, Mark L.; Provin, T. L. "[Hydrogen Sulfide in Drinking Water Treatment Causes & Alternatives](#)" (PDF). Texas A&M University. Retrieved 1 December 2014.

Nielsen, A.H., Vollertsen, J. & Hvitved-Jacobsen, T., 2006. Kinetics & stoichiometry of aerobic sulfide oxidation in wastewater from sewers—Effects of pH & temperature. *Water environment research*, 78(3), pp.275-283.

Nikolausz, M., Kappelmeyer, U., Székely, A., Ruzsnyák, A., Márialigeti, K. & Kästner, M. (2008). Diurnal redox fluctuation & microbial activity in the rhizosphere of wetland plants. *European Journal of Soil Biology*, 44(3), pp.324-333.

Limitations

This report has been prepared for the use of the client, Mackay Sugar Limited, for the purpose of this commission only.

CQG¹ takes no responsibility & disclaims all liability for any loss or damage that any party may suffer as a result of using or relying on any such information or recommendations contained in this report.

To the maximum extent permitted by law CQG expressly disclaims responsibility for or liability arising from:

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- Reliance on the report by a third party, or use of the report other than for the purpose stated.

The report relates only to the project described herein & must be reviewed by a competent expert before being used for any other purpose. CQG accepts no responsibility for other use of the data.

This report does not provide a complete assessment of the environmental status of the Site but is limited to the scope defined herein, including limited sampling of pond waters and sediments. Results for waters in Ponds Two and Three and the sediments in all ponds taken in the non-crush period may not be reflective of the non-crush conditions due to the residence times in the ponds and legacy contaminants in the sludge.

Should further information become available regarding the conditions of the Site, CQG reserves the right to review the report in the context of the additional information.

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¹ CQ Environmental Pty Ltd (ABN 61 107 574 514) trading as CQG Consulting (CQG)

ATTACHMENT A:

Nicola Mylne Curriculum Vitae and Statutory Declaration

Staff Profile

Nicola Mylne

Senior Environmental Scientist

Nicola is a highly experienced senior environmental scientist, proficient in project implementation, stakeholder management, system development and environmental compliance.

Nicola is a Senior Environmental Scientist and Manager of the CQG Mackay Office. Nicola has over ten years of industrial and mining experience, including roles with BMA Coal and Wesfarmers. She is an Infrastructure Sustainability Accredited Professional (ISAP), holds a Maritime Security Identification Card (MSIC) and has completed all North Queensland Bulk Ports (NQBP) inductions and access requirements. Prior to joining CQG Nicola was the senior environmental adviser for Wesfarmers Curragh and has operated in superintendent roles managing teams and contractors. Most recently she has provided ongoing environmental management support to Dalrymple Bay Coal Terminal and is proficient in the application of coastal and marine protection. Nicola has developed scopes of works and tenders, managed contracts and holds supervisor qualifications. Her project management experience and knowledge will be invaluable in the provision of organisational support and has a passion for the practical development and application of environmental management systems. She is familiar with developing budgets and implementing the organisational and resourcing requirements for project support.

Her experience is in a variety of environmental disciplines including development and management of environmental management systems, regulatory compliance, auditing and environmental monitoring. She has excellent report writing skills and has been involved in data collation and technical reporting regarding national greenhouse emissions reporting and national pollution inventory reporting.

Nicola's key strengths in environmental compliance and auditing provide clients with the assurance that they are getting practical advice in order to determine management outcomes. Her auditing style is thorough, encompasses stakeholder engagement and attention to detail.



Specialisations

- Auditing and compliance
- Water management
- Port and mining

Qualifications

- Bachelor of Environmental Science (2004)
- Infrastructure Sustainability Accredited Professional
- Lead Auditor

Staff Profile

Nicola Mylne

Senior Environmental Scientist



Career Summary

- **Jan 2018 to Current** – CQG Consulting – Senior Environmental Scientist
- **Sep 2015 to Jan 2018** – CQG Consulting – Environmental Scientist
- **Jan 2011 to Aug 2015** – Wesfarmers (Curragh Mine) – Senior Environmental Advisor
- **Apr 2010 to Jan 2011** – BMC (South Walker Creek Mine) – Environmental Advisor
- **Mar 2009 to Apr 2010** – BMA Coal (Gregory Crinum Mine) – Graduate Environmental Advisor
- **Mar 2008 to Mar 2009** – BMA Coal (Blackwater Mine) – Graduate Environmental Advisor
- **Jan 2005 to Feb 2008** – Central Queensland University – Technical / Research Officer

Relevant Project Experience

Dalrymple Bay Coal Terminal (DBCT):

- Nicola offered secondment environmental management support to DBCT and includes the management of air, water and offshore aspects. This role requires liaison with the community and industry compliance and monitoring sensitive receptors in and around the Terminal. She assisted DBCT to develop sustainability plans and to complete compliance audits.

Wesfarmers Curragh Mine:

- Nicola managed several large projects at Curragh Mine during her time as Senior Environmental Advisor including:
 - o the development of an onsite landfill and associated civil works and contractors;
 - o mine site rehabilitation and monitoring; and
 - o regulated dam assessment and compliance, including tailings management.

Queensland Sugar Limited (QSL):

- QSL has six bulk sugar loading terminals located in coastal environments in close proximity to the Great Barrier Reef. This project involved sweet water characterisation through an in-depth monitoring program of the wash down and marine waters. Terminal specific management options were determined that were practical and effective, including identifying operating and capital expenditure.

BHP Billiton South Walker Creek

- During her time at BHP Billiton, Nicola was heavily involved in the management of contracting earthworks for topsoil, civil works and mine site rehabilitation. She ensured that the projects were completed safely, on time and within budget. This involved coordinating heavy mobile equipment, mining schedules and approvals.

Statutory Declaration

Environmental Protection Act 1994

Environmental Evaluation

Suitably qualified person

A Statutory Declaration is a written statement of facts that is sworn or declared under the Oaths Act 1867. This Statutory Declaration must be completed by the person who conducted the environmental evaluation and accompany the environmental report submitted to the Department of Environment and Heritage Protection (the department).

Oaths Act 1867

QUEENSLAND TO WIT

I Nicola Mylne
Insert the name of the person making this declaration
of 180 Quay Street
Insert the street address of the person making this declaration
Rockhampton, 4700

in the State of Queensland do solemnly and sincerely declare that:

- I am the suitably qualified person and author of an environmental report entitled
Mackay Sugar Limited Racecourse Mill Effluent Pond Environmental (Odour) Assessment

Insert title of the environmental report

In accordance with the environmental evaluation issued by the department under the Act to:

Mackay Sugar Limited

15 May 2018

Insert name of recipient of the notice

Insert date of the notice

A copy of my report is attached to this statutory declaration and marked "A".

I possess the following qualifications and experience relevant to this environmental evaluation:

Copy of Curriculum Vitae is attached detailing qualifications and experience.

I have not knowingly included any false, misleading or incomplete information in the report; and

I have not knowingly failed to reveal any relevant information or document to the department.

I certify that:

Statutory Declaration
Suitably qualified person

- The report addresses the relevant matters for the evaluation and is factually correct; and
- The opinions expressed in it are honestly and reasonably held.

I make this solemn declaration conscientiously believing the same to be true, and by virtue of the *Oaths Act 1867*.

Taken and declared before me, at 180 Quay Street, Rockhampton 4700

Insert location

this 26 day of 02 in the year 2019

Insert day (e.g. 18th)

Insert month

Insert year

Signed

(Person making this declaration)

Signed

Madison-Lee Annice Day

Printed name and registration number (if applicable)



ATTACHMENT B:

Sampling & Analysis Plan

1 General Information

1.1 Overview of SAP

A notice to conduct or commission an environmental evaluation (EE) was issued to Mackay Sugar Limited (MSL) on 15 May 2018 (STAT1122 reference CR70825) by the Department of Environment and Science (DES) in relation to community complaints regarding odour nuisance and perceived potential health effects from Racecourse Mill's effluent treatment ponds.

CQG Consulting (CQG) has been engaged to assist MSL with fulfilling the requirements of the EE notice through the completion of the monitoring described in this sampling and analysis plan (SAP) to facilitate the completion of the Remediation Options Assessment and Environmental Assessment Report. This document is a sampling and analysis plan (SAP) for hydrogen sulphide, water and sludge monitoring at MSL's Racecourse Mill effluent ponds (the site).

The scope of this SAP is to identify sources of odours at the effluent ponds and includes the following:

- Hydrogen sulphide (H₂S) monitoring;
- Water quality sampling;
- Sludge sampling; and
- Meteorological data recording.

The above will be conducted by CQG.

2 Hydrogen Sulphide Monitoring

2.1 Pre-mobilisation planning

- MSL and CQG to confirm a date for the site visits;
- JSEA (including all sampling activities) to be completed by CQG Project Manager prior to site visit. CQG Project Director to review and approve.
- Locations to be ground truthed to determine security and access requirements for monitoring instrumentation;
- MSL to seek permission from landowners in the identified sensitive receptor properties (as identified in **Figure 2.1**) for placement of monitoring instrumentation; and
- Secondary options of monitoring instrumentation location to be determined by CQG if permission not granted by the landowners.

2.2 Sampling Methodology

- H₂S gas will be monitored at three (3) locations, one (1) upwind of the effluent ponds and two (2) downwind to monitor odour nuisance at the nominated sensitive receptors. The locations of the monitoring sites are presented in **Figure 2.1** and will be located as close as possible to these nominated locations;
- H₂S gas will be monitored using an Acrulog logger providing continual data;
- Data will be downloaded weekly to ensure consistency and to enable correlation of the data to operational conditions at the Mill. They will be downloaded using Acrustat software via Bluetooth;
- Crushing season monitoring will commence in early October and continue until the beginning of December (duration of 45 days) and will be inclusive of the crushing and the end of crush activities;
- Non-crush season monitoring will commence at the completion of the crush season monitoring (likely to be mid-December) for a period of 15 days; and
- Two loggers will measure in units parts per million (ppm) and one unit will measure in parts per billion (ppb). The PPB unit will be located at the furthest downwind sensitive location.

3 Water and Sludge Monitoring

3.1 Pre-mobilisation planning

- MSL and CQG to confirm a date for the sampling;
- Sampling from the bank is first preference, sampling from a boat will be considered only as a secondary option due to health and safety considerations;
- Confirm if lifejackets are required by MSL; and
- Confirm methodology with MSL based on ground -truthing the locations.

3.2 Sampling Methodology

- Sampling frequency and characteristics are identified in **Table 3.1**;
- Potential indicator parameters for (H₂S) will be monitored in water and sludge at the effluent ponds;
- Field staff will wear a new pair of powder free nitrile gloves per sample to avoid cross-contamination;
- Sampling equipment will be decontaminated between each location using Decon 20;
- One sample each of water and sludge will be collected at each of the effluent ponds (3 in total);
- Sampling to be conducted during the crushing and non-crushing seasons;
- Sludge sampling will be undertaken by a depth integrated sediment sampler or a piston sampler. Methodology to be determined after ground truthing accessibility and depth of the effluent ponds confirmed.
- Water samples will be collected using a grab sample pole;
- Sample bottles are to be double checked to ensure completely filled and seals are adequate;
- Samples will be kept chilled in an esky with ice-bricks;
- Eskies will be sent or delivered to a National Association of Testing Authorities (NATA) accredited laboratory for analysis with a Chain of Custody form (COC) noting analysis required etc.

Table 3.1 Water and Sludge Sampling at Effluent Ponds

	Effluent Pond 1	Effluent Pond 2	Effluent Pond 3
Crush Season (May 2018 to November 2018)	1 x water 1 x sludge	1 x water 1 x sludge	1 x water 1 x sludge
Non-Crush Season (December 2018 to April 2019)	1 x water 1 x sludge	1 x water 1 x sludge	1 x water 1 x sludge

- Parameters to be analysed include
 - pH
 - Electrical Conductivity (EC)
 - Total Dissolved Solids
 - Total Suspended Solids
 - Sulphides
 - Sulphate
 - Sulphur
 - Ammonia
 - Nitrate
 - Nitrite
 - Total Nitrogen
 - Carbon Dioxide
 - Reactive Phosphorus
 - Total Phosphorus
 - Biological Oxygen Demand
 - Chemical Oxygen Demand
 - Carbohydrates as Sugar
 - Sulfate Reducing Bacteria.

4 Meteorological Monitoring

4.1 Pre-mobilisation planning

- Location of meteorological station to be determined by MSL and CQG; and
- The unit will be set up at a location that is free from moving equipment.

4.2 Sampling methodology

- Meteorological station to provide real time data to MSL and CQG;
- Contractor to be managed by MSL;
- Data from the weather station to be checked by CQG weekly to make correlations with H₂S results and operational activities at the Mill and effluent ponds.

5 Field Equipment

Field equipment required for sampling the site is listed in **Table 5.1**. Check off the checklist prior to arrival on site.

Table 5.1: Sampling equipment required

General:	✓
2x Acrulog IPX H2S Parts Per Million Monitor (PPM)	
1x Acrulog IPX H2S Parts Per Billion Monitor (PPB)	
Field Kit (Large)	
Water Quality Meter	
Piston sampler/ depth integrated sediment sampler	
Demineralised Water	
Decon 90	
Pencils/Pens	
Permanent marker	
Field note book	
Laptop with Bluetooth and Acrulog software installed to download data from Acrulog devices	
Chain of custody forms	
Field Sheets	

Table 2 outlines the safety equipment required to complete this sampling. Personal protective equipment (PPE) must be worn at all times whilst conducting sampling. Check off the checklist in the field.

Table 2: Safety Equipment

Safety:	✓
PPE	
Safety glasses / sunglasses	
First aid kit – snake bite kit	
Long sleeved Hi vis shirt and long pants	
Steel capped boots	
Leather work gloves	
Broad brimmed hat	
Have available in the vehicle	
Sunscreen	
JSEA	
Site map	
Drinking water and sunscreen	
Rain coat	
Mobile phone	
SAP	



Legend

Hydrogen Sulphide
Monitoring Points

N

Scale 1:6,000 (A3)

0 50 100 200 300

Metres

Map Projection: Map Grid of Australia 1994 Zone 55

Figure 2.1

Mackay Sugar Limited

Racecourse Mill

**Hydrogen Sulphide
Monitoring Points**



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PO Box 8384, Allenstown 4700
Ph: +61 7 4922 9222 Fax: +61 7 4922 0195

Project No: 18059
19 September 2018

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ATTACHMENT C:

Hydrogen Sulfide (H₂S) Monitoring Results

Date	Date and time (hh:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)					
11/10/2018	11/10/2018, 08:35:47	0.6		7.4	N	0	1.22966667	56.4					
	11/10/2018, 08:36:47	0.7	55										
	11/10/2018, 08:37:47	0.8	53.5										
	11/10/2018, 08:38:47	0.9	52.1										
	11/10/2018, 08:39:47	1	50.5										
	11/10/2018, 08:40:47	1	49.1										
	11/10/2018, 08:41:47	1	47.9										
	11/10/2018, 08:42:47	1	46.6										
	11/10/2018, 08:43:47	0.9	45.4										
	11/10/2018, 08:44:47	0.8	44.5										
12/10/2018	11/10/2018, 08:45:47	0.7		9.5	NNE	0	1.040933333	43.4					
	11/10/2018, 08:46:47	0.8	42.7										
	11/10/2018, 08:47:47	0.8	41.8										
	11/10/2018, 08:48:47	0.7	41.2										
	11/10/2018, 08:49:47	0.6	40.9										
	12/10/2018, 21:13:14	0.022	87.7										
	12/10/2018, 21:23:14	0.02	88.1										
	12/10/2018, 21:33:14	0.031	88.3										
	13/10/2018	13/10/2018, 07:00:47	0.8						9.3	NE	7.4	6.986	99.1
		13/10/2018, 07:01:47	0.8					99.1					
13/10/2018, 23:23:14			88.1										
13/10/2018, 23:33:14		0.007	88.3										
15/10/2018, 18:13:02			67.9										
15/10/2018, 18:33:02		0.004	71.5										
15/10/2018, 18:43:02		0.004	73										
15/10/2018, 18:53:02		0.003	74.1										
15/10/2018, 19:03:02		0.003	75.4										
15/10/2018, 19:13:02			76.5										
15/10/2018	15/10/2018, 23:33:02	0.01		7.1	SE	0.2	2.78305	76.5					
	15/10/2018, 23:33:02	0.008	21.7										
	16/10/2018, 22:13:02	0.02	21.7										
	16/10/2018, 22:33:02	0.024	21.6										
	17/10/2018, 00:33:02	0.019	82.6										
	17/10/2018, 17:03:02	0.019	82.8										
	17/10/2018, 17:13:02	0.009	83.3										
	17/10/2018, 17:23:02	0.6	59.1										
	17/10/2018, 08:37:30	0.6	56.9										
	17/10/2018, 08:38:30	0.6	54.9										
17/10/2018	17/10/2018, 08:39:30	0.6		6.00	NE	0.00	2.53	53.5					
	17/10/2018, 08:40:30	0.6	52.1										
	17/10/2018, 08:41:30	0.6	51										
	17/10/2018, 08:42:30	0.6	21										
	18/10/2018, 01:03:02	0.079	20.9										
	18/10/2018, 01:13:02	0.011	20.8										
	18/10/2018, 01:23:02	0.018	81.9										
	18/10/2018, 08:33:02	0.006	76.1										
	18/10/2018, 09:33:02	0.015	85.3										
	18/10/2018, 23:43:02	0.006	91.4										
18/10/2018	19/10/2018, 07:01:30	0.6	0	7.1	SE	0.4	30.55991667	90.1					
	19/10/2018, 07:02:30	0.6	0										
	19/10/2018, 07:03:30	0.6	0										
	19/10/2018, 07:04:30	0.6	0										
	19/10/2018, 07:05:30	0.6	0										
	19/10/2018, 07:06:30	0.6	0										
	19/10/2018, 07:07:30	0.6	0										
	19/10/2018, 07:08:30	0.6	0										
	19/10/2018, 07:09:30	0.6	0										
	19/10/2018, 07:10:30	0.6	0										

Date	Date and time (hh:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
19/10/2018	19/10/2018, 07:06:30		0.6	0				86.1
	20/10/2018							
22/10/2018	20/10/2018, 19:33:02			9.70	E	0.00	3.07	81
	22/10/2018, 05:23:02							93
	22/10/2018, 10:02:49		0.6	7.9	ENE	0	1.0972	28.6
	23/10/2018, 07:22:55							81.1
23/10/2018	23/10/2018, 22:12:55			8.7	ENE	0	2.376	81.1
	24/10/2018, 17:52:55							63.3
	24/10/2018, 18:02:55							65.9
	24/10/2018, 18:12:55							68.1
	24/10/2018, 18:22:55							70.5
	24/10/2018, 18:32:55							72.3
	24/10/2018, 18:42:55							73.5
	24/10/2018, 18:52:55							75.2
	24/10/2018, 19:02:55							76
	24/10/2018, 19:12:55							77.2
	24/10/2018, 19:22:55				E	0.2	1.70035	77.6
	24/10/2018, 19:32:55							78.8
	24/10/2018, 19:42:55							79.9
	24/10/2018, 19:52:55							81.6
	24/10/2018, 20:02:55							81.9
	24/10/2018, 20:12:55							84.9
	24/10/2018, 20:22:55							84.7
	24/10/2018, 21:22:55							84.8
	24/10/2018, 21:52:55							87.7
	24/10/2018, 23:32:55							88.8
24/10/2018	25/10/2018, 18:42:55							24.7
	25/10/2018, 19:02:55							23.9
	25/10/2018, 19:12:55							23.5
	25/10/2018, 19:22:55							23.1
	25/10/2018, 19:32:55							22.7
	25/10/2018, 19:42:55						1.7688	22.3
	25/10/2018, 19:52:55							21.9
	25/10/2018, 20:02:55							21.5
	25/10/2018, 20:12:55							21.4
	25/10/2018, 20:22:55							21.4
	25/10/2018, 21:52:55							19.9
	26/10/2018, 17:42:55							64
25/10/2018	26/10/2018, 17:52:55							66.3
	26/10/2018, 18:02:55							68
	26/10/2018, 18:12:55							69.6
	26/10/2018, 18:22:55							71.3
	26/10/2018, 18:32:55							72.9
	26/10/2018, 18:42:55							74.2
	26/10/2018, 18:52:55							75
	26/10/2018, 19:02:55						1.63955	76
	26/10/2018, 19:12:55				ESE	0.2		76.9
	26/10/2018, 19:22:55							79.5
	26/10/2018, 19:32:55							80.5
	26/10/2018, 19:52:55							77.9
	26/10/2018, 20:02:55							80.2
	26/10/2018, 20:12:55							81.8
	26/10/2018, 20:22:55							83.5

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
26/10/2018	26/10/2018, 21:22:55		0.003					83.5
	26/10/2018, 21:32:55		0.003					82.2
	27/10/2018, 17:32:55		0.006					30
	27/10/2018, 17:42:55		0.01					29
	27/10/2018, 17:52:55		0.01					28.1
27/10/2018	27/10/2018, 18:02:55		0.01					27.4
	27/10/2018, 18:12:55		0.008					26.8
	27/10/2018, 18:22:55		0.007					26.4
	27/10/2018, 18:32:55		0.006					25.9
	27/10/2018, 18:42:55		0.003					25.6
27/10/2018	27/10/2018, 18:52:55		0.003					25.3
28/10/2018	28/10/2018, 03:12:55		0.028					19.7
	28/10/2018, 03:22:55		0.06					19.5
	28/10/2018, 04:02:55		0.004					19.1
	29/10/2018, 02:02:55		0.005					21.9
	29/10/2018, 02:12:55		0.036					21.8
29/10/2018	29/10/2018, 02:22:55		0.059					21.7
	29/10/2018, 02:32:55		0.068					21.5
	29/10/2018, 02:42:55		0.027					21.5
	29/10/2018, 03:12:55		0.005					21.4
	29/10/2018, 03:22:55		0.006					21.4
29/10/2018	29/10/2018, 04:02:55		0.004					21.3
31/10/2018	31/10/2018, 21:52:11		0.004	12.00	ENE	0.00	3.65	88.5
1/11/2018	01/11/2018, 17:32:11		0.003					76.2
	01/11/2018, 17:42:11		0.005					79.1
	01/11/2018, 17:52:11		0.005					80.2
	01/11/2018, 18:02:11		0.003					80.1
	03/11/2018, 07:48:59	0.6	0					60
3/11/2018	03/11/2018, 07:49:59	0.6	0					58.7
	03/11/2018, 07:50:59	0.6	0					57.2
	03/11/2018, 07:51:59	0.6	0					56.4
	03/11/2018, 20:42:11		0.003					81.9
	04/11/2018, 18:02:11		0.003					68.8
4/11/2018	04/11/2018, 18:12:11		0.004					69.7
	04/11/2018, 18:22:11		0.005					71.3
	04/11/2018, 18:32:11		0.006					73
	04/11/2018, 18:42:11		0.006					74.7
	04/11/2018, 18:52:11		0.006					76.2
4/11/2018	04/11/2018, 19:02:11		0.006					77.6
	04/11/2018, 19:12:11		0.005					78.7
	04/11/2018, 19:22:11		0.005					79.8
	04/11/2018, 19:32:11		0.005					79
	04/11/2018, 19:42:11		0.004					81.3
4/11/2018	04/11/2018, 19:52:11		0.004					82.1
	04/11/2018, 20:02:11		0.003					83.3
	04/11/2018, 20:12:11		0.003					82.7
	04/11/2018, 20:22:11		0.003					83.4
	04/11/2018, 20:32:11		0.003					83.9
4/11/2018	05/11/2018, 17:56:06		0.004					68.7
	05/11/2018, 18:06:06		0.003					69.9
	05/11/2018, 18:16:06		0.004					71.4
	05/11/2018, 18:26:06		0.003					72.7

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
5/11/2018	05/11/2018, 18:36:06			7.6	N	0	5.154333333	73.7
	05/11/2018, 19:06:06							76.4
	05/11/2018, 19:16:06							77.8
	05/11/2018, 19:56:06							81.3
	05/11/2018, 20:06:06							81.7
6/11/2018	06/11/2018, 17:56:06							62.7
	06/11/2018, 18:06:06							64
	06/11/2018, 18:16:06							65.9
	06/11/2018, 18:26:06							67.7
	06/11/2018, 18:36:06							69.9
	06/11/2018, 18:46:06							72.2
	06/11/2018, 18:56:06							74
	06/11/2018, 19:06:06							75.6
	06/11/2018, 19:16:06							76.9
	06/11/2018, 19:26:06							77.3
	06/11/2018, 19:36:06							78
	06/11/2018, 19:46:06							79.6
	06/11/2018, 19:56:06							81.5
	06/11/2018, 20:06:06							79
	06/11/2018, 20:16:06							78.4
	06/11/2018, 20:26:06							79.5
	06/11/2018, 20:36:06							82.2
6/11/2018	06/11/2018, 20:46:06							83.5
	06/11/2018, 20:56:06							82.2
	06/11/2018, 21:06:06							85.3
	07/11/2018, 18:06:06							683
	07/11/2018, 18:16:06							70.3
7/11/2018	07/11/2018, 18:46:06							73.5
	07/11/2018, 19:06:06							75.6
	15/11/2018, 11:07:24							65.7
	15/11/2018, 17:37:24							66.4
	15/11/2018, 17:47:24							67.3
15/11/2018	15/11/2018, 17:57:24							67.5
	15/11/2018, 18:07:24							68.9
	15/11/2018, 18:17:24							69.4
	15/11/2018, 18:27:24							69.9
	15/11/2018, 18:37:24							73.5
	15/11/2018, 18:57:24							74.2
	15/11/2018, 19:07:24							74.6
	15/11/2018, 19:17:24							75.7
	15/11/2018, 19:27:24							76.7
	15/11/2018, 19:37:24							77.7
	15/11/2018, 19:47:24							78.8
	15/11/2018, 20:07:24							80.2
	15/11/2018, 20:17:24							80.2
	15/11/2018, 20:27:24							81.2
	15/11/2018, 20:37:24							82.7
	15/11/2018, 20:47:24							84.6
	15/11/2018, 20:57:24							86.2
15/11/2018	15/11/2018, 21:47:24							86.2
	15/11/2018, 21:47:24							86
	15/11/2018, 23:27:24							

Washdown: 9/11/18-12/11/18

Date	Date and time (hh:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
16/11/2018	16/11/2018, 17:47:24		0.003	8.8	ENE	0	2.21	66.1
	16/11/2018, 17:57:24		0.004					66.4
	16/11/2018, 18:07:24		0.004					68.6
	16/11/2018, 18:17:24		0.006					69
	16/11/2018, 18:27:24		0.004					69.7
	16/11/2018, 18:37:24		0.003					70.8
	16/11/2018, 18:47:24		0.005					71.7
	16/11/2018, 18:57:24		0.004					74.3
	16/11/2018, 19:07:24		0.004					75.5
	16/11/2018, 19:17:24		0.004					76.5
	16/11/2018, 19:27:24		0.003					77.5
	16/11/2018, 19:47:24		0.004					78.5
	16/11/2018, 19:57:24		0.004					79.6
	16/11/2018, 20:07:24		0.005					81
	16/11/2018, 20:47:24		0.003					83.8
	16/11/2018, 20:57:24		0.005					83.4
	16/11/2018, 21:07:24		0.004					83.3
	16/11/2018, 21:17:24		0.005					83.6
	16/11/2018, 21:27:24		0.003					82
	16/11/2018, 21:37:24		0.005					85.4
	16/11/2018, 21:47:24		0.003					85
	16/11/2018, 21:57:24		0.013					85.4
	16/11/2018, 22:17:24		0.003					83
17/11/2018	17/11/2018, 17:47:24		0.004	7.8	E	0	2.19	62.3
	17/11/2018, 17:57:24		0.004					63.2
	17/11/2018, 18:07:24		0.005					64.6
	17/11/2018, 18:17:24		0.005					65.8
	17/11/2018, 18:27:24		0.006					67.3
	17/11/2018, 18:37:24		0.005					68.5
	17/11/2018, 18:47:24		0.005					69.9
	17/11/2018, 18:57:24		0.006					71.5
	17/11/2018, 19:07:24		0.006					73
	17/11/2018, 19:17:24		0.006					74.5
	17/11/2018, 19:27:24		0.005					76.3
	17/11/2018, 19:37:24		0.005					77.3
	17/11/2018, 19:47:24		0.004					78
	17/11/2018, 19:57:24		0.004					80
	17/11/2018, 20:07:24		0.003					78.7
	17/11/2018, 20:17:24		0.004					80.9
	17/11/2018, 20:27:24		0.004					82.6
	17/11/2018, 20:37:24		0.003					84.4
	17/11/2018, 21:57:24		0.003					83
	17/11/2018, 22:17:24		0.003					84.7
18/11/2018	18/11/2018, 17:47:24		0.003	7.3	E	0	1.07	66.4
	18/11/2018, 17:57:24		0.003					65
	18/11/2018, 18:07:24		0.003					66.7
	18/11/2018, 18:17:24		0.003					68.5
	18/11/2018, 18:37:24		0.003					71
19/11/2018	19/11/2018, 01:57:24		0.006	10.7	E	0	0.7	87.2
	19/11/2018, 03:17:24		0.003					84.1
	19/11/2018, 07:37:24		0.004					83
	20/11/2018, 23:57:24		0.003					88.1

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
21/11/2018	21/11/2018, 00:07:24		0.003	10.1	ENE	0	0.68	88.9
	21/11/2018, 18:17:24		0.003					72
	22/11/2018, 17:37:24		0.003					67.7
	22/11/2018, 17:47:24		0.003					69.1
	22/11/2018, 17:57:24		0.003					70.3
	22/11/2018, 18:37:24		0.005					76
	22/11/2018, 18:47:24		0.006					79
	22/11/2018, 18:57:24		0.009					81.3
	22/11/2018, 19:07:24		0.007					82.3
	22/11/2018, 19:17:24		0.006					83.6
22/11/2018	22/11/2018, 19:27:24		0.005					84.9
	22/11/2018, 19:37:24		0.004					86.2
	22/11/2018, 19:47:24		0.003					87.1
	23/11/2018, 17:46		0.004					61
	23/11/2018, 17:56		0.005					62.1
	23/11/2018, 18:06		0.005					63.6
	23/11/2018, 18:16		0.005					65.2
	23/11/2018, 18:26		0.005					67
	23/11/2018, 18:36		0.005					68.6
	23/11/2018, 18:46		0.007					69.8
23/11/2018	23/11/2018, 18:56		0.006					71.7
	23/11/2018, 19:06		0.006					73.1
	23/11/2018, 19:16		0.006					74.1
	23/11/2018, 19:26		0.004					74.7
	23/11/2018, 19:36		0.003					75.9
	23/11/2018, 19:56		0.003					78
	23/11/2018, 20:06		0.003					79
	23/11/2018, 20:16		0.004					79.5
	23/11/2018, 20:26		0.003					80.4
	23/11/2018, 20:36		0.003					81.4
24/11/2018	23/11/2018, 20:46		0.004					81.6
	23/11/2018, 20:56		0.003					83
	23/11/2018, 21:06		0.003					84.6
	23/11/2018, 23:16		0.003					86.5
	23/11/2018, 23:36		0.003					87.4
	24/11/2018, 1:26		0.003					87.9
	24/11/2018, 5:16		0.003					89.5
	24/11/2018, 6:16		0.03					95.1
	24/11/2018, 6:26		0.039					95.6
	24/11/2018, 6:36		0.006					95.9
24/11/2018	24/11/2018, 17:46		0.005					60.3
	24/11/2018, 17:56		0.006					61.4
	24/11/2018, 18:06		0.006					63.7
	24/11/2018, 18:16		0.006					66.1
	24/11/2018, 18:26		0.008					68.2
	24/11/2018, 18:36		0.01					70.4
	24/11/2018, 18:46		0.011					72.3
	24/11/2018, 18:56		0.01					73
	24/11/2018, 19:06		0.009					75.2
	24/11/2018, 19:16		0.008					76.8
24/11/2018	24/11/2018, 19:26		0.007					77.5
	24/11/2018, 19:36		0.007					80.7

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
24/11/2018	24/11/2018 19:46		0.006					80.8
	24/11/2018 19:56		0.005					81.4
	24/11/2018 20:06		0.005					82.7
	24/11/2018 20:16		0.004					82.9
	24/11/2018 20:26		0.004					83
	24/11/2018 20:36		0.004					84
	24/11/2018 20:46		0.004					84.2
	24/11/2018 20:56		0.004					86.9
	24/11/2018 22:06		0.003					85.6
	24/11/2018 22:56		0.003					86.6
	24/11/2018 23:46		0.003					87.8
	25/11/2018 17:36		0.004					61.9
	25/11/2018 17:46		0.005					63.3
	25/11/2018 17:56		0.005					64.9
25/11/2018	25/11/2018 18:06		0.006					67
	25/11/2018 18:16		0.006					68.2
	25/11/2018 18:26		0.005					69.2
	25/11/2018 18:36		0.004					70.8
	25/11/2018 18:46		0.004					72.2
	25/11/2018 18:56		0.003					73.2
	25/11/2018 21:56		0.003					68.6
	25/11/2018 22:06		0.004					69.1
	25/11/2018 22:16		0.004					71.4
	25/11/2018 22:26		0.003					71.9
	26/11/2018 0:46		0.003					79
	26/11/2018 0:56		0.003					79.7
	26/11/2018 3:36		0.003					84.6
	26/11/2018 3:46		0.003					86.5
	26/11/2018 17:16		0.003					49.9
	26/11/2018 17:26		0.005					57.4
	26/11/2018 17:36		0.01					59
	26/11/2018 17:46		0.011					60.8
	26/11/2018 17:56		0.013					62.7
	26/11/2018 18:06		0.013					64.7
	26/11/2018 18:16		0.014					65.4
	26/11/2018 18:26		0.014					67.2
	26/11/2018 18:36		0.016					68.5
	26/11/2018 18:46		0.016					69.8
	26/11/2018 18:56		0.015					71.1
	26/11/2018 19:06		0.015					71.6
	26/11/2018 19:16		0.015					74.4
	26/11/2018 19:26		0.013					77
	26/11/2018 19:36		0.016					77.6
	26/11/2018 19:46		0.017					78.7
	26/11/2018 19:56		0.02					78.7
	26/11/2018 20:06		0.015					84.3
	26/11/2018 20:16		0.005					84.1
	26/11/2018 20:26		0.004					84
	26/11/2018 20:36		0.006					80.8
	26/11/2018 20:46		0.005					83.3
	26/11/2018 20:56		0.007					80.7
	26/11/2018 21:06		0.007					83.5

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
26/11/2018	26/11/2018 21:16		0.006					84
	26/11/2018 21:26		0.005					83.6
	26/11/2018 21:36		0.006					83.7
	26/11/2018 21:46		0.006					84.5
	26/11/2018 21:56		0.004					86
	26/11/2018 22:06		0.005					83.5
	26/11/2018 22:16		0.004					84.5
	26/11/2018 22:26		0.003					84.6
	26/11/2018 22:36		0.004					86.1
	26/11/2018 22:46		0.003					85.6
	26/11/2018 22:56		0.004					84.8
	26/11/2018 23:06		0.004					86.9
	26/11/2018 23:16		0.003					86.5
	26/11/2018 23:26		0.003					89.8
	26/11/2018 23:46		0.004					87
	27/11/2018 15:56		0.006					64.4
27/11/2018	27/11/2018 16:06		0.007					66
	27/11/2018 16:16		0.008					66.5
	27/11/2018 16:26		0.008					70.2
	27/11/2018 16:36		0.008					71.5
	27/11/2018 16:46		0.005					72.4
	27/11/2018 16:56		0.003					71.9
	27/11/2018 17:16		0.004					73.6
	27/11/2018 17:26		0.003					75.3
	27/11/2018 17:36		0.003					76.9
	27/11/2018 17:56		0.004					79.6
	27/11/2018 18:06		0.003					80.4
	27/11/2018 18:16		0.004					80.9
	27/11/2018 18:36		0.003					82.6
	27/11/2018 20:36		0.009					87.8
	27/11/2018 21:56		0.006					89.9
	28/11/2018 20:46		0.004					66.2
28/11/2018	28/11/2018 21:26		0.003					68.5
	28/11/2018 21:36		0.005					69.6
	28/11/2018 21:46		0.007					70.9
	28/11/2018 21:56		0.007					71.5
	28/11/2018 22:06		0.007					73.5
	28/11/2018 22:16		0.006					74.8
	28/11/2018 22:26		0.005					75.4
	28/11/2018 22:36		0.005					75.6
	28/11/2018 22:46		0.004					76.3
	28/11/2018 22:56		0.004					77.5
	28/11/2018 23:06		0.003					78.4
	28/11/2018 23:16		0.003					78.9
	28/11/2018 23:36		0.003					79.2
	28/11/2018 23:46		0.004					79.8
	28/11/2018 23:56		0.003					80.2
	29/11/2018 0:06		0.003					80.9
	29/11/2018 0:16		0.004					81.2
	29/11/2018 0:26		0.004					81.7
	29/11/2018 0:36		0.004					82.4
	29/11/2018 0:46		0.003					83.1

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
29/11/2018	29/11/2018 3:56		0.007	9.6	NNW	0	1.060333333	57.6
	29/11/2018 4:06		0.009					57.8
	29/11/2018 4:16		0.007					61.7
	29/11/2018 4:26		0.01					61.9
	29/11/2018 4:36		0.008					62.8
	29/11/2018 4:46		0.009					62.5
	29/11/2018 4:56		0.008					63.7
	29/11/2018 5:06		0.013					64.3
	29/11/2018 5:16		0.033					66.8
	29/11/2018 5:26		0.02					67.7
	29/11/2018 5:36		0.032					66.2
	29/11/2018 5:46		0.015					69.8
	29/11/2018 5:56		0.008					71.4
	29/11/2018 6:06		0.005					72.5
	29/11/2018 6:16		0.003					72.6
	29/11/2018 17:46		0.003					57.1
	29/11/2018 17:56		0.005					58.4
	29/11/2018 18:06		0.006					58.8
	29/11/2018 18:16		0.009					59.8
	29/11/2018 18:26		0.009					62.6
	29/11/2018 18:36		0.011					64.9
	29/11/2018 18:46		0.012					67.3
	29/11/2018 18:56		0.01					69.9
	29/11/2018 19:06		0.009					72
	29/11/2018 19:16		0.01					71.1
	29/11/2018 19:26		0.009					73.8
	29/11/2018 19:36		0.007					73.6
	29/11/2018 19:46		0.008					75.5
	29/11/2018 19:56		0.01					78.1
	29/11/2018 20:06		0.007					75.8
	29/11/2018 20:16		0.008					76.9
	29/11/2018 20:26		0.008					78.1
	29/11/2018 20:36		0.008					79
	29/11/2018 20:46		0.007					77.9
	29/11/2018 20:56		0.007					79.1
	29/11/2018 21:06		0.006					80
	29/11/2018 21:16		0.003					83.1
	29/11/2018 21:26		0.003					83.4
	29/11/2018 21:36		0.003					83.8
	29/11/2018 21:46		0.005					85.1
	29/11/2018 21:56		0.003					84.4
	29/11/2018 22:06		0.004					84.6
	29/11/2018 22:16		0.003					85.4
29/11/2018	30/11/2018 18:46		0.003	7.1	NNE	0	2.613283333	76.3
	30/11/2018 19:06		0.003					80.6
	30/11/2018 19:26		0.003					80.6
30/11/2018	30/11/2018 19:36		0.004	11	N	0	0.4745	82.3
	3/12/2018 21:06		0.004					78.4
	3/12/2018 21:16		0.007					81.7
	3/12/2018 21:26		0.007					84.5
	3/12/2018 21:36		0.007					86.5
	3/12/2018 21:46		0.006					87.4

Date	Date and time (h:mm:ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
3/12/2018	3/12/2018 21:56		0.003					88.3
	4/12/2018 16:26		0.004					68.9
	4/12/2018 16:36		0.004					71
	4/12/2018 16:56		0.003					72.4
	4/12/2018 17:06		0.003		NNE	15.8	0.38473333	74.4
	4/12/2018 22:46		0.024	12.5				86.6
	4/12/2018 22:56		0.032					88.4
4/12/2018	4/12/2018 23:06		0.024					89.2
	4/12/2018 23:36		0.009					90.9
	5/12/2018 1:36		0.005					92.4
	5/12/2018 1:46		0.009	10.8	NE	35.8	0.89225	92.7
5/12/2018	5/12/2018 7:19	0.6	0					83.3
	6/12/2018 4:06		0.003					91.2
	6/12/2018 4:26		0.005					89.8
6/12/2018	6/12/2018 4:36		0.01					89.9
	6/12/2018 4:46		0.008					90.1
	6/12/2018 4:56		0.01					90.6
	6/12/2018 6:36		0.003		SE	29.2	1.4788	90.6
	6/12/2018 6:46		0.005	18				91.1
	6/12/2018 10:06		0.011					89.6
	6/12/2018 10:16		0.006					89.6
	6/12/2018 14:06		0.006					88.3
	6/12/2018 14:26		0.003					89.7
	11/12/2018 1:06		0.004	13	SE	0.2	0.389491667	85.9
	11/12/2018 4:56		0.003					87.9
	18/12/2018 9:41		0.004					45.9
18/12/2018	18/12/2018 17:41		0.003					70.5
	18/12/2018 17:51		0.005					72.3
	18/12/2018 18:01		0.006					73
	18/12/2018 18:11		0.005					73.9
	18/12/2018 18:21		0.005					74.9
	18/12/2018 18:31		0.003					76
	18/12/2018 18:41		0.004					77
	18/12/2018 18:51		0.007					77.6
	18/12/2018 19:01		0.003					78.8
	18/12/2018 21:41		0.003					87.2
	18/12/2018 22:25	0.6	0					51.4
	18/12/2018 22:26	0.6	0	9.5	S	0.2	1.64	51
	19/12/2018 2:41		0.014					88.7
	19/12/2018 3:01		0.025					88.5
	19/12/2018 3:11		0.021					88.5
	19/12/2018 4:11		0.036					89
	19/12/2018 4:21		0.012					89
	19/12/2018 4:31		0.018					89.1
	19/12/2018 7:11		0.006					85.7
	19/12/2018 7:21		0.013					85.4
	19/12/2018 7:31		0.008					85
	19/12/2018 7:41		0.004					84.8
	19/12/2018 17:31		0.003					71.8
	19/12/2018 18:01		0.003					76.8
	19/12/2018 18:11		0.005					76.1
	19/12/2018 18:21		0.004					78.9

Date	Date and time (h/hmm/ss)	UW1 (PPM)	DW2 (converted to ppm)	Wind Speed (average)	Wind Direction (average)	Rainfall (daily total mm)	Carbohydrates (daily loss tonnes)	Humidity (%)
19/12/2018	19/12/2018 18:31		0.004					79.6
	19/12/2018 18:41		0.004					80.5
	19/12/2018 22:41		0.009					85.8
	19/12/2018 22:51		0.013					86
	19/12/2018 23:01		0.016					86.5
	19/12/2018 23:41		0.013	9.9	SSE	0	0.51	87.8
	20/12/2018 18:01		0.003					76.9
	20/12/2018 18:11		0.003					77.9
	20/12/2018 18:21		0.003					79.6
	20/12/2018 18:31		0.003					80.7
	20/12/2018 18:41		0.004					81.8
	20/12/2018 18:51		0.003					82.9
	20/12/2018 19:01		0.003					83.9
	20/12/2018 19:11		0.003	12.2	SSE	0	0.88	84.7

ATTACHMENT D:

Pond Water Field Sheets

[illegible]

Authorised by: C. Gordon

Verena Lund

Comments:

Attachment E:

Pond Sludge Field Sheets

SOIL SAMPLING AND ANALYSIS DATA SHEET

Sample ID	Depth (m)	Time	Colour	Physical structure	Biological Properties	Moisture Content	Other (Saline/Erosion/ASS/Odour)	Comments
POND	surface	10:30	black	ash visible on surface	no plants or sludge	very wet	/	odorous
POND 3	~3- 4m	11:15	black	shaggy, black	/	very wet	/	odorous -
POND 2	~3- 4m	12:10	black	shaggy, black	/	very wet	/	odorous
~ pond depth 5 assumed, samples taken by long reach digger from the base of the effluent pond,								
~ sampled directly from the bucket of the digger (centre sample of the sludge.)								

SOIL SAMPLING AND ANALYSIS DATA SHEET

Sample ID	Depth (m)	Time	Colour	Physical structure	Biological Properties	Moisture Content	Other (Saline/Erosion/Ass/Odour)	Comments
POND 1	surface	10:30	black	ash visible on surface	no plants or sludge	very wet	/	odorous
POND 3	~3-4m	11:15	black	slimy, black	/	very wet	/	odorous -
POND 2	~3-4m	12:10	black	slimy, black	/	very wet	/	odorous
~	pond depth is assumed							
~	samples taken by digger from the base of the effluent pond							
~	sampled directly from the bucket of the digger (centre sample of the sludge)							

ATTACHMENT F:

Meteorological Conditions

Date	MAXIMUM Wind Speed km/h	AVERAGE Wind Speed km/h	STDEV Wind Speed km/h	S THETA Wind Direction Degr	MAXIMUM Peak Wind Gust km/h	MAXIMUM Rain Gauge mm	AVGDIR Wind Direction Degr	Direction DESCRIPTION	TOTAL Rain Gauge mm
11/10/2018	23.6	7.4		5.6	65.3	30.8	0	358.2 N	0
12/10/2018	26	9.5		6.2	59.2	35.5	0	18.9 NNE	0
13/10/2018	28.8	9.3		6	79.5	35.5	0.6	34.4 NE	7.4
14/10/2018	36.1	6.9		4.2	88.8	43.8	1.2	349.4 N	15
15/10/2018	24.5	7.1		6.4	83.1	30.8	0.2	133.6 SE	0.2
16/10/2018	20.5	5.5		4.8	89.6	28.4	0.2	35.5 NE	0.2
17/10/2018	25.8	6		5.2	92.4	33.1	0	38.5 NE	0
18/10/2018	24.4	7.1		5.6	75.7	31.9	0.2	138.5 SE	0.4
19/10/2018	26.2	9.9		6.7	67.3	34.3	0	114.3 ESE	0
20/10/2018	27.4	9.7		7.3	72.6	34.3	0	91.7 E	0
21/10/2018	23.4	6.9		6.3	90.5	31.9	0.2	78 ENE	0.2
22/10/2018	26.7	7.9		6.7	69.6	35.5	0	63.8 ENE	0
23/10/2018	24.3	8.7		5.4	48	31.9	0	75.1 ENE	0
24/10/2018	23.8	7.6		6.4	90.2	30.8	0.2	98.1 E	0.2
25/10/2018	22.2	7		5.7	100.6	27.2	0	36.2 NE	0
26/10/2018	26.7	8.6		7.5	98	33.1	0.2	111 ESE	0.2
27/10/2018	22.3	6.5		5	55.4	29.6	0.2	341.6 NNW	0.2
28/10/2018	25	8.9		5.8	69.1	33.1	0	11.8 NNE	0
29/10/2018	27.6	9.6		6.1	67.6	35.5	0	13.7 NNE	0
30/10/2018	26.1	12.3		5.3	28.7	34.3	0	39.9 NE	0
31/10/2018	30.7	12		6.3	51.3	37.9	0	71.6 ENE	0
1/11/2018	29.2	12.2		6.4	31.6	45	0.2	74 ENE	1.2
2/11/2018	33.7	17.6		5.6	14.6	43.8	0.4	97.5 E	1.8
3/11/2018	34.6	14		8.5	53.7	46.1	0.2	130.8 SE	1.2
4/11/2018	28.8	9.8		7.8	97.6	43.8	0.2	82.6 E	0.2
5/11/2018	23.8	7.6		6.1	72.5	33.1	0	356.2 N	0
6/11/2018	24.8	7.5		6.1	64.9	31.9	0.2	349.9 N	0.2
7/11/2018	23.4	7.9		6.1	82.2	29.6	0	9.2 N	0
8/11/2018	25.7	9		6.4	67.8	36.7	0	8.4 N	0
9/11/2018	30.2	13.7		5.8	27.2	39	0.4	128.5 SE	0.4
10/11/2018	33.1	17.3		5.6	20.8	43.8	0.2	115.5 ESE	0.6
11/11/2018	35.7	13.9		8.4	38.7	46.1	0.2	124.2 SE	0.4
12/11/2018	31.8	13.4		6.9	31.2	37.9	0.8	124.2 SE	1.2
13/11/2018	31.1	11.9		8	68.3	42.6	0	141.4 SE	0
14/11/2018	35.5	11.3		8.2	58.7	43.8	0	145 SE	0
15/11/2018	28.3	9.2		7.5	91.4	36.7	0	90.6 E	0
16/11/2018	26.3	8.8		7.6	92.1	33.1	0	74.9 ENE	0
17/11/2018	24.2	7.8		6.5	96.1	31.9	0	57.3 ENE	0
18/11/2018	22.5	7.3		5.7	93.3	28.4	0	81.7 E	0
19/11/2018	26.3	10.7		6	45.5	30.8	0	96.9 E	0
20/11/2018	28.8	15.8		4.8	15.9	39	0	85.8 E	0
21/11/2018	25.1	10.1		6.7	68.9	31.9	0	63.2 ENE	0
22/11/2018	27.1	11.6		6.3	47.1	37.9	0	352.7 N	0
23/11/2018	29.5	10.2		6.7	40.5	39	0.2	325.5 NW	3

Date	MAXIMUM Wind Speed km/h	AVERAGE Wind Speed km/h	STDEV Wind Speed km/h	S THETA Wind Direction Degs	MAXIMUM Peak Wind Gust km/h	MAXIMUM Rain Gauge mm	AVGDIR Wind Direction Degs	Direction DESCRIPTION	TOTAL Rain Gauge mm
24/11/2018	29	7.7	7.7	5.7	80.7	35.5	0.2	333.2NNW	0.2
25/11/2018	28.6	7.7	7.7	6.9	69.8	34.3	0.2	333.3NNW	0.2
26/11/2018	32.2	11.4	11.4	7.8	42.5	47.3	0	342.7NNW	0
27/11/2018	28.2	6.7	6.7	5.5	101.1	33.1	0	268.9W	0
28/11/2018	24.1	6.7	6.7	5	92.3	30.8	0	340.3NNW	0
29/11/2018	34.3	9.6	9.6	6.3	79.6	42.6	0	326.9NNW	0
30/11/2018	27	7.1	7.1	6.6	92.7	37.9	0	19.6NNE	0
1/12/2018	23.1	7.4	7.4	6.6	89.9	30.8	0	35.7NE	0
2/12/2018	23.8	8.2	8.2	5.9	65.1	33.1	0.2	2.8N	0.2
3/12/2018	27.9	11	11	7.4	41.8	36.7	0	356.7N	0
4/12/2018	40.5	12.5	12.5	6.5	77.9	59.2	1	21.1NNE	15.8
5/12/2018	32.1	10.8	10.8	5.6	82.9	40.2	1.2	45.7NE	35.8
6/12/2018	32.8	18	18	5.5	24.2	45	1.4	133.2SE	29.2
7/12/2018	35	15.9	15.9	3.9	20.4	46.1	1.2	153.7SSE	89.2
8/12/2018	39.7	18.6	18.6	4.9	16.8	49.7	1	152.6SSE	15.8
9/12/2018	36	18.8	18.8	4.4	12.2	49.7	0.4	154.7SSE	26.4
10/12/2018	35	16.3	16.3	4	14.5	52.1	0.2	146.4SSE	1.6
11/12/2018	32.3	13	13	5.8	20.6	41.4	0.2	137.6SE	0.2
12/12/2018	24.6	11.7	11.7	4.3	18.7	30.8	0.4	126.4SE	2.6
13/12/2018	30.1	11.1	11.1	4	26.9	35.5	0.4	95.8E	8.4
14/12/2018	25.4	6.9	6.9	4.6	93.6	33.1	2	2.5N	60
15/12/2018	19.6	6	6	4.1	55	27.2	0.2	354.3N	5.2
16/12/2018	23.2	5	5	3.1	57.8	30.8	1.4	180.1S	4.6
17/12/2018	29.9	12.5	12.5	4.5	43.8	36.7	1.2	163SSE	46.4
18/12/2018	27.2	9.5	9.5	5.6	38.2	37.9	0.2	181S	0.2
19/12/2018	25.1	9.9	9.9	5.6	42.4	36.7	0	156.3SSE	0
20/12/2018	28.3	12.2	12.2	6.1	33.8	42.6	0	146.3SSE	0
21/12/2018	24.6	8.3	8.3	6.5	59.3	30.8	0	145.7SE	0

ATTACHMENT G:

DES Notice to MSL



Department of
Environment and Science

Ref CR70825 / STAT1122; EPPR00423513

15 May 2018

Mackay Sugar Limited
372 Anzac Avenue
MARIAN QLD 4753

Attn: Philip Kearney
Email: p.kearney@mkysugar.com.au

Dear Directors

Environmental Evaluation STAT1122 – Mackay Sugar Limited, Racecourse Sugar Mill

Please find enclosed the Notice to conduct or commission an environmental evaluation issued to Mackay Sugar Limited by the Chief Executive of the Department of Environment and Science (the department) under the *Environmental Protection Act 1994*.

The notice to conduct or commission an environmental investigation is issued in respect of the activities of Mackay Sugar Limited at Racecourse Sugar Mill, on land described as Lot 1 & 2 RP703613, Lot 3 & 4 RP704748, Lot 1 & 2 RP704750, Lot 1 RP704739, Lot 1 RP732066, Lot 1 & 2 RP723347, Lot 9 RP749853, Lot 8 RP904457, Lot 2 CP854468, Lot L of Lot 632 on CP859415, Lot M of Lot 632 on CP859415, situated at Peak Downs Highway, Racecourse.

Should you have any queries in relation to this letter or require more information about the Notice, please contact Amelia Sellars, Senior Environmental Officer of the department on telephone (07) 4999 6850 or via email Amelia.Sellars@des.qld.gov.au.

Yours sincerely

A handwritten signature in black ink, appearing to be "Brett Glosko", written over a horizontal line.

Brett Glosko
Delegate of the Chief Executive
Department of Environment and Science
Environmental Protection Act 1994

Enc. - Notice to conduct or commission an environmental evaluation

Notice

Environmental Protection Act 1994

Environmental Evaluation

Notice to conduct or commission an environmental evaluation

This notice to conduct or commission an environmental evaluation is issued by the administering authority pursuant to section 322 of the Environmental Protection Act 1994.

Mackay Sugar Limited
372 Anzac Avenue
MARIAN QLD 4753

Your reference: EPPR00423513

Our reference: CR70825 / STAT1122

15 May 2018

Take notice: that under the *Environmental Protection Act 1994* (the Act) a notice to conduct or commission an environmental investigation is issued to Mackay Sugar Limited (you) by the administering authority. The administering authority is the Chief Executive of the Department of Environment and Heritage Protection (the department).

The notice to conduct or commission an environmental investigation is issued in respect of the activities of Mackay Sugar Limited at Racecourse Sugar Mill, on land described as Lot 1 & 2 RP703613, Lot 3 & 4 RP704748, Lot 1 & 2 RP704750, Lot 1 RP704739, Lot 1 RP732066, Lot 1 & 2 RP723347, Lot 9 RP749853, Lot 8 RP904457, Lot 2 CP854468, Lot L of Lot 632 on CP859415, Lot M of Lot 632 on CP859415, situated at Peak Downs Highway, Racecourse (the premises).

A. Grounds

The notice to conduct or commission an environmental investigation is issued on the following grounds:

- Mackay Sugar Limited (MSL) holds environmental authority (EA) EPPR00423513, previously development permit ENDC00437305. The EA approves environmentally relevant activity (ERA) 28 - sugar milling or refining, consisting of either –
 - a) Crushing or grinding 200t or more of sugar cane in a year; or
 - b) Manufacturing 200t or more of sugar or other sugarcane products in a year.
- Since November 2015, the department has received numerous reports from community members regarding odour nuisance and alleged health effects associated with effluent treatment ponds that receive waste water from Racecourse Sugar Mill.
- The department has conducted several inspections to the effluent treatment ponds and as part of the investigation, MSL was directed to undertake odour monitoring for hydrogen sulphide and to conduct water monitoring of the ponds.

Notice to conduct or commission an environmental evaluation

- The department's Technical Support Unit assessed the results of the monitoring program and advised that the monitoring indicated the levels of H₂S detected had the potential to cause environmental nuisance to sensitive receptors.
- It was also noted that water monitoring conducted in effluent treatment pond 2 during the monitoring program identified parameters that exceeded release limits specified in the environmental authority (EA) with the exception of pH.
- The Technical Support Unit also identified that the monitoring conducted by MSL lacked comprehensive water monitoring of parameters associated with H₂S generation in all the effluent treatment ponds. The monitoring period also included numerous equipment failures.
- In accordance with s326B(1)(b) of the *Environmental Protection Act 1994*, the department is satisfied on reasonable grounds that the effluent treatment ponds associated with Racecourse Sugar Mill are causing, or are likely to cause environmental harm on the environmental values of air (odour nuisance) and possibly surface water.

B. Requirements

Action 1:

Conduct an investigation into the levels of hydrogen sulphide as close as possible to the sensitive receptors adjacent to the Racecourse Mill effluent treatment ponds. The investigation should incorporate the following:

- Continuous hydrogen sulphide (H₂S) monitoring should include at least three locations and be capable of continuous data collection for at least 60 days;
- The locations of H₂S monitoring stations should be placed to capture upwind and downwind data from the ponds. At least two stations must be selected to represent prevailing downwind conditions near the sensitive receptors;
- Continuous H₂S monitoring for at least 45 days during the crushing season;
- Continuous H₂S monitoring for at least 15 days outside of the crushing season;
- Installation of a meteorological station capable of continuous monitoring of wind speed and direction near the effluent ponds and be capable of continuous meteorological data collection for the same period as the continuous H₂S monitoring (at least 60 days);
- Continuous H₂S monitoring must be made in accordance with the methods described in the most recent version of the department's Air Quality Sampling Manual; and
- Compare monitoring results with appropriate national and international ambient air quality standards, including the *Environmental Protection (Air) Policy 2008*.

Action 2:

Provide an assessment and comparison of potential remediation options to address odour nuisance at sensitive receptors. The assessment must include:

- Available best practice treatment methods;

Notice to conduct or commission an environmental evaluation

- ii) Detailed description of remedial works required;
- iii) Cost benefit analysis for preferred works; and
- iv) Timeframes for implementation.

Action 3:

Submit an environmental report outlining the results of the above investigations to the department on or before **31 January 2019**

Note: The submission of regular update reports has not been included as an action item as part of the EE. The lack of regular updates as to the progress of the EE will not impact the environmental outcomes of the investigation.

The environmental investigation must be carried out, and the environmental report prepared, by an appropriately qualified person. An appropriately qualified person is defined as a person or persons who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.

The environmental report must be submitted to the department on or before:

- **Close of business 31 January 2019.**

As the recipient of this notice, you are also required to provide a statutory declaration in the form attached, to accompany the environmental report submitted to the department. The suitably qualified person who prepares the environmental report must also provide a statutory declaration in the form attached to accompany the environmental report submitted to the department.

You can view an electronic version of the statutory declaration for a recipient using the following search term ([ESR/2016/1997](#)).¹

An electronic version of the statutory declaration for a suitably qualified person form is available using the search term ([ESR/2016/2266](#)).

Take notice:

- the requirements of the notice to conduct or commission an environmental investigation take effect immediately upon service of this notice;
- this notice remains in force until further notice from the department; and
- you are responsible for meeting the costs of conducting or commissioning the environmental evaluation, preparing the environmental report and providing any further information as requested by the department.

C. Reviews and appeals

The provisions regarding reviews of decisions and appeals are found in sections 519 to 539 of the Act.

¹ This is the publication number. The publication number can be used as a search term to find the latest version of a publication at <www.des.qld.gov.au>.

Notice to conduct or commission an environmental evaluation

A person who is dissatisfied with certain decisions of the department, may be able to apply to have the department review that original decision.

Generally, a request to have a decision reviewed must be made:

- within 10 business days of the decision being notified to the person;
- be supported by enough information to enable the department to decide the application for review; and
- be made using the application for review of an original decision form ([ESR/2015/1573](#)).

Where an application has been made for a decision to be reviewed, the applicant may also apply to the relevant court for a stay of the decision to secure the effectiveness of the review.

Once the original decision has been reviewed, a person who is dissatisfied with the review decision may be able to appeal against that decision to the relevant court within 22 business days after receiving notice of the review decision.

A person whose interests are or would be adversely affected by a decision of the department may also be able to request a statement of reasons for a decision or a statutory order review under the *Judicial Review Act 1991*.

For further information about reviews and appeals see the:

- [Information sheet - internal review and appeal to the Planning and Environment Court \(ESR/2015/1572\)](#).
- Information sheet - internal review and appeal to the Land Court ([ESR/2015/1742](#)).

You may have other legal rights or obligations and should seek your own legal advice.

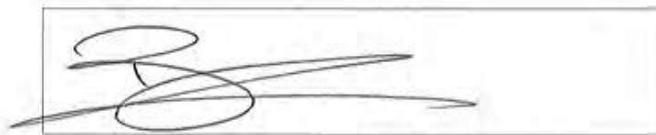
D. Penalty

Failure to comply with a notice to conduct or commission an environmental evaluation is an offence.

- The maximum penalty for a corporation is 1500 penalty units, totalling \$189,225.

Should you have any queries in relation to this notice, please contact Amelia Sellars of the department on telephone number (07) 4999 6850.

Notice to conduct or commission an environmental evaluation



Signature

15/05/2018

Date

Brett Glosko
 Manager (Compliance) Industry and Development
 Delegate of the Chief Executive
 Department of Environment and Science
Environmental Protection Act 1994

Enquiries:

Level 1, 22-30 Wood Street
 MACKAY QLD 4740

Ph: (07) 4999 6883

Email: cwes_mackay@des.qld.gov.au



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