



Wattle Glen Waste Management Facility Environmental Annual Report 2017

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1.0 Introduction

1.1 Background

Wattle Glen Waste Management Facility (Wattle Glen) is located on Halletts Road, in Redbank Plains. Wattle Glen is a dry landfill facility and operates under Environmental Authority (EA) EPPR00633413.

As a part of Wattle Glen's responsibilities subject to the approvals of the facility, analysis and interpretation of data obtained from the environmental monitoring program is undertaken, and reported to the Department of Environment and Heritage (DEHP). Table 1 below outlines the general scope for monitoring tasks performed at Wattle Glen.

Table 1 – Scope of Environmental Monitoring for 2017

Monitoring Aspect	Frequency
Groundwater Quality	Every six (6) months
Groundwater Levels	Every six (6) months
Stormwater Quality	Quarterly and/or upon release
Leachate Quality	Annually
Dust Deposition	Upon Complaint
Surface Gas Emissions	Monthly
Odour	Twice Monthly

1.2 Summary

This report is prepared in accordance with the aforementioned agency licence requirements in order to summarise the environmental monitoring undertaken within the facility over the 2017 period. Summarised within this report are the results of all the monitoring undertaken within this monitoring period, including any anomalies, changes in site conditions or operational procedures which may have contributed to the changes in monitoring data.

2.0 Water Monitoring

2.1 Background to Water Monitoring

Wattle Glen water monitoring has been undertaken according to EA requirements. Groundwater monitoring was undertaken biannually, stormwater monitoring was undertaken quarterly and leachate monitoring was undertaken annually throughout 2017.

The results of groundwater, stormwater and leachate quality monitoring are detailed in the following report.

2.2 Groundwater Monitoring

Wattle Glen South Landfill

Groundwater monitoring from within the Wattle Glen South Landfill area commenced in 1997, following acquisition of the landfill facility by Veolia (formerly known as Collex). Monitoring initially occurred from two groundwater monitoring bores, labelled BH1 and BH2, located within the mine pit. These bores were buried as part of landfill development, and were replaced by bores GW1, GW2 and GW3 located outside the limits of the void. In late 2003, monitoring bore GW2 was also buried as part of landfill extension to the south of the void, therefore in February 2004, a replacement monitoring bore (GW4) was constructed along the south-eastern boundary of the landfill site. Bore GW3 was then buried in November 2004 followed by GW1 in November 2006. These bores were not replaced.

Wattle Glen North Landfill

In February 2004, monitoring bore GW5 was constructed on the southern edge of the proposed landfill area. Monitoring of this bore has occurred since its construction. In support of the development application for this landfill proposal, two additional groundwater monitoring bores (GW7 and GW8) were constructed.

In situ low flow sampling pumps were installed in bores GW4, GW5 and GW8 in October 2013. It should be noted that GW7 was decommissioned in 2013 due to deformation of bore integrity and therefore not used in analysis. Refer to Appendix 1 for detailed locations of each bore. The low flow pump technology has been employed with aims to increase accuracy and control over groundwater quality monitoring. See below (Table 2) for details of the groundwater bore infrastructure.

Table 2 – Details of Groundwater Monitoring Infrastructure

Bore	Location	Depth to Bottom of Bore	Current Status
GW4	South-Eastern corner of WG South	80m	Active
GW5	South-West corner of WG North	72m	Active
GW7	North-Eastern corner of WG North	54m	Decommissioned in 2013
GW8	North-West of WG North	60m	Active

All groundwater monitoring throughout 2017 was performed by Veolia's Environmental Officer, with samples analysed by the NATA accredited, ALS and Symbio laboratories in Brisbane. Monitoring was undertaken in May and August 2017.

2.3 Groundwater Level Trends

In support of groundwater quality assessment, groundwater level trending is utilised to review any statistical trending which may indicate disruptions to the baseline conditions of the groundwater system. All groundwater depths are monitored through manual dipping of bores at regular intervals. Groundwater level trending is detailed below in Figure 1.

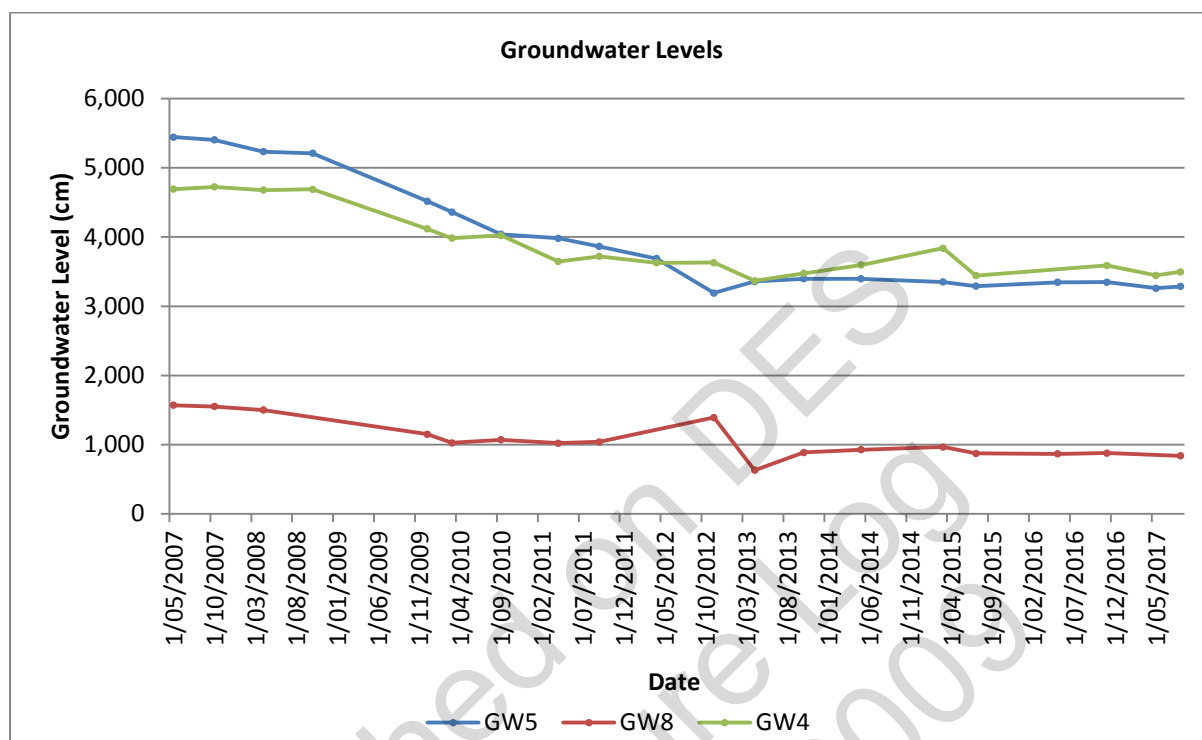


Figure 1 – Groundwater Levels (cm) from 2007-2017

The groundwater levels of detection bores have steadily declined over the decade, with background bore GW8 remaining fairly consistent.

Up Gradient/Background Bores	Down Gradient/Detection Bores
GW8	GW4
	GW5

Engineering surveys determined that the general flow of groundwater at the Wattle Glen Facility slopes from the North-West to the South-East. As GW8 is situated hydraulically up gradient of the landfill, accessing a local stream, it is nominated as the background bore, where MB4 and MB5 are considered down gradient detection bores.

2.4 Groundwater Quality Summary

To adequately summarise the groundwater characteristics, a review of the main qualities commonly used as indicators of disruption from landfilling activities are pH, conductivity, TOC, ammonia and TDS (Lisk 1991) (Nicholson, Cherry & Reardon 1983). Please note that data from GW7 has been omitted as this bore is no longer in use.

Groundwater pH



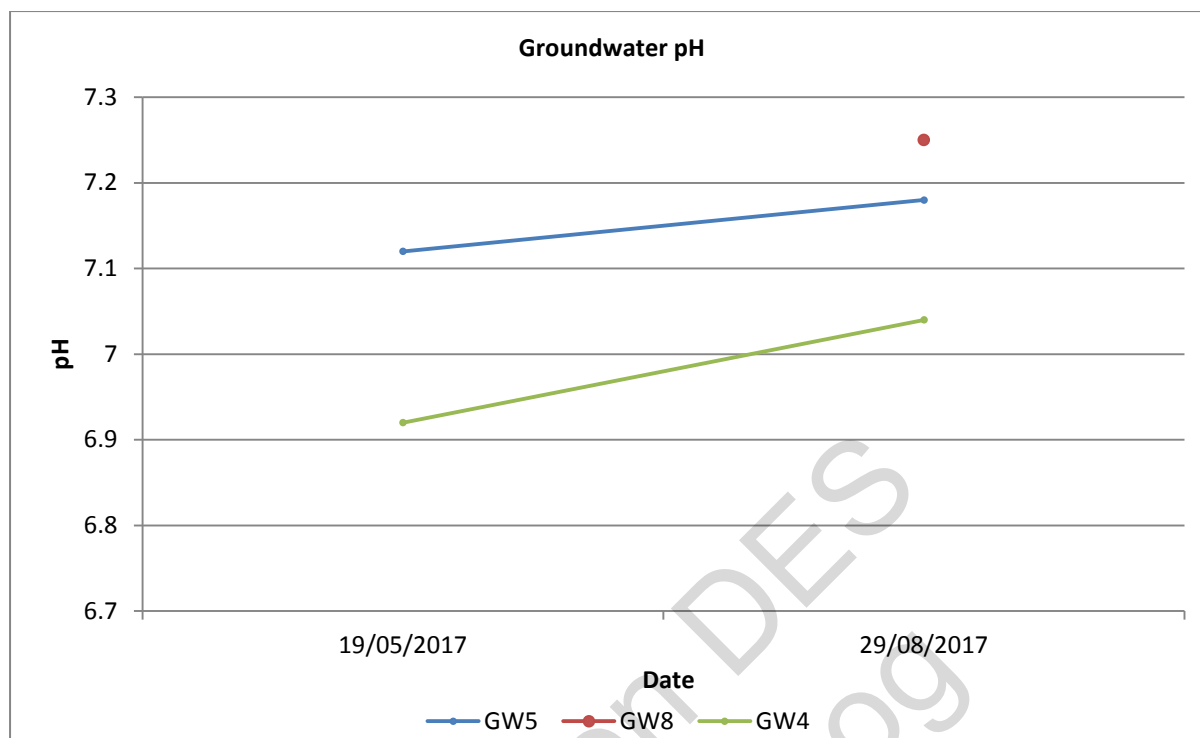


Figure 2 – Groundwater pH trends for 2017

The pH of detection bores has steadily increased throughout 2017. Results from GW8 are only available from the August sampling round as there was restricted access in May 2017.

Groundwater Conductivity (EC)

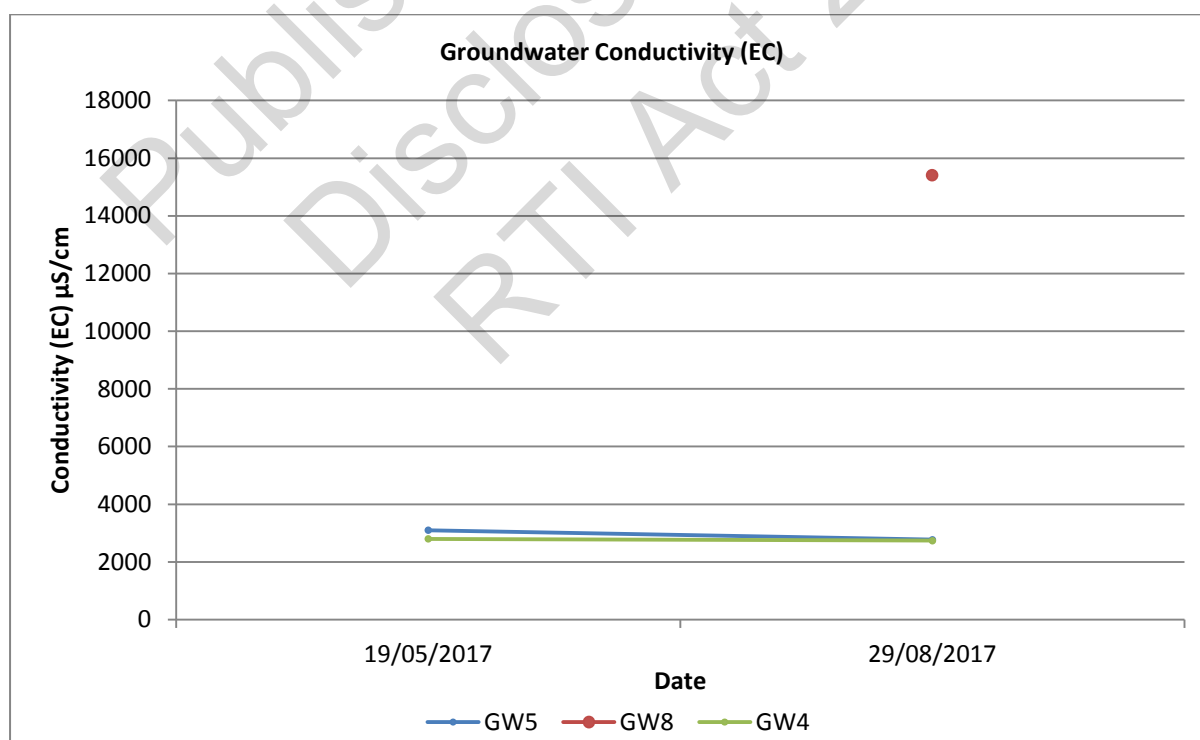


Figure 3 – Groundwater Conductivity (EC) trends for 2017

Groundwater conductivity concentrations have remained very consistent throughout the year, the noticeable difference between bores is the higher levels of EC in GW8 (15,400 μ S/cm). Due to restricted access in May, GW8 was sampled once in August 2017.

Groundwater Total Organic Carbon (TOC)

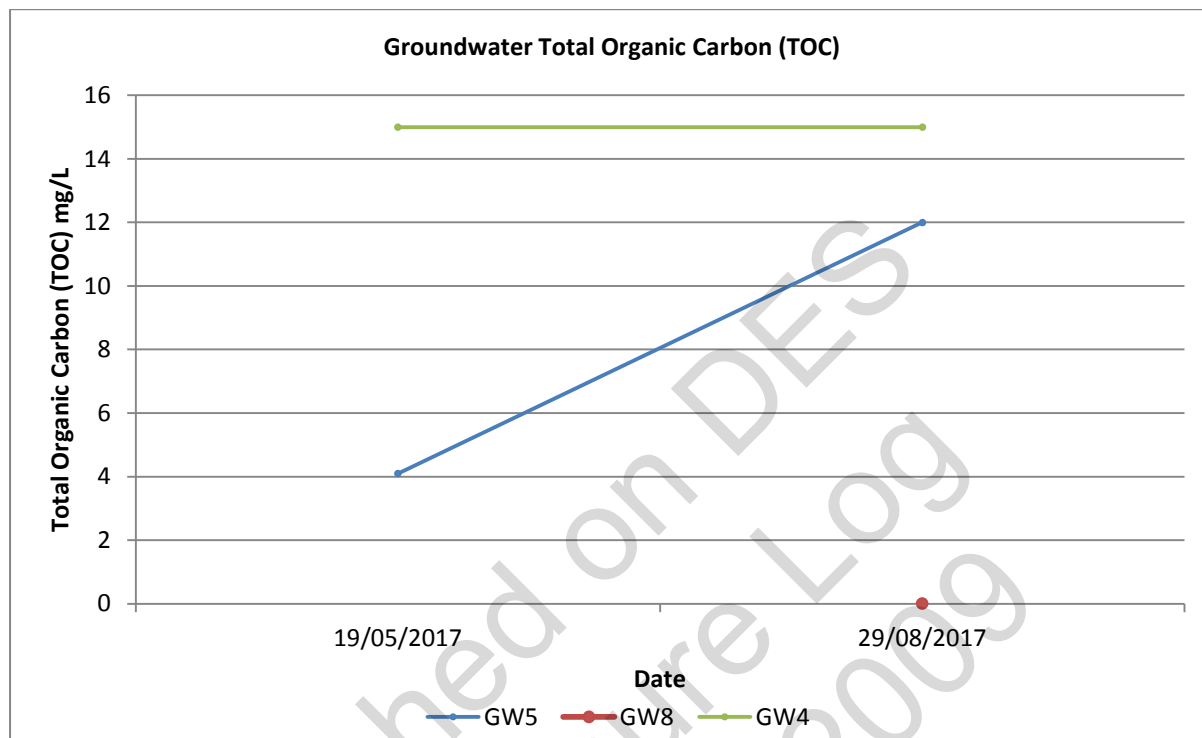


Figure 4 – Groundwater Total Organic Carbon (TOC) trends for 2017

GW4 had the highest levels of TOC of all bores, and remained consistent (15mg/L) for both sampling events. There was an increasing trend of TOC in GW5 throughout 2017 and due to restricted access to GW8, the May sample was omitted and August levels read at below 1mg/L.

Groundwater Ammonia

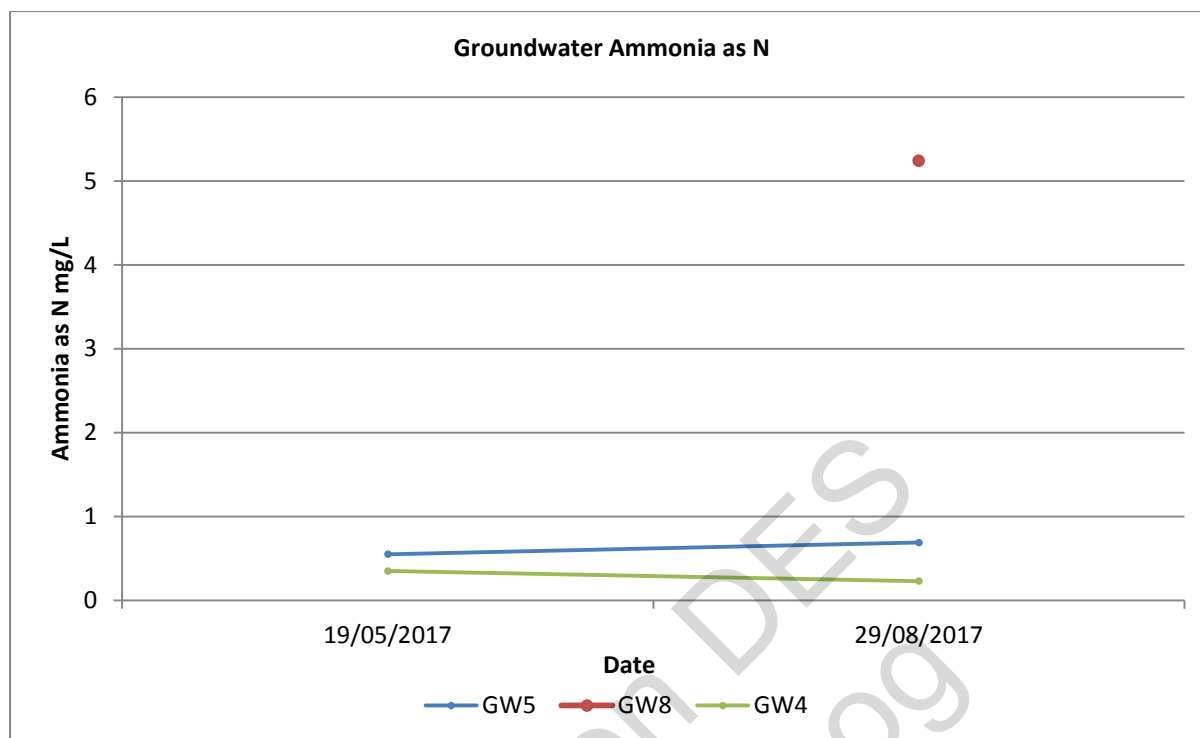


Figure 5 – Groundwater Ammonia as N trends for 2017

Concentrations of ammonia remained relatively low and consistent in GW4 and GW5. In comparison, ammonia levels in GW8 are higher than remaining bores, with concentrations at 5.24mg/L in August (May sample was omitted due to lack of access).

See Table 3 below, for a summary of groundwater quality reporting in 2017. The summary indicates a number of contrasts between background and detection bores, although no attributions can be definitively linked to site activities.

Table 3 – Summary of Groundwater Quality Reporting

Parameter	Background Bore Range	Observed Detection Bore Conditions
pH	7.25	Detection bore pH values are slightly lower than the baseline range, varying generally between 6.92 and 7.18.
Conductivity (EC)	15,400 μ S/cm	Conductivity is significantly lower in detection bores GW4 and GW5, varying between 2800 μ S/cm and 3100 μ S/cm.
Total Organic Carbon (TOC)	<1 mg/L	TOC in detection bores was significantly higher than background conditions, with range varying between 4.1mg/L and 15mg/L.
Ammonia	5.24 mg/L	Detection bore ammonia concentrations were considerably lower in GW4 and GW5 with levels ranging between 0.23mg/L and 0.69mg/L.

For a complete list of groundwater analytes, their minimum monitoring frequency and concentrations in the environment refer to Appendix 2.

2.5 Stormwater Monitoring

Receiving Environment Monitoring Program

Condition G10 of the Environmental Authority EPPR00633413 states that contaminants from settled treated stormwater require continuous monitoring when discharging. Indicators include: pH, total suspended solids (TSS) and total petroleum hydrocarbons (TPH). The site licence criteria for contaminants permitted to be released are as follows:

- pH value between 6.5 and 8.5
- Dissolved Oxygen (DO) minimum 6mg/L
- Total Suspended Solids maximum 80mg/L
- Total Organic Carbon (TOC) maximum 20 mg/L

It is important to note that there were no site discharges that occurred during 2017.

Stormwater sampling was conducted quarterly (at a minimum); by the Veolia Environmental officer and quality analysis was completed by Australian Laboratory Services (ALS). Samples were collected and analysis was performed in the field and within the laboratory. Stormwater quality data is analysed and interpreted for the purpose of reporting. Refer to Appendix 3 for location of Wattle Glen stormwater pond.

2.6 Stormwater Quality Summary

Stormwater pH

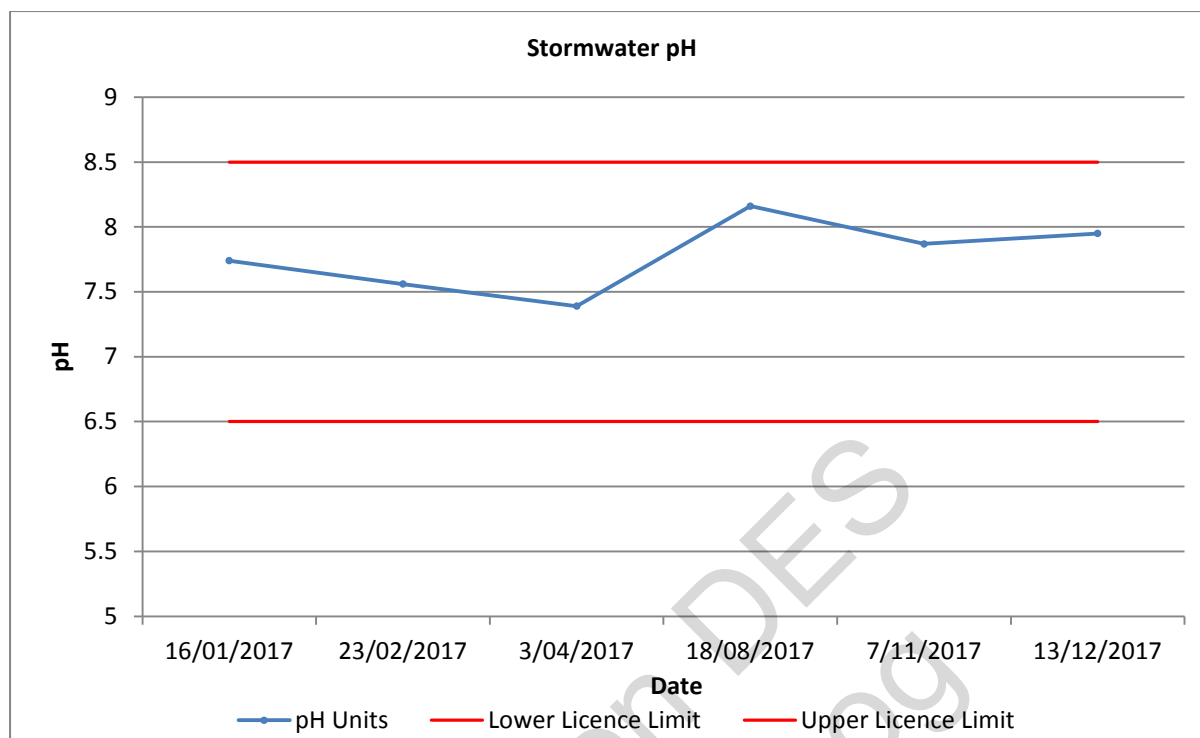


Figure 6 – Stormwater pH trends for 2017

pH showed an increase in alkalinity between April and August 2017, with levels remaining slightly higher than earlier records throughout the rest of the year.

Stormwater Dissolved Oxygen (DO)

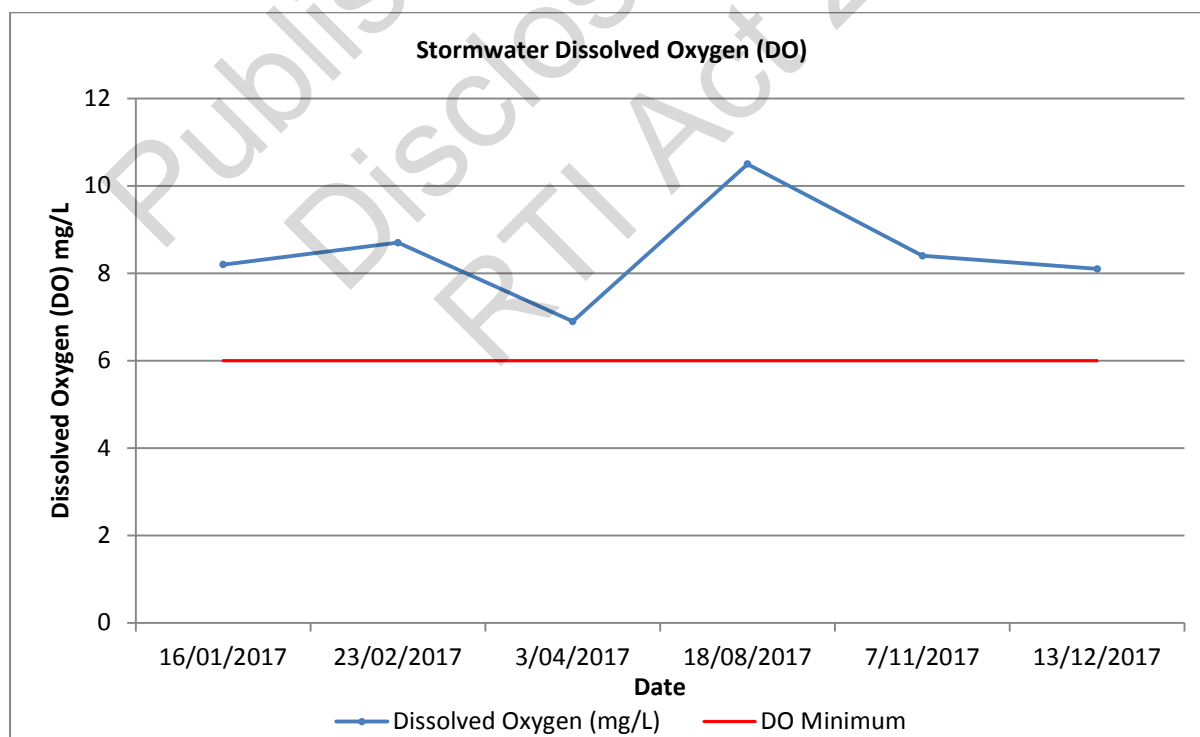


Figure 7 – Stormwater Dissolved Oxygen (DO) trends for 2017

The overall trend of DO concentrations is fairly consistent throughout the year, with the exception of August, where levels peaked at 10.5mg/L

Stormwater Total Suspended Solids (TSS)

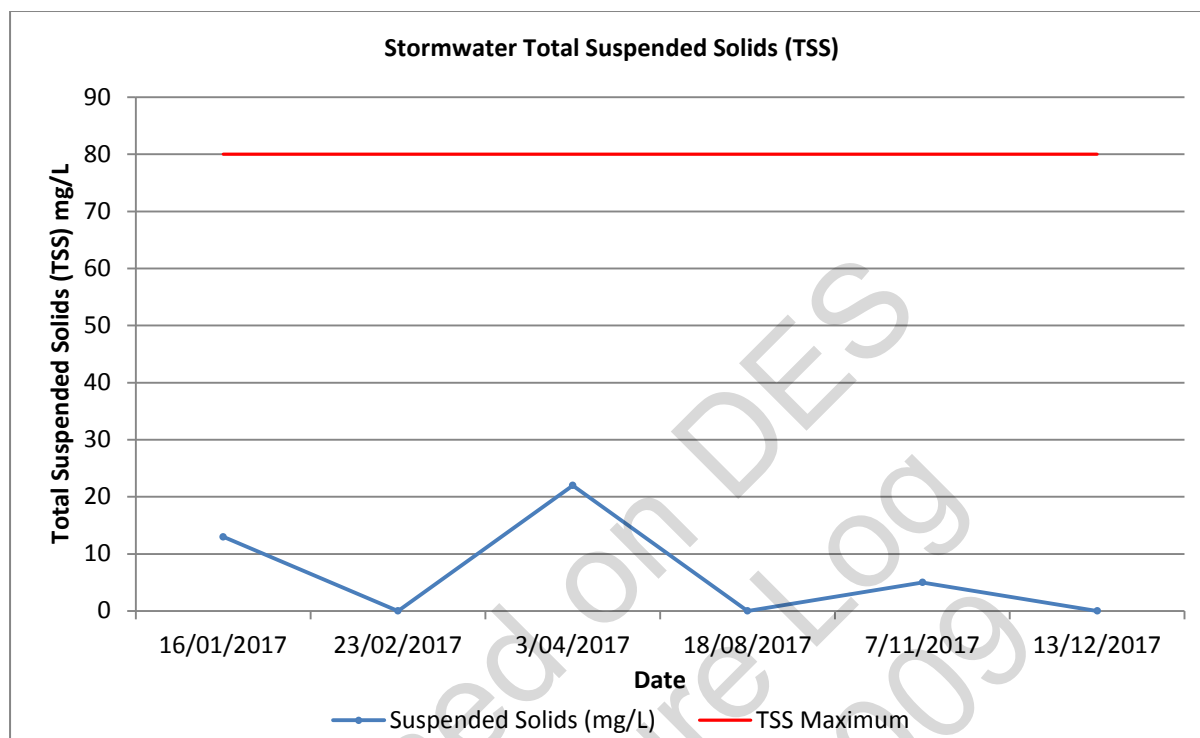


Figure 8 – Stormwater Total Suspended Solids (TSS) trends for 2017

TSS peaked in April 2017, with levels reaching 22mg/L. Concentrations then declined to ≤ 5 mg/L for the remaining sampling season.

Stormwater Total Organic Carbon (TOC)

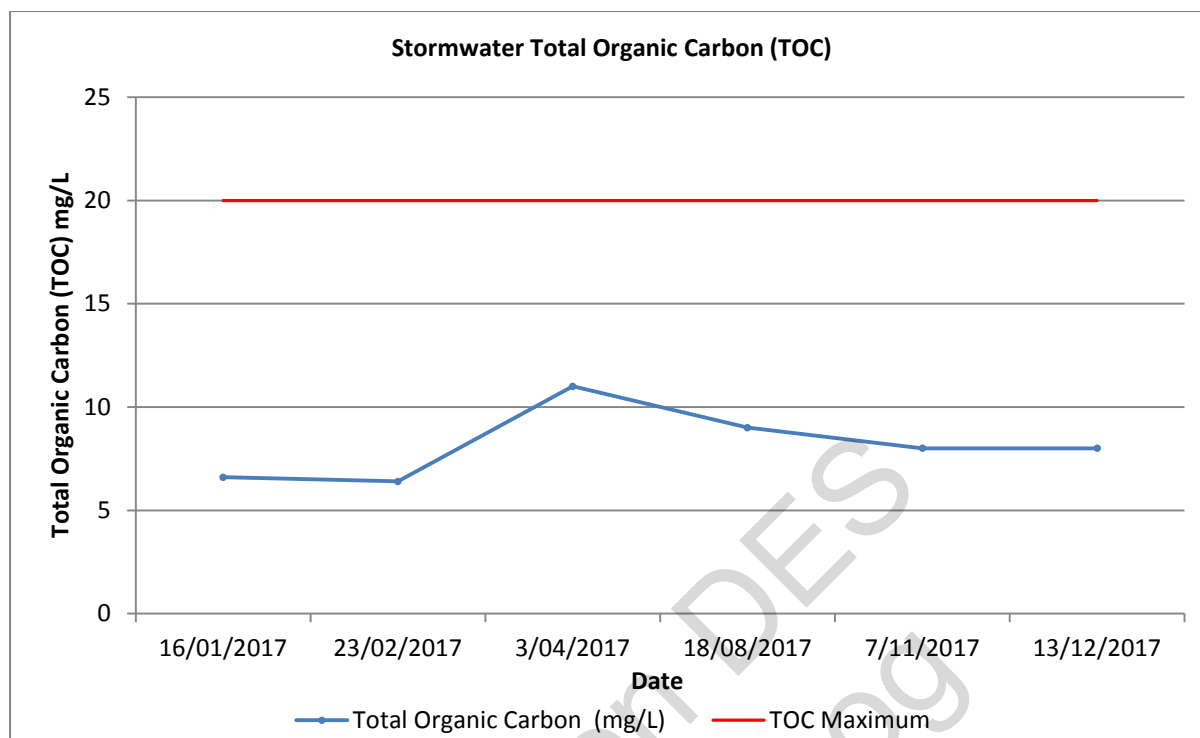


Figure 9 – Stormwater Total Organic Carbon (TOC) trends for 2017

A slight increase in TOC levels were seen between February and April, with concentrations peaking at 11mg/L. TOC levels steadily decreased throughout the remainder of 2017.

3.0 Leachate Monitoring

Assessment of leachate quality provides a general characterisation, identifies any significant variations over time and provides a baseline for identifying any potential impacts on the groundwater or surface water systems. Leachate sampling was carried out by the Veolia Environmental officer annually for Wattle Glen South. Wattle Glen North (WGN) did not have an active leachate recirculation system during the temporary infrastructure upgrades in 2016, which did not allow for a sample to be retrieved. Although the WGN 2016 sample is absent, Wattle Glen South (2016) and both WGN and WGS leachate qualities (2017) are represented below.

The quality of analysis was completed by Australian Laboratory Services (ALS). Samples are collected in the field and analysis performed in the laboratory. Leachate quality data is analysed and interpreted for the purpose of reporting.

3.1 Leachate Quality Summary

As leachate is sampled annually, a comparison of the 2016 and 2017 leachate parameters has been represented below in Table 4. Due to missing data from Wattle Glen North in 2016, a comparative analysis will only be discussed for Wattle Glen South.

Table 4 – Wattle Glen Leachate Data

Analyte	Wattle Glen South		Wattle Glen North
	27 October 2016	12 September 2017	3 November 2017
pH	8.24	8.30	7.67
Ammonia as N (mg/L)	720	508	1180
Bicarbonate as HCO ₃ (mg/L)	4000	4750	7230
Calcium (mg/L)	20	54	18
Chloride (mg/L)	3600	2430	1560
Total Iron (mg/L)	1.6	0.98	10.2
Lead (mg/L)	0.0026	0.001	0.010
Nitrate as N (mg/L)	<0.05	0.30	4.74
Potassium (mg/L)	410	264	52
Sodium (mg/L)	2740	2750	459
Sulphate (mg/L)	135	<10	<50
Conductivity (µS/cm)	16000	15000	17700
Total Organic Carbon (mg/L)	2200	885	4200
Zinc (mg/L)	0.18	0.075	0.076

In a comparison between 2016 and 2017 leachate qualities, there was a decrease in concentrations of all analytes with the exception of: pH, bicarbonate, calcium, nitrate and sodium. With the significant increase in calcium concentrations between 2016 and 2017, there was also a considerable decrease in sulphate concentrations.

4.0 Air Quality

Air quality monitoring for Wattle Glen consists of landfill gas and an odour offensiveness rating.

4.1 Gas Monitoring

Two different capping methods are implemented for each landfill. The Wattle Glen North landfill surface is covered with a low permeability clay system to encapsulate gases. The clay cover is maintained and sealed where gas release is identified to prevent any further outbreaks within the area. Wattle Glen South is currently undergoing the final stages of Phytocapping, where plants are used to regulate the evapotranspiration, absorption and encapsulation of rainfall/gases instead of the traditional clay cap. Throughout 2017, all efforts have been made to minimise the release of gas from the landfill structures. A gas collection system is in place to maximise extraction of methane gas from within the landfill. All the gas structures are monitored on a regular basis and maintained to maximise continued gas extraction.

Surface gas has been monitored across both the capped landfill surfaces and revegetated surfaces alike. As landfill gas monitoring frequencies are not specified in the EA, the Veolia Environmental officer conducted surveys as often as necessary to ensure the protection of human health and loss of methane to the atmosphere. Refer to Appendix 4 for a surface gas monitoring template.

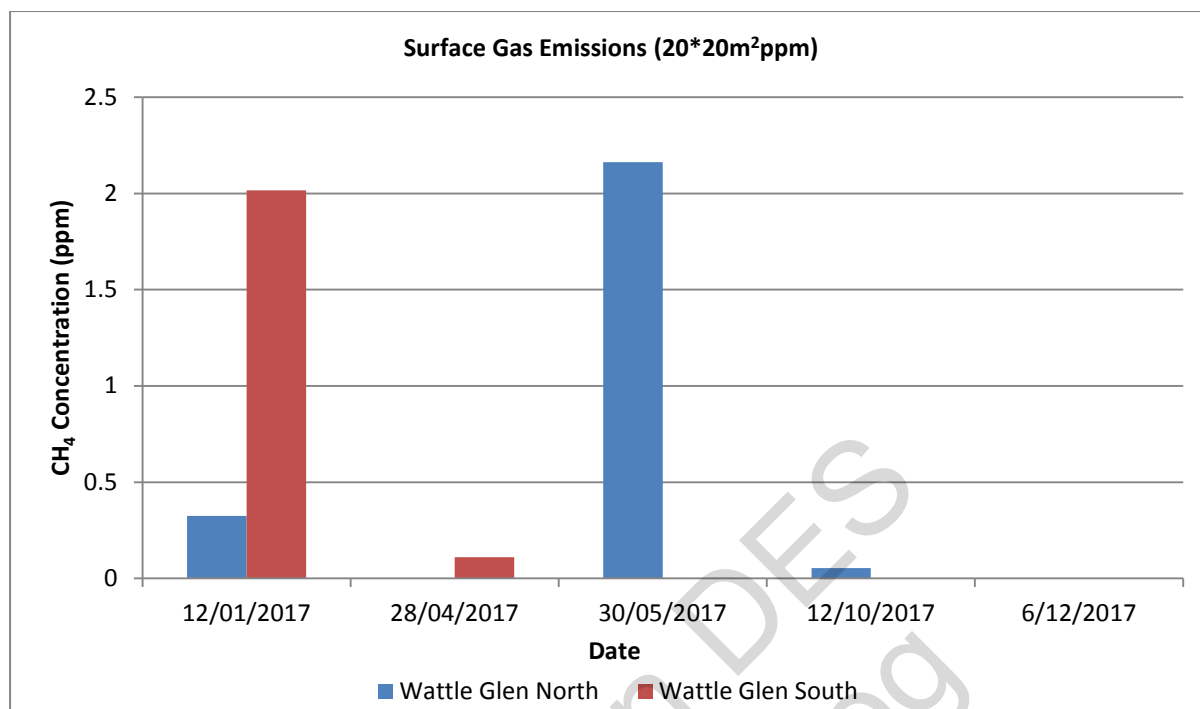


Figure 10 – Surface Gas Emission trends for 2017

Throughout 2017, the highest point source records of methane detected were from Wattle Glen south in January and Wattle Glen north in May (365ppm and 400ppm respectively). As the total concentrations of methane are averaged over the area of each landfill, peak methane levels were observed on Wattle Glen North, in May with concentrations at 2.16ppm/20x20m² area.

12/01/2017	Methane detection at well MF D
28/04/2017	Methane detected at well B20
12/10/2017	Methane detected on WGN western batter

4.2 Odour Monitoring

Odour monitoring was undertaken at the Wattle Glen Waste Management Facility throughout 2017. No significant offsite odours were noticed and no odour complaints were received.

With respect to wind direction, eight monitoring locations have been allocated (four sites outside of the site boundary and four sites within the site boundary) to account for all areas of potential odour nuisance. Monitoring locations are detailed in Appendix 5.

Odour monitoring was performed using olfactory senses. The following methodology has been implemented:

- Odour sampling is conducted for ten minutes, per location. The assessor inhales every ten seconds and records data in accordance with the scales specified in Table 5.
- The date, time, odour offensiveness rating (see table 5), wind direction, wind speed and any comments are recorded to give a quantitative measure of odour and trigger levels.

Table 5 – Odour Measurement Scale

Offensiveness Scale	Descriptor	Effects on Receptor
0	Pleasant	Odour is perceived as pleasant.
1	Neutral	Odour is not perceived as pleasant or unpleasant.
2	Slightly Unpleasant	Mildly unpleasant, however bearable even for prolonged exposure.
3	Offensive	Causes recognisable displeasure to sense of smell, may be bearable for short exposure, but reluctance to submit oneself to longer exposures is likely. Long term exposure may cause stress-like symptoms.
4	Strongly Offensive	Repulsive to sense of smell. Would soon elicit attempts to avoid exposure. May cause slight physiological effects following exposure e.g. headaches, slight nausea.
5	Noxious	Causes almost immediate attempts to avoid. May cause noticeable physiological effects following exposure e.g. pronounced nausea, feeling faint headed.

5.0 Complaints

Wattle Glen Waste Management Facility received no formal complaints during 2017.

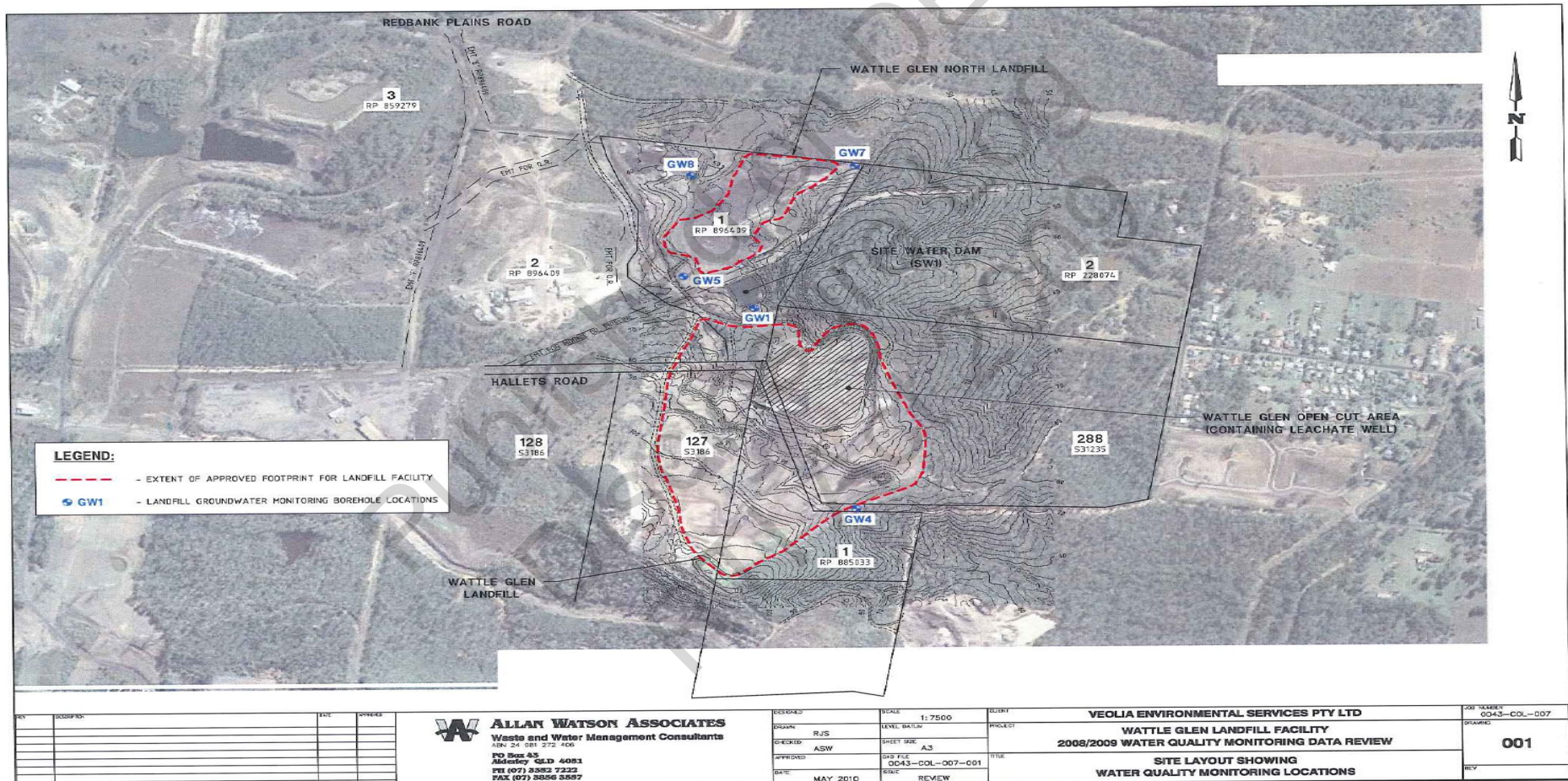
6.0 References

Lisk, DJ 1991, 'Environmental effects of landfills', *Science of the Total Environment*, vol. 100, pp. 415-468.

Nicholson, RV, Cherry JA & Reardon, EJ 1983, 'Migration of contaminants in groundwater at a landfill: A case study 6. Hydrogeochemistry', *Journal of Hydrology*, vol. 63, issues. 1-2, pp. 131-176.

7.0 Appendices

7.1 Appendix 1 Groundwater Bore Monitoring Locations



7.2 Appendix 2 Groundwater Sampling Frequencies

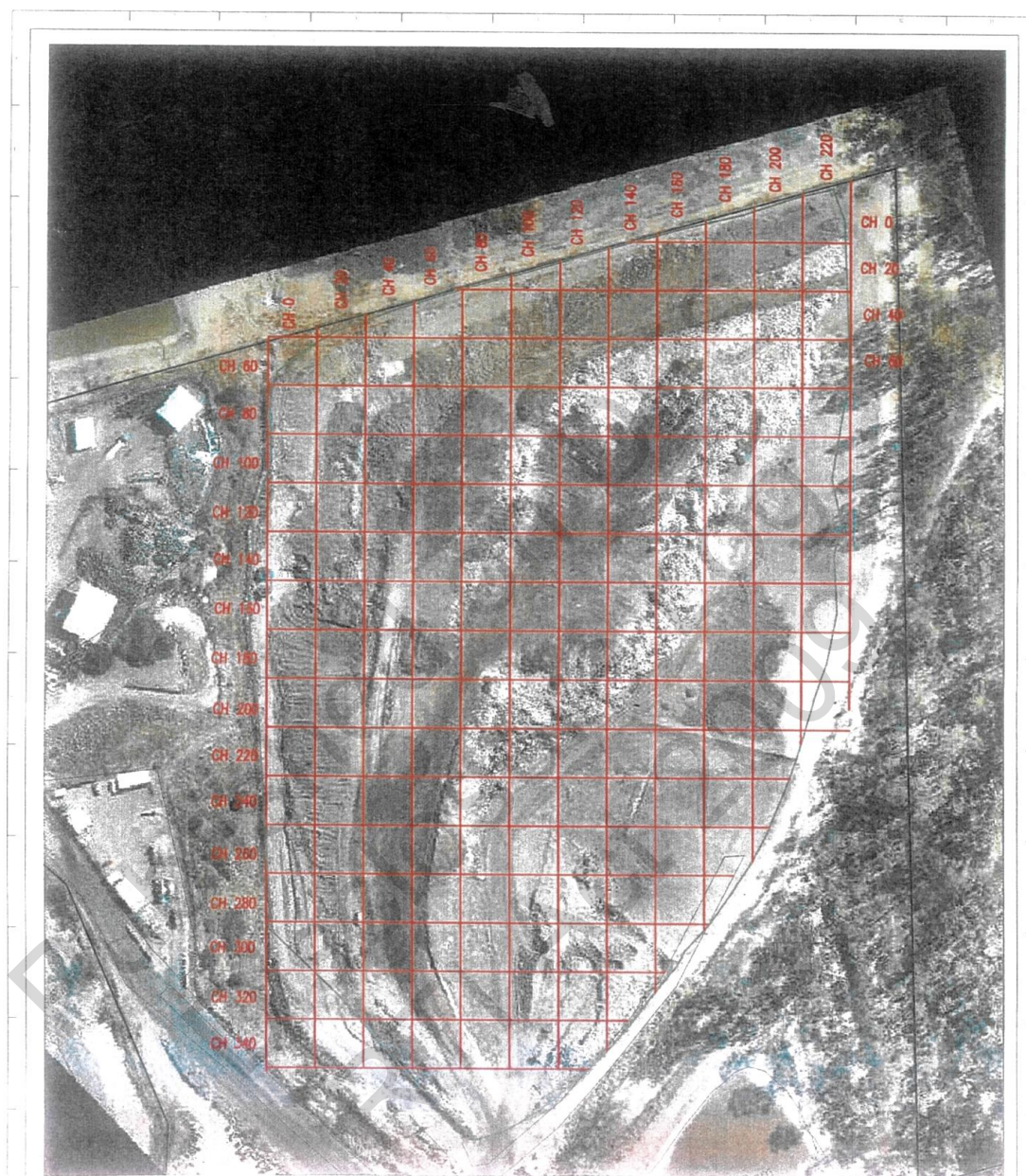
Monitoring Point	Analyte	Units	Limit	Minimum Frequency
GW4	pH	pH units	No prescribed limit	Every six months
GW5	Ammonia	mg/L	No prescribed limit	Every six months
GW8	Calcium	mg/L	No prescribed limit	Every six months
	Copper	mg/L	No prescribed limit	Every six months
	Total Iron	mg/L	No prescribed limit	Every six months
	Lead	mg/L	No prescribed limit	Every six months
	Nitrate as N	mg/L	No prescribed limit	Every six months
	Bicarbonate	mg/L	No prescribed limit	Every six months
	Sodium	mg/L	No prescribed limit	Every six months
	Potassium	mg/L	No prescribed limit	Every six months
	Sulphate	mg/L	No prescribed limit	Every six months
	Conductivity	mg/L	No prescribed limit	Every six months
	TOC	mg/L	No prescribed limit	Every six months
	Zinc	mg/L	No prescribed limit	Every six months
	Chloride	mg/L	No prescribed limit	Every six months

7.3 Appendix 3 Stormwater Monitoring Location

Wattle Glen stormwater sample Location

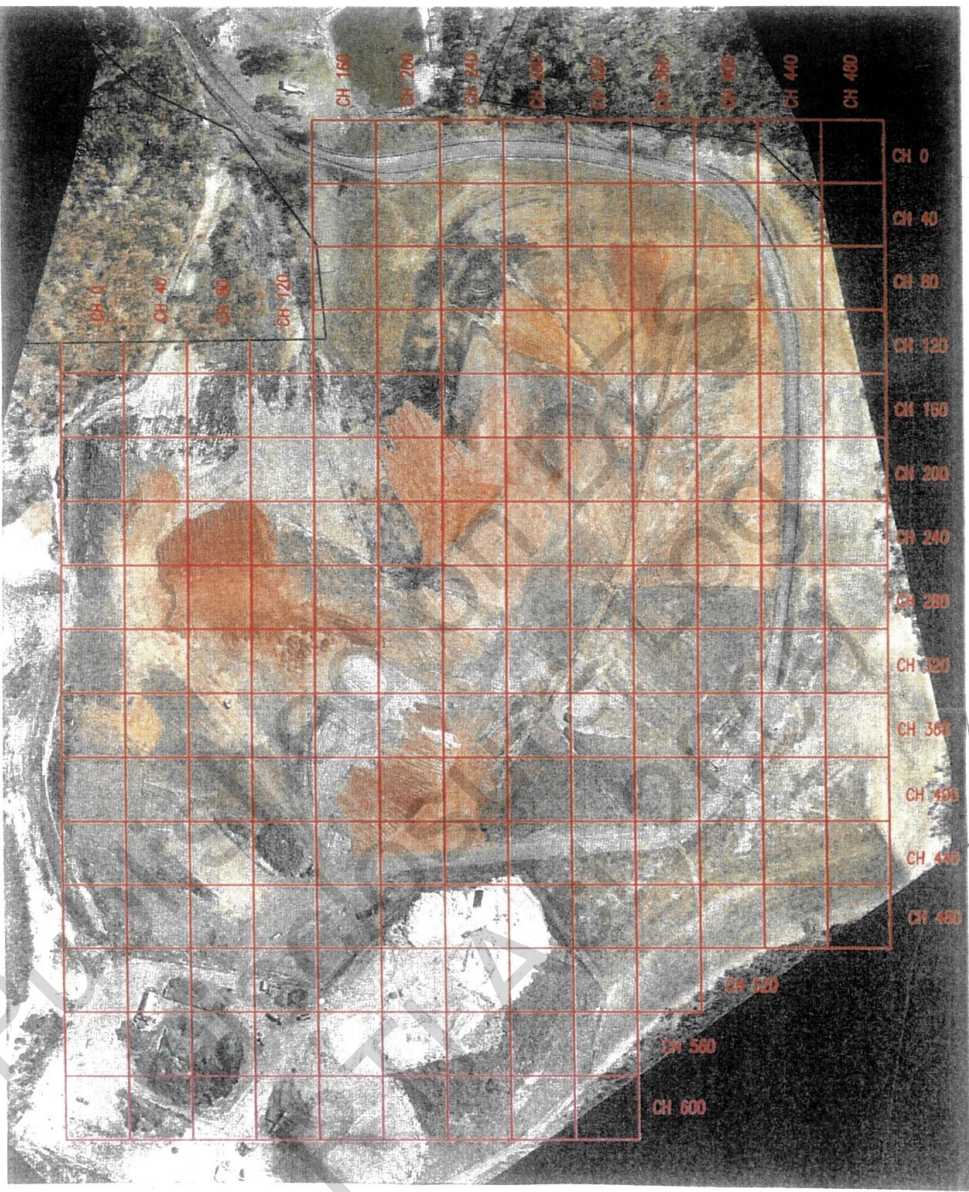


7.4 Appendix 4 Surface Gas Monitoring Form



WATTLE GLEN NORTH SURFACE GAS MONITORING FORM

Recorded by:		Date:		Time:	
Temperature:		Wind direction:		Wind level (N.L.M.S):	
Comments:					



VEOLIA SOUTH
WATTLE GLEN NORTH SURFACE GAS MONITORING FORM

Recorded by:	Date:	Time:
Temperature:	Wind direction:	Wind level (N,L,M,S):
Comments		

7.5 Appendix 5 Odour Monitoring Locations

Wattle Glen Odour Monitoring Locations 2012



Veolia Australia and New Zealand

A: QLD State Office | 166 Boundary Rd | Rocklea | QLD | 4106

p4(6) Personal inform | P: +61 7 32750154

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1	p4(6) Personal inform Environmental Officer		h4p4(6) Personal informati Remediation Services Manager		22/03/2018