

# Annual Report

## Assessment of Environmental Performance - Woodlawn Bioreactor and Crisps Creek Intermodal Facility



# Quality Information

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# 1 Introduction

## 1.1 Eco-Precinct Overview

The Woodlawn Eco-Precinct (the Eco-Precinct), owned and operated by Veolia Australia and New Zealand (Veolia), is located approximately 250 kilometres (km) south west of Sydney in the NSW Southern Tablelands. A site location plan is provided in **Appendix 1**. The Eco-Precinct, which covers an area of 6000 hectares, comprises of the 'Pylara' and 'Woodlawn' agricultural properties. An integral part of the Woodlawn property is the Woodlawn Bioreactor (the Bioreactor), where waste landfilling and landfill gas extraction occurs in the void of a remnant open cut mine, approximately 33 million cubic metres (m<sup>3</sup>) in capacity.

The Bioreactor has been operating since September 2004, with the collection of landfill gas from landfill waste to extract methane for energy generation commencing in 2008. This occurs at the adjacent Woodlawn Bio Energy Power Station (the Power Station). Waste to the Bioreactor from Sydney is transported in shipping containers via rail and unloaded onto road trucks at the Crisps Creek Intermodal Facility (IMF), also owned and operated by Veolia and located approximately 8 km away in the township of Tarago. Local waste from neighboring councils and businesses is transported via road.

In accordance with relevant legislative requirements and industry best practice, the environmental performance of the Bioreactor and the IMF is managed to stringent conditions, the reporting of which forms the basis of this Annual Report (the Report). This Report has been prepared in accordance with Environment Protection Licence (EPL) 11436, as well as documenting performance against EPL 11455, issued and regulated by the NSW Environment Protection Authority (EPA) for the Bioreactor and the IMF respectively.

The Report is submitted to the EPA in conjunction with the Annual Returns which comprise statements of compliance and summaries of monitoring and compliance for both sites, as required under Condition R1 of the EPLs for the reporting period of 6 September 2017 to 5 September 2018.

## 1.2 Legislative Requirements

The main legislative instrument governing the environmental performance and activities undertaken at the Bioreactor and the IMF pertaining to this Report is the Protection of the Environment Operations Act 1997 (POEO Act) regulated by the EPA, as well as its associated regulations.

The EPL for each site has been issued under s55 of the POEO Act. Conditions of the EPLs stipulate the environmental and operational parameters that need to be addressed by Veolia in the management strategies adopted for both the sites to maintain compliance where relevant. This Report is split into a section for each site and contains these management strategies.

# Part 1 EPL 11436 Woodlawn Bioreactor

## 2 Bioreactor Operations

In accordance with EPL 11436, the Bioreactor is permitted to accept material classified as General Solid Waste (Putrescible) as described in the Waste Classification Guidelines (EPA, 2014) for the scheduled activity 'Waste disposal by application to land'. The other activity permitted on the EPL is 'Electricity generating works' for the generation of energy from the extraction of landfill gas.

In addition to the waste management and energy generation activities, the site EPL mandates the administrative, operative and reporting conditions for the Bioreactor, as described in **Table 2.1** below. A licence boundary plan is provided in **Appendix 2**.

### 2.1 Bioreactor Licence Conditions

EPL 11436 details the operating conditions and environmental monitoring requirements for the Bioreactor as noted in **Table 2.1**.

*Table 2.1: Bioreactor EPL 11436 Licence Conditions*

Condition	Compliance with Condition
1. Administrative conditions	Noted
2. Discharges to air and water and application to land	Noted
3. Limit conditions	<p><b>L1. Pollution of Waters</b> The Bioreactor is deemed a zero discharge site, as all surface and stormwater that comes into contact with waste or leachate is captured, stored and treated onsite. Non contaminated water is managed through diversion drains and bunds. No water was discharged during this reporting period.</p> <p><b>L3. Waste</b> All waste received at the Bioreactor during this reporting period was in accordance with the waste types permitted in the EPL. Waste generated onsite was deposited in the Bioreactor.</p> <p><b>L4. Noise Limits</b> No noise complaints were received during this reporting period indicating that noise at the Bioreactor was likely maintained within the 35 dB(A) LAeq (15 minute) criteria at the nearest residential receiver. Noise</p>

	monitoring will be undertaken by Veolia on the receipt of any such complaints.
	<b>L5. Hours of Operation</b> All operational activities at the Bioreactor, including haulage of waste from the IMF were undertaken between 6:00 am and 10:00 pm, Monday to Saturday during this reporting period as permitted.
	<b>L6. Potentially Offensive Odour</b> 32 odour complaints were received at the premises during this reporting period which is lower than the last reporting period (41).  An annual independent odour audit is used to assess the effectiveness of odour control measures and to identify improvements to existing odour management practices at the site. The odour audit report indicated Veolia has implemented all recommendations from the previous odour audit and is further discussed in <b>Section 6</b> of this Report. Veolia will continue to implement recommended actions from the odour audit in combination with improving current odour control measures identified by Veolia.
<b>4. Operating conditions</b>	<b>O1. Activities Carried out in a Competent Manner</b> All licensed activities undertaken at the Bioreactor in this reporting period were carried out in a competent manner and under a high standard of environmental management for which Veolia is certified under ISO 14001.
	<b>O2. Maintenance of Plant and Equipment</b> The maintenance and operation of all plant and equipment on the premises associated with the licensed activities was undertaken in a proper and efficient condition as required by qualified technicians. Details of all major plant and equipment at the site are stored in a computerised maintenance management system in order to schedule and complete the required maintenance. Veolia operators hold the appropriate qualifications and licenses to operate plant and equipment used as part of Bioreactor operations.
	<b>O3. Dust</b> All operations and activities were carried out at the Bioreactor in a manner to minimise dust at the boundary of the premises. These included all access roads from the IMF to the Bioreactor and the haul road used for ancillary operations being sealed, the use of water trucks for dust suppression as required and monthly sampling to monitor for the presence and quantity of depositional dust.
	<b>O4. Emergency Response</b> The Emergency Response Plan (ERP) for the Bioreactor is maintained on the premises and electronically on Veolia's Business Management System, an online platform for storing Veolia policies procedures and plans. The ERP contains procedures for minimising the risk of and managing incidents such as fires, spills, explosions etc. at the Bioreactor, as well as incorporates the Pollution Incident Response Management Plan (PIRMP) in accordance with the EPL. As per the PIRMP requirements, the ERP is tested annually. Testing of the PIRMP was undertaken on 5/08/2019.  The PIRMP was activated in this reporting period on 15/07/2019 due to a foam spill from Leachate Treatment Plant., which was contained effectively at the premises.



	<p><b>O5. Processes and Management</b></p> <p>The processes and management of water quality is documented and implemented on site in accordance with the EPL and the Landfill Environmental Management Plan (LEMP) for the Bioreactor. The LEMP provides guidance on the management of surface and stormwater systems such as drainage and pumping networks to divert clean water from any water that has come in contact with waste or leachate.</p> <p>Clean surface and stormwater collected from within the void is pumped to Evaporation Dam 3 South (ED3S) for evaporation.</p> <p>Water contaminated by waste or leachate is pumped to the Leachate Treatment Plant, treated and stored in the coffer dam in ED1 for evaporation and potential use as process water for Heron Resources. The existing leachate aeration dam is used as a contingency. Mechanical evaporators may be used to assist evaporation and are controlled by wind direction sensors to prevent the drifting of sprayed liquids from the premises.</p> <p>The wash bay, used for cleaning of containers and equipment associated with Bioreactor operations, collects sediment in a drainage sump. This sump is periodically drained and the resultant waste deposited in the Bioreactor.</p> <p>Veolia notes that the supervisory licence requirements (condition O5.7) has been revoked by the NSW Government and is no longer relevant to the Woodlawn Operation from the 1<sup>st</sup> June 2017.</p> <p><b>O6. Waste Management</b></p> <p>All licensed activities associated with this condition were carried out in accordance during this reporting period.</p> <p>A closure plan shall be submitted prior to the closure date of the Bioreactor.</p> <p>Monitoring undertaken within the Bioreactor void and around the licenced boundary during this reporting period validated that groundwater flows from an inward gradient towards the void ensuring no outward movement of leachate occurs.</p> <p>Since April 2016, Veolia has comprehensively re-designed the landfill tipping profile and its gas collection infrastructure to maximise gas collection and minimise the impacts of higher leachate levels in the void. We have already invested in a completely new collection infrastructure across the void. Veolia has also continued to extract and treat leachate from the void at an average of 2.48 litres per second (L/s) using the current system. These actions have resulted in improvements in gas collection achieving an average of 3986.2 cubic metres per hour(m<sup>3</sup>/h) of landfill gas flow this reporting period.</p> <p>The void leachate recirculation, collection and treatment system continued to be maintained and operated to optimise the Bioreactor conditions for treatment of leachate, other waste waters and</p>
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	<p>contaminated storm waters. Excess leachate was extracted, treated and transferred for storage in ED3 lagoons 1, 2, 3, 4 &amp; 5 (ED3N-1, ED3N-2, ED3N-3 &amp; ED3N-4, ED3SS).</p> <p>The construction of the Leachate Treatment Plant (LTP) was completed and commissioning undertaken in this reporting period to achieve an EPA target limit of 350 m3/day. Current throughput is at 250 - 300 m3/day. The long term management of the ED3N dams will be to remove the stored liquid by 31 December 2022.</p> <p>Leachate from waste accepted within the Sydney Metropolitan Area via Veolia's transfer facilities continued to be the only liquid imported into the void during this reporting period and was processed through the leachate treatment system as approved by the EPA.</p> <p>Virgin Excavated Natural Material (VENM) is continuously sourced from onsite and offsite locations for use as cover material during the reporting period.</p> <p>All waste accepted within the Bioreactor in this reporting period was screened prior to final disposal to ensure only waste conforming to EPL 1436 was received.</p> <p>Veolia will undertake final capping of the Bioreactor when required and in accordance with the EPL.</p> <p>Veolia operate the Bioreactor to maximise the production of landfill gas for generation of renewable energy at the Power Station, where 7 generators have been installed and commissioned, with 2 auxiliary flares as back up treatment of landfill gas emissions captured. The generators and flares satisfy the design, installation and operational requirements within the EPL.</p> <p>The landfill gas extraction and utilisation infrastructure in the Bioreactor has been designed to meet the conditions of the landfill including settlement.</p> <p>In this reporting period, Veolia continued to construct temporary access roads to minimise waste delivery vehicles coming in contact with and tracking waste to external surfaces. Dedicated site vehicles that only operate within the void and other operational areas were utilised. Any vehicles exiting the facility are required to use the wheel wash facility to prevent the tracking of materials.</p> <p>In addition to tracking of materials, a monthly site inspection checklist is used to ensure practical measures are in place at the site to prevent materials leaving the premises.</p>
<b>5. Monitoring and recording conditions</b>	<p>Noted, all compliance monitoring was carried out in this reporting period in accordance with EPL requirements. The results of which are detailed in Section 3. There was 1 non-compliance with condition M2 of EPL 11436 in this reporting period - where due to insufficient water volume, Veolia were unable to obtain samples. This has been reported in the 2019 Annual Return.</p>



<b>6. Reporting conditions</b>	Noted and addressed in this Report and the annual return documents, where relevant. Notifications to the EPA were undertaken in a timely fashion.
<b>7. General conditions</b>	Noted.
<b>8. Pollution Studies and Reduction Programs</b>	<p><b>U1. Long-term Leachate Treatment Solution</b></p> <p>U1.1 and 1.2 The Leachate Treatment Plant was commissioned in the reporting period (2018/2019) which included the following processes:</p> <ul style="list-style-type: none"> <li>- Throughput management to steadily increase leachate treatment to achieve EPA target of 346 m3/day (4litres/sec) ;</li> <li>- Permeate quality management of the final product going into the coffer dam;</li> <li>- Foam management via chemical and mechanical mechanisms;</li> <li>- Temperature control via monitoring through SCADA &amp; in-line monitoring systems; and</li> <li>- Monitoring weather conditions</li> </ul> <p>There was 1 non-compliance with condition U1 of EPL 11436 in this reporting period - due to a delay in the commissioning/operational commencement date required under the licence. This has been reported in the 2019 Annual Return.</p> <p>U1.3 Monthly progress reports on the LTP commissioning and optimisation were submitted to the EPA in this reporting period (refer <b>Appendix 6</b>).</p> <p><b>U2 Management Plan – Evaporation Dam Seepage</b></p> <p>U2.1 Earth2Water was engaged to install new groundwater bores as part of the management strategy for the remediation measures for the dams proposed in the previous reporting period.</p> <p>Evaporation System has been installed in ED1 within the reporting period</p>
<b>9. Special Conditions</b>	Noted.

## 2.2 Complaints

Veolia operates a telephone complaints line that enables the receipt of complaints from members of the public, as required under the EPL. Other complaints that were received off site during this reporting period were logged by the EPA. Veolia recorded a total of 32 complaints, relating only to odour, during this reporting period. Upon receipt of an odour complaint, Veolia recorded all the details into the site complaints register as required under the EPL and Site Management followed up with the complainant to determine the nature (and scale) of the odour.

In order to proactively engage in effective odour management, Veolia participates in regular community liaisons to encourage and gather feedback from the local residents regarding the odour performance at the Bioreactor. These liaisons are facilitated through the Community Liaison Committee (CLC) to voice their concerns with the Bioreactor site. Community concerns may also be raised at meetings attended by local community representatives, committee members/executives from the Tarago & District Progress Association Inc. (TADPAI) and local councilors from Goulburn Mulwaree Council. Veolia continues to attend such meetings and implement activities to eliminate and minimise odour sources at the site based on annual odour audit recommendations.

# 3 Bioreactor Environmental Monitoring

## 3.1 Bioreactor Monitoring Points

Veolia is required to monitor environmental performance of the Bioreactor under EPL 11436. **Table 3.1** details the EPL ID, sampling location, frequency and the type of monitoring undertaken at each licensed point. A monitoring location plan is included in **Appendix 3**.

*Table 3.1: Bioreactor Licensed Monitoring Points*

EPA ID	Sampling Location	Frequency	Type of Monitoring
1	GMBH1	Quarterly	Subsurface Gas
2	GMBH2		
4	GMBH4		
5	Gas Extraction Booster	Annual	Landfill Gas Input
6	Landfill Surface	Quarterly	Surface Gas
7	Landfill Gas Flare	Annual / Continuous	Air Discharge
8	Landfill Gas Engine Exhaust Point	Annual	Air Discharge
9	Meteorological Station	Continuous	Meteorological
10	DG28 – Pylara	Monthly	Particulates – Deposited Matter
11	DG22		
12	DG34		
13	Site 115 – Allianoyonyige Creek	Quarterly	Surface Water
14	Spring 2 – Crisps Creek		
15	Site 105 – Crisps Creek		
16	WM200 – RWD		
17	WM201		
18	ED3SS (Lagoon 5)		
19	WM203 – ED3N		
22	Pond 5		
23	Leachate Pond	Annual	Leachate
24	Leachate Recirculation System		
25	MB1	Quarterly / Annual	Groundwater
26	MB2		
27	MB3		
28	MB4		
30	MB6		
31	MB7		
33	MB10		
41	ED3B		
42	WM1		

45	WM5		
46	WM6		
48	P38A & P38B	Quarterly	Standing Water Level
49	P200A		
50	P200B		
51	P58A & P58B		
52	P59A & P59B		
53	P100A & P100B		
54	WM202 - ED3S	Quarterly	Storage Volume
55	MW8S	Quarterly	Groundwater
56	MW8D		
57	MW9S		
58	MW10S (Dry well)		
59	ED1	Quarterly	Surface Water
60	MB28	Quarterly	Groundwater
61	Effluent from Leachate Treatment Plant	Weekly	Discharge
62	ED1 Cofferd Dam	Monthly	Surface Water
63	SP2-MW1	Quarterly	Groundwater
64	MW-FRC1		
65	MB10S		

All monitoring data collected at the monitoring points identified in **Table 3.1** during this reporting period has been tabulated and provided in **Section 3.2** or in **Appendix 4**. Graphs of data collected have been developed to assist in the assessment of trends and depict any variability within the monitoring results are presented in **Section 3.2** or in **Appendix 5**.

## 3.2 Bioreactor Monitoring Results

### 3.2.1 Bioreactor Landfill Gas Monitoring Results

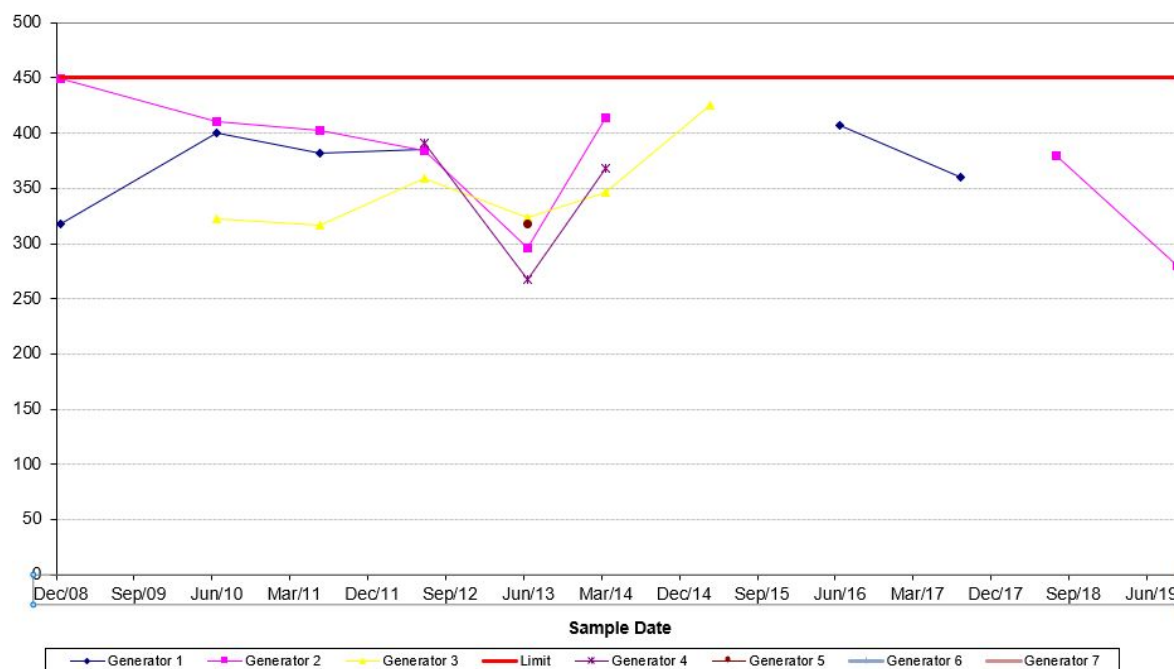
*Table 3.2.1: Bioreactor Landfill Gas Monitoring Results*

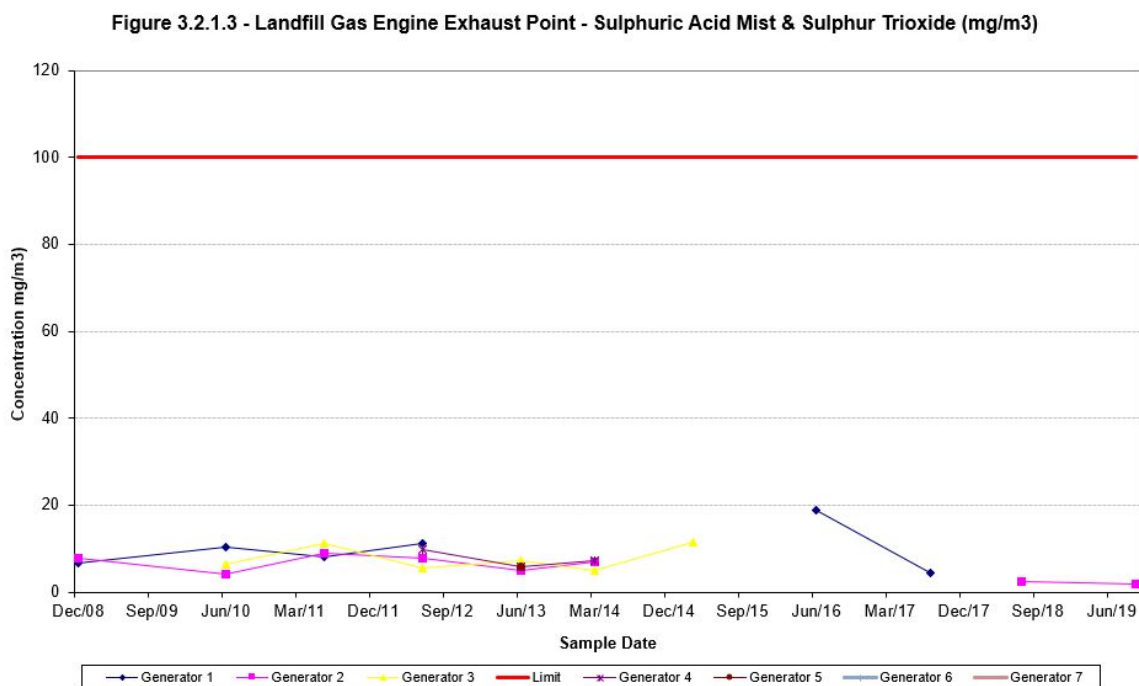
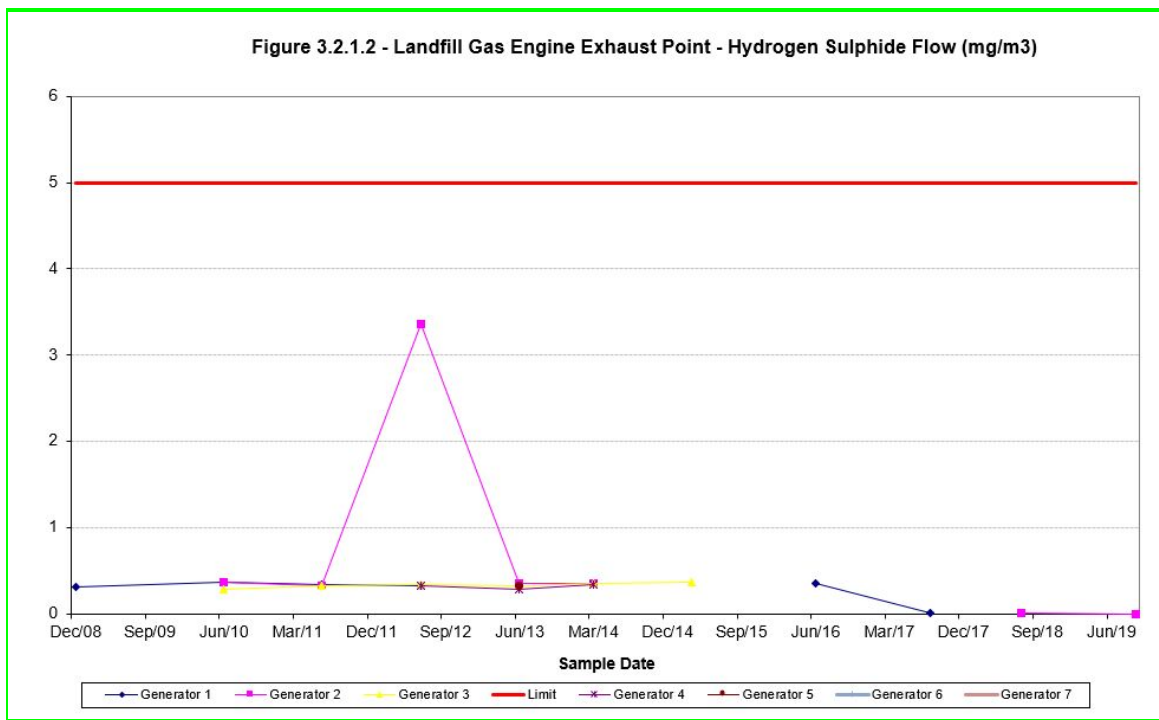
Parameter	Results/Discussion																													
Subsurface Gas	Monitoring of 3 subsurface gas monitoring bores (GMB) was undertaken on a quarterly basis as per EPL requirements and is summarised in <b>Table 3.2.1.1</b> below:																													
	<i>Table 3.2.1.1: Subsurface Gas Monitoring Result</i>																													
	<table><tr><th rowspan="2">Gas Monitoring Bore ID</th><th colspan="4">Purged Methane Reading (%)</th><th></th></tr><tr><th>13/11/18</th><th>27/2/19</th><th>15/7/19</th><th>15/8/19</th><th></th></tr><tr><td>GMBH1</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr><tr><td>GMBH2</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr><tr><td>GMBH4</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr></table>	Gas Monitoring Bore ID	Purged Methane Reading (%)					13/11/18	27/2/19	15/7/19	15/8/19		GMBH1	0	0	0	0		GMBH2	0	0	0	0		GMBH4	0	0	0	0	
	Gas Monitoring Bore ID		Purged Methane Reading (%)																											
		13/11/18	27/2/19	15/7/19	15/8/19																									
	GMBH1	0	0	0	0																									
GMBH2	0	0	0	0																										
GMBH4	0	0	0	0																										

	The results show that the gas collection network is effectively capturing and controlling landfill gas within the landfill void. Engineered impermeable barriers and the natural subsurface of the void wall also minimises the potential movement of landfill gas from the Bioreactor, allowing for maximum extraction through the gas collection system.														
Landfill Gas Extraction Booster	<p>The data reported for the landfill gas extraction booster at the Power Station is consistent to the historical average since 2016 as summarised in <b>Table 3.2.1.2</b> below:</p> <p><i>Table 3.2.1.2: Landfill Gas Extraction Booster Monitoring Results Summary</i></p> <table><tr><th>Parameter</th><th>Historical Average</th><th>2018/2019 Result</th></tr><tr><td>Temperature (° C)</td><td>2.7</td><td>8.7</td></tr><tr><td>Volumetric Flow (m3/hr)</td><td>2157</td><td>3986</td></tr><tr><td>Methane (%)</td><td>53.4</td><td>52.04</td></tr></table> <p>The detailed data for each of the parameters required under the EPL for the gas extraction booster is provided in <b>Table 1</b> (refer <b>Appendix 4</b>).</p>			Parameter	Historical Average	2018/2019 Result	Temperature (° C)	2.7	8.7	Volumetric Flow (m3/hr)	2157	3986	Methane (%)	53.4	52.04
Parameter	Historical Average	2018/2019 Result													
Temperature (° C)	2.7	8.7													
Volumetric Flow (m3/hr)	2157	3986													
Methane (%)	53.4	52.04													
Surface Gas	<p>Surface gas monitoring was completed on a quarterly basis as per EPL requirements, which are summarised in <b>Table 3.2.1.3</b> below. The detailed tabulated data is available in <b>Table 2</b> (refer <b>Appendix 4</b>).</p> <p><i>Table 3.2.1.3: Surface Gas Monitoring Results Summary</i></p> <table><tr><th>Parameter</th><th>Minimum</th><th>Maximum</th><th>Average</th></tr><tr><td>Methane (%)</td><td>0.0002</td><td>0.0649</td><td>0.004</td></tr></table> <p>Methane was detected in varying amounts over the waste surface with a decreasing overall average of 0.004% during this reporting period compared to 0.009% last reporting period.</p> <p>The emission threshold concentration for methane detected in surface gas emission testing is 500 parts per million (0.05%), as recommended in (Environmental Guidelines for Solid Waste Landfills, Second Edition 2016).</p> <p>Surface gas monitoring enables site operational personnel to investigate and apply corrective actions where any high concentrations of methane has been detected to maintain the effectiveness of the landfill cap and prevent migration of landfill gas through preferential pathways to the surface.</p> <p>This can include application of cover material in areas of the void demonstrating settlement cracking, commissioning and rebalancing of gas extraction wells and installing additional gas collection infrastructure. During this reporting period vegetation mulch bio-cover was implemented around wells which have assisted in mitigating odour and reducing surface gas emissions.</p>			Parameter	Minimum	Maximum	Average	Methane (%)	0.0002	0.0649	0.004				
Parameter	Minimum	Maximum	Average												
Methane (%)	0.0002	0.0649	0.004												

<b>Landfill Gas Flare</b>	<p>The landfill gas flares are manufactured to a residence time of 0.3 seconds with a destruction efficiency of 98% for methane and non methanogenic organic compounds to meet the requirements of the EPL. Monitoring was continuously performed during this reporting period, an average of which is summarised in <b>Table 3.2.1.4</b> below.</p> <p style="text-align: center;"><i>Table 3.2.1.4: Landfill Gas Flare Monitoring Results</i></p> <table><tr><th>Parameter</th><th>Units</th><th>Result</th></tr><tr><td>Temperature</td><td>°C</td><td>1000</td></tr><tr><td>Residence Time</td><td>Seconds</td><td>&lt; 0.3</td></tr></table>	Parameter	Units	Result	Temperature	°C	1000	Residence Time	Seconds	< 0.3
Parameter	Units	Result								
Temperature	°C	1000								
Residence Time	Seconds	< 0.3								
<b>Landfill Gas Engine Exhaust Point(s)</b>	<p>Monitoring of a landfill gas engine exhaust point was completed during the reporting period. The results are consistent with the previous monitoring period and presented in <b>Tables 3.1</b> to <b>3.5</b> (refer <b>Appendix 4</b>).</p> <p>Concentration limits for each of the following pollutants are stipulated in the EPL, all of which were below the threshold for the exhaust point test within this reporting period and consistent with previously reported levels, as demonstrated in <b>Figures 3.2.1.1 – 3.2.1.3</b>.</p> <ul style="list-style-type: none"><li>• Nitrogen Oxides;</li><li>• Hydrogen Sulphide;</li><li>• Sulphuric Acid Mist; and</li><li>• Sulphur Trioxide.</li></ul> <p>*Note: Only required to sample one engine exhaust due to sample type of engine.</p>									

Figure 3.2.1.1 - Landfill Gas Engine Exhaust Point - Nitrogen Oxide Flow (mg/m3)



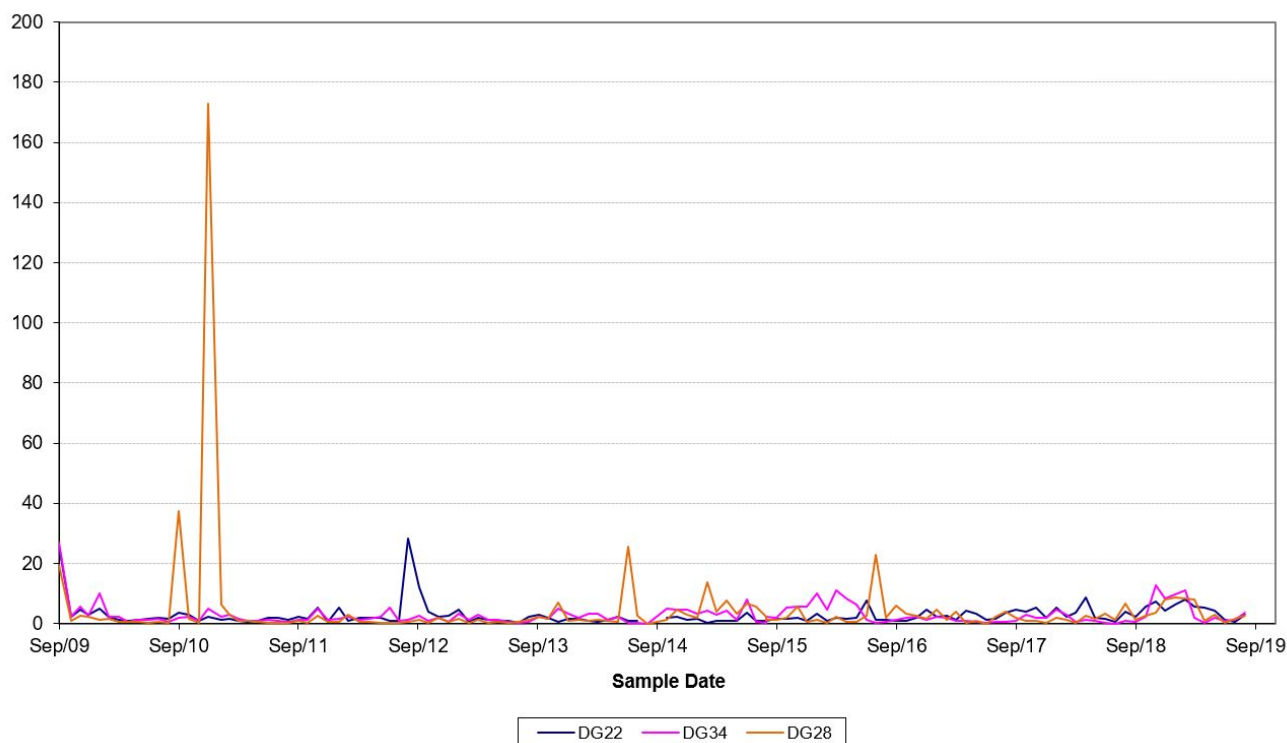




### 3.2.2 Bioreactor Air Quality Monitoring Results

*Table 3.2.2: Bioreactor Air Quality Monitoring Results*

Parameter	Results/Discussion																			
Meteorological Station	<p>Veolia operates an onsite meteorological station to continuously monitor climatic data listed in the EPL. Meteorological data recorded includes (but is not limited to):</p> <ul style="list-style-type: none"><li>• Wind speed at 10m;</li><li>• Wind direction at 10m;</li><li>• Temperature at 2m;</li><li>• Temperature at 10m;</li><li>• Rainfall;</li><li>• Solar radiation; and</li><li>• Sigma theta at 10m</li></ul> <p>Meteorological data is logged in 15 minute and 24 hour intervals and can be made available for the 2018/2019 reporting period upon request. Servicing and calibration of the meteorological station is carried out quarterly by Hydrometric Consulting Services (calibration reports can be provided upon request).</p>																			
Particulates/Dust Monitoring	<p>Monitoring of 3 depositional dust gauges (DG) was completed on a monthly basis as required under the EPL, the results of which are generally consistent with previously reporting periods as depicted in <b>Figure 3.2.2.1</b>.</p> <p>The results of total insoluble solids found within the depositional dust samples are summarised for each of the monitoring locations in <b>Table 3.2.2.1</b> below, with the detailed results tabulated in <b>Tables 4.1 - 4.3</b> (refer <b>Appendix 4</b>).</p> <div><p><i>Table 3.2.2.1: Dust Monitoring Results</i></p><table><tr><th rowspan="2">Dust Gauge</th><th colspan="3">Summary Total insoluble Solids (g/m2/month)</th></tr><tr><th>Minimum</th><th>Maximum</th><th>Average</th></tr><tr><td>DG22</td><td>0.5</td><td>8</td><td>4.47</td></tr><tr><td>DG34</td><td>0.4</td><td>12.6</td><td>4.57</td></tr><tr><td>DG28</td><td>0.4</td><td>8.8</td><td>4.12</td></tr></table></div> <p>The maximum dust level recorded in this reporting period was 12.6 g/m2/month at DG34 which is located on the West side of the Bioreactor in November 2018. The high level of total insoluble solid reflects the dust storm event that occurred in the months of November 2018 and January 2019, it is also noted that it has been a dry year with the average rainfall being 336mm.</p> <p>Overall dust suppression is generally consistent with previous years and a measure of the dust control measures that the site has in place.</p>	Dust Gauge	Summary Total insoluble Solids (g/m2/month)			Minimum	Maximum	Average	DG22	0.5	8	4.47	DG34	0.4	12.6	4.57	DG28	0.4	8.8	4.12
Dust Gauge	Summary Total insoluble Solids (g/m2/month)																			
	Minimum	Maximum	Average																	
DG22	0.5	8	4.47																	
DG34	0.4	12.6	4.57																	
DG28	0.4	8.8	4.12																	



**Figure 3.2.2.1 – Bioreactor Depositional Dust Levels (g/m<sup>2</sup>/month)**

### 3.2.3 Bioreactor Surface Water Monitoring Results

The findings from water quality monitoring of surface water locations required under the EPL is summarised in **Table 3.2.3** below with detailed data provided in **Tables 5.1 - 5.11** (refer **Appendix 4**). Key quality indicators selected to identify likely impacts from the Bioreactor include:

- pH,
- Electrical conductivity (EC),
- Ammonia (NH<sub>3</sub>),
- Total organic carbon (TOC),
- Iron (Fe),
- Sulphate (SO<sub>4</sub>), and
- Zinc (Zn).

These are depicted in the trend graphs (**Figures 3.2.3.1 – 3.2.3.10**) provided in **Appendix 5**.

**Table 3.2.3: Bioreactor Surface Water Monitoring Results**

Parameter	Results/Discussion
<b>Site 115 – Allianoyonyiga Creek</b>	Site 115 is situated downstream of the evaporation dams. 3 out of 4 quarterly monitoring events required under the EPL was undertaken in

	<p>this monitoring period, due to insufficient flow, and have been documented in the Annual Return.</p> <p>Based on the results provided in <b>Table 5.1</b> (refer <b>Appendix 4</b>), the pollutant concentration trends from previous monitoring periods are generally consistent.</p> <ul style="list-style-type: none"> <li>• Mean pH at 7.58 for this location indicates slightly alkaline water.</li> <li>• EC at 3343.3 <math>\mu\text{S}/\text{cm}</math>, indicating fresh to brackish water.</li> <li>• <math>\text{NH}_3</math> at 1.67mg/L and TOC at mean of 33.7 mg/L concentrations recorded in this monitoring period remain consistent with historical monitoring results</li> <li>• Heavy metal concentrations are of low magnitude for this reporting period – less than 0.02 mg/L for Pb and less than 0.5mg/L for Zn, indicating no contaminated runoff is impacting surface water at this monitoring location.</li> <li>• Note that Heron Resources have pumped out the water in ED2 cell closest to the creek and lined it with a plastic membrane</li> </ul>
<b>Spring 2</b>	<p>Spring 2 is located upstream of the Bioreactor and adjacent to Crisps Creek. The site therefore provides background water quality information to site operations. The spring naturally overflows to Crisps Creek during rainfall events.</p> <p>4 out of 4 quarterly monitoring events required under the EPL were undertaken in this monitoring period, and have been documented in the Annual Return. Water quality trend in Spring 2, based on the results provided in <b>Table 5.2</b> (refer <b>Appendix 4</b>), is consistent with water quality from historical monitoring records.</p> <ul style="list-style-type: none"> <li>• pH is consistent with previous years (average 6.8) and reflective of the overall range of 3.5 – 8.5 for this location;</li> <li>• EC (average 540 <math>\mu\text{S}/\text{cm}</math>) for this reporting period is indicative of fresh water.</li> <li>• <math>\text{SO}_4</math> (average 170 mg/L) shows an identical trend to conductivity, again indicating a direct effect on EC.</li> <li>• Pb (average 0.01mg/L) and Zn (average 6.9mg/L) concentrations continue to show slow decline from overall averages with some variability likely due to dilution following wet weather periods and concentration during drier periods.</li> <li>• <math>\text{NH}_3</math> (average 0.2mg/L) and TOC (average 19mg/L) concentrations recorded in this monitoring period were consistent with historical monitoring results.</li> </ul>
<b>Site 105 – Crisps Creek</b>	<p>Site 105 is located downstream of the Bioreactor and tailings dams. 1 out of 4 quarterly monitoring events required under the EPL were undertaken in this monitoring period, due to insufficient flow, and have been documented in the Annual Return.</p>

	<p>Water quality trends in Site 105, based on the results provided in <b>Table 5.3</b> (refer <b>Appendix 4</b>) are consistent with previous monitoring results.</p> <ul style="list-style-type: none"> <li>• pH (7.4) is within the overall range of 5.4 – 8.6 for this location, indicating relatively neutral water;</li> <li>• EC (916 <math>\mu\text{S}/\text{cm}</math>) is consistent with historical results, reflecting brackish water.</li> <li>• TOC (14 mg/L) and <math>\text{NH}_3</math> (0.1 mg/L) was consistent with historical trends.</li> <li>• Zn and Pb remain consistent and average 0.19 mg/L and 0.03 mg/L respectively consistent with historical results.</li> </ul>
<b>WM200 Raw Water Dam</b>	<p>The Raw Water Dam is located to the west of the dolerite stockpile and collects uncontaminated water. Quarterly monitoring events were undertaken in accordance with EPL conditions.</p> <p>Based on the results provided in <b>Table 5.4</b> (refer <b>Appendix 4</b>), the results for WM200 remain generally consistent with the previous reporting periods.</p> <ul style="list-style-type: none"> <li>• pH (average 8.1) indicates slightly alkaline water;</li> <li>• EC (average 1570 <math>\mu\text{S}/\text{cm}</math>) is consistent with historical results;</li> <li>• <math>\text{SO}_4</math> level (average 81 mg/L) is lower than previous reporting period;</li> <li>• Zn and Fe levels were lower at averages of 1.3 mg/L and 0.13mg/L respectively than previous reporting period;</li> <li>• TOC was an average of 4.5 mg/L in this reporting period which is consistent with historical results. This could be reflective of the presence of organic matter from riparian zone vegetation surrounding the dam.</li> <li>• <math>\text{NH}_3</math> at an average of 0.3 mg/L is consistent with historical results.</li> </ul>
<b>WM201 – Entrance Road Culvert</b>	<p>The Entrance Road Culvert collects surface water runoff from the Woodlawn Bioreactor administration office and workshop areas. No samples were obtained in this reporting period due to insufficient flow and being a dry year the past two years, and have been documented in the Annual Return, the results of past years' are provided in <b>Table 5.5</b> (refer <b>Appendix 4</b>).</p> <p>Veolia will continue monitoring this location in the next reporting period for any likely contaminant run off impacts.</p>
<b>ED3SS – Lagoon 5</b>	<p>Evaporation Dam 3 South-South (ED3SS) is a new storage point to manage treated leachate by evaporation. Quarterly monitoring events were undertaken in accordance with the EPL.</p> <p>Based on the water quality results provided in <b>Table 5.6</b> (refer <b>Appendix 4</b>), for ED3SS, the following can be confirmed:</p> <ul style="list-style-type: none"> <li>• pH (average 8.4) appears to be fairly consistent with the existing treated leachate quality</li> <li>• EC average 24400 <math>\mu\text{S}/\text{cm}</math> appears to be generally consistent with the existing treated leachate quality</li> </ul>

	<ul style="list-style-type: none"> <li>• SO<sub>4</sub> averages (1151 mg/L) appears to be fairly consistent with the existing treated leachate quality</li> <li>• Fe levels (average 18.8mg/L) Zn levels (average 6.4mg/L) are lower than previous monitoring periods</li> <li>• NH<sub>3</sub> concentrations (average 452.5 mg/L) remained stable over the course of the reporting period</li> <li>• TOC (average 2825 mg/L) appears to be fairly consistent with the existing treated leachate quality</li> </ul>
<b>WM203 – Evaporation Dam 3 North</b>	<p>Evaporation Dam 3 North (ED3N) is a storage point to manage treated leachate by evaporation. Quarterly monitoring events were undertaken in accordance with the EPL.</p> <p>Based on the water quality results provided in <b>Table 5.7</b> (refer <b>Appendix 4</b>), for WM203, the following can be confirmed:</p> <ul style="list-style-type: none"> <li>• pH (average 8.4) appears to be generally consistent with previous reporting periods.</li> <li>• EC average (35525 µS/cm) appears to be fairly consistent with previous reporting periods;</li> <li>• SO<sub>4</sub> averages (6217.5 mg/L) appears to be fairly consistent with previous reporting periods;</li> <li>• Fe levels (average 53.8 mg/L) are slightly higher than previous years whilst Zn levels (average 133.25) reflect a downward trend.</li> <li>• NH<sub>3</sub> concentrations (average 546 mg/L) remained stable over the course of the reporting period (508 – 581mg/L).</li> <li>• TOC is trending upward (average 3310 mg/L) from the previous reporting period.</li> </ul>
<b>Pond 5</b>	<p>Pond 5 is situated on a bench within the landfill void and acts as a transfer point to capture stormwater from the walls of the landfill void to Evaporation Dam 3 South.</p> <p>3 out of 4 quarterly monitoring events required under the EPL were undertaken in this monitoring period, due to insufficient flow, and have been documented in the Annual Return, the results of which are tabulated in <b>Table 5.8</b> (refer <b>Appendix 4</b>). These water quality results consistent results with previous reporting periods.</p> <ul style="list-style-type: none"> <li>• pH average of 5.6 confirms acidic nature of water that comes in contact with the void walls and is generally consistent with previous results</li> <li>• EC (average 2740 µS/cm) is generally consistent with previous results;</li> <li>• SO<sub>4</sub> trends (average 1405.7 mg/L) is generally consistent with previous results</li> <li>• Pb average of 0.4 mg/L is generally consistent with previous results</li> <li>• Zn (average 180.1 mg/L) is generally consistent with previous results;</li> <li>• NH<sub>3</sub> (average 10.3 mg/L) and TOC (average 16.7 mg/L) both mirror a similar trend which appears quite variable over historical monitoring results.</li> </ul>

	<p>These results and trends are deemed representative of the stormwater quality captured from the walls of the void.</p>
<b>WM202 – ED3S</b>	<p>Evaporation Dam 3 South is a storage point to manage stormwater from the void by evaporation. Quarterly monitoring events were undertaken in accordance with EPL conditions.</p> <p>Water quality results indicated a similar trend to previously reported data as seen in <b>Table 5.9</b> (refer <b>Appendix 4</b>).</p> <ul style="list-style-type: none"> <li>• pH levels indicate an acidic, yet stable trending result with the average pH of 3.5 appears to be generally consistent with previous reporting periods;</li> <li>• Fe (average 16.5 mg/L) is lower compared to previous reporting periods;</li> <li>• Zn at an average of 1075.25 mg/L is consistent with previous reporting periods;</li> <li>• SO<sub>4</sub> (average 10142.5 mg/L) is consistent with previous reporting periods</li> <li>• EC (average 12000 µS/cm) remains within the overall average. Both SO<sub>4</sub> and EC concentrations reflect the signature for Acid Mine Drainage (AMD) contaminated waters from remnant mining operations stored in Evaporation Dam 3 South.</li> <li>• NH<sub>3</sub> concentrations (average 168.5 mg/L) which is consistent with previous reporting periods.</li> </ul>
<b>ED1 – Evaporation Dam 1</b>	<p>Evaporation Dam 1 (ED1) is a storage point to manage runoff stormwater from its external catchment including dolerite stockpile area. Quarterly monitoring events were undertaken in accordance with the EPL.</p> <p>Based on the water quality results provided in <b>Table 5.10</b> (refer <b>Appendix 4</b>), for ED1, the following can be confirmed:</p> <ul style="list-style-type: none"> <li>• pH (average 2.7) which is consistent with previous reporting periods</li> <li>• EC average 24325 µS/cm which is consistent with previous reporting periods</li> <li>• SO<sub>4</sub> (averages 31025 mg/L) and Fe levels (average 526.8 mg/L) is greater than the previous reporting period</li> <li>• Zn levels (average 2587 mg/L) is lower than the previous reporting period</li> <li>• NH<sub>3</sub> concentrations (average 17.85 mg/L) remained stable over the course of the reporting period.</li> <li>• TOC averages 13.2 mg/L remains consistent with previous reporting periods</li> </ul> <p>Fe and Zn levels were noted significantly higher in quarter 4 this reporting period as Heron Resources were pumping into ED1 from the tailings dam at that time as part of the overall management of water across the site. Water will be progressively evaporated.</p>



<b>ED1 Coffe Dam</b>	<p>Evaporation Dam 1 (ED1) coffe dam is a storage point to manage treated leachate from the Leachate Treatment Plant. Monthly monitoring events were undertaken in accordance with the EPL.</p> <p>*note: samples were only collected in July and August 2019 this reporting period as the sufficient level in the dam filled at the start of July 2019. Permeate was first discharged into the coffe dam on 29<sup>th</sup> April 2019.</p> <p>Based on the water quality results provided in <b>Table 5.11</b> (refer <b>Appendix 4</b>), for ED1 coffe dam, the following can be confirmed:</p> <ul style="list-style-type: none"> <li>• pH (average 9.37) which is meets proposed reporting requirements</li> <li>• EC average 21800 µS/cm, Biochemical oxygen demand average 48.5 mg/L and Chemical oxygen demand 2640 mg/L meet reporting threshold</li> <li>• NH<sub>3</sub> concentrations (average 0.4 mg/L) remained stable over the couple samples taken of the reporting period.</li> <li>• Chloride averages 4060 mg/L remained stable over the couple samples in the reporting period</li> </ul>
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### 3.2.4 Bioreactor Leachate Monitoring Results

Leachate quality monitoring is undertaken annually at 2 monitoring locations in the Bioreactor as required by the EPL. Effluent quality from the Leachate Treatment Plant is also monitored and sampled. The findings from this reporting period are summarised in **Table 3.2.4** below with the detailed data provided in **Tables 6.1** and **6.2** (refer **Appendix 4**). The key quality indicators selected to characterize the leachate and identify any migration into groundwater or surface water monitoring locations include:

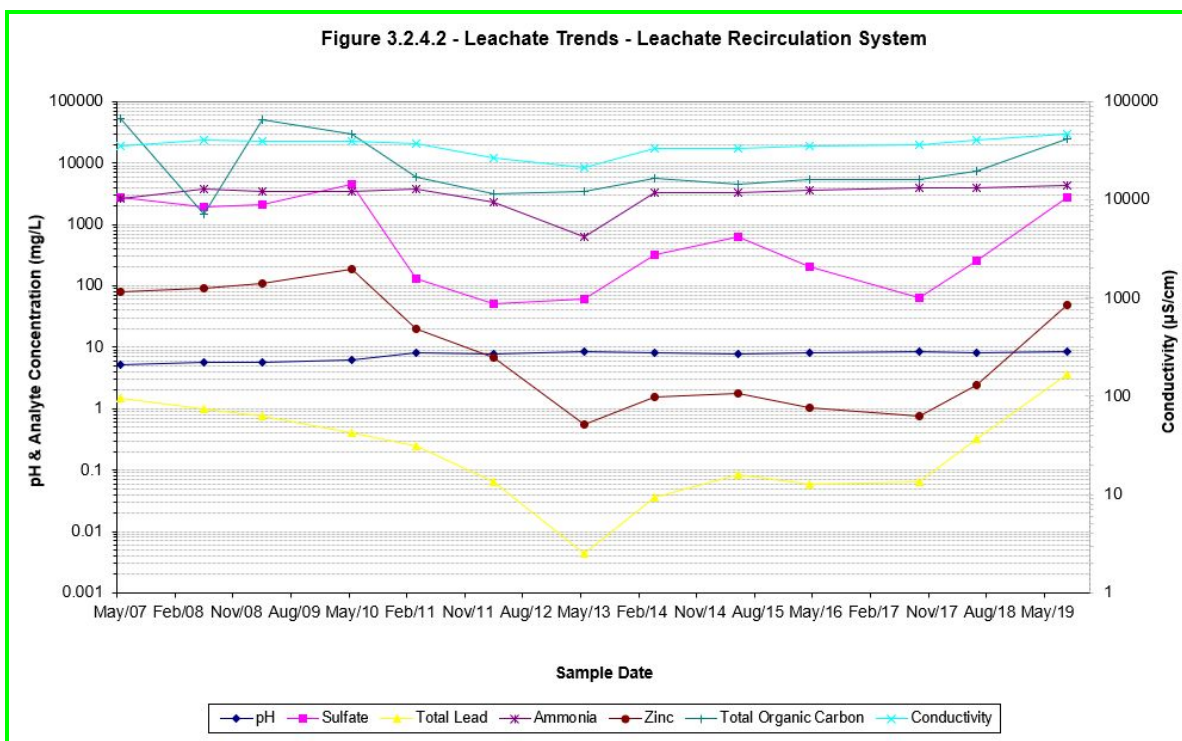
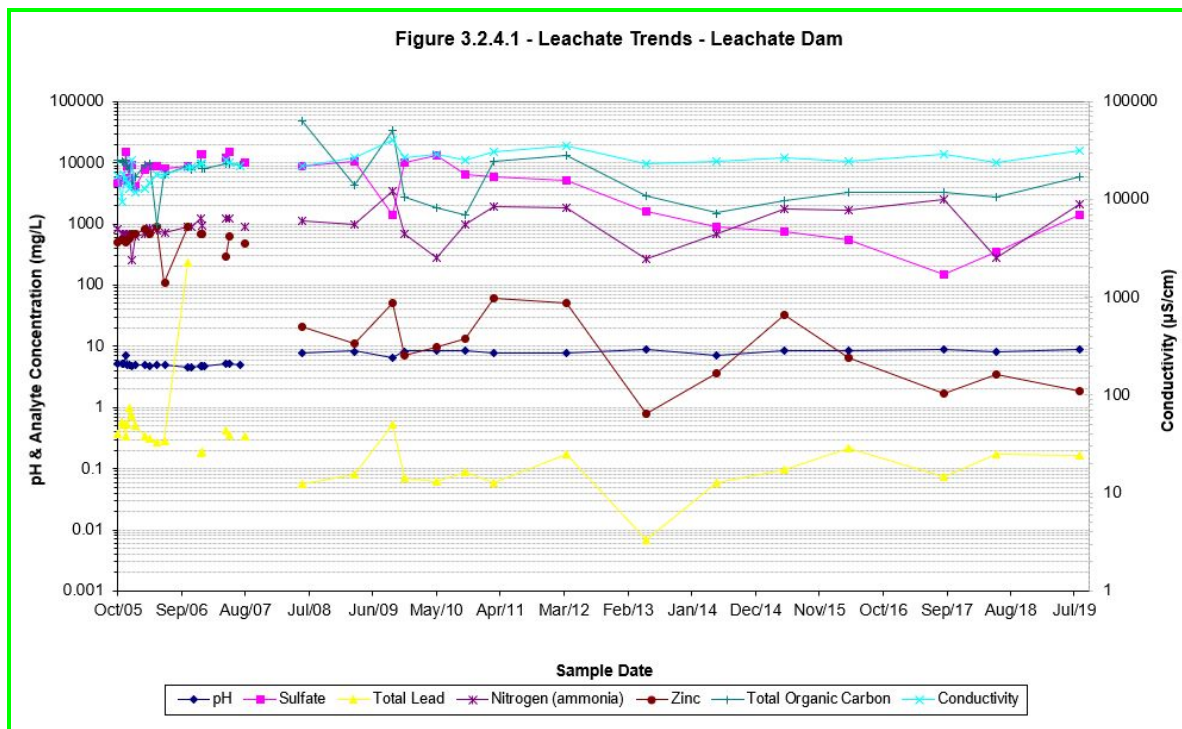
- pH,
- Electrical Conductivity (EC),
- Sulphate (SO<sub>4</sub>),
- Lead (Pb),
- Zinc (Zn),
- Ammonia (NH<sub>3</sub>), and
- Total Organic Carbon (TOC).

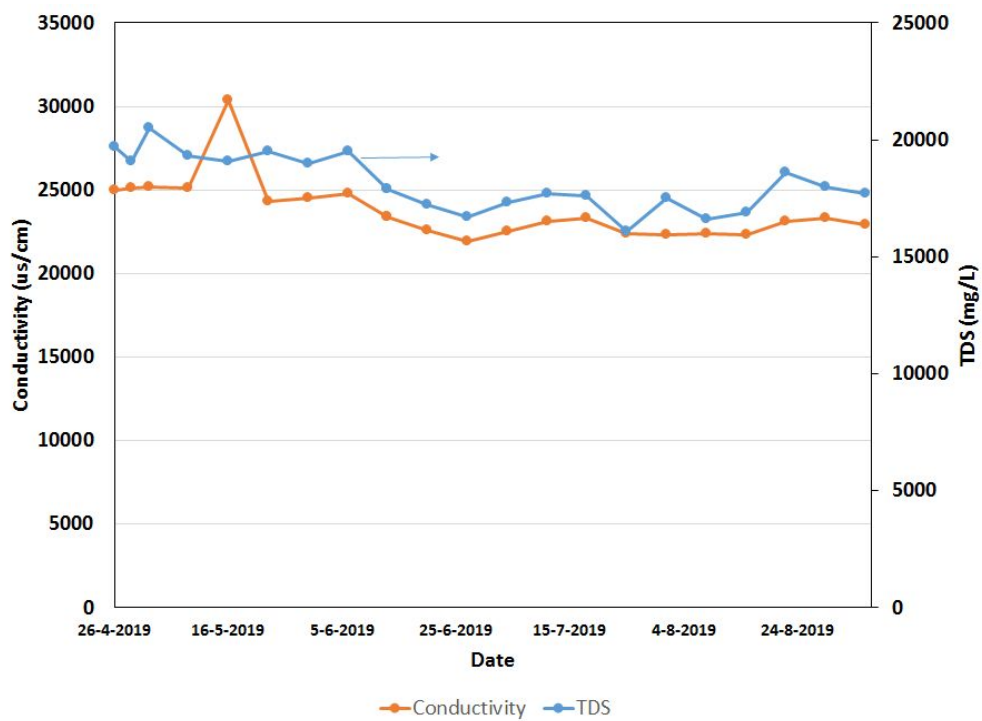
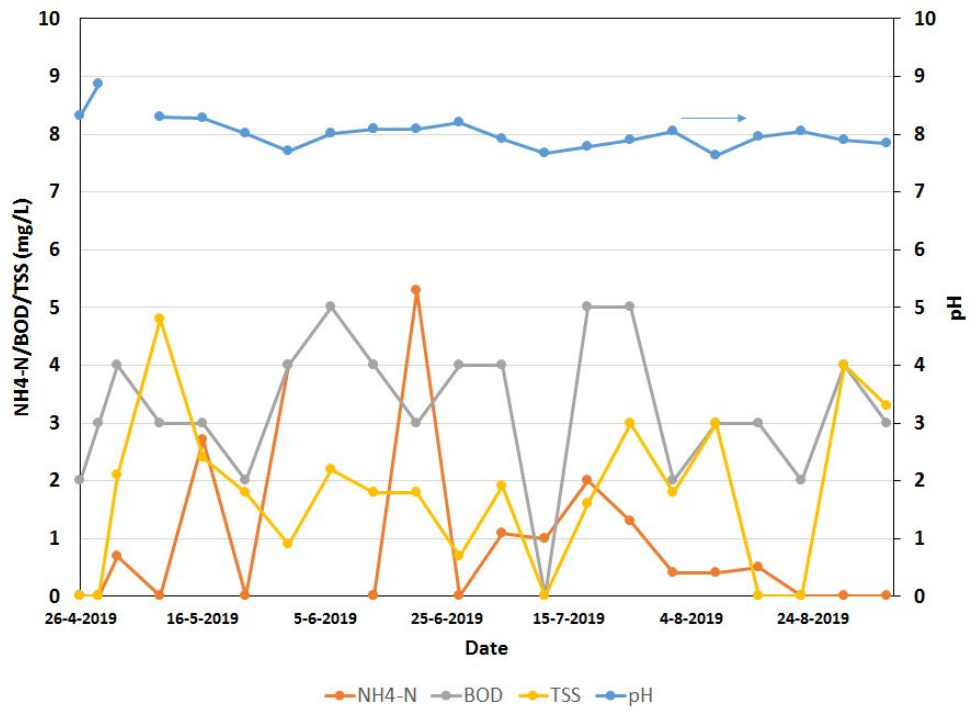
These are depicted in the subsequent trend graphs **Figures 3.2.4.1** and **3.2.4.2**.

*Table 3.2.4: Bioreactor Leachate Monitoring Results*

Parameter	Results/Discussion
<b>Leachate Dam</b>	<p>The leachate dam is located at the northwest rim of the landfill void where leachate collected and extracted from the void is treated by aeration to oxidise organic compounds. An annual monitoring round was completed during this reporting period as per the requirements of the EPL.</p>

	<p>Based on the results provided in <b>Table 6.1</b> (refer <b>Appendix 4</b>), the characteristics of the leachate are:</p> <ul style="list-style-type: none"> <li>• pH (8.78) is consistent with the previous reporting period</li> <li>• EC (31900 <math>\mu\text{S}/\text{cm}</math>) is consistent with the previous reporting period;</li> <li>• <math>\text{SO}_4</math>, one of the dominant anions, (1430 mg/L) is consistent with previous reporting readings;</li> <li>• Pb (0.166 mg/L) and Zn (1.82 mg/L) is consistent with the previous reporting period</li> <li>• <math>\text{NH}_3</math> (2100 mg/L) is consistent with previous reporting;</li> <li>• TOC (5940 mg/L) is consistent with previous reporting</li> </ul>
<b>Leachate Recirculation System</b>	<p>The leachate recirculation system is located within the landfill void, comprised of a network of drainage sumps, pipes, pumps and wells that are used to collect and extract leachate from the waste mass.</p> <p>An annual round was completed during this reporting period in accordance with the EPL, the results of which are detailed in the <b>Table 6.2</b> (refer <b>Appendix 4</b>).</p> <p>Based on these results, the leachate collected directly from the recirculation system displays similar characteristics to the leachate pond, with some exceptions as summarised below:</p> <ul style="list-style-type: none"> <li>• pH (8.56) is generally consistent with previous reporting period;</li> <li>• EC (46,200 <math>\mu\text{S}/\text{cm}</math>) is consistent with the previous reporting period and is generally consistent with the overall annual average for this location;</li> <li>• <math>\text{SO}_4</math> (2720 mg/L) is consistent with previous reporting period;</li> <li>• Both Pb and Zinc are consistent with previous reporting period, 3.7 mg/L and 48.2 mg/L respectively.</li> <li>• TOC (24200mg/L) is consistent with historical monitoring results.</li> </ul>
<b>Effluent from Leachate Treatment Plant</b>	<p>The effluent from the Leachate Treatment Plant is located at the ultrafiltration membrane shed at the Leachate treatment Plant. Based on the results provided in <b>Table 6.3</b> (refer <b>Appendix 4</b>), the water quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• pH (average 7.95) consistent with throughout reporting period and meets proposed limits;</li> <li>• EC (average 24029.2 <math>\mu\text{S}/\text{cm}</math>) remains stable, consistent with throughout the reporting period;</li> <li>• <math>\text{NH}_3</math> (average 2 mg/L) is well below proposed limits;</li> <li>• BOD (3.35 mg/L) is well below proposed limits;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.</p>





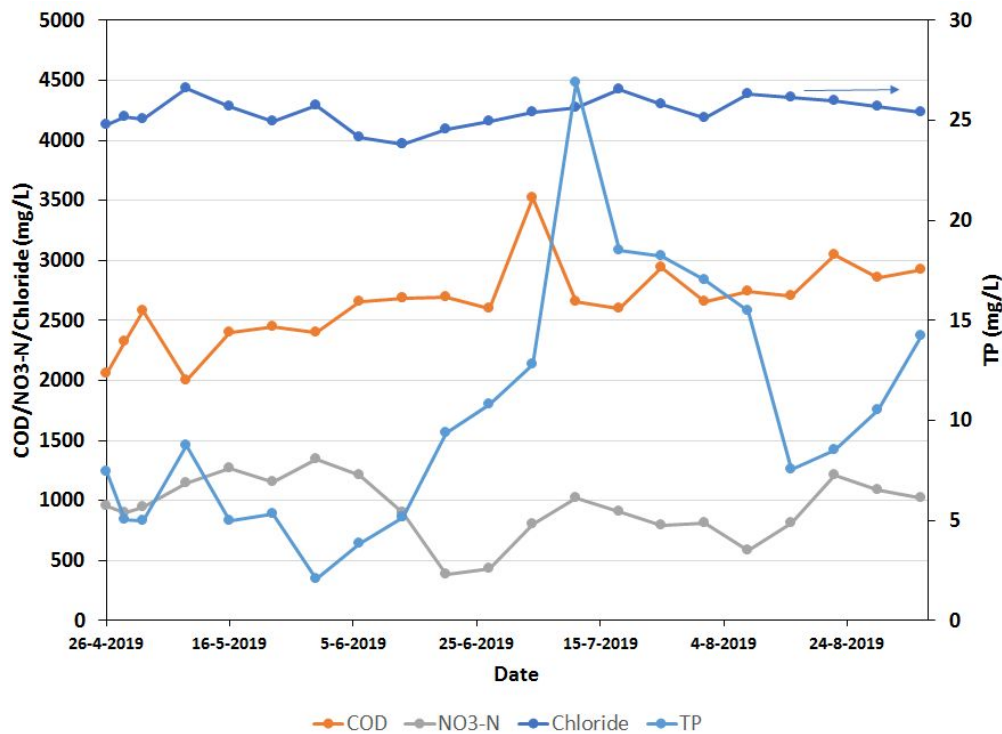


Figure 3.2.4.3 – Leachate Trends – Effluent for Leachate Treatment Plant

### 3.2.5 Bioreactor Groundwater Monitoring Results

Groundwater quality monitoring at 19 locations was undertaken in this reporting period as required by the EPL, comprising 1 annual and 3 quarterly rounds of monitoring, the results of which are summarised in **Table 3.2.5** below. Detailed data is provided in Tables 7.1 – 7.18 (refer **Appendix 4**).

The groundwater monitoring well network allows for an assessment of potential impacts from the waste operations at the Bioreactor, evaporation dams and tailing dams. The key quality indicators selected to detect any pollutants in groundwater samples are the same as those deemed characteristic for leachate and are as follows:

- pH
- Electrical Conductivity (EC),
- Sulphate (SO<sub>4</sub>),
- Lead (Pb),
- Zinc (Zn),
- Ammonia (NH<sub>3</sub>), and
- Total Organic Carbon (TOC).

These are depicted in the trend graphs **Figures 3.2.5.1 to 3.2.5.15** (refer **Appendix 5**).

*Table 3.2.5: Bioreactor Groundwater Monitoring Results*

Parameter	Results/Discussion
<b>MB1</b>	<p>MB1 is located down gradient of the landfill void. Based on the results provided in <b>Table 7.1</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 776.5 m RL) was slightly lower than previous reporting periods due to insufficient rainfall events;</li> <li>• pH (average 7.4) neutral – to slightly alkaline consistent with previous reporting period;</li> <li>• EC (average 1645 <math>\mu\text{S}/\text{cm}</math>) is slightly lower than but generally consistent with previous readings representing fresh water;</li> <li>• <math>\text{SO}_4</math> (average 303.75 mg/L) is generally consistent with previous periods;</li> <li>• Pb and Zn (average 0.0004 mg/L and 2.6 mg/L respectively) are generally consistent with previous periods.</li> <li>• <math>\text{NH}_3</math> (average 0.13) is consistent with previous reporting periods.</li> <li>• TOC (7 mg/L) is consistent with the previous reporting period and historical trends. The concentration is indicative of natural conditions. Veolia will continue to monitoring this parameter in the future to ensure water quality at this location is preserved.</li> </ul> <p>All trends at this location indicate fairly stable concentration and there is no indication of contamination from mining or Bioreactor activities. No significant variations or anomalies were recorded for any analyte tested during this monitoring period.</p>
<b>MB2</b>	<p>MB2 is located upstream of Evaporation Dam 2. Based on the results provided in <b>Table 7.2</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 778.37 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 7.06) neutral, consistent with previous reporting period;</li> <li>• EC (average 6395 <math>\mu\text{S}/\text{cm}</math>) and <math>\text{SO}_4</math> (average 4075 mg/L) is consistent with previous periods;</li> <li>• Pb (average 0.0002 mg/L) indicates a stable trend consistent with the previous reporting period.</li> <li>• Zn (average 0.04 mg/L) is generally consistent with previous reporting periods.</li> <li>• <math>\text{NH}_3</math> (0.1 mg/L) same as previous monitoring periods of non detection rates;</li> <li>• TOC (4 mg/L) is consistent with previous reporting periods.</li> </ul> <p>All trends indicate fairly stable concentration and there is no indication of contamination from mining or Bioreactor activities. No significant variations or anomalies were recorded for any analyte tested during this monitoring period.</p>



<b>MB3</b>	<p>MB3 is located upstream of the Bioreactor and mine site. Based on the results provided in <b>Table 7.3</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 790.71 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 6.9) near neutral is consistent with previous reporting period;</li> <li>• EC (average 2955 <math>\mu</math>S/cm) is consistent with previous readings representing fresh water;</li> <li>• SO<sub>4</sub> (average 1073 mg/L) is stable and consistent with previous periods;</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 0.0014 mg/L) are stable and consistent with previous periods.</li> <li>• NH<sub>3</sub> (0.1 mg/L) is consistent with previous monitoring periods of non detection rates;</li> <li>• TOC (5 mg/L) result is consistent with historical results. The concentration is indicative of natural conditions. Veolia will continue monitoring this parameter in the future to ensure water quality at this location is preserved.</li> </ul> <p>All trends indicate fairly stable concentration and provide an indication of background groundwater concentrations.</p>
<b>MB4</b>	<p>MB4 is located downstream of the Bioreactor. Based on the results provided in <b>Table 7.4</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 773.19 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 5.4) slightly acidic, consistent with previous reporting period;</li> <li>• EC (average 1612.5 <math>\mu</math>S/cm) represents fresh water salinity and is consistent with previous period. This trend is reflected in SO<sub>4</sub> (average 190 mg/L) results for this period;</li> <li>• Pb (average 0.005 mg/L) remains stable while Zn (average 0.9 mg/L) is seen to fluctuate which appears consistent with historical cyclic trends;</li> <li>• NH<sub>3</sub> (0.1 mg/L) is consistent with previous monitoring periods of non detection rates;</li> <li>• TOC (2 mg/L) result is consistent with historical results. The concentration is indicative of natural conditions. Veolia will continue monitoring this parameter in the future to ensure water quality at this location is preserved.</li> </ul> <p>All trends indicate fairly stable concentrations and there is no indication of contamination from mining or Bioreactor activities.</p>
<b>MB6</b>	<p>MB6 is located downstream of Evaporation Dam 3 and upstream of the Bioreactor. Based on the results provided in <b>Table 7.5</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 784 m RL) was consistent with historical results;</li> <li>• pH (average 6.22) slightly acidic consistent with previous reporting period;</li> </ul>

	<ul style="list-style-type: none"> <li>• EC (average 4097.5 <math>\mu\text{S/cm}</math>) represents brackish water and the trend is mirrored by <math>\text{SO}_4</math> (average 630.5 mg/L) consistent with previous periods;</li> <li>• Pb (average 0.001 mg/L) and Zn (average 9.8 mg/L) is consistent with previous periods;</li> <li>• TOC (4.3 mg/L) and <math>\text{NH}_3</math> average of 0.35 mg/l is lower than the previous reporting period.</li> </ul> <p>Due to Heron Resources underground mining activities, Veolia expects this bore to become dry in the next reporting period.</p>
<b>MB7</b>	<p>MB7 is located upstream of Evaporation Dam 3. Based on the results provided in <b>Table 7.6</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 785.59 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 7.39) neutral is consistent with the previous reporting period;</li> <li>• EC (average 7690 <math>\mu\text{S/cm}</math>) and <math>\text{SO}_4</math> (average 194 mg/L) follow a similar stable trend to previous reporting periods ;</li> <li>• Pb (average 0.0003 mg/L) is consistent throughout the reporting period whilst Zn (average 0.12 mg/L) shows a fluctuating trend consistent with historical cycles;</li> <li>• <math>\text{NH}_3</math> (0.18mg/L) is consistent with previous monitoring periods of non detection rates;</li> <li>• TOC (12 mg/L) appears consistent with the previous reporting period. The concentration is indicative of natural conditions. Veolia will continue monitoring this parameter in the future to ensure water quality at this location is preserved.</li> </ul> <p>All trends indicate fairly stable concentration and there is no indication of contamination from mining or Bioreactor activities.</p>
<b>MB10</b>	<p>MB10 is located adjacent to Evaporation Dam 1. Based on the results provided in <b>Table 7.7</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 780.6 m RL) was consistent with previous monitoring periods;</li> <li>• pH (average 7.3) neutral is consistent with previous reporting periods;</li> <li>• EC (average 8597.5 <math>\mu\text{S/cm}</math>) is of brackish quality consistent with previous readings;</li> <li>• <math>\text{SO}_4</math> (average 3747.5 mg/L) mirrors EC and is generally consistent with previous periods;</li> <li>• Pb (average 0.0002 mg/L) is stable while Zn (average 0.005 mg/L) and is generally consistent with previous reporting periods;</li> <li>• <math>\text{NH}_3</math> (&lt; 0.1 mg/L) is consistent with previous monitoring periods of non detection rates;</li> <li>• TOC (3 mg/L) appears consistent with the previous reporting period. The concentration is indicative of natural conditions.</li> </ul>

	<p>Veolia will continue monitoring this parameter in the future to ensure water quality at this location is preserved.</p> <p>All trends indicate fairly stable concentrations and there is no indication of contamination from mining or Bioreactor activities.</p>
<b>ED3B</b>	<p>ED3B is located downstream of Evaporation Dam 3. Based on the results provided in <b>Table 7.8</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 784.12 mRL) was consistent with previous monitoring periods;</li> <li>• pH (average 7.6) is neutral – slightly alkaline and consistent with previous reporting period;</li> <li>• EC (average 8282.5 <math>\mu</math>S/cm) indicating brackish water and SO<sub>4</sub> (average 1320 mg/L) follow similar trends consistent with previous periods;</li> <li>• Pb (average 0.0002 mg/L) remains stable while Zn (average 0.17 mg/L) is consistent with previous monitoring periods.</li> <li>• NH<sub>3</sub> (0.35 mg/L) is at non detection rates;</li> <li>• TOC (9 mg/L) is slightly higher but reflective of historical results in previous reporting periods.</li> </ul> <p>All trends indicate fairly stable concentrations at this location with no evidence of contamination from mining or Bioreactor activities.</p>
<b>WM1</b>	<p>WM1 is located northeast of the landfill void. Based on the results provided in <b>Table 7.9</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 741.72 m RL) is consistent with previous monitoring periods;</li> <li>• pH (average 7.4) neutral – to slightly alkaline consistent with previous reporting period;</li> <li>• EC (average 3215 <math>\mu</math>S/cm) represents slightly brackish water, and is consistent with previous historical records;</li> <li>• SO<sub>4</sub> (average 11630 mg/L) is similar in trend to EC and demonstrating a long term upward trend;</li> <li>• Both Pb (average 0.004 mg/L) and Zn (average 5.23 mg/L) remain consistent with previous reporting periods.</li> <li>• NH<sub>3</sub> (average 0.2 mg/L) is close to, or within, non-detection rates;</li> <li>• TOC (4 mg/L) is consistent with previous monitoring period reflective of natural conditions;</li> </ul> <p>All trends indicate fairly stable concentrations at this location with no evidence of contamination from mining or Bioreactor activities.</p>
<b>WM5</b>	<p>WM5 is located to the west of the void near Evaporation Dam 3 South. Based on the results provided in <b>Table 7.10</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 783.42mRL) is consistent with long term averages;</li> <li>• pH (average 7.5) neutral is consistent with the previous period.</li> <li>• EC (average 11325 <math>\mu</math>S/cm) is representative of saline water and consistent with the previous reporting period;</li> </ul>

	<ul style="list-style-type: none"> <li>• SO<sub>4</sub> (average 353.75 mg/L) is consistent with previous monitoring periods.</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 0.19 mg/L) can be seen to be fluctuating which appears consistent with historical cyclic trends;</li> <li>• NH<sub>3</sub> (average 0.1 mg/L) is close to non-detection rates;</li> <li>• TOC (16 mg/L) is consistent with previous monitoring periods reflecting natural conditions;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested in this location during this monitoring period from the data available.</p>
<b>WM6</b>	<p>WM6 is located to the west of the void adjacent to Evaporation Dam 3 North. Based on the results provided in <b>Table 7.11</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 785.9 m RL) is consistent with the previous reporting period;</li> <li>• pH (average 6.3) is slightly acidic, but stable and consistent with previous reporting period;</li> <li>• EC (average 14000 µS/cm) represents brackish to slightly saline water, consistent with previous reporting period;</li> <li>• SO<sub>4</sub> (average 499.5 mg/L) mirrors EC's stable trend;</li> <li>• Pb (average 0.004 mg/L) and Zn (average 0.14 mg/L) are both similar to the previous reporting period and generally consistent with historical fluctuations.</li> <li>• NH<sub>3</sub> (average 0.1 mg/L) is close to, or within, non-detection rates;</li> <li>• TOC (0.05 mg/L) is consistent with previous monitoring period reflecting natural conditions;</li> </ul> <p>All trends are relatively consistent and there is no indication of contamination from mining or Bioreactor activities.</p>
<b>MW8S</b>	<p>MW8S is located on the northern side of ED3N. Based on the results provided in <b>Table 7.12</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 784.85 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 7.34) is neutral and consistent with previous reporting period;</li> <li>• EC (average 10175 µS/cm) remains stable with previous reporting period results;</li> <li>• SO<sub>4</sub> (average 2565 mg/L) continues to show a declining trend but is generally consistent with previous periods;</li> <li>• Pb (average 0.0039 mg/L) is stable whilst Zn (average 29.8 mg/L) is generally consistent with previous periods.</li> <li>• NH<sub>3</sub> (average 0.3 mg/L) is close to, or within, non-detection rates;</li> <li>• TOC (11 mg/L) is consistent with previous monitoring period reflecting natural conditions;</li> </ul>

	<p>The fluctuations noted could be attributed to the recharging of this well only following significant wet weather events which indicates that this well intercepts the shallow unconfined aquifer.</p> <p>There is no indication of contamination from mining or Bioreactor activities.</p>
<b>MW8D</b>	<p>MW8D is located adjacent to MW8S. Based on the results provided in <b>Table 7.13</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 785.34 m RL) was consistent with long term average since 2004;</li> <li>• pH (average 6.9) slightly acidic to neutral consistent with previous reporting period.</li> <li>• EC (average 5492.5 <math>\mu</math>S/cm) represents brackish water which is consistent with previous readings;</li> <li>• SO<sub>4</sub> (average 2157 mg/L) mirrors EC consistent with previous periods;</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 4.25 mg/L) are both consistent with previous periods;</li> <li>• NH<sub>3</sub> (0.2mg/L) is at non detection rates;</li> <li>• TOC (0.05 mg/L) is consistent with previous monitoring period reflecting natural conditions;</li> </ul> <p>All trends indicate fairly stable concentrations with no evidence of contamination from mining or Bioreactor activities.</p>
<b>MW9S</b>	<p>MW9S is located on the northwest side of ED3N. Based on the results provided in <b>Table 7.14</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 786.29) was consistent with previous reporting period;</li> <li>• pH (average 7.04) consistent with previous reporting period;</li> <li>• EC (average 10,845 <math>\mu</math>S/cm) remains stable, consistent with previous reporting period for brackish water;</li> <li>• SO<sub>4</sub> (average 4985 mg/L) is consistent with previous periods;</li> <li>• Pb (average 0.001 mg/L) and Zn (average 0.19 mg/L) were both generally consistent with historical results.</li> <li>• NH<sub>3</sub> (0.3 mg/L) is at non detection rates;</li> <li>• TOC (8 mg/L) reflecting natural conditions is consistent with historical results;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.</p>
<b>MW10S</b>	<p>MW10S is located on the northeast side of ED3.</p> <p>No sampling of MW10S could be undertaken during the reporting period as this well was continually dry. This has been a consistent observation since the well was commissioned in 2007.</p> <p>No data is available to produce tables or graphs for this monitoring point.</p>

<b>MB28</b>	<p>MB28 is located downstream of ED1. Based on the results provided in <b>Table 7.15</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 779.10) was consistent throughout this reporting period;</li> <li>• pH (average 7.25) is neutral;</li> <li>• EC (average 11900 <math>\mu\text{S}/\text{cm}</math>) remains stable, throughout the reporting period;</li> <li>• <math>\text{SO}_4</math> (average 846.75 mg/L) is consistent;</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 1.36 mg/L) were both generally consistent in this reporting period.</li> <li>• <math>\text{NH}_3</math> (0.2 mg/L) is at non detection rates;</li> <li>• TOC (4 mg/L) reflecting natural conditions is consistent throughout this reporting period;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.</p>
<b>SP2-MW1</b>	<p>SP2-MW1 is located adjacent to Spring 2. This shallow bore was installed as part of the ED1 and ED2 seepage management scheme. * This bore was installed and ready to be tested from quarter 2 of this reporting period. Based on the results provided in <b>Table 7.16</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 777.10);</li> <li>• pH (average 7.41) being neutral, was consistent throughout the reporting period;</li> <li>• EC (average 3696.7 <math>\mu\text{S}/\text{cm}</math>) remains stable, consistent with for fresh to brackish water;</li> <li>• <math>\text{SO}_4</math> (average 186.73 mg/L) is consistent this reporting period;</li> <li>• Pb (average 0.0003 mg/L) and Zn (average 0.4 mg/L) were both reported as low to non-detectable</li> <li>• Cu (0.004 mg/L) reflected low to non-detectable;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.</p>
<b>MW-FRC1</b>	<p>MW-FRC1 is located adjacent to the farm road culvert. This shallow bore was installed as part of the ED1 and ED2 seepage management scheme. *This bore was installed and ready to be tested from quarter 2 of this reporting period. Based on the results provided in <b>Table 7.17</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 778.27);</li> <li>• pH (average 7.17) consistent throughout this reporting period;</li> <li>• EC (average 6023 <math>\mu\text{S}/\text{cm}</math>) remains stable for brackish water;</li> <li>• <math>\text{SO}_4</math> (average 180.67 mg/L) is consistent this reporting period;</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 0.08 mg/L) were both generally consistent and reflect low to non-detectable.</li> <li>• Cu (0.003 mg/L) reflected low to non-detectable;</li> </ul>



	No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.
<b>MB10S</b>	<p>MB10S is located adjacent to MB10 at the toe end of ED1. This shallow bore was installed as part of the ED1 and ED2 seepage management scheme. *This bore was installed and ready to be tested from quarter 2 of this reporting period. Based on the results provided in <b>Table 7.18</b> (refer <b>Appendix 4</b>), the groundwater quality at this location can be described as:</p> <ul style="list-style-type: none"> <li>• SWL (average 780.13);</li> <li>• pH (average 7.32) consistent throughout this reporting period;</li> <li>• EC (average 2086 <math>\mu\text{S}/\text{cm}</math>) remains stable for fresh to brackish water;</li> <li>• <math>\text{SO}_4</math> (average 759.3 mg/L) is consistent this reporting period;</li> <li>• Pb (average 0.0002 mg/L) and Zn (average 1.13 mg/L) were both generally consistent and reflect low to non-detectable.</li> <li>• Cu (0.01 mg/L) reflected low to non-detectable;</li> </ul> <p>No significant variations or anomalies were recorded for any analyte tested at this location during this monitoring period.</p>

### 3.2.6 Bioreactor Piezometers Level Monitoring Results

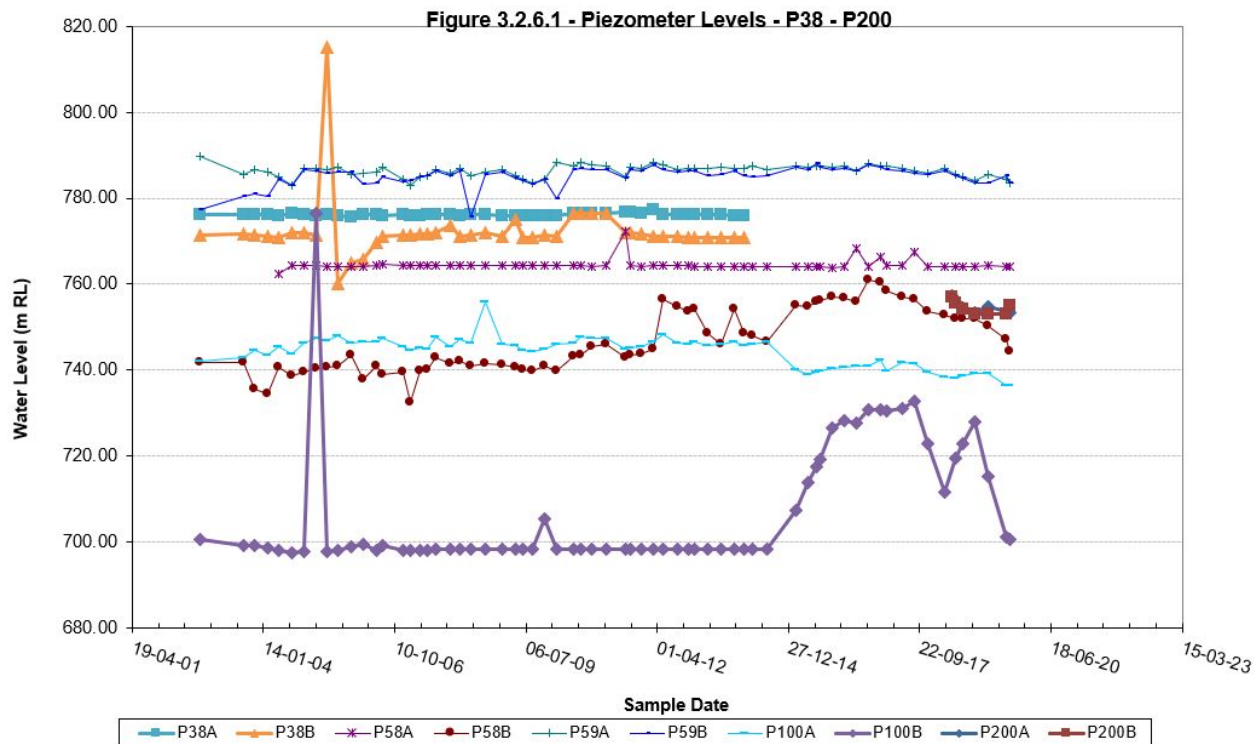
Measurements for groundwater standing water levels (SWL) in the vicinity of the Bioreactor were undertaken at 6 out of 6 piezometers around the landfill void in accordance with the EPL and have been documented in the Annual Return. Each location consists of a shallow (reference A) and deep (reference B) piezometer.

The findings of the monitoring are summarised in Table 3.2.6 below and detailed quarterly levels are provided in Tables 8.1 – 8.5 (refer **Appendix 4**)

*Table 3.2.6: Bioreactor Piezometers Level Monitoring Results*

Parameter	Results/Discussion
<b>P38A &amp; P38B</b>	<p>P38 is located east of the void. Standing water levels are presented in <b>Table 8.1</b> (refer <b>Appendix 4</b>). This monitoring location was deemed unsafe to access due to a rock slip on the Southern side of the Bioreactor void wall in 2010. An application to remove this monitoring point from the licence was submitted to the EPA and rejected during this reporting period. Following this decision, Veolia engaged a geotechnical consultant and earthmoving company to provide safe access. Monitoring re-commenced immediately.</p> <p>SWL in P38A (shallow aquifer) ) indicated a stable standing water level ranging from 776 metres Relative Level (m RL) to 776.07 RL during this reporting period.</p>

	SWL in P38B (deep) ranged from 770.71 m RL to 771.81 m RL in this reporting period, consistent with previous reporting periods.
<b>P200A &amp; P200B</b>	<p>P200 is located east of the void. Standing water levels are presented in <b>Table 8.2</b> (refer <b>Appendix 4</b>).</p> <p>SWL in P200A (shallow) showed a range of 753.34 m RL to 754.86 m RL and is stable.</p> <p>SWL in P200B (deep) showed a range of 752.95 m RL to 755 m RL and is stable.</p>
<b>P58A &amp; P58B</b>	<p>P58 is located west of the void. Standing water levels are presented in <b>Table 8.3</b> (refer <b>Appendix 4</b>).</p> <p>SWL in P58A (shallow) showed a range of 763.95 m RL to 764.25 m RL and is stable.</p> <p>SWL in P58B (deep) is similar to previous reporting period fluctuating between 744.25 m RL and 751.99 m RL.</p>
<b>P59A &amp; P59B</b>	<p>P59 is located west of the void and to the south of P58. Standing water levels are presented in <b>Table 8.4</b> (refer <b>Appendix 4</b>).</p> <p>SWL in P59A (shallow) ranged from 783.60 m RL to 785.50 m RL in this reporting period, consistent with previous reporting period.</p> <p>SWL in P59B (deep) ranged between 783.60 m RL and 785.20 m RL, consistent with previous reporting period.</p>
<b>P100A &amp; P100B</b>	<p>P100 is located northeast of the void. Standing water levels are presented in <b>Table 8.5</b> (refer <b>Appendix 4</b>).</p> <p>SWL in P100A (shallow) is consistent with the previous reporting period averaging between 736.33 m RL to 739.25 m RL.</p> <p>P100B (deep) averaged between 700.63 m RL and 727.83 m RL which indicates water above the base level of 698.29 m RL which has been recorded in previous periods.</p> <p>This increase is likely due to the compaction of landfill waste at higher levels within the void preventing water ingress.</p>



**Figure 3.2.6.1 – Piezometer Standing Water Levels – P38 to P200**

### 3.2.7 Bioreactor Evaporation Dam Volume Monitoring Results

The Evaporation Dam 3 (ED3) system comprises extracted (and treated) leachate from the landfill void and captured stormwater. The water volume has to be maintained in all Evaporation Dam 3 (Lagoon systems) below the freeboard level at all times.

Additional monitoring is conducted for other dams managed by Veolia. Note, water levels for ED1N (Mine legacy water) began when the licence condition was established.

Water levels are taken monthly as detailed in **Table 3.2.7**, which shows that the dam levels and required freeboard requirements.

	ED3 SOUTH		ED3 NORTH				LTP Permeate	ED1N (Legacy)
Date	ED3S	ED3S-S	ED3N Lagoon 1	ED3N Lagoon 2	ED3N Lagoon 3	ED3N Lagoon 4	ED1 Coffer Dam	ED1N
	RL	RL	RL	RL	RL	RL		
26/09/2018	790.59	792.86	790.17	790.82	789.92	791.00	786.53	N/A
29/10/2018	790.53	792.77	790.82	790.95	789.84	790.99	786.53	N/A
26/11/2018	790.51	792.67	790.71	791.14	789.73	791.07	786.53	N/A
17/12/2018	790.55	792.69	790.74	791.23	789.76	791.14	786.53	N/A
25/1/2019	790.53	792.5	790.54	791.06	789.74	791.00	786.53	N/A
25/2/2019	790.49	792.36	790.38	790.97	789.89	790.92	786.53	N/A
27/3/2019	790.57	792.26	790.30	790.91	789.89	790.97	786.53	N/A
30/4/2019	790.58	792.18	790.22	790.92	789.95	791.09	786.53	786.38
30/5/2019	790.6	792.14	790.18	790.95	790.01	791.11	786.62	785.80
25/6/2019	790.72	792.13	790.19	791.01	790.11	791.16	786.75	785.86
26/7/2019	790.75	792.18	790.15	791.00	790.12	791.17	786.83	785.82
26/8/2019	790.8	792.17	790.09	790.95	790.10	791.13	786.88	785.77
Minimum	790.49	792.13	790.09	790.82	789.73	790.92	786.53	785.77
Mean	790.60	792.41	790.37	790.99	789.92	791.06	786.61	785.93
Maximum	790.8	792.86	790.82	791.23	790.12	791.17	786.88	786.38
<b>Max Freeboard levels</b>	<b>791.2</b>	<b>793.6</b>	<b>791.3</b>	<b>791.1</b>	<b>791</b>	<b>791.3</b>	<b>792</b>	<b>788.8</b>

Table 3.2.7: Bioreactor Evaporation Dam Volume Monitoring Results (RLs AHD)

# Part 2 EPL 11455 Crisps Creek Intermodal Facility

## 4 Intermodal Facility Operations

Veolia operates the Crisps Creek Intermodal Facility (IMF) which is comprised of a hardstand located adjacent to the regional rail network (approximately 1 km south of Tarago train station and 8 km from the Bioreactor) to enable transfer of containerised waste received by rail from Sydney onto road trucks and subsequent to the Bioreactor for disposal.

### 4.1 IMF Licence Conditions

The IMF is operated under EPL 11455 which details the operating conditions and environmental monitoring requirements as noted in **Table 4.1**.

*Table 4.1: IMF Licence Conditions*

Condition	Compliance with Condition
1. Administrative conditions	Noted
2. Discharges to air and water and application to land	Noted
3. Limit conditions	<p><b>L1. Pollution of Waters</b> All clean surface and storm water collected at the IMF was diverted to the onsite retention system for storage, as part of the first flush stormwater management system, in this reporting period. Following rainfall events, surface water monitoring was undertaken to assess the water quality prior to discharge.</p> <p><b>L5. Waste</b> All waste received at the IMF during this reporting period was in accordance with the waste types permitted in the EPL, received via rail from the Clyde and Banksmeadow Transfer Terminal in Sydney. All waste was maintained in sealed containers and transported to the Bioreactor on the same day.</p> <p><b>L6. Noise Limits</b> No noise complaints were received during this reporting period indicating that noise from operational activities at the IMF was likely maintained within the 35 dB(A) LAeq (15 minute) criteria at the nearest residential receiver. Similarly, it can be inferred that noise from freight trains did not exceed 45 dB(A) LAeq (15 minute and 50 dB(A) LAeq (15 minute before and after 7:00 am respectively.</p> <p>Noise monitoring will be undertaken by Veolia on the receipt of any such complaints.</p> <p><b>L7. Hours of Operation</b></p>

	<p>All operational activities at the IMF including haulage of waste to the Bioreactor were undertaken between 6:00 am and 10:00 pm, Monday to Saturday during this reporting period as permitted under the DA.</p> <p><b>L8. Potentially Offensive Odour</b> No odour complaints were received for the IMF during this reporting period.</p>
<b>4. Operating conditions</b>	<p><b>O1. Activities Carried out in a Competent Manner</b> All licenced activities undertaken at the IMF in this reporting period were carried out in a competent manner and under a high standard of environmental management for which Veolia is certified under ISO 14001.</p> <p><b>O2. Maintenance of Plant and Equipment</b> The maintenance and operation of all plant and equipment on the premises associated with the licenced activities was undertaken in a proper and efficient condition as required by qualified technicians. All major plant and equipment at the site is stored in a computerised maintenance management system in order to schedule and complete the required maintenance. All Veolia operators hold the appropriate qualifications and licenses to operate plant and equipment used as part of IMF operations.</p> <p><b>O3. Dust Control</b> All operations and activities were carried out at the IMF in a manner to minimise dust at the boundary of the premises. These included operating on a hardstand site with fully paved access roads to the site. All haulage of waste to the Bioreactor occurred within enclosed containers. Monitoring for the presence and quantity of depositional dust is undertaken monthly to verify the performance.</p> <p><b>O4. Stormwater and Wastewater Management – Operating Phase</b> The first flush stormwater management system was operated effectively in this reporting period in accordance with the EPL requirements to capture all the clean storm and surface water from the paved and sealed areas of the IMF. No sewage was removed from the IMF in this reporting period. Uncontaminated stormwater is permitted under the EPL to be utilised in vegetated areas of the IMF, as required.</p> <p><b>O5. Tracking of Mud and Waste</b> As all waste container unloading and movements occurred within enclosed containers on a hardstand site, tracking of waste from the IMF did not occur during this reporting period. No opening of containers was required to be undertaken at the IMF during this reporting period.</p> <p><b>O6. Waste Transportation</b> All containers utilised in the transportation of waste in this reporting period were maintained in accordance with the EPL requirements to minimise potential odour emissions. All containers had rubber seals to prevent the leakage of leachate during transport and handling activities.</p> <p><b>O7. Fire Extinguishment</b> There were no fires at the IMF during this reporting period.</p> <p><b>O8. Fire Fighting Capability</b> All Veolia operators are trained in handling emergency situations, which include fire fighting in accordance with site specific Emergency Response Plans. Fire extinguishers and a 20,000 litre water tank were maintained onsite during this reporting period to enable effective fire fighting capabilities. In</p>

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	addition, Crisps Creek and Mulwaree River are located adjacent to the IMF as approved and readily available water source for fire fighting. The Tarago Fire Brigade is also located approximately 10 km from the site which enables fast mobilisation at the site.
<b>5. Monitoring and recording conditions</b>	Noted, all compliance monitoring was carried out in this reporting period in according to EPL requirements, the results of which are detailed, along with any non conformances in Section 5.
<b>6. Reporting conditions</b>	Noted and addressed in this Report and the annual return documents, where relevant. Notifications to the EPA were undertaken in a timely fashion.
<b>7. General conditions</b>	Noted.
<b>8. Pollution studies and reduction programs</b>	N/A
<b>9. Special Conditions</b>	N/A



# 5 Intermodal Environmental Monitoring

## 5.1 IMF Monitoring Points

Veolia is required to monitor environmental performance of the IMF under the site EPL. **Table 5.1** details the EPA ID, Veolia monitoring point identification, frequency and the type of monitoring undertaken at each licensed point. A monitoring location plan is included in **Appendix 3**.

*Table 5.1: IMF Licensed Monitoring Points*

EPA ID	Veolia ID	Frequency	Type of Monitoring
1	Site 110 - Upstream	Quarterly	Surface Water
2	Site 150 - Downstream		
3	IMF First Flush		
4	DG18 IMF	Monthly	Dust / Particulates

Veolia also undertakes additional surface water quality monitoring at Site 130 (located upstream of Crisps Creek Intermodal in Mulwaree River) to provide additional background quality information.

## 5.2 IMF Monitoring Results

### 5.2.1 IMF Surface Water Monitoring Results

Surface water quality monitoring at 3 monitoring locations was undertaken as required by the EPL, the findings of which are summarised in **Table 5.2.1**. Detailed quality results are provided in **Tables 9.1 to 9.4** (refer **Appendix 4**). The key quality indicators selected to identify any contamination in the receiving surface waters from site operations include:

- pH,
- Electrical Conductivity (EC),
- Sulphate (SO<sub>4</sub>),
- Iron (Fe),
- Zinc (Zn),
- Ammonia (NH<sub>3</sub>), and
- Total Organic Carbon (TOC).

These are depicted in trend graphs **Figures 5.2.1.1 to 5.2.1.4** (refer **Appendix 5**).

Table 5.2.1: IMF Surface Water Monitoring Results

Parameter	Results/Discussion
Site 110 - Upstream	<p>Site 110 is located upstream of the IMF in Crisps Creek. It is approximately 8 km downstream of the Bioreactor.</p> <p>Results provided in <b>Table 9.1</b> (refer <b>Appendix 4</b>) indicate the following trends:</p> <ul style="list-style-type: none"> <li>pH is close to neutral (average 7.03), consistent with previous reporting periods;</li> <li>EC (average 40 <math>\mu</math>S/cm) is consistent with the previous period and representative of fresh water salinity;</li> <li>SO<sub>4</sub> (average 18.2 mg/L) is lower than previous reporting periods;</li> <li>Fe (average 0.49 mg/L) is consistent with previous reporting periods, whilst Zinc indicates a fluctuating trend (average 0.62mg/L), consistent with historical cyclic results;</li> <li>NH<sub>3</sub> (average 0.1 mg/L) is consistent with previous reporting periods and continues to be at non-detection levels.</li> <li>TOC (average 4 mg/L) is slightly lower than the previous reporting period and is generally reflective of natural organic matter in streams.</li> </ul> <p>While the indicator trends for this location indicate some variability over time, this is not uncommon when sampling intermittent streams.</p>
Site 130 - Upstream	<p>Site 130 is located upstream of the IMF in the Mulwaree River.</p> <p>Results provided in <b>Table 9.2</b> (refer <b>Appendix 4</b>) indicate the following trends:</p> <ul style="list-style-type: none"> <li>pH is close to neutral (average 7.87), consistent with the previous reporting period;</li> <li>EC (average 442 <math>\mu</math>S/cm) is consistent with the previous reporting period and representative of fresh water salinity;</li> <li>SO<sub>4</sub> (average 18.5 mg/L) is consistent with previous reporting period;</li> <li>Fe and Zn, average 2.01 mg/L and 0.003 mg/L respectively indicate consistency with fluctuating cycles in previous reporting periods;</li> <li>NH<sub>3</sub> (&lt;0.1 mg/L) continued to be un-detectable during this reporting period.</li> <li>TOC (average 11 mg/L) is consistent with previous reporting periods.</li> </ul>
Site 150 – Mulwaree River	<p>Site 150 is located 2 km downstream of the IMF on the Mulwaree River, which is also downstream of a railway bridge and Braidwood Road.</p> <p>Results provided in <b>Table 9.3</b> (refer <b>Appendix 4</b>) indicate the following trends:</p>

	<ul style="list-style-type: none"> <li>pH (average 8.03) is slightly alkaline, consistent with the previous reporting period;</li> <li>EC (average 703 <math>\mu\text{S}/\text{cm}</math>) shows a fluctuating trend and is generally consistent with previous periods and fresh water salinity;</li> <li><math>\text{SO}_4</math> (average 26 mg/L) reflecting EC trend, is generally consistent with previous reporting period;</li> <li>Fe and Zn, average 0.49 mg/L and 0.04 mg/L respectively indicate consistency with fluctuating cycles in previous reporting periods.</li> <li><math>\text{NH}_3</math> (<math>&lt; 0.1\text{mg}/\text{L}</math>) continued to be not detected during this reporting period.</li> <li>TOC (average 10 mg/L), is generally consistent with previous reporting periods;</li> </ul> <p>These results are consistent with the trends for Site 110.</p>
<b>First Flush Stormwater Outlet</b>	<p>The IMF First Flush is located at the surface water outlet point of the site, prior to runoff into Crisps Creek.</p> <p>Results provided in <b>Table 9.4</b> (refer <b>Appendix 4</b>) indicate the following trends:</p> <ul style="list-style-type: none"> <li>pH (average 7.29) is close to neutral, consistent with the previous reporting period;</li> <li>EC (average 180.25 <math>\mu\text{S}/\text{cm}</math>) shows a slight downward trend but is generally consistent with the previous period and representative of fresh water salinity;</li> <li><math>\text{SO}_4</math> (average 18.95 mg/L) is also slightly higher but generally consistent with previous reporting period;</li> <li>Fe and Zn, average 0.85 mg/L and 0.22 mg/L are generally consistent with the previous period but reflective of fluctuating cycles.</li> <li><math>\text{NH}_3</math> an average of (0.2 mg/L) is also slightly higher but generally consistent with previous reporting period;</li> </ul> <p>TOC (average 8.75 mg/L) which is consistent with previous reporting period reporting periods.</p>

### 5.2.2 IMF Air Quality Monitoring Results

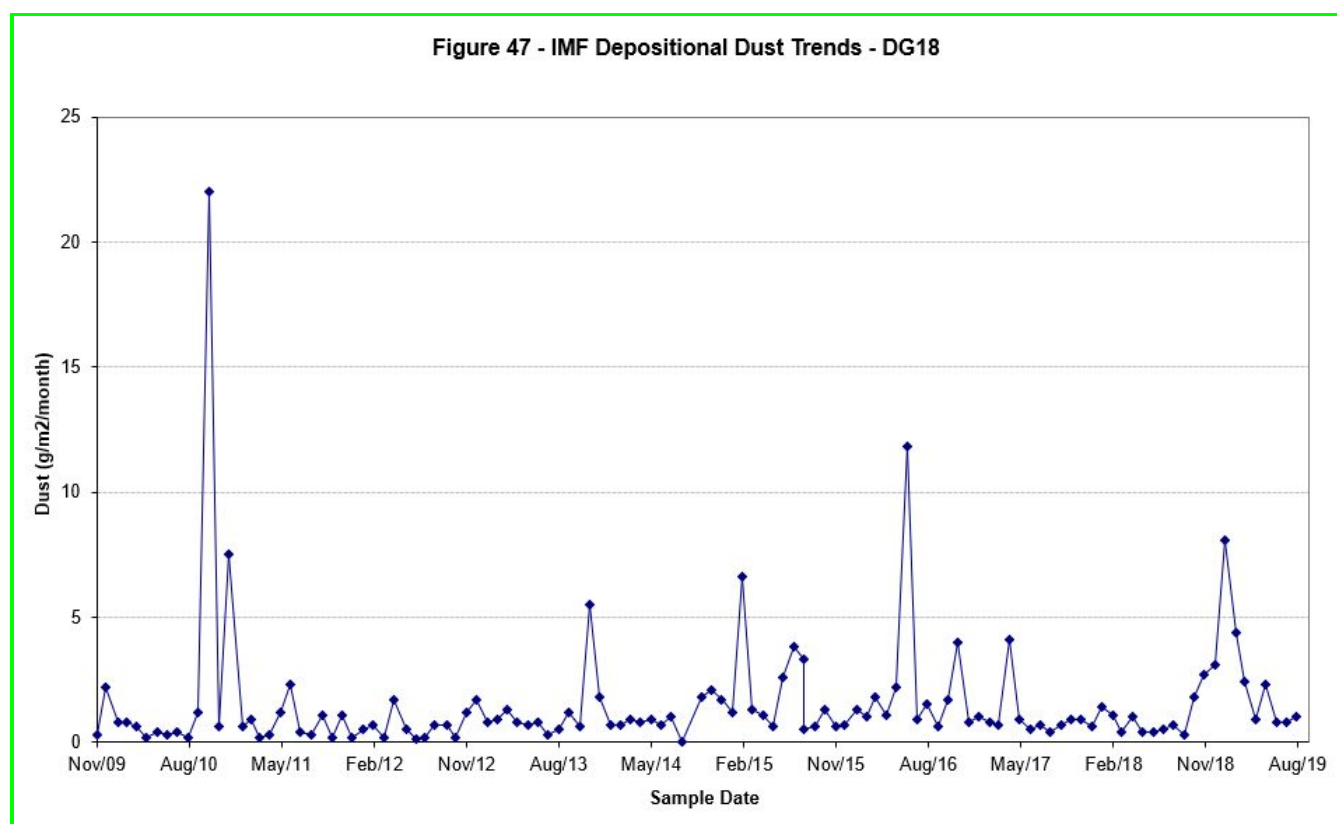
Dust monitoring is undertaken monthly at 1 location at the IMF in accordance with the EPL. A summary of this reporting period is provided in **Table 5.2.2.1** and detailed in **Table 10** (refer **Appendix 4**).

The results at DG18 indicate an average level of total insoluble solid matter is 2.38 g/m<sup>2</sup>/month, which is slightly higher compared to overall historical trends as seen in the subsequent graph in Figure 5.2.2.1. The high level of total insoluble solid of 8.1 g/m<sup>2</sup>/month for January 2019 reflects the dust storm event that occurred in the months

of December 2018 and January 2019, it is also noted that it has been a dry year with the average rainfall being 336mm. The handling of waste and associated operational activities at the IMF are undertaken in a manner to ensure minimal emissions of dust. This includes no opening of containerised waste on unloading and operating on hardstand site.

*Table 5.2.2: Dust Monitoring Results*

Dust Gauge	Summary Total Insoluble Solids (g/m <sup>2</sup> /month)		
	Minimum	Maximum	Average
DG18	0.3	8.1	2.38



**Figure 5.2.2.1 – IMF Depositional Dust Levels – DG18**

# 6 Performance

## 6.1 Audit Findings

An independent compliance audit was undertaken at the Woodlawn Bioreactor by the NSW EPA during this reporting period. The focus of the audit was to assess compliance against conditions attached to EPL 11436 and the legislative requirements relating to Pollution Incident Response Management Plans (PIRMP). The key findings are presented in **Table 6.1**, along with the corrective actions implemented by Veolia.

*Table 6.1: 2018/2019 Audit Findings and Corrective Actions*

Item No.	Criteria	Audit Finding	Target/ Action Date	2018-19 Action Status
<b>Environment Protection Licence 11436</b>				
1.	Condition M2 Requirement to monitor concentration of pollutants discharged - Water Quality Monitoring Points Frequency	No action required however the licensee is encouraged to negotiate this condition to accommodate periods of low or no flow where groundwater cannot be feasibly sampled.	Ongoing	<b>Complete</b>  Veolia advised the EPA that this was in relation to surface water monitoring points not groundwater.  Veolia will liaise with the EPA regarding surface water monitoring process when the site experiences no surface water flows.  Reported as non compliance in the annual return.
2.	Condition M3 Testing Methods – concentration limits Methods of analysis	Monitoring must be carried out in accordance with the Approved Methods unless another method is approved in writing by the EPA. The licensee must not exceed the limits specified for the overflow points.	Ongoing	<b>In progress</b>  Veolia liaised with NATA laboratories to confirm compliance with this condition. Feedback to be received.
3.	Condition U1	Long-term Leachate Treatment Solution	No further action required	<b>Complete</b>  Veolia has addressed this matter with the EPA regional office.  Reported as non compliance in the annual return.

Protection of the Environment Operations (General) Regulation 2009- Chapter 7, Part 3A				
4.	Clause 98 C (1) d) Inventory of potential pollutants	The licensee must ensure that an inventory of all potential pollutants is included in the PIRMP.	31 July 2019	<b>Complete</b>  The PIRMP was updated with other potential pollutants on site.
5.	Clause 98 C (1) n) Testing of the plan	The licensee must ensure that the PIRMP includes the dates the plan has been tested and name of person who carried out the test.	31 July 2019	<b>Complete</b>  Veolia has addressed this matter. The PIRMP was updated with the date of testing and names of people who carried out the test.

## 6.2 Conclusion

Based on the results of monitoring undertaken at both the Bioreactor and IMF sites in accordance with the respective EPLs, the overall environmental performance of the Woodlawn Eco Project in this reporting period can be demonstrated to be well managed.

- Sampling as per the licence was carried out, noting that due to surface water flows after rainfall not being evident, a physical water sample was not able to be taken.
- There were 2 non-compliances in this reporting period. These have been documented in the Annual Return, which has been submitted to the EPA, as follows:
  - Licence Condition Number M2: Requirement to monitor concentration of pollutants discharged. Missed sampling periods as per condition M1 at certain locations relating to the lack of flow recorded at these points during sampling sessions.
  - Licence Condition Number U1.1: Long Term Leachate Treatment Solution not meeting the proposed dateline (30 September 2018). The Leachate Treatment Plant, as part of the Long-term Leachate Treatment Solution, was commissioned on 4 October 2018.
- In this reporting period, Veolia have also implemented the recommendations for environmental and operational improvements identified in the 2017/2018 Report as discussed in **Table 6.2**.

*Table 6.2: 2018/2019 Improvement Actions*

Item No.	Recommendation	2018-19 Action Status
1.	<b>Evaporation Dam Seepage Management Strategy for ED1</b> <ul style="list-style-type: none"> <li>• Installation of additional evaporative systems in ED1</li> <li>• Groundwater and surface water assessment around ED1</li> </ul>	Complete <ul style="list-style-type: none"> <li>• 2 evaporators were installed in ED1 on 4 Sep 2019</li> <li>• The groundwater and surface water assessment around ED1 were completed with 3 groundwater monitoring bores installed as part</li> </ul>

		of the seepage management scheme. These bores were installed in Q1 of 2019, with monitoring commencing from Q2 of 2019.
2.	<b>Stormwater management in the void</b> <ul style="list-style-type: none"> <li>Completion of stormwater management project</li> </ul>	In progress <ul style="list-style-type: none"> <li>Construction of 1 in 100 year stormwater catchment dams on various benches in the landfill void are underway, including the installation of 6 stormwater pumps to service these.</li> </ul>
3.	<b>Odour Management</b> <ul style="list-style-type: none"> <li>Improvement and expansion of wells in the void to minimise leachate recirculation and improve gas extraction</li> <li>Construction of new gas manifold on the perimeter of the Bioreactor that will supply gas to Hub 2 Bioenergy Plant</li> </ul>	In progress <ul style="list-style-type: none"> <li>Veolia intends to install further gas extraction fans and infrastructure for Hub 2 of the Bioenergy plant from 2020</li> <li>The Woodlawn Infrastructure Plan outlines the key objectives for the bioreactor, including layout of gas extraction systems, stormwater management design and implementation which is linked to the leachate minimisation plan.</li> </ul>
4.	<b>Leachate Treatment Plant</b> <ul style="list-style-type: none"> <li>Commission and operation of plant to extract and treat leachate more efficiently (done and ongoing)</li> <li>Store treated effluent from the plant in ED1 coffer dam, this water will be used for process water by Heron Resources (ongoing)</li> <li>Conduct an independent audit for the leachate and water management system in line with the Development consent (DA-31-02-99 condition 70T) requirements</li> </ul>	Complete <ul style="list-style-type: none"> <li>The Leachate Treatment Plant was commissioned on 4/10/2018</li> <li>The first discharge of treated leachate from the LTP to the coffer dam was on 26/04/2019</li> <li>The independent leachate and water management audit was completed in June 2019.</li> </ul>
5.	<b>Groundwater Management</b> <ul style="list-style-type: none"> <li>Further assessment of the west side of the Bioreactor to improve the groundwater monitoring network as WM4 was decommissioned during the 2016/17 reporting period.</li> </ul>	Complete <ul style="list-style-type: none"> <li>The replacement bore was installed in Q1 2019 - MB29</li> </ul>



## 6.3 Future Recommendations

Additional improvements proposed for the 2019/2020 reporting period at the Bioreactor and the IMF are as follows in **Table 6.3**:

*Table 6.3: 2019/2020 Reporting Period Recommendations*

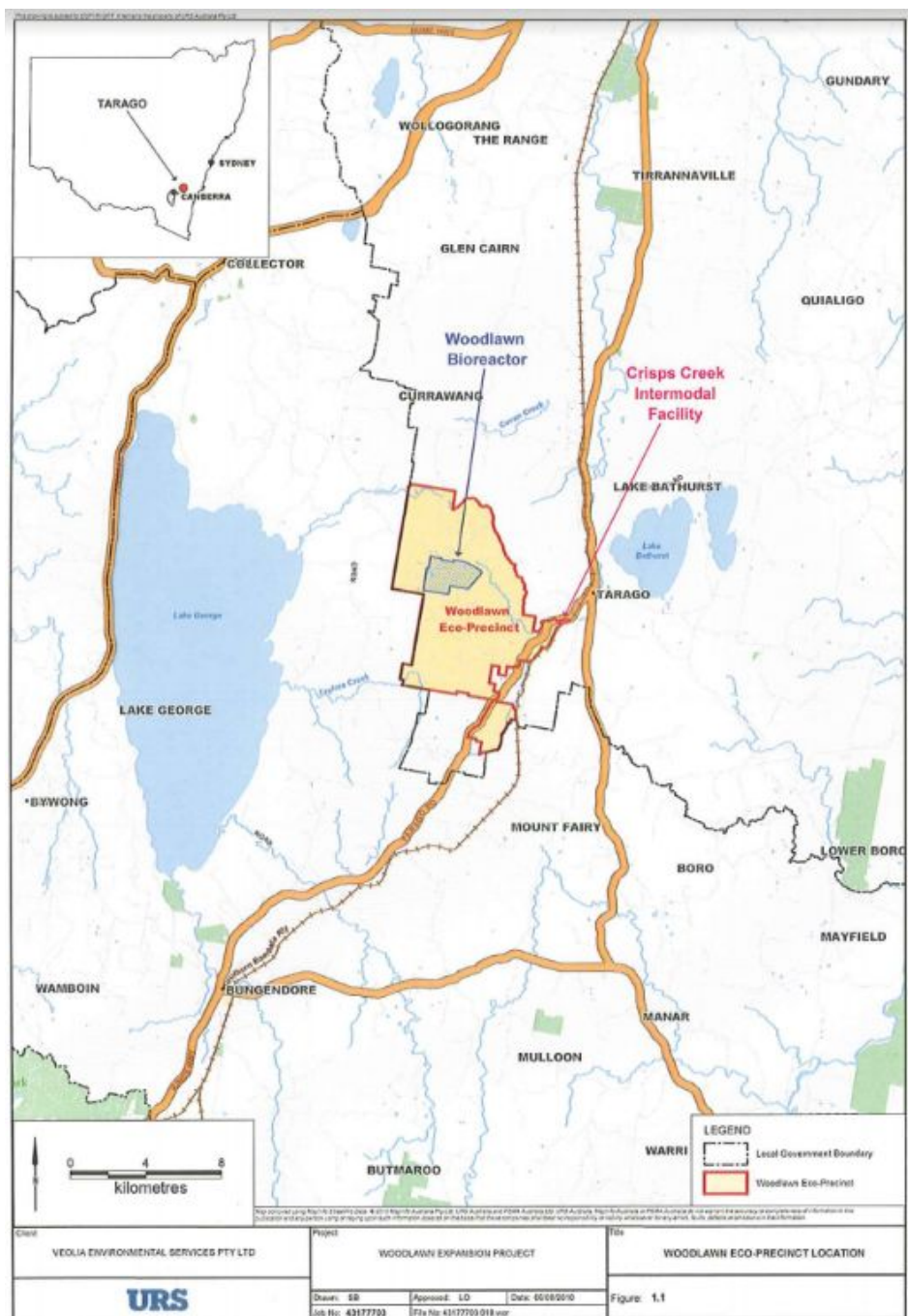
Item No.	Recommendation
1.	Veolia should continue the current community liaison program (including the Woodlawn Community Liaison Committee and the Tarago and District Progress Association Inc.) to notify affected/nearby residents of works and address concerns.
2.	Veolia should continue to improve landfill gas capture, management of fugitive emission and waste placement of the Bioreactor, including the continuous monitoring of performance. Re develop the Woodlawn infrastructure Plan for 2020.
3.	Continue to develop and optimise the operation of the Woodlawn Leachate Treatment plant, achieving consistent treatment target of 4l/sec.
4.	<p>Veolia to engage a suitably qualified person to revise the site water balance to provide a more accurate assessment of how the leachate / water management system is tracking against its key objectives given that many of the assumptions from the 2017 water balance have changed.</p> <p>Water Balance to encompass Heron Resources water management objectives and ensure that the updated water balance is more accurate and continues to monitor all leachate / water flows around the site. (ED1 evaporation, ED3N Lagoon system evaporation plan)</p>
5.	Review evaporation systems of ED1 mine legacy water and asses capabilities of the existing system and modify as required to meet the development consent requirements.
6.	Continue to seek measures that will reduce the volume of leachate produced including the containment of runoff from the existing void batters/benches.

# Reference and Related Documents

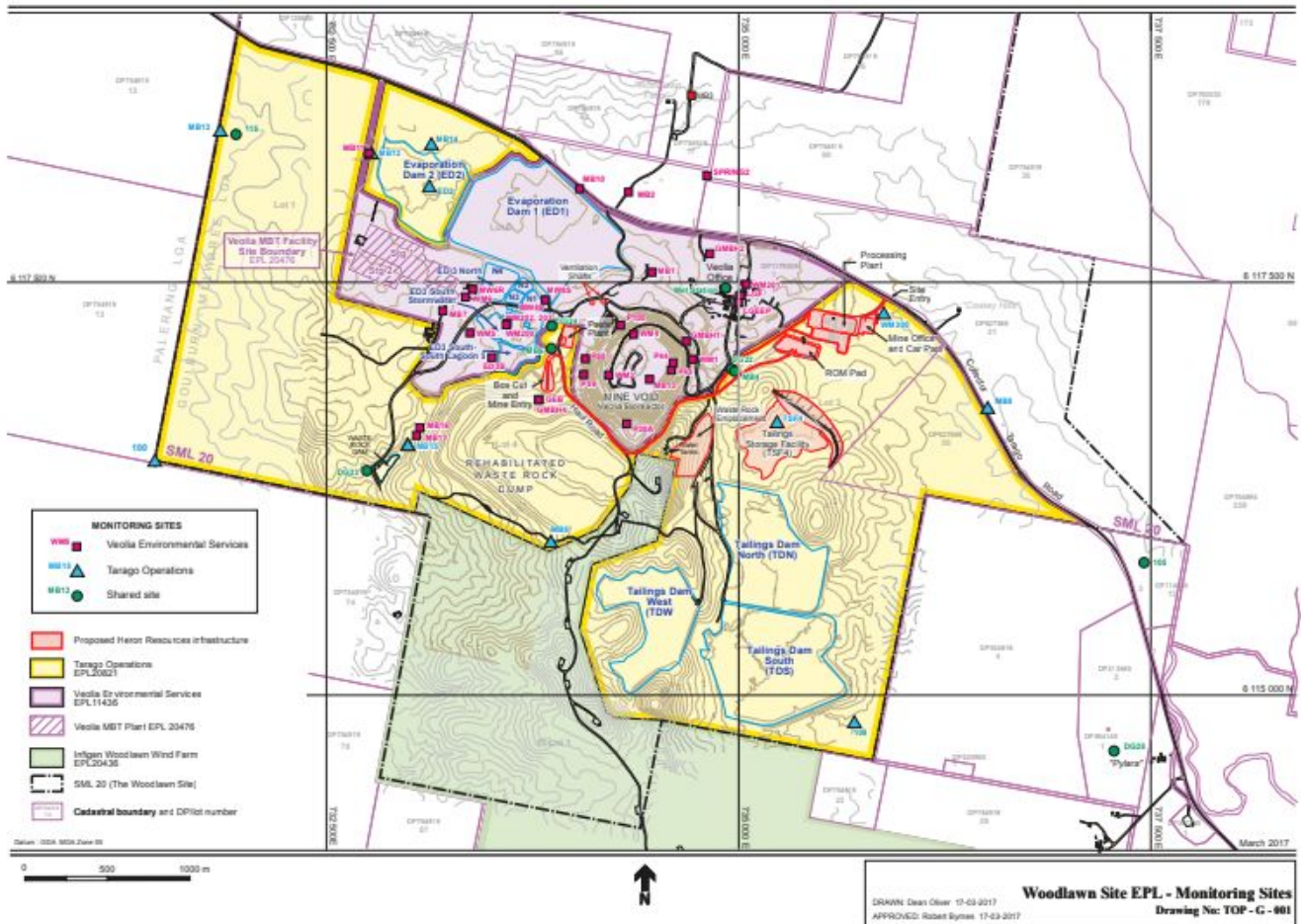
Document Name
<b>Earth2Water (2010)</b> EPL - Annual Assessment of Woodlawn Bioreactor and Intermodal Facility Monitoring Data, 30 November 2010
<b>Earth2Water (2010)</b> EPL - Annual Assessment of Woodlawn Bioreactor and Intermodal Facility Monitoring Data, 30 November 2010
<b>EPA (2016)</b> Environmental Guidelines: Solid Waste Landfills Second Edition, April 2016
<b>Veolia (2018)</b> Annual Environmental Monitoring Report – Woodlawn Bioreactor and Crisps Creek Intermodal Facility, November 2018

# Appendices

## Appendix 1 Site Location Plan

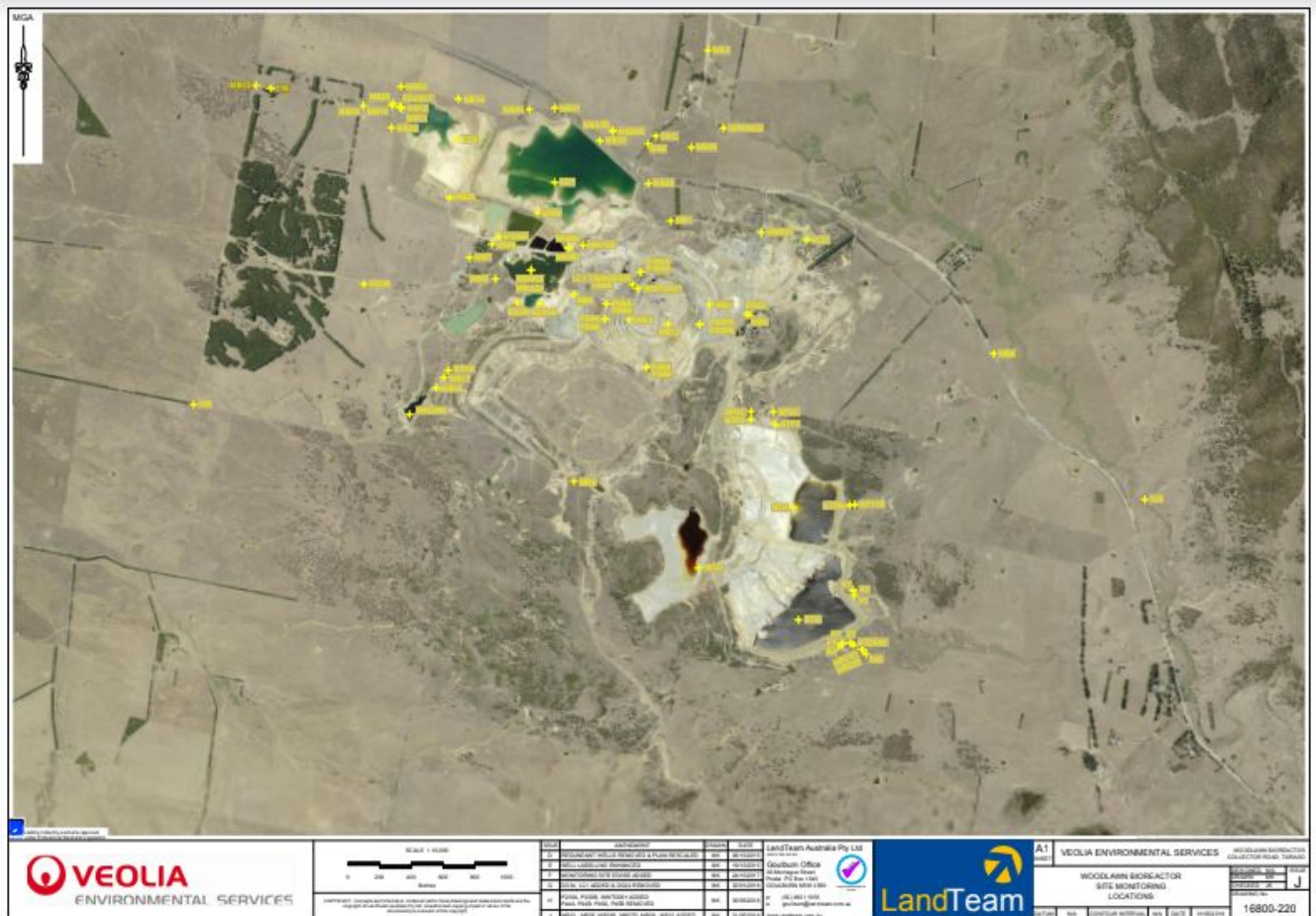


## Appendix 2 EPL Boundary





## Appendix 3 Monitoring Locations Plan



**Appendix 4 Tabulated Monitoring Results**

**Appendix 5 Monitoring Trend Graphs**

**Appendix 6 Leachate Treatment Plant Monthly  
Reports**