Veolia Australia & New Zealand

Woodlawn Bioreactor Expansion Project

Independent Odour Audit #9

August 2021

Final Report

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LIST OF ABBREVIATIONS & DEFINITION

AS/NZS 4323.3	Australian/New Zealand Standard 4323.3: 2001: *Determination of odour concentration by dynamic olfactometry*
AS/NZS 4323.4	Australian/New Zealand Standard 4323.4:2009. *Stationary source emissions - Area source sampling - Flux chamber technique.*
ATF	Alterative Treatment Facility
BOM	Bureau of Meteorology
BWMS	Bioreactor Waste Management System
C & D	construction & demolition
COD	Chemical oxygen demand
DEM-S	Derived Smoothed Digital Elevation Model
DPIE	Department of Planning, Industry and Environment
EA 2010	Environmental Assessment Woodlawn Expansion Report (August 2010)
ED1	Evaporation Dam 1
ED3N	Evaporation Dam 3 North
ED3S	Evaporation Dam 3 South
EPL	Environment Protection License
FAOA	field ambient odour assessment
HRT	hydraulic retention time
IAC	impact assessment criterion
IFH	Isolation Flux Hood
IMF	Crisps Creek Intermodal Facility
IOA	Independent Odour Audit
KOPs	knock-out pots
LMS	Leachate Management System

LOM	Liquid Odour Method
LTD	Leachate Treatment Dam
LTP	Leachate Treatment Plant
MBR	Membrane Bioreactor
MBT	Mechanical Biological Treatment
MLP	Measurement Location Point
mm	millimetres
MSW	municipal solid waste
MW	megawatts
MWOO	mixed waste organic material
NATA	National Association of Testing Authorities
NSW EPA	New South Wales Environment Protection Authority
OER	odour emission rate
PTFE	polytetrafluoroethylene
RH	relative humidity
RL	reduced level
SCADA	supervisory control and data acquisition
SOER	specific odour emission rate
Solid Waste Guidelines 2016	NSW EPA Environmental Guidelines: Solid Waste Landfills (2016)
SRTM	Shuttle Radar Topography Mission
the 2020 Emissions Testing Report	Emission Testing Report Veolia Environmental Services (Australia) Pty Ltd Woodlawn Biogas Power Station, Tarago: September 2020
the Audit	2020 Independent Odour Audit
the Biofilter Manual	*The Biofilter System Operating & Maintenance Manual – Revision 0* dated November 2016

the Biofilter Trial Report	Report for the biofiltration trial at Woodlawn Bioreactor dated March 2017
the **December 2020 ADC Report**	*Veolia Environmental Services (Australia) Pty Ltd - Alternative Daily Cover – Odour Trial Study: December 2020 – Final Report*, 16 December 2020
the LMS May 2016 Report	*Woodlawn Bioreactor Facility Odour Modelling Study - Proposed Addition of ED3S to Leachate Management System* dated May 2016 Report
the Previous Model	The original EA 2010 odour dispersion modelling study used in the *Odour and Dust Impact Assessment (Rev 5)* Report dated 2 August 2010
the Site	Woodlawn Bioreactor Facility, Collector Road, Tarago, NSW
TOU	The Odour Unit Pty Ltd
tpa	tonnes per annum
TWL	Top Water Level
US EPA	United States Environment Protection Agency
USGS	United States Geological Survey
VENM	Virgin Excavated Natural Material
Veolia	Veolia Australia & New Zealand
WALTER	Woodlawn Aerated Leachate Treated Effluent Refiner
WIP 2020	Woodlawn Infrastructure Plan – 13 October 2020

CHEMICAL NOMENCLATURE

CH_4	methane
CO_2	carbon dioxide
$Fe_2(SO_4)_3$	ferric sulphate
GIS	Geographic Information System
H_2S	hydrogen sulphide
H_2SO_4	sulphuric acid

N_2	nitrogen gas
NOx	nitrogen oxides
SO_3	sulphur trioxide

UNITS OF MEASUREMENTS

ha	hectare
km	kilometres
kW	kilowatts
L	litres
L/day	litres per day
L/min	litres per minute
L/s	litres per second
m	metres
m/s	metres per second
m^2	square metres
m^3	cubic metres
ou	odour concentration
$ou.m^3/m^2.s$	specific odour emission rate
$ou.m^3/s$	odour emission rate
ppm	parts per million, by volume

1 INTRODUCTION

In February 2021, Veolia Australia & New Zealand (**Veolia**) engaged The Odour Unit Pty Ltd (**TOU**) to carry out the ninth Independent Odour Audit (the **Audit**) of the Woodlawn Bioreactor Facility located at Collector Road, Tarago, NSW (the **Site**).

The specific scope of works for the Audit is detailed in *Condition 7* of *Schedule 4* in the *Specific Environmental Conditions - Landfill site* and enforced by *Section 75J* of the *Environmental Planning and Assessment Act 1979* as part of the project approval for the Woodlawn Waste Expansion Project.

1.1 WOODLAWN WASTE EXPANSION PROJECT BACKGROUND AND CONTEXT

In March 2010, Veolia issued an application to the Department of Planning & Infrastructure (**DPI**) seeking approval to increase the maximum throughput rate of the Woodlawn Bioreactor from 500,000 to 1.13 million tonnes per annum (**tpa**). Simultaneously, Veolia was also seeking to increase the maximum throughput rate of the nearby Crisps Creek Intermodal Facility (**IMF**) to 1.18 million tpa. In addition to these items, the proposal application entailed:

- Installing additional lighting at the Site;
- Extending the approved hours of operation at the Bioreactor and the IMF;
- Increasing the number of truck movements transporting waste to the Bioreactor from the IMF; and
- Increasing the amount of waste transported to the Site by road from regional councils from 50,000 to 130,000 tpa.

Veolia received approval for the Woodlawn Waste Expansion Project on 16 March 2012.

1.2 AUDIT OBJECTIVES

In accordance with the project approval requirements of *Condition 7* of *Schedule 4* in the *Specific Environmental Conditions - Landfill sites* (DA 10_0012), Veolia is required to carry out an independent odour audit three months from the date of project approval and annually thereafter, unless otherwise agreed by the Director-General. The Audit must:

a. *Consult with the Environment Protection Authority and the Department of Planning, Industry and Environment;*

b. *Audit the effectiveness of the odour controls on-site in regard to protecting receivers against offensive odour;*

c. *Review the Proponent's production data (that are relevant to the odour audit) and complaint records;*

d. *Review the relevant odour sections of the Air Quality and Greenhouse Gas Management Plan for the project and assess the effectiveness of the odour controls;*

e. *Measure all key odour sources on-site, including:*

   i. *consideration of wet weather conditions providing all raw data used in this analysis;*
   ii. *consideration of (but not limited to) all liquid storage area, active tipping faces, waste cover area, aged waste areas and recirculation of leachate into waste in the void; and*

   iii. *a comparison of the results of these measurements against the predictions in the Environment Assessment.*

f. *Determine whether the project is complying with the requirements in this approval to protect receivers against offensive odour;*

g. *Outline all reasonable and feasible measures (including cost/benefit analysis, if required) that may be required to improve odour control at the site; and*

h. *Recommend and prioritise (mandatory and non-mandatory) recommendations for their implementation.*

In addition to the above, *Condition 9* of *Schedule 5* under DA 10_0012 requires the Audit to "…*include consideration of the Crisps Creek IMF site in any Independent Odour Audit required by condition 7 in schedule 4*." This is included as part of the Audit.

This is the ninth Independent Odour Audit (**IOA**) commissioned since the Woodlawn Waste Expansion project approval was granted.

1.3 COMPLIANCE WITH AUDIT OBJECTIVES

The Audit consists of the following key items, as required by the project approval for the Site:

- **Fieldwork***:* the collection of odour samples from key sources (as per *Condition 7 (e)),* recording of relevant field observations, measurements, and discussions with Veolia Woodlawn staff regarding the operations of the Bioreactor and IMF. The odour emissions inventory developed in the previous IOAs was used by the audit team as a basis for the sampling program in the Audit;

- **Reviewing***:* a comprehensive review of all new relevant assessments undertaken and documentation since the 2019 IOA. In the Audit, this included a review of:

  - Landfill gas capture and trend since the previous audit;

- The status of the long-term leachate management solution via the construction and commissioning of a Leachate Treatment Plant (**LTP**);
- Leachate quality data;
- Record of received waste tonnage per month;
- Odour complaints register and responses by Veolia;
- Emission Testing Report Veolia Environmental Services (Australia) Pty Ltd Woodlawn Biogas Power Station, Tarago: September 2020 (**the 2020 Emissions Testing Report**);
- *The MBT Facility Biofilter System Operating & Maintenance Manual – Revision 0* dated November 2016 (the **Biofilter Manual**); and
- Waste Infrastructure Plan – 13 October 2020 (**WIP 2020**).

- **Modelling**: the undertaking of an update and re-run of the site-specific odour dispersion model study used as part of the project approval process; and
- **Reporting***:* a comprehensive summary of all aspects of the Audit, complying with the Audit objectives specified in **Section 1.2**.

The WIP 2020 and the Biofilter Manual are commercial-in-confidence documents that have been utilised by TOU under privilege to assist with the thorough undertaking of the Audit. All relevant information has been extracted and reproduced as required in the Audit report.

1.3.1 Consultation with DPIE and NSW EPA

As required in *Condition 7 (A)* of the project approval, TOU initiated a consultation process with both the New South Wales Environment Protection Authority (**NSW EPA**) and the Department of Planning, Industry and Environment (**DPIE**) on 17 February 2021 via email correspondence. A copy of the letter issued to the NSW EPA & DPIE, and related responses, are appended as **Appendix A**.

1.3.2 Additional Work to Audit requirements

In addition to the approval requirements, the following work components were included in the Audit:

- Assess the operability and odour performance of the biofilter-based odour control system at the Mechanical Biological Treatment (**MBT**) Facility, with the objective of continuous improvement in odour mitigation and optimisation;
- Completion of a field ambient odour assessment (**FAOA**) survey during the Odour Audit. The FAOA surveys were conducted before 0730 hrs and after 2100 hrs, as well as midday;

- Assessment of the odour potential for all the leachate evaporation dams, i.e. ED3N-2, ED3N-3, ED3N-4, ED3SS (also known as Lagoon 2 – 5), and ED1 Cofferdam;

- Collection of liquid samples of treated leachate stored in the evaporation lagoons for odour laboratory analysis, prepared using the Liquid Odour Method (**LOM**) as described in **Section 4.3**;

- Re-run of the site-specific odour dispersion model (as completed in the previous IOA) with the current factors and data. This includes the Woodlawn Bioreactor and MBT Facility; and

- Assess and comment on the effectiveness of strategies developed to optimise landfill gas extraction and leachate management to minimise the fugitive gas/odour emission as outlined in the WIP 2020.

The following report summarises the Audit carried out by the auditors at the Site.

2 THE SITE

2.1 WOODLAWN BIOREACTOR FACILITY BACKGROUND

The Site is located 250 km south of Sydney, within the 6,000 hectares (**ha**) Woodlawn Eco-Precinct, in the Southern Tablelands near Goulburn in New South Wales. An aerial view of the Site, highlighting the key areas as they currently stand, is shown in **Figure 2.1**.

Prior to waste operations, the Site operated as a base metals open-cut mine site during the 1970s and 1990s, processing copper, lead and zinc. Since September 2004, the mine void has been operated as an in-situ Bioreactor, historically receiving putrescible waste solely from the Sydney metropolitan area via the Clyde Transfer Terminal Facility. Since early 2012, receival of waste from local regional areas had commenced.

Waste received and contained within the Bioreactor undergoes anaerobic decomposition resulting in the production of landfill gas. The landfill gas, predominately rich in methane (**CH_4**) and carbon dioxide (**CO_2**), is continuously extracted from the Bioreactor and directly consumed via purpose-built landfill gas-fired engines that form the Site's power plant. Each landfill gas-fired engine can generate up to 1.065 Megawatts (**MW**) of 'green' electricity. All electricity generated is exported to the main grid. The Bioreactor process is described in further detail in **Section 2.2**.

Aside from generating electricity from waste at the Site, Veolia is also undertaking mine rehabilitation works and has established aquaculture and horticulture projects within the Eco-Precinct. In early-October 2018, Veolia had also commenced operation of its long-term leachate management solution via the commissioning and optimisation of the LTP at the Site, which falls under a separate development consent and environment protection licence (**EPL**), but at the time of the Audit continues to be in the process-proving stage. The Audit has provided commentary on the implication of the LTP in the context of leachate management and odour emissions (see **Section 2.4.6** & **Section 8.2.1.1**). The existing leachate treatment dam (**LTD**) is still operating at capacity and servicing the Bioreactor operations at the Site.

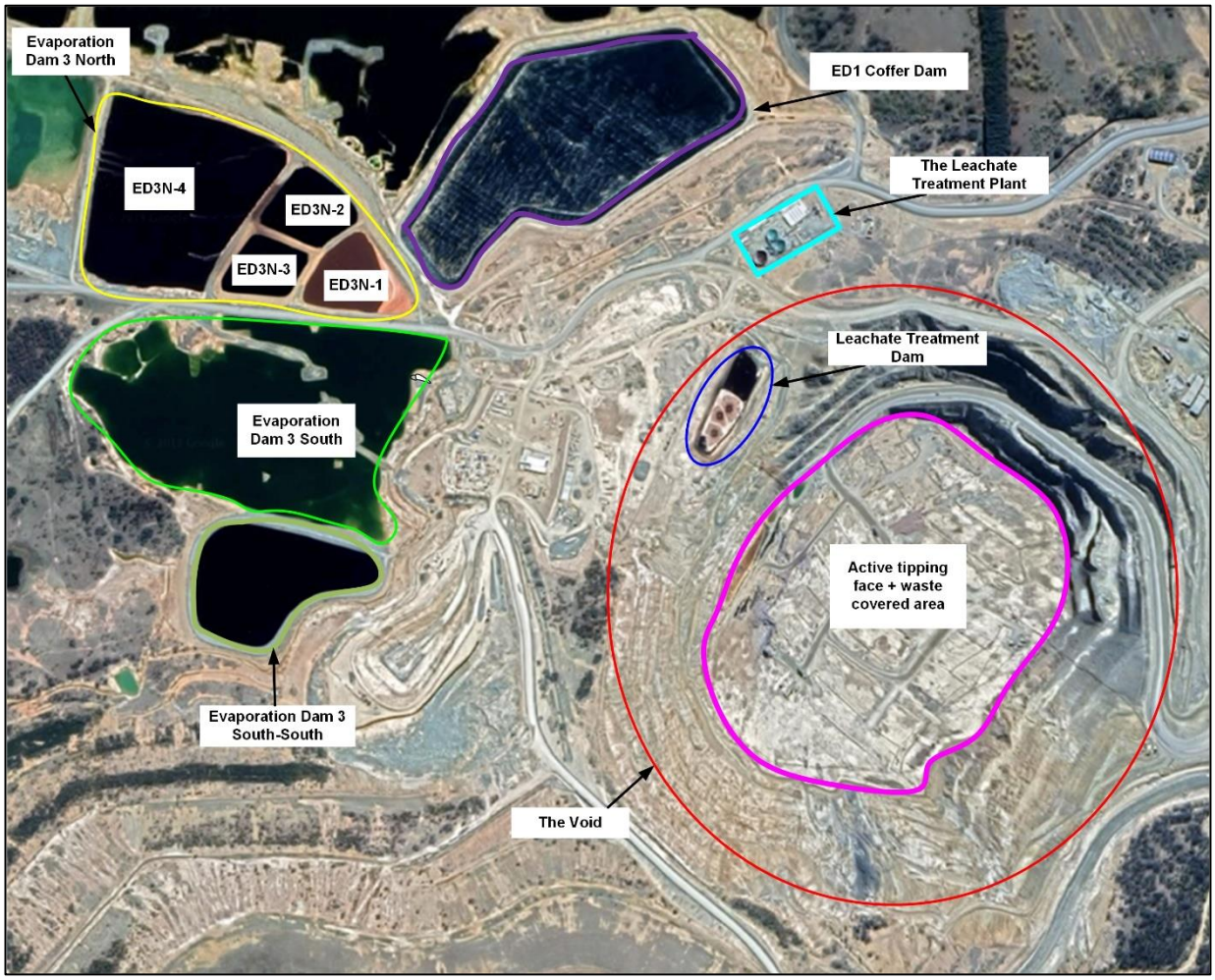


Figure 2.1 – An aerial view illustrating the layout of the Site as of the Audit (Map source: Google Earth ®)

2.2 PROCESS OVERVIEW

The Site has the approval to operate between 0600 hrs to 2200 hrs on Mondays to Saturdays, with no activities on Sundays, Good Friday, or Christmas Day. For the Audit, the operational processes at the Site have been categorised under two primary management systems, namely:

1. The Bioreactor Waste Management System (**BWMS**); and

2. The Leachate Management System (**LMS**).

The above management systems are described in a concise detail in **Section 2.3** & **Section 2.4**, respectively. Further details regarding these systems are contained in the *Environmental Assessment Woodlawn Expansion Report* dated August 2010 (**EA 2010**).

2.3 BIOREACTOR WASTE MANAGEMENT SYSTEM

At first glance, the Bioreactor surface layout appears to be a simple landfilling operation, consisting of the following:

- An active tipping face;
- Waste covered areas, including daily cover, intermediate cover, and biocover;
- A mobile tipping platform;
- Leachate extraction, transfer, and re-injection via the LMS. The re-injection feature of the LMS is very rarely used, but the extraction and transfer are actively utilised (see **Section 2.3.2**);
- Stormwater management; and
- A gas extraction system.

On closer inspection, however, there are complex procedures for the effective operation of the Bioreactor. A consequence of these procedures is a constantly evolving and dynamic site layout that varies temporally, spatially, and operationally. The key operations of the Bioreactor comprise of, but are not limited to:

- the requirement of covering areas of waste;
- the timing and necessary provisions for a given waste lift;
- the landfill gas collection system, including:
    - the strategic placement and maintenance of the vertical landfill gas extraction wells gridded system;
    - landfill gas collection pipe network;
    - condensate management and the leachate removal system; and
    - individual gas wells in the waste to manage high-risk areas prone to the release of fugitive landfill gas emissions from the surface of the Void;
- setup of the leachate extraction and recirculation system;
- stormwater management in the Void, including catchment management and stormwater captured within the Void perimeter; and
- application of biocover material to manage fugitive landfill gas emissions, as outlined in the WIP 2020 (refer to **Section 10.2.1** for further details).

The Void layout and operations prevalent at the time of the Audit are shown in **Figure 2.2**.

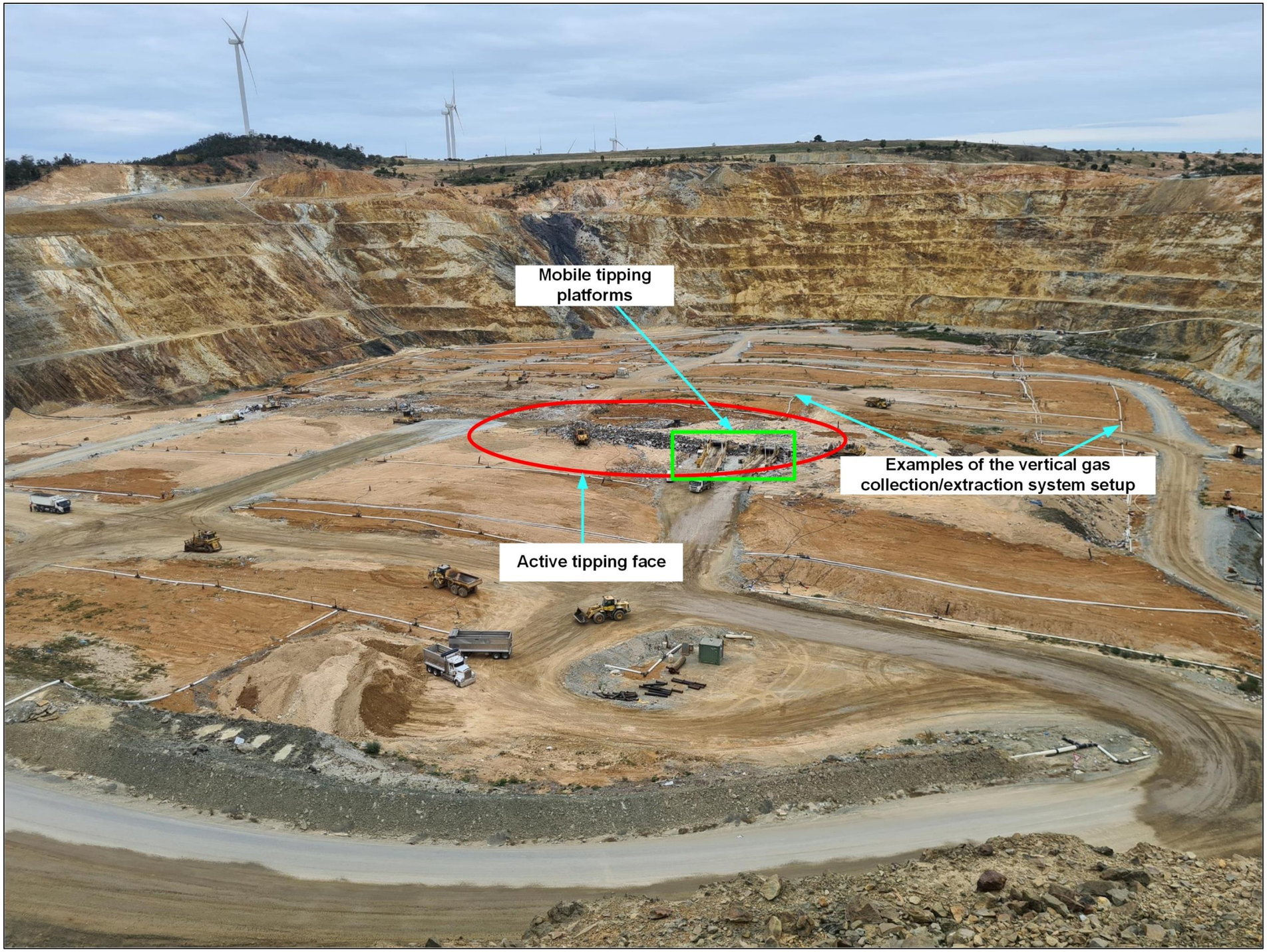


Figure 2.2 – Void layout and operations: 8 March 2021

2.3.1 Current procedure for operating the Bioreactor

The current procedure for operating the Bioreactor consists of the receival of putrescible waste transported to Woodlawn by rail from Sydney, after being containerised at one of the Veolia-operated transfer terminal facilities located at Clyde and Banksmeadow. The fully sealed containerised waste is received at the IMF and transported by a series of trucks to the Bioreactor, where waste is unloaded via a mobile tipping platform and subsequently transported by a dozer prior to compaction at the active tipping face area (as highlighted in **Figure 2.2**). The active tipping face area is progressively covered daily. As advised by Veolia in previous audits, covering the active tipping face is an on-going operational process, although the daily active tipping area will vary depending on positioning in the Void, gas infrastructure and weather conditions. It was evident in the Audit that the size of the active tipping face is still well below the area size specified in the EA 2010 (further discussed in **Section 8.2.1.6**).

When required, it is understood by the Audit that the tipping process is supplemented by hydrogen sulphide (**H_2S**) emission control measures, including:

- Capture and combustion of landfill gas;
- Potential to add metal oxide (haematite and/or magnetite) to the waste; and
- The addition of biocover material to the surface.

The current procedure for operating the Bioreactor significantly restricts leachate recirculation due to its previously documented impact on landfill gas extraction through leachate pooling effects within the waste mass of the Bioreactor.

2.3.2 Leachate extraction and transfer via the LMS

In the context of the Bioreactor operations, the LMS comprises of three major aspects:

1. Leachate extraction and transfer, including extraction pumps, ring main and tank transfer system, all of which are located within the Void. Leachate re-injection (or recirculation) is a back-up option for leachate transfer within the Void;
2. Leachate treatment via the LTD and LTP (refer to **Section 2.4.5** and **Section 2.4.6**, respectively); and
3. Treated leachate management via evaporation, which is discussed in **Section 2.4.1** to **Section 2.4.4**.

The Audit notes that if and when leachate recirculation is utilised within the Void, this is completed via a direct method into dedicated reinjection wells. This has the effect of minimising the exposure of leachate partitioning from the liquid phase to the gas phase through aerosol generation and/or evaporation pathways, which can subsequently lead to the generation of odorous emissions. As the leachate percolates through the upper layers of waste, a proportion of the liquid is retained in the upper layers of waste. Veolia had previously utilised covered reinjection trenches as part of the leachate recirculation process; however, this is understood to remain discontinued as part of the normal operations of the Bioreactor.

As of the Audit, and based on the WIP 2020, the use of leachate recirculation is no longer needed for maintaining effective steady-state operations within the waste mass of the Bioreactor. It is only used or required during exceptional circumstances. As such, there is only one reinjection infrastructure being kept as a contingency leachate management method when the leachate transfer system experiences any failure or requires maintenance. The re-injection point is currently located in the eastern wall of the void, with a 110 mm high-density polyethylene pipe placed into the waste during the previous three lifts. The re-injection point is connected to the ring main and normally in the closed position. In the circumstance of leachate transfer system failure or any downtime due to maintenance schedule, e.g. pump failure or pipe damage, the valve between the re-injection point and the ring main will be opened to allow the extracted leachate to be re-injected to the waste. The re-injection will be stopped once the leachate transfer system is back to normal operation.

2.3.3 Landfill gas extraction

The landfill gas collection system is constantly expanded to promote better gas capture as waste filling progresses around the Void. The operational management and instalment of landfill gas extraction infrastructure in the Void are extensively described in the WIP 2020, as well as previous Woodlawn Infrastructure Plans reviewed by the audit team. The configuration during placement of waste on the surface of the Void and a waste lift is designed to ensure streamlined gas (and leachate) extraction. All extracted landfill gas is directed to the on-site power station, with moisture removal undertaken via a series of single or double knock-out pots (referred to as **KOPs** in the WIP 2020) along the landfill gas flow lines and the main header line.

2.4 LEACHATE MANAGEMENT SYSTEM

The key features of the LMS include:

- Evaporation Dam 3 North (**ED3N**), also known as evaporation lagoon 1-4;
- Evaporation Dam 3 South-South (**ED3S-S**), also known as evaporation lagoon 5;
- LTD; and
- The LTP.

Each of these listed features is described in **Section 2.4.2** to **Section 2.4.5**, respectively. Further details regarding the LMS have been previously documented and can be found in *Chapter 8* of the *EA 2010*, with updated features documented in the WIP 2020.

2.4.1 Volume reduction of treated leachate

It is a condition of the Site's EPL that no leachate (treated or untreated) can be directly discharged from the Site. The only means of volume reduction is through mechanical and/or natural evaporation processes. The details about the mechanical evaporation process of treated leachate are discussed in **Section 2.4.2.1**.

2.4.2 Evaporation Dam 3 North (ED3N)

ED3N pond system covers a total surface area of 6.1 hectares (**ha**), at top water level (**TWL**), and is divided into four (4) discrete lagoons, namely:

1. **ED3N–1:** receives treated leachate from the leachate treatment dam. The pond was empty at the time of the Audit;

2. **ED3N–2***:* receives treated leachate from the LTD. The pond surface area, as of the Audit, is approximately 0.61 ha. This is equivalent to approximately 53% of the volume storage capacity;

3. **ED3N–3**: receives treated leachate from the LTD. The pond surface area, as of the Audit, is approximately 0.62 ha. This is equivalent to approximately 90% of the volume storage capacity; and

4. **ED3N–4**: receives treated leachate from the LTD. The pond surface area, as of the Audit, is approximately 3.66 ha, equivalent to approximately 70% of the volume storage capacity. There are up to five mechanical evaporators available that draw treated leachate from ED3N-4 to promote evaporation as a means of volume reduction. Further details on the mechanical evaporation process at the Site are described in **Section 2.4.2.1.**

Note: The surface areas and volumes of ED3N were as of March 2021 and provided by Veolia. At least 0.5 metres (**m**) freeboard is always maintained in the ED3N pond system.

2.4.2.1 ED3N - Mechanical evaporation system

2.4.2.1.1 System A

A mechanical evaporation system at the Site is currently active to manage the growing need for volume reduction in the ponds to retrieve storage capacity. The mechanical evaporation system is described and operated as per the WIP 2020. For ED3N-4, the mechanical evaporation system at the Site consists of four (4) Turbomist ® evaporation units, driven by a common pump system. It is understood that the actual operating performance of the evaporation units is approximately 840-900 L/min. This evaporation mechanism is known as System A, as shown in **Figure 2.3**.

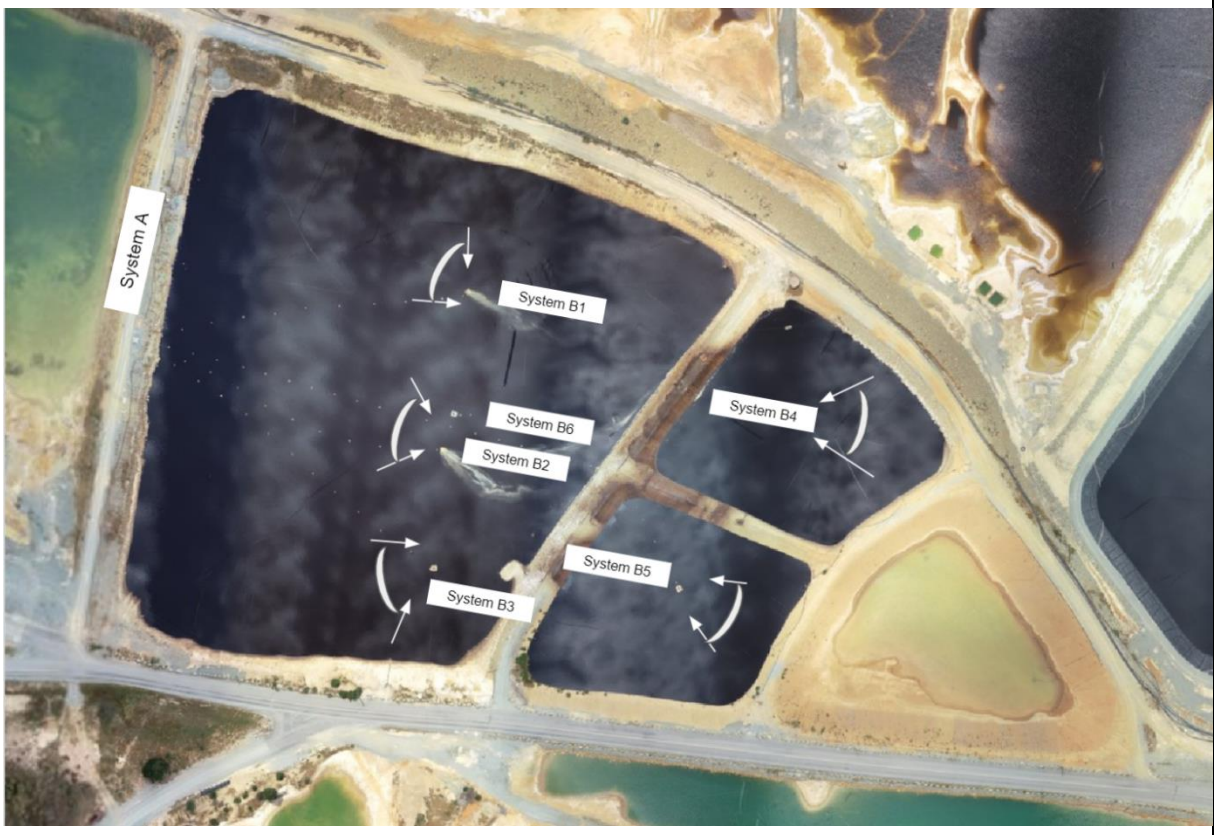


Figure 2.3 – The mechanical evaporation system layout for ED3N (**Source:** WIP 2020)

2.4.2.1.2 System B

System B, which is a surface spray evaporator system, is composed of six (6) sprays (one in each of ED3N2 and ED3N3, and four in ED3N4) floating in the middle of the dams and controlled by a weather station on the western bank of ED3N4. At the time of the Audit, ED3N-1 was empty and therefore did not have an active surface spray evaporation system. The operation of System B is in accordance with the feedback provided from the weather station, including temperature, humidity, wind direction and wind speed. Each of the sprayers is controlled independently, with setpoints based on weather conditions. As shown in **Figure 2.3**, the nominal location of each surface spray evaporator and the operating wind direction range is presented as arrows, with the span range visually illustrated. As documented in the WIP 2020, System B is still under an active trial period, and the setpoints are being tested to ensure the spray mist will not drift out of the dam area. As the humidity and temperature conditions vary across the seasonal cycles, the setpoint for wind speed is modified accordingly. The operation and effectiveness of System B are regularly reviewed by the Site, and setpoints are optimised as required. A photo showing the operation of the surface spray evaporator system is shown in **Figure 2.4**.

Figure 2.4 – Operation of System A and System B at the Site (**Source:** WIP 2020)

2.4.2.1.3 Middle Bank Evaporation System

Since the last IOA, another evaporation system has been installed in the ED3N area, located in the middle bank, as shown in **Photo 2.1** and **Figure 2.5**. An electric pump is set up and moved between ED3N2 and ED3N4, discharging into the spray system on the middle bank of the ponds. As the spray is at a modest distance from the external boundary of the ED3N area and the injection spray height is low, this system has the capacity to operate under most weather conditions. It is only turned on manually, weather dependent. During active operation, this spray system is controlled by a timer that operates based on seasonal conditions.

Photo 2.1 - A view of the ED3N middle bank spray evaporation system: 8 March 2021

Figure 2.5 – The ED3N middle bank spray evaporation system (**Source**: WIP 2020)

2.4.3 Evaporation Dam 3 South-South (ED3S-S)

ED3S-S receives treated leachate from the LTD. The pond surface area at TWL is 2.2 ha. At the time of the Audit, ED3S-S was at approximately 82% volume storage capacity, equivalent to a water surface area of approximately 2.0 ha. A photo of ED3S-S, as occurred during the Audit, is shown in **Photo 2.2**.

Note: The surface area and volume of ED3S-S were as of March 2021 and provided by Veolia.

2.4.3.1 Mechanical Evaporation System

A ring main evaporation system is installed away from the bank of ED3S-S. A total of four spray bars, each bar with 5-6 nozzles, are installed at the north, west, south, and east of ED3S-S, respectively, approximately 2 m away from the bank. The spray nozzles are controlled by an in-situ weather station and operate only when the wind is blowing from a certain direction, i.e. behind the bank into the dam. In addition to the ring main evaporation system, ED3S-S has three floating surface spray evaporators, similar to that described in **Section 2.4.2.1.2**. The operation of the surface spray evaporators occurs only during the daytime on weekdays and based on weather conditions.

Photo 2.2 – ED3S-S: 9 March 2021

2.4.4 Evaporation Dam 1 Coffer Dam

The Evaporation Dam 1 (**ED1**) coffer dam stores treated effluent from the LTP. The TWL of the ED1 coffer dam is approximately 6.4 ha. At the time of the Audit, ED1 Coffer Dam was at approximately 70% volume storage capacity, equivalent to a water surface area of approximately 5.98 ha

2.4.4.1 Mechanical Evaporation System

A similar ring main evaporation system to that installed in ED3SS (refer to **Section 2.4.3.1**) is being installed to ED1 coffer dam. Due to the shape configuration of ED1 coffer dam, there are five (5) spray stations proposed, as shown in **Figure 2.6**. The spray system works on the discharge pump from LTP, so the spray system will activate when LTP is discharging.

2.4.4.2 Contingency Storage Capacity

As previously mentioned, effluent from the LTP is transferred to ED1 coffer dam for storage and evaporation. ED1 coffer dam needs to maintain a minimum freeboard of 0.5 m. As outlined in the WIP 2020, a new dam for LTP effluent is intended to be constructed once ED1 coffer dam reaches 80% of the volume storage capacity.

Figure 2.6 – ED1 Coffer Dam: Proposed Evaporation Spray System (**Source**: WIP 2020)

2.4.5 Leachate Treatment Dam

The LTD is in the upper north-western edge of the Void and is an integral part of the LMS at the Site. Leachate from the Void is pumped directly to the LTD as required. Since the 2012 IOA, the LTD was upgraded from a batch-based wastewater treatment system to a continuous configuration. The upgraded system was commissioned in April 2013. Following this upgrade, the LTD process was modified since the previous audit to consist of anoxic and aeration zones to increase the efficiency of the leachate treatment process. **Photo 2.3** shows the LTD as occurred during the Audit, and **Figure 2.7** illustrates the current continuous treatment configuration for the LTD.

Photo 2.3 – A view of the LTD: 9 March 2021

The LTD has a hydraulic retention time (**HRT**) of 33 days (dependent on treatment flow) and is capable of the continuous treatment of approximately 259,000 – 346,000 litres per day (**L/day**) of untreated leachate, equivalent to a current maximum treatment capacity of 3-4 L/s. The raw leachate is pumped from the Void and discharged into the anoxic zone of the LTD for denitrification. Following treatment in the anoxic zone, the leachate migrates to the aeration zone to promote mixing, oxygen transfer and nitrification. The effluent from the aeration zone of the LTD is dosed in-situ with ferric sulphate (**$Fe_2(SO_4)_3$**) and a polymer to facilitate coagulation and flocculation processes before passing through a settling tank known as the Woodlawn Aerated Leachate Treated Effluent Refiner (**WALTER**). Under this treatment configuration, the LTD requires desludging at a frequency that is determined by Veolia experts. The sludge from the settling tank is returned to the LTD as required. Any sludge from the desludging process (and any excess sludge that may be generated) is transported and returned to

the waste in the Void where it is buried and covered. A process flow schematic is shown in **Figure 2.7**.

2.4.6 Leachate Treatment Plant

As previously mentioned in **Section 2.1**, the Site has constructed and commissioned the LTP as the long-term leachate management strategy, which is currently undergoing process-proving. As indicated in the WIP 2020, the LTP is in the process proving stage which includes, but is not limited to, biomass growth, biological process tuning and process optimisation. The LTP is located on the northern side of the Void, between the Bioreactor and Evaporation Dam 1 (as shown in **Figure 2.1**), and consists of a membrane bioreactor (**MBR**) treatment system with a design capacity of approximately 4 L/s. The MBR system has been designed as a modified activated sludge biological process to treat the main parameters found in the raw leachate extracted from bioreactor to a higher quality effluent. The LTD and LTP are currently operated simultaneously at the Site, providing an improvement in leachate management and treatment capacities from the Void.

A process flow schematic of the LTP is provided in **Figure 2.8,** with a flow schematic of the upgraded leachate management system at the Site shown in **Figure 2.9**. The key treatment process stages of the LTP includes:

1. A primary treatment stage, including screening to remove gross solids, large materials, and other pollutants;
2. A balance tank to regulate treatment flow;
3. Anoxic Tanks;
4. Aeration Tanks; and
5. An ultrafiltration membrane system.

The product of the process stages above is a high-quality effluent that will be stored in the ED1 coffer dam. Given that the LTP is in the process proving stage, the preliminary critical control points and critical limits are continuously monitored with alarms and automatic shutdown using a dedicated Supervisory Control and Data Acquisition (**SCADA**) controls system if critical limits are reached. A view of the LTP is shown in **Photo 2.4**. A process flow schematic and diagram of the LTP is shown in **Figure 2.8** and **Figure 2.9**.

Overall, from an odour emissions viewpoint, the Audit has obtained leachate treatment data of the effluent from the LTP and can comment that it is of a quality that will contribute negligible levels of odour. At the time of the Audit visit, ED1 coffer dam was at approximately 70% volume storage capacity, as shown in **Photo 2.5**. Due to on-going safety concerns with access, the area source sampling of this dam continues to be not possible during the Audit. Instead, the collection of liquid samples from ED1 coffer dam was possible (refer to **Table 6.5** for further details) to assess its odour release potential under evaporated conditions. An overview of the LTP flow concept is shown in **Figure 2.10**.

Photo 2.4 – A view of the LTP: 9 March 2021

Photo 2.5 – ED1 Coffer Dam: 9 March 2021

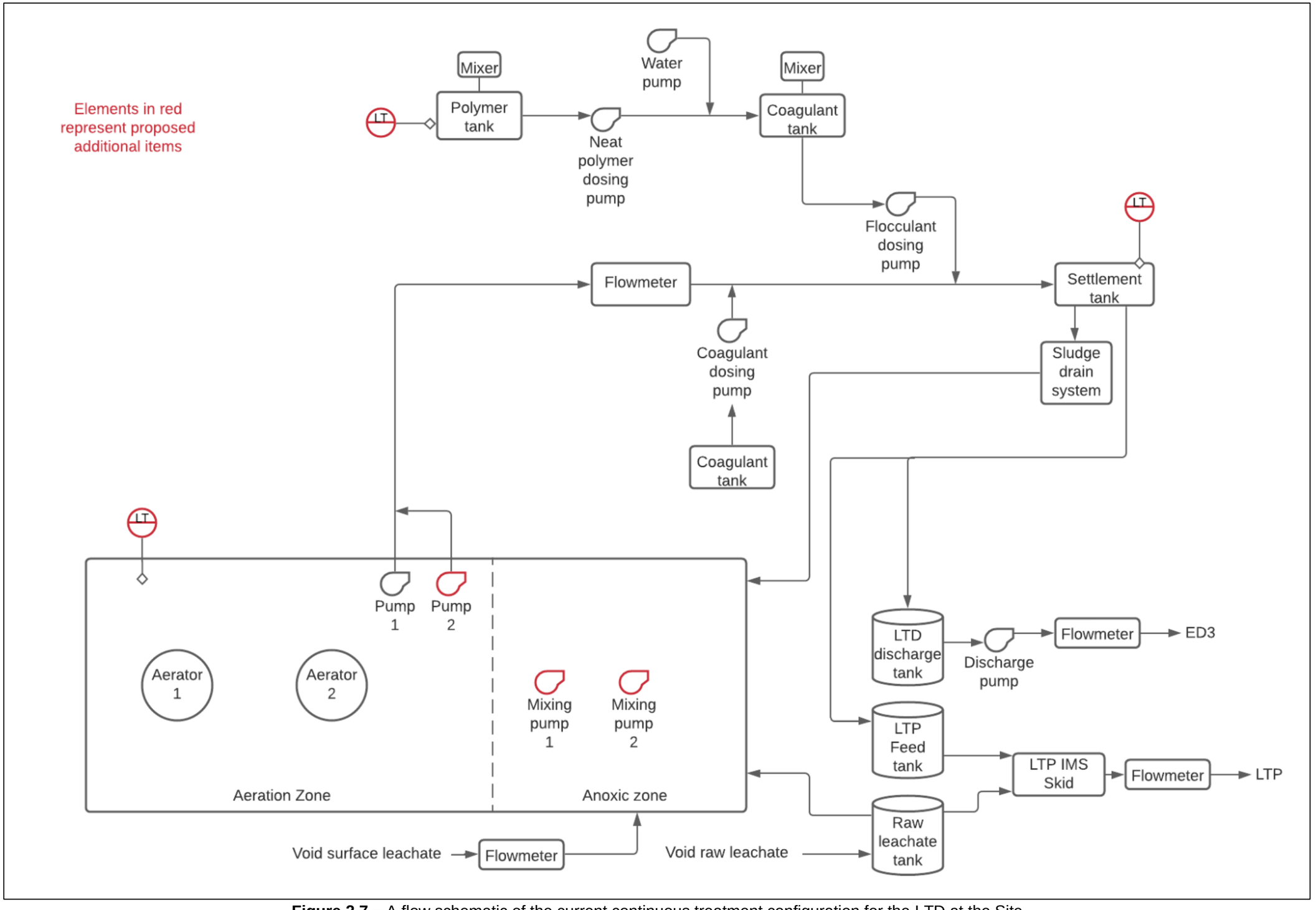


Figure 2.7 – A flow schematic of the current continuous treatment configuration for the LTD at the Site

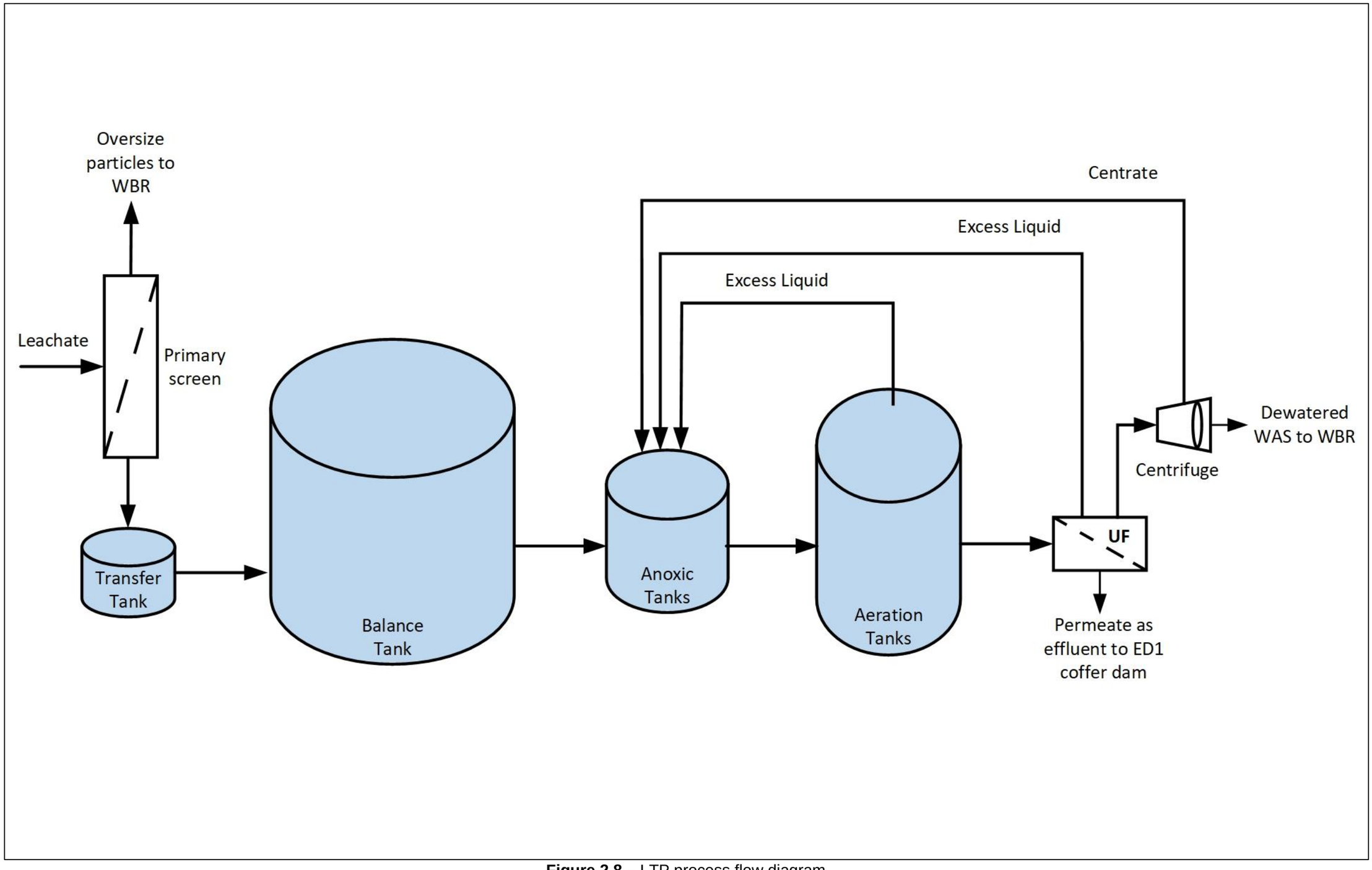


Figure 2.8 – LTP process flow diagram

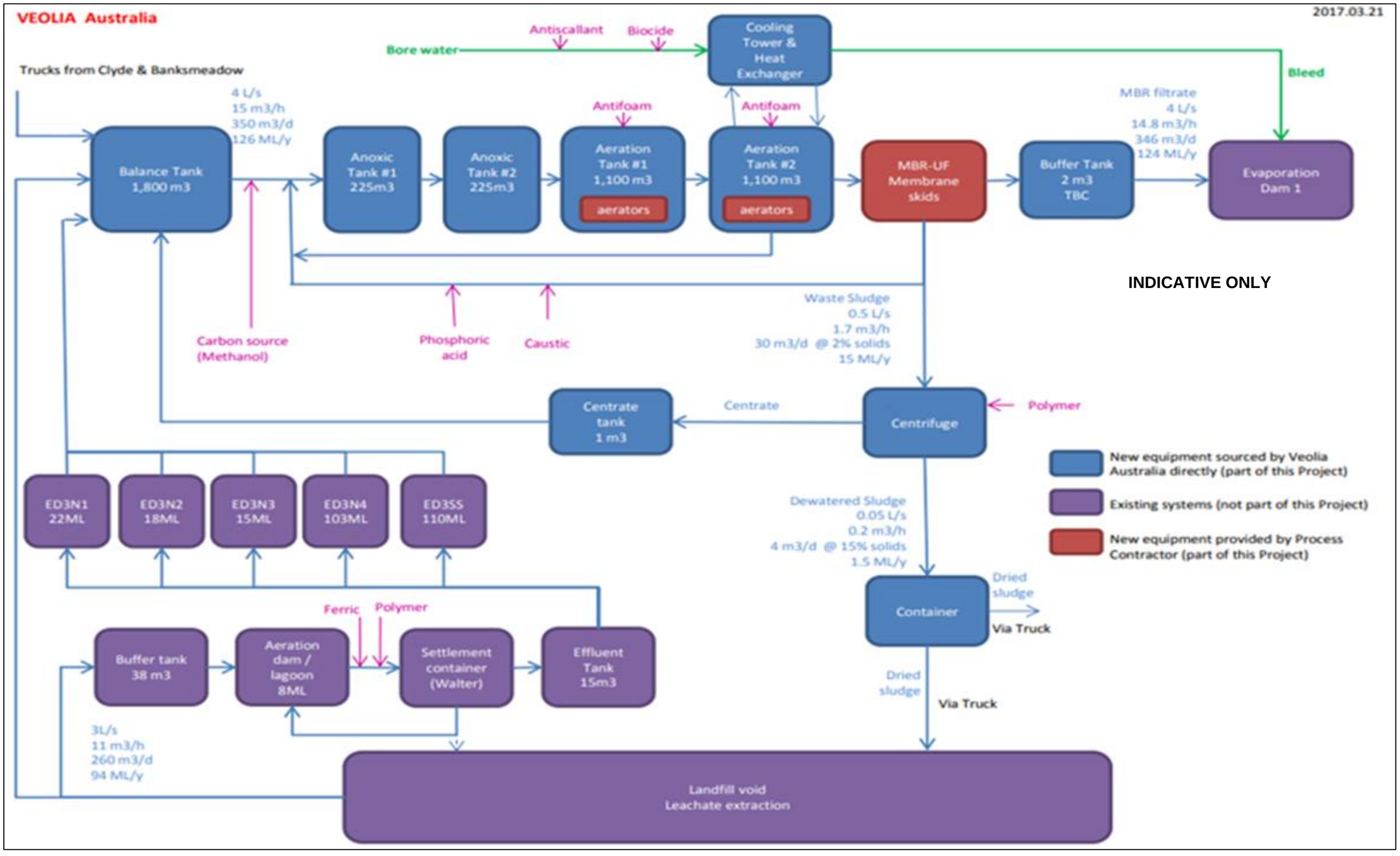


Figure 2.9 – A flow schematic of the upgraded leachate management system at the Site (**Source:** Previous IOA)

Figure 2.10 - Concept layout of the LMS for the Bioreactor (**Source:** WIP 2020)

2.5 STORMWATER MANAGEMENT

2.5.1 ED3S Stormwater

ED3S continues to receive stormwater runoff which is managed as acid mine drainage. At TWL, the pond surface area is 8.94 ha. At the time of the Audit, the pond surface area was approximately 7.15 ha.

2.5.2 Stormwater Infrastructure in the Void

During stormwater events, all stormwater pumps operate to ensure stormwater water is transferred to ED3S. According to the WIP 2020, the Void has been divided into multiple sub-catchment areas, as shown in **Figure 2.11**. Each sub-catchment has either natural or engineered drainage and flow control infrastructure, such as concrete dish drains, clay berms, pumps, and pipes to manage stormwater captured in the area. These systems minimise the amount of stormwater flow from the Bioreactor walls onto the waste surface of the Void and, in turn, the potential generation of excess leachate from stormwater flows. At the current stage, as shown in **Figure 2.12**, the stormwater management system is composed of seven (7) on-duty pumps and seven (7) buffer ponds, as well as the related water drain, diversion, and delivery pipework system.

2.5.2.1 Management of contaminated surface water

Surface water collected on the covered landfill surface is drained to temporary storage ponds and is transferred to Pond 5. Where it is suspected that leachate may have contaminated surface water, a sample is collected for testing of ammonia (a key indicator for contamination) to demonstrate that the water quality is suitable for discharge to ED3S. If it is found that the surface water has encountered waste or leachate, the water will be managed as leachate through the established treatment pathways of the LMS.

2.5.2.2 Management of high rainfall events

Any stormwater into the Void, especially the portion that directly falls on the waste surface of the Void and the run-off from the upper benches, is one major source of excess leachate generation. As documented in the WIP 2020, it is indicated that leachate generation is very sensitive to high rainfall events due to the large, increasing catchment area and partial stormwater interception (the implication of this is discussed in **Section 8.2.1.10**).

During high rainfall events, large volumes of rainwater fall onto the waste surface. Currently, stormwater is not 100% intercepted from the surface of the waste before becoming contaminated. Following high rainfall events, the leachate extraction system prioritises the extraction of surface water over leachate collected from the sub-surface (i.e. within the Bioreactor). As leachate extraction rate is limited to up to 4 L/s at the LTP, owing to the leachate treatment system capacity, these rainfall events result in further accumulation of leachate in the Bioreactor, potential reducing the efficiency of the landfill gas capture infrastructure and management of fugitive landfill gas emissions from the Void. Given this treatment capacity, if a suitable monitoring and performance metric protocol is established, the capability of diverting diluted contaminated stormwater to one of the evaporation dams (i.e. ED3S and ED3N) will present an opportunity to mitigate the adverse impacts associated with high rainfall events on the

landfill gas capture infrastructure and provide an improved odour outcome for the Site under such circumstances.

Given the importance of the management of high rainfall events in the Void, the WIP 2020 indicates that continuous improvement of the stormwater management system is actively being undertaken as part of operational excellence and optimisation. This will continue to remain an integral part of managing the Void and addressed in the annual IOAs.

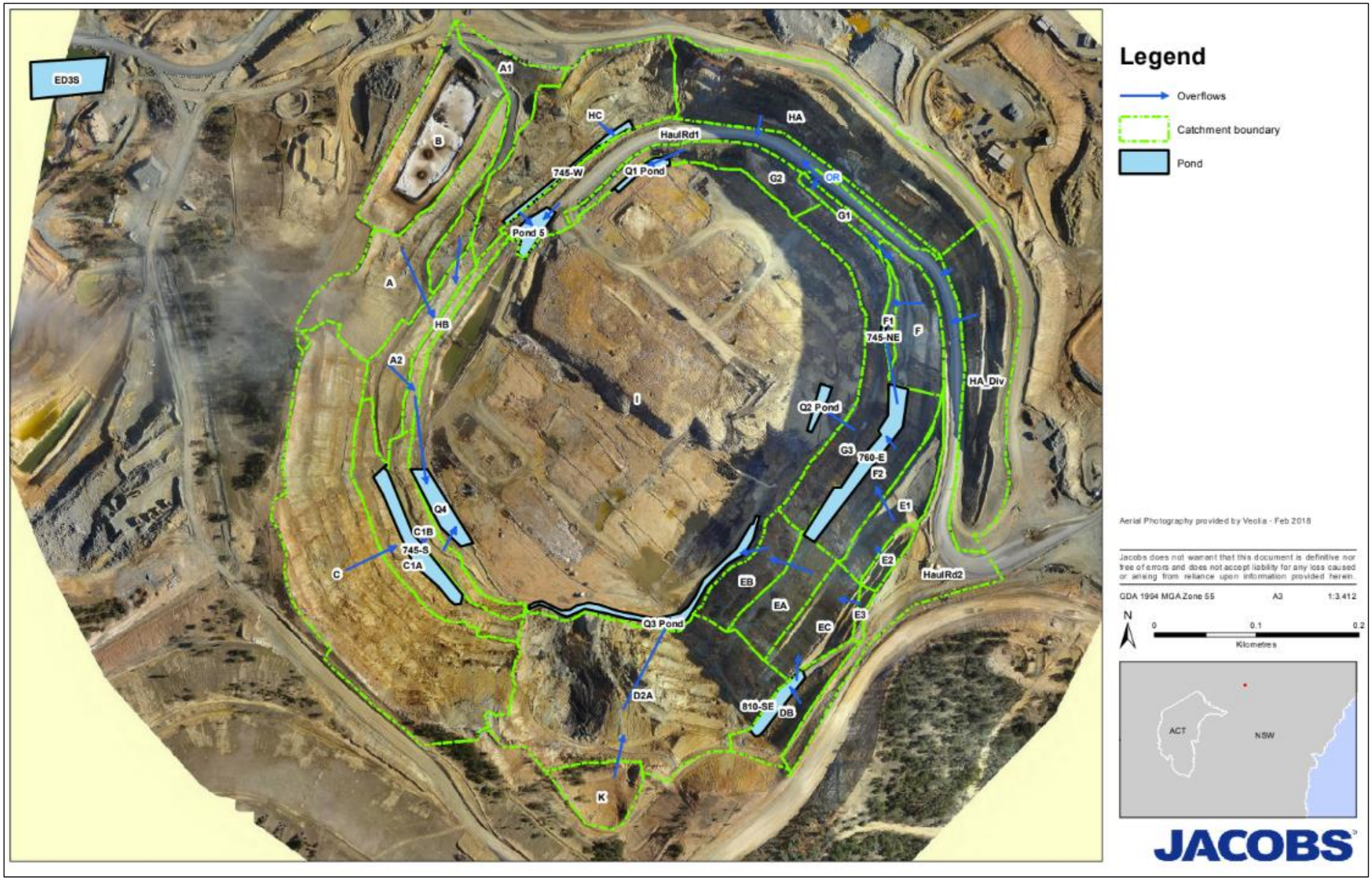


Figure 2.11 – Surface water management strategy in the Void as outlined in the WIP 2020

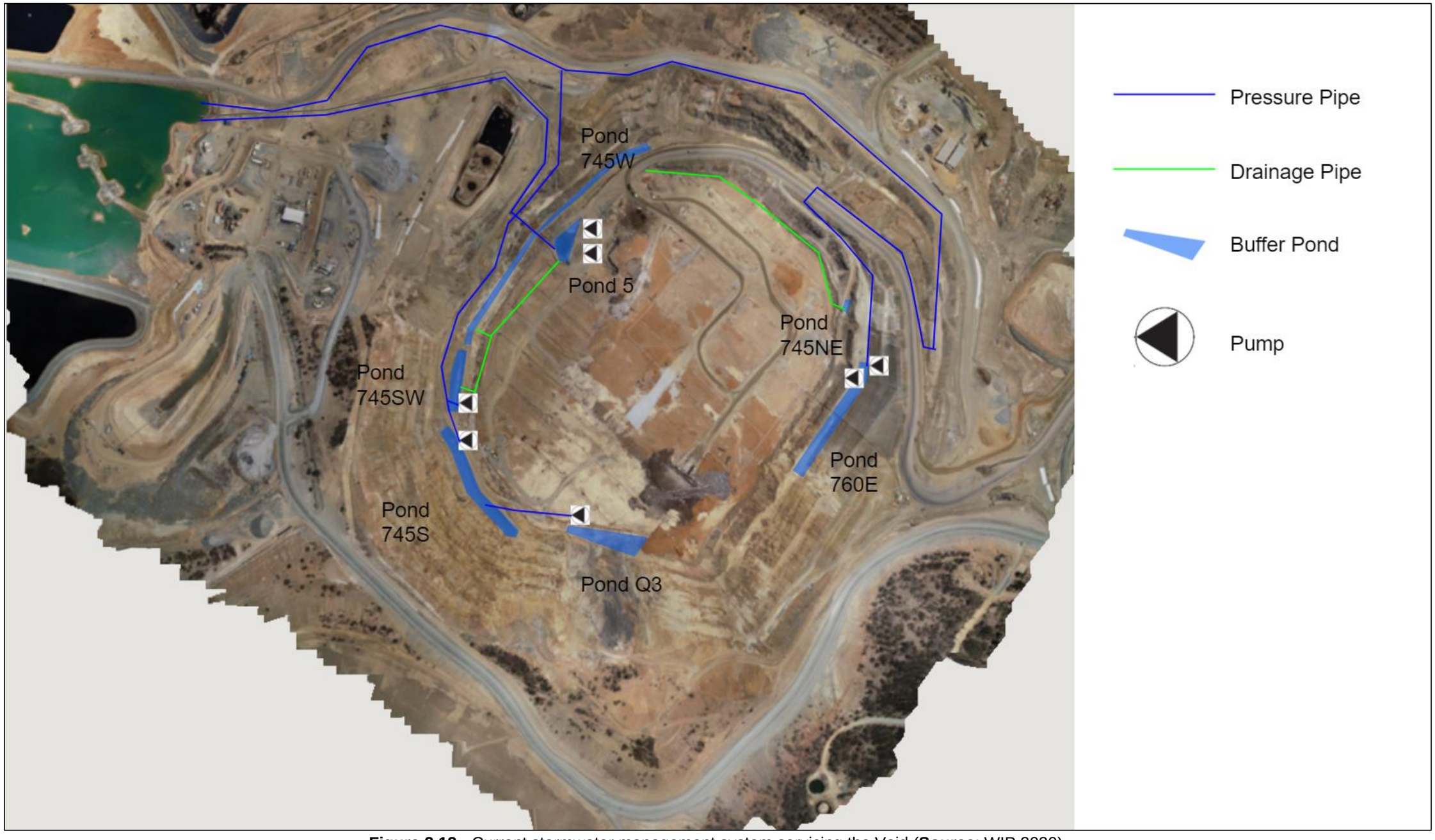


Figure 2.12 - Current stormwater management system servicing the Void (**Source**: WIP 2020)

2.6 MBT FACILITY OPERATIONS

The MBT Facility at the Site operates under a separate EPL to the Bioreactor operations and is capable of processing up to 144,000 tonnes of putrescible waste per annum. The operation of the MBT Facility includes the receipt of solid waste from municipal, commercial, and industrial sources within the Sydney Metropolitan Area. The waste is transported in a similar manner to the Bioreactor, which is via the IMF. Upon receipt at the MBT Facility, the waste is processed in the following manner:

- Waste is accepted, weighed, and unloaded on the Reception Building pit of the waste processing building, where it is screened for conforming waste;
- Waste is then loaded to the BRS drums in batches to ensure a maximum residence time of 3-4 days;
- The waste from BRS drums is transferred to Refining Building for mechanical sorting with equipment, such as trommels, to separate waste into different sized fractions, magnets to remove ferrous material and ballistic separators to segregate light organic material from inorganic material for composting. The refined and screened organic material is provisionally stored in the Organic Buffer Storage Building;
- The refined and screened organic material is transferred from the Organic Buffer Storage Building to the Fermentation Building for composting. Aerated stockpiles of the organic material are formed in specially designed cells through an automated delivery system. Oxygen, temperature, and moisture levels are regulated through a dedicated SCADA system to ensure optimum and controlled conditions for composting to occur. The process of fermentation will effectively create a biologically stable product, at the end of which the compost produced will be moved into the Maturation Storage Pad Area, located adjacent to the fermentation buildings, until required for use; and
- Recovered ferrous metals are captured in the bin located outside the Refining Building and stored inside of the Organic Buffer Storage Building prior to transport off-site. Any residual material is sent to the Bioreactor for disposal.

2.6.1 Odour Control System

To facilitate the operations from an odour management perspective, the MBT Facility has been designed with a purpose-built biofilter-based odour control system. There are two biofilter systems at the MBT Facility, namely:

- **Biofilter System 1**, which is responsible for treating process and building airflow from the Reception Building and BRS Drum System; and
- **Biofilter System 2**, which is responsible for treating process and building airflow from the Organic Buffer Storage, Fermentation Building and Refining Building.

The Audit understands that the design philosophy for both odour control systems was identical in that consideration was given to the type of processes that will be occurring in the MBT Facility, the potential for each of these processing areas to generate odours,

the layout of the MBT Facility site, the proximity of the site to potential odour receptors, and experience base from several other large in-vessel composting facilities across Australia. The product of this process resulted in a design that achieves the following objectives:

- Capture and/or containment of all odours generated at key processing areas including the Reception Building, BRS Drum System, Refining Building, and Organic Buffer Storage Building;
- The maintenance of negative pressure conditions in the above areas, under normal operating conditions;
- Capture of the bulk of the odours generated in the Fermentation Building, without necessarily achieving negative pressure conditions; and
- Treatment of all odour captured by the two independent collection systems in a pair of up-flow, open-bed biofilters, each equipped with a foul air humidification system.

2.6.2 MBT Odour Emissions Identification and Characterisation

An operational odour analysis was undertaken to identify and characterise all key emission points at the MBT Facility to facilitate the sampling program conducted in the Audit. This analysis resulted in the following key sources of interest:

- The biofilter system performance outlet discharge cells; and
- The maturation storage pad area.

All other locations are considered negligible, provided the odour control system infrastructure, operating setpoints, and design practices are followed.

3 SAMPLING PROGRAM

As per *Condition 7 (e)* of *Schedule 4* in the *Specific Environmental Conditions - Landfill site,* this Audit measured all current and key sources at the Site. As previously highlighted in **Section 1.3**, the odour emissions inventory developed in previous IOAs was used as a basis for the sampling program in the Audit and updated where required.

3.1 SAMPLING SCOPE

The Audit involved the collection of a total of fifty-four (54) gas samples, namely:

- Thirty-nine (39) gas samples for odour concentration measurement; and
- Fifteen (15) liquid samples for odour concentration measurement testing using an in-house NATA-accredited Liquid Odour Concentration Determination Method (refer to **Section 4.3** & **Appendix B** for details). The liquid samples, whilst not being a requirement for the Audit, were collected from the pond sources containing treated leachate, including ED3N-2, ED3N-3, ED3N-4, ED3S-S, ED1 Coffer Dam, and the LTP to quantify the odour emissions caused by the natural or mechanical evaporation of the lagoons liquid contents (refer to **Section 8.2.1.4** for further details and results).

3.2 SAMPLING SCHEDULE

The sampling program schedule for the Audit is summarised in **Table 3.1.** As shown in **Table 3.1**, there are several key sampling locations at the Site. This includes:

- The Bioreactor;
- ED3N System;
- ED3S System;
- The LTP; and
- The MBT Facility.

The sampling program schedule includes all key sources requested in *Condition 7 (e) of Schedule 4 in the Specific Environmental Conditions - Landfill site* with the following exceptions:

- **Leachate recirculation***:* Since the 2012 IOA, the Audit has been unable to observe and thus collect representative samples for this scenario. Since the completion of EA 2010, Veolia has developed a leachate recirculation system that involves direct injection of leachate into the waste, which eliminates the need for spraying over the surface (refer to **Section 8.2.1.1.1**). The audit team understands this will continue to remain normal practice, both for the Audit and future IOAs. Therefore, no suitable access points for the collection of odour samples from this source is – and will continue to be – possible. Notwithstanding this, as previously mentioned in **Section 2.3.2**, there is only one reinjection infrastructure being maintained in the Bioreactor as a contingency/back-up option for leachate management when the leachate transfer system experiences

any failure. Therefore, the use of leachate recirculation technique is not used extensively as part of the normal operation for the Bioreactor. On this basis, it is not considered to be a significant source of odour. Subsequent IOAs will continue to assess the circumstances relating to leachate recirculation within the Void and document any variation in leachate recirculation practices as required.

3.2.1 Wet Weather Conditions

The Site encountered intermittent and very light wet weather conditions in the days leading up to and during the Audit visit period. As a result, the Audit was able to collect odour samples under wet weather conditions and observed the effects of wet weather regarding the need to handle increased levels of leachate and stormwater catchment in the Void.

3.2.2 Crisps Creek Intermodal Facility

No samples were collected from the IMF as all waste transportation is a fully contained process until the displacement of the contents into the Void via the mobile tipping platform. Instead, as per previous IOAs, an olfactory assessment (refer **to Section 8.2.1.9**) and FAOA survey monitoring program (refer to **Section 7**) was adopted to evaluate the odour performance of the IMF in the Audit.

3.2.2.1 Waste container management

The Audit notes that it is a requirement that all waste containers are to be designed, constructed, and maintained to prevent the emission of odour and be watertight to prevent the leakage of leachate from waste containers during transport and handling activities. This is a condition of consent for the Clyde Transfer Terminal Facility and Banksmeadow Transfer Terminal Facility, which is where the waste containerisation process occurs. As such, and as per previous audits, the Audit team classifies the IMF as a very low-risk source regarding odour. Moreover, as per previous audits, there are virtually no active pathways for odour emission release from this operation that can be practically measured under normal operations. Therefore, and as will be discussed in **Section 8.2.1.8** and noted in previous audits, the IMF continues to be a negligible contributor to the Site's overall operational odour emissions footprint.

Table 3.1 – The Audit sampling program schedule as conducted between 8 March 2021 and 11 March 2021		
Location	**Source Type^**	**No. of samples collected**
The Bioreactor		
Active Tipping Face	Area source	3
Waste Covered Area	Area source	6
Leachate Treatment Dam		
LTD	Area source	2
ED3N Pond System		
ED3N - 2	Area source (3) + Liquid odour measurement (3)	6
ED3N - 3	Area source (3) + Liquid odour measurement (3)	6
ED3N - 4	Area source (3) + Liquid odour measurement (3)	6
ED3S Pond System		
ED3S-S	Area source (3) + Liquid odour measurement (3)	6
ED1 Coffer Dam		
ED1 Coffer Dam	Liquid odour measurement	3
MBT Facility		
MBT Biofilter 1 System	Point source	4
MBT Biofilter 2 System	Point source	7
MBT Maturation Pad	Area source	5
TOTAL		**54**

^ see **Section 4** for details

4 SAMPLING METHODOLOGY

The sampling methodologies described in this section are associated with the 'Source Type' descriptions presented in **Section 3.2** - **Table 3.1**. Given the nature and characteristics of the emission sources sampled, the following sampling techniques are adopted in the Audit:

- Point source sampling, as detailed in **Section 4.1**;
- Area source sampling, as detailed in **Section 4.2**; and
- The liquid odour measurement method, as detailed in **Section 4.3**.

4.1 POINT SOURCE SAMPLING METHOD

The method used for the collection of gas samples from the inlet and outlet locations of the biofilter systems at the MBT Facility involved the use of a point source sampling, consisting of the drum and pump method. This method involves the drawing of the sample air through a polytetrafluoroethylene (**PTFE**) sampling tube into a single-use, Nalophan sample bag. The bag was housed within a container (sampling drum) that was evacuated with a vacuum pump, and the sample collected by induced flow. The "lung method", by which this sampling procedure is known, allowed the sample air to be collected without encountering any potentially odorous material. **Figure 4.1** illustrates a schematic of the point source sampling method.

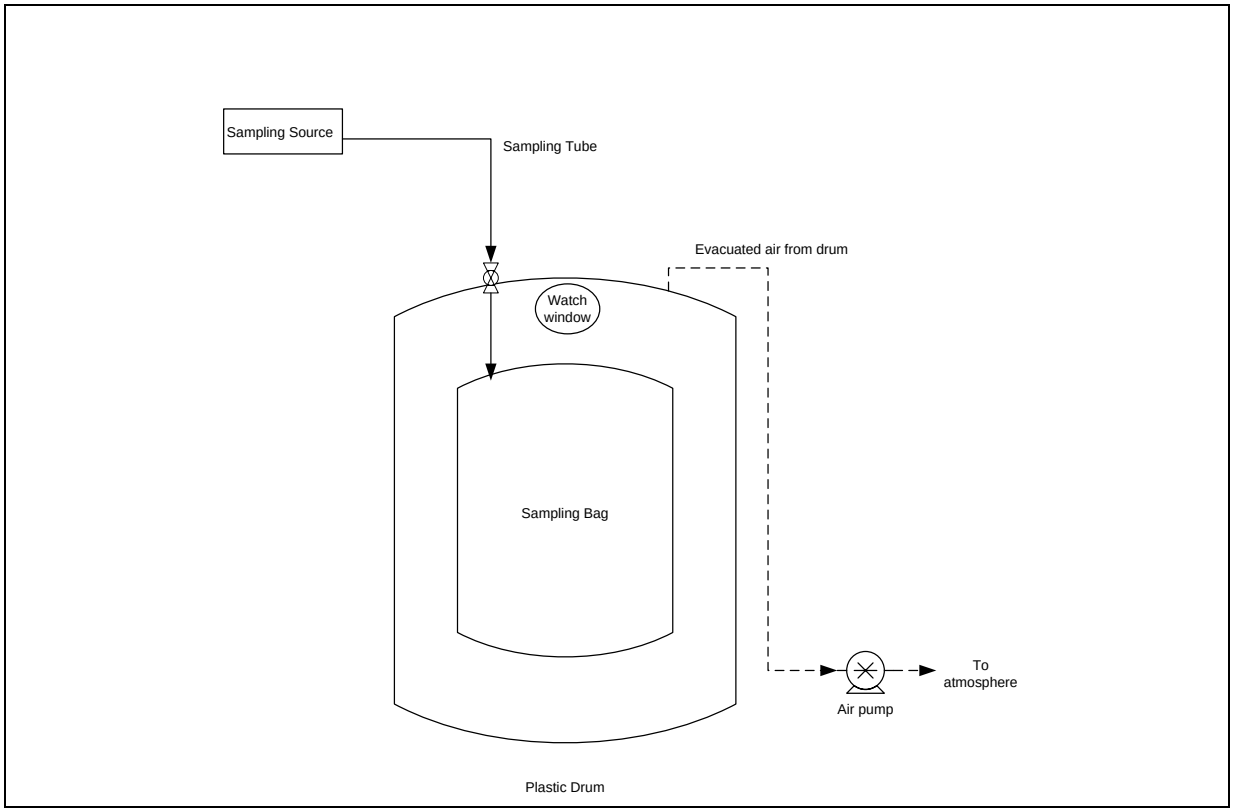


Figure 4.1 - Schematic of point source sampling

4.2 AREA SOURCE SAMPLING METHOD

The objective of the area source sampling was to collect representative odour samples from both solid and liquid surface areas at the Site. This was undertaken using an isolation flux hood (**IFH**). All sampling using the IFH was carried out according to the method described in the United States Environment Protection Agency (**US EPA**) technical report '*EPA/600/8-86/008*', from which Australian Standard 4323.4:2009 (**AS/NZS 4323.4**) is based upon and is considered an '*Other Approved Method (OM-8)' by EPA (DEC, 2007)*. TOU's IFH adheres to the design specifications, materials of construction and supporting equipment that the US EPA report '*EPA/600/8-86/008*' defines. The IFH has a diameter of 0.406 m, a chamber surface area of 0.126 square metres (**m^2**) and a chamber volume of 30 litres (**L**), equivalent to 0.03 cubic metres (**m^3**), when the skirt of the hood is inserted into the liquid or solid surface by the specified 25 millimetres (**mm**). Dry nitrogen is then introduced to the IFH at a sweep rate of 5 L/min.

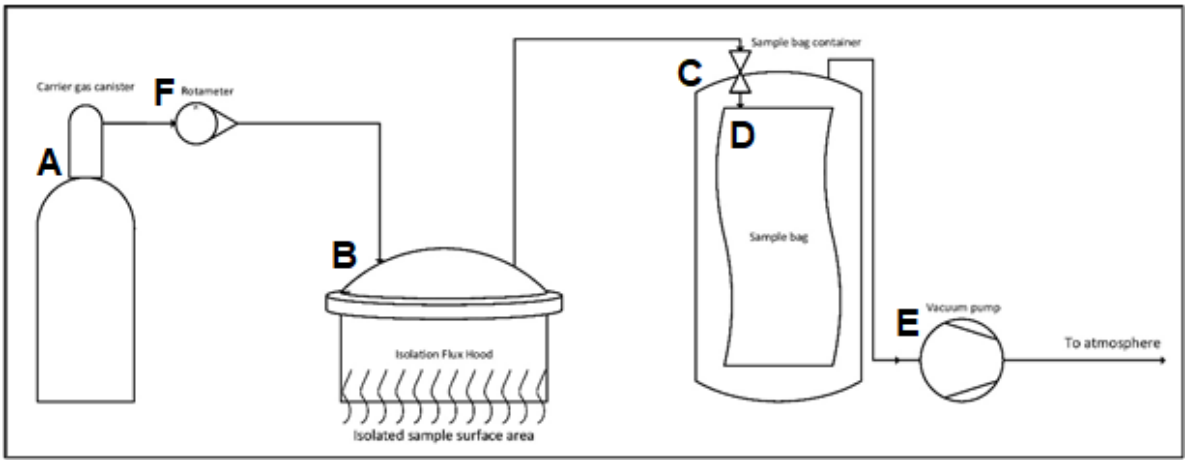
As these area sources are open to the atmosphere, wind is a major factor in the release of odorous pollutants from the surface and conveying the pollutant from the source to areas beyond the boundary. The IFH system is designed to simulate the transfer of odorous pollutants by the wind, resulting in a controlled and consistent sampling environment. This is achieved by the flux of near pure nitrogen gas into the IFH that is positioned on the liquid or solid surface. On a liquid surface, this is achieved by floating the IFH within an inflated tyre inner tube. The nitrogen gas then transports the odour from the surface in the same way the wind does, albeit at a very low sweep velocity. This odorous air is then collected for odour and/or chemical analysis. As the IFH has a constant 5 L/min inflow of nitrogen gas to it, the sampling chamber remains under positive pressure and produces a net outflow through the vent on top of the IFH, therefore eliminating any chance of contamination of external air from the atmosphere. The IFH's volume of 30 L and the 5 L/min nitrogen sweep rate results in a gas residence time of six minutes. The US EPA method prescribes a minimum of four air changes to achieve optimum purging and equilibrium in the hood, and therefore a total of 24 minutes is allowed before sampling commences. The sample is then collected over a 10-minute period to obtain a 20 L sample for odour and/or chemical analysis.

The US EPA method followed by TOU may be summarised as follows (and as described in the schematic of the sampling equipment shown in **Figure 4.2**)**:**

- Dry nitrogen is directed into the IFH via odour free PTFE tubing until it has reached equilibrium. The nitrogen is channelled to a manifold fitted with small outlets above the surface, which direct the air towards the centre of the surface;
- The nitrogen flow (5 L/min) purges the flux hood with a residence time of four times the chamber volume occurring before sampling begins; and
- The odorous sample is drawn through a Teflon tube, into a single-use, odour-free Nalophan sample bag secured inside a drum that is under vacuum. The balance of the gas flow is vented to the atmosphere.

The IFH is manufactured from acrylic resin to ensure it does not contribute to the odour sample. All other surfaces in contact with the sample are made from PTFE or stainless

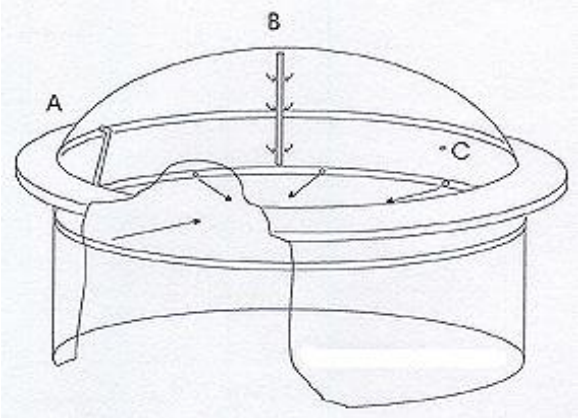
steel. An example of IFH sampling on a solid surface and a liquid surface is shown in **Photo 4.1** & **Photo 4.2**, respectively.



Key

A	Cylinder of nitrogen gas.
B	Isolation Flux Hood (a detailed diagram is shown in **Figure 4.3**)
C	Lung chamber (sampling drum)
D	Nalophan sampling bag
E	Sampling pump
F	Air flow meter

Figure 4.2 - Schematic of the isolation flux hood setup



Key

A	Inlet gas from the gas cylinder.
B	Outlet to sample bag.
C	Additional gas outlet points for other sampling, or temperature and moisture monitoring.

Figure 4.3 – Details of the isolation flux hood chamber

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Photo 4.1 – An example of IFH sampling on a solid surface at the MBT Facility as occurred on 11 March 2021

Photo 4.2 – An example of IFH sampling on a liquid surface (ED3N-4) as occurred on 8 March 2021

4.3 LIQUID ODOUR METHOD

4.3.1 Overview

The Liquid Odour Method (**LOM**) was developed by TOU for measurement of the odour release potential from process liquors, which is universally applicable to aqueous solutions containing odorous substances. In simple terms, it measures the odour released when an odorous liquid evaporates. It is directly relevant to the mechanical evaporation units in use at the Site and natural evaporation processes for volume reduction of treated leachate (refer to **Appendix D** for details on methodology).

4.4 AIR FLOW MEASUREMENTS

Air flow measurements from the biofilter inlet were recorded by inserting a hot-wire anemometer into a pre-drilled hole in ductwork for Biofilter System 1 and Biofilter System 2 at the MBT Facility. The collection of these airflows was necessary to enable an OER to be calculated (refer to **Table 6.3**).

5 ODOUR MEASUREMENT METHODS

5.1 ODOUR MEASUREMENT LABORATORY

All samples collected for the Audit were tested at TOU's NATA Accredited Odour Laboratory.

5.1.1 Odour Concentration Measurement

TOU's odour laboratory operates to the Australian Standard for odour measurement '*Determination of odour concentration by dynamic olfactometry'* (**AS/NZS 4323.3**) which prescribes a method for sample analysis that provides quality assurance/quality control and ensures a high degree of confidence in the accuracy, repeatability, and reproducibility of results.

The concentration of the gaseous odour samples was measured using a technique known as dynamic olfactometry. Dynamic olfactometry involves the repeated presentation of both a diluted gaseous odour sample and an odour-free air stream to a panel of qualified assessors through two adjacent ports on the olfactometer (known as the Odormat™). TOU utilises four to six trained assessors (or panellists) for sample analysis, with the results from four qualified panellists being the minimum allowed under the AS/NZS 4323.3. For the Audit, four panelists were used.

The method for odour concentration analysis involves the odorous gas sample initially being diluted to the point where it cannot be detected by any member of the panel. The assessor's step- up to the olfactometer, in turn, takes a sniff from each port, then choose which port contains the odour and enter their response. At each stage of the testing process, the concentration of the odorous gas is systematically increased (doubled) and re-presented to the panellists. A round is completed when all assessors have correctly detected the presence of the odour with certainty. The odour is presented to the panel for three rounds and results taken from the latter two rounds, as stated in AS/NZS 4323.3.

The results obtained give an odour measurement measured regarding odour units (**ou**). One (1) ou is the concentration of odorous air that can be detected by 50% of members of an odour panel (persons chosen as representative of the average population sensitivity to odour). It is effectively the concentration of an odour at detection threshold level. The odour concentration of a sample expressed in odour units is the number of times the sample must be diluted to elicit a physiological response (the detection threshold level) from a panel. For example, twenty (20) odour units would mean that the odour sample will need to be diluted 20 times for the concentration to be at detection threshold level. This process is defined within AS/NZS 4323.3. The odour units can be subsequently multiplied by an emission rate or volumetric flow to obtain an Odour Emission Rate (**OER**) or a specific odour emission rate (**SOER**) for area source samples collected using the IFH method (refer to **Section 4.1** & **Section 5.1.2**).

5.1.2 Specific Odour Emission Rate

For area source samples collected using the IFH method, the results from odour concentration testing, derived in odour units (see **Section 4.1** for details), is multiplied by an emission rate to obtain a SOER. SOER is a measure of odour released from a

representative point at a source. The SOER is multiplied by the area of the source to obtain the OER or the total odour released from each source, that is:

- SOER ($ou.m^3\,m^{-2}\,s^{-1}$) = OC × Q / A; and
- OER ($ou.m^3\,s^{-1}$) = SOER × area of source (m^2)

where:

- OC = odour concentration of compound from air in the chamber (ou)
- Q = sweep gas volumetric flow rate into chamber ($m^3\,s^{-1}$)
- A = sample source total surface area (m^2)

The SOER is presented in the units $ou.m^3/m^2.s$ as per convention, and as referred to in the document – Klenbusch, M.R., 1986. USEPA Report No. EPA/600/8-86/008 '*Measurement of gaseous emission rates from land surfaces using an emission isolation flux chamber, - Users Guide'*. The OER is presented in the units' $ou.m^3/s$ as referenced in the AS/NZS 4323.3.

5.1.3 Odour Measurement Accuracy

The repeatability and odour measurement accuracy of the Odormat™ is determined by its deviation from statistically reference values specified in AS/NZS 4323.3. This includes the calculation of instrumental repeatability (r), where r must be less than 0.477 to comply with the standard criterion for repeatability. Its accuracy (A) is also tested against the 95th percentile confidence interval, where A must be less than 0.217 to comply with the accuracy criterion as mentioned in the Standard. The Odormat™ V01 complied with all requirements set out in the AS/NZS 4323.3 (see **Appendix B** – Result sheets: *Repeatability and Accuracy*). The calibration gas used was 51.4 parts per million (**ppm**), by volume, n-butanol in nitrogen gas (**N_2**).

6 ODOUR TESTING RESULTS

This chapter is dedicated to addressing the following audit requirement as outlined in **Section 1.2**, namely:

e. Measure all key odour sources on-site including:

i. consideration of wet weather conditions providing all raw data used in this analysis;
ii. consideration of (but not limited to) all liquid storage area, active tipping faces, waste cover area, aged waste areas and recirculation of leachate onto waste in the Void;
iii. a comparison of the results of these measurements against the predictions in the EA.

All key odour sources at the Site were measured in the Audit, with the results presented in several tables, as follows:

- **Table 6.1** summarises the odour emission results obtained from the Audit and compares the results against the EA 2010 predictions. As there are no EA 2010 predictions for the ED3S Pond System, the results are compared with the emissions data used in the odour modelling study titled *Proposed Addition of ED3S to Leachate Management System* and dated 30 May 2016 (the **LMS May 2016 Report**) as well as the results obtained for the ED3N Pond System in the Audit;

- **Table 6.2** summaries the global mean SOER results derived in the Audit and compares these results to those derived in the previous IOAs conducted between 2012 and 2017;

- **Table 6.3** summarises the MBT Facility biofilter system results;

- **Table 6.4** summarises the MBT Facility Maturation Storage Pad Area results; and

- **Table 6.5** summarises the liquid odour measurement results.

In **Section 8.5**, **Table 8.4** summarises the odour emission rates from emission sources amenable to quantitative measurements. These sources have been ranked in descending order. The results in **Table 8.4** do not include potential gas pathways and other fugitive emission sources from the waste surface, due to the difficulty in assigning an appropriate emission area for these sources to calculate an OER derived from the SOER and the area. This was a similar constraint in the previous IOAs.

Table 6.1 - The Audit odour emission testings results obtained between 8 March 2021 and 11 March 2021 compared with that adopted in EA 2010

Source	The Audit				EA	
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2.s$)**	**Odour Character**	**SOER Range ($ou.m^3/m^2.s$)**	**SOER Model Input ($ou.m^3/m^2.s$)**
Bioreactor (The Void)						
Active Tipping Area						
Active tipping face (less than one day old)	SC21148	4,100	2.2	garbage, pineapple	1.0 – 7.3*	7.3 (wet fresh waste emission adopted)
	SC21149	5,310	3.1	garbage, pineapple		
	SC21150	7,510	4.4	garbage, pineapple		
Aged Waste	n/m**				0.5	
Waste Covered Area (Virgin Excavated Natural Material (VENM) Cover)						
Waste Covered Area: 150 mm	SC21145	181	0.102	dirt, soil	0.1 - 0.2* (covered)	0.2 (covered)
	SC21146	256	0.127	garbage		
	SC21147	91	0.050	dirt, soil		
Waste Covered Area: 300 mm	SC21142	70	0.044	dirty, soil, mild garbage	7.5 – 23.9*** (fugitive emissions)	23.9*** (fugitive emissions)
	SC21143	166	0.106	grain, dirt		
	SC21144	59	0.035	dirt		

***** includes dry and wet covered waste
** unable to be sampled in the Audit due to access and safety concerns prevailing at the time
*** represents potential gas pathways
n/m = not measured

Table 6.1 (continued) - The Audit odour emission testings results obtained between 8 March 2021 and 11 March 2021 compared with that adopted in EA 2010

Source	The Audit				EA	
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2.s$)**	**Odour Character**	**SOER Range ($ou.m^3/m^2.s$)**	**SOER Model Input ($ou.m^3/m^2.s$)**
Bioreactor (The Void)						
Leachate Treatment Dam						
Leachate Treatment Dam (Aerated Zone)	SC21137	664	0.392	ammonia, dirty, rotten	0.1 - 7.4*	3.6
Leachate Treatment Dam (Anoxic Zone)	SC21136	9,740	5.8	ammonia, dirty, rotten		
Leachate recirculation system						
Leachate recirculation system	n/m				1.6 – 2.5	2.5
Landfill Gas Extraction System						
Landfill gas inlet	n/m				n/a	
Catchment Pond (leachate)^^						
Storage Pond 7	n/m				2.1 – 8.8	8.8
Catchment Pond (stormwater)^^						
Storage Pond 3 (Stormwater)	n/m				n/a	

* includes partially / fully treated leachate (dependent on the treatment stage of the process at the time samples were collected)
n/m = not measured
n/a = not applicable
^^ no longer in use

Table 6.1 (continued) - The Audit odour emission testings results obtained between 8 March 2021 and 11 March 2021 compared with that adopted in EA 2010

Source	The Audit				EA	
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2.s$)**	**Odour character**	**SOER Range ($ou.m^3/m^2.s$)**	**SOER Model Input ($ou.m^3/m^2.s$)**
Evaporation Dams						
ED3N Pond System						
ED3N-1	Empty at the time of the Audit				2.1 – 8.8	8.8
ED3N-2	SC21130	58	0.037	dirty, faecal	0.1 – 7.4	0.2*
	SC21131	45	0.029	dirty, faecal		
	SC21132	304	0.195	dirty		
ED3N-3	SC21127	2,050	1.3	mildly sour, dusty		
	SC21128	664	0.423	sour, dusty		
	SC21129	279	0.181	sour		
ED3N-4	SC21124	332	0.207	dusty, dirt	0.1 – 0.7	0.7**
	SC21125	430	0.268	dusty, dirt		
	SC21126	1,720	1.1	cement, dusty		
ED3S-S Pond System						
ED3S-S	SC21133	3,160	1.9	rotten, rendering	0.159***	
	SC21134	4,100	2.4	rotten, dirty, rendering		
	SC21135	3,760	2.3	rotten, dirty		
ED3S Pond System						
ED3S	n/m				0.0 - 0.5	0.5

* partially / fully treated leachate
** includes groundwater and fully treated leachate
*** Not obtained from the EA. Source of emission data is the LMS May 2016 Report: Table 2.1
n/a = not applicable
n/m = not measured
n/d = not determined

Table 6.2 – Global mean SOER results: Comparison between the Audit and previous IOAs									
Source	**The Audit**	**2019 IOA**	**2018 IOA**	**2017 IOA**	**2016 IOA**	**2015 IOA**	**2014 IOA**	**2013 IOA**	**2012 IOA**
Location	**TOU SOER (ou.m³/m².s)**								
ED3N-1	n/a (empty)	n/a (empty)	0.356	0.132	0.130	0.132	0.017	0.30	394
ED3N-2 & 3^	0.361	0.0745	0.102	0.129	0.175	0.118	0.049	11.6 ^^^^	0.29
ED3N-2	0.0867	0.0881	0.169	0.120	0.148	0.145	0.066	20.1 ^^^	0.21
ED3N-3	0.635	0.0609	0.035	0.139	0.20	0.091	0.032	0.2	0.37
ED3N-4	0.522	0.0856	0.095	0.163	0.248	0.269	0.023	0.0604	0.41
Active Tipping Face	3.24	5.26	7.59	9.52	8.16	7.51^^^^^	4.28	3.04	8.36
Leachate Treatment Dam	3.07	9.19	0.186	0.243	0.27	0.276	0.026	0.323	0.46
Construction and Demolition Tip Face	n/a	n/a	n/a	n/a	n/m	0.326	n/a	0.293	n/a
ED3S	n/m	0.094	0.058	0.116	0.277	No previous measurements available as ED3S, ED3S-S, and Stormwater Pond 3 are new sources			
ED3S-S	2.19	0.554	0.13	1.97	0.437				
Stormwater Pond 3^^	n/a	n/a	n/a	n/a	n/a				
Storage Pond 7^^	n/a	n/a	n/a	n/a	n/a	n/m^^	n/a#		85

^ as specified in the EA 2010
^^ no longer exists
^^^ represents the sub-optimal pond contents that have now been treated (see **IOA 2013 Report** for details)
^^^^ bulk of emissions originating from ED3N-2 (see **IOA 2013 Report** for details)
^^^^^ includes testing results reflecting sampled areas with the polymer slurry applied
# There was no designated area for this location (see **IOA 2014 Report** for details)
n/a = not applicable
n/m = not measured

Table 6.3 – MBT Facility: Biofilter System Results: 8 March 2021 and 11 March 2021						
Sample Location		**TOU Sample Number**	**Odour Concentration (ou)**	**Odour Emission Rate (ou.m³/s)**	**Odour character**	**Inlet Airflow (m³/hr, actual)**
MBT Biofilter 1						
MBT Biofilter 1	Western Cell Section (Composite)	SC21138	431	1,460	pine, fermented garbage	--
	Middle Cell Section (Composite)	SC21139	470	1,590	fermented garbage	
	Eastern Cell Section (Composite)	SC21140	664	2,250	fermented garbage, dirt, soil	
	Common Inlet	SC21141	2,660	27,000	garbage	44,300
MBT Biofilter 2						
MBT Biofilter 2	South-west Cell Section (Composite)	SC21156	558	3,120	dirt, compost, fertiliser, sweet	--
	Western Cell Section (Composite)	SC21157	1,450	8,110	dirt, soil, compost, fermented	
	North-western Cell Section (Composite)	SC21158	2,230	12,500	dirt, soil, compost, fermented	
	North-eastern Cell Section (Composite)	SC21159	2,900	16,200	compost, dirt, fermented, sour	
	Eastern Cell Section (Composite)	SC21160	2,230	12,500	dirt, soil, compost, fermented	
	South-eastern Cell Section (Composite)	SC21161	1,330	7,440	dirt, soil, compost, fermented	
	Common Inlet	SC21162	6,890	231,000	garbage, dirt, compost	149,000

Table 6.4 – MBT Facility: Maturation Storage Pad Area Results: 8 March 2021 and 11 March 2021					
Sample Location		**TOU Sample Number**	**Odour Concentration (ou)**	**Specific Odour Emission Rate (ou.m³/m².s)**	**Odour character**
MBT Maturation Storage Area					
MBT Maturation Pad	Screened	SC21151	6,320	3.02	compost, blood, ammonia
	~ 6 months old (September 2020)	SC21152	558	0.267	dirt, soil, ammonia
	~ 4 months old (November 2020)	SC21153	332	0.148	dirt, soil, ammonia
	~ 2 months old (January 2021)	SC21154	470	0.235	dirt, soil
	~ 1 month old (February 2021)	SC21155	279	0.14	dirt, soil

Table 6.5 – LOM derived odour emission rates for mechanical and natural evaporation methods: As collected on 11 March 2021 ^^^^

Sample Location	TOU Sample Number	Odour Concentration (ou)	Calculated Liquid Odour Potential (ou/mL)	Mechanical Evaporation Rate (L/min) per evaporator^ η = 20% / 30%	Mechanical Evaporation Mean Odour Emission Rate ($ou.m^3/s$) per evaporator η = 20% / 30%	Mechanical Evaporation Mean Odour Emission Rate ($ou.m^3/s$) ALL evaporators^^^ η = 20% / 30%
Evaporation method: Mechanical						
ED3N-2	SC21169	38	1.84	70 / 105	System A is not used for ED3N-1, ED3N-2 and ED3N-3, refer to **Section 2.4.2.1.1**. The OER for the surface spray evaporators has not been quantified in the Audit, as their contribution is considered negligible in the context of other on-site emission sources.	
	SC21170	38	1.84			
	SC21173	32	1.55			
ED3N-3	SC21166	49	2.37			
	SC21167	38	1.84			
	SC21168	45	2.18			
ED3N-4	SC21163	166	8.04		3,200 / 4,980	12,800 / 19,900
	SC21164	91	4.41			
	SC21165	45	2.18			
Evaporation method: Natural						
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**Calculated Liquid Odour Potential (ou/mL)**	**Current Surface Area (m^2)**	**Natural Evaporation rate (mm/month) ^^**	**Natural Evaporation – Mean Odour Emission Rate ($ou.m^3/s$)**
ED3S-S	SC21174	99	4.79	20,100	92.67	2,070
	SC21175	45	2.18			
	SC21176	49	2.37			
ED1 Coffer Dam	SC21177	16	0.775	59,810		1,630
	SC21178	16	0.775			
	SC21179	16	0.775			
ED3N-2	SC21169	38	1.84	6,080		372
	SC21170	38	1.84			
	SC21173	32	1.55			
ED3N-3	SC21166	49	2.37	6,230		465
	SC21167	38	1.84			
	SC21168	45	2.18			
ED3N-4	SC21163	166	8.04	36,600		5,500
	SC21164	91	4.41			
	SC21165	45	2.18			

^ Mechanical evaporation rate is based on 20% / 30% evaporation efficiency per evaporator.
^^ The natural evaporation rate is based on the mean evaporation rate recorded between May 2007 to June 2012, refer to **Appendix C**.
^^^ Based on four active and identical evaporators as is the current mode of operation, at an operating performance of 225L/min.
^^^^Surface spray & ring main evaporation systems not included in calculation.

6.1 COMMENTS ON RESULTS

The following sections comment on the results presented in **Table 6.1**, **Table 6.2**, **Table 6.3**, **Table 6.4** and **Table 6.5**.

6.1.1 The Void Samples

The following comments are made based on the Void samples collected in the Audit:

- The sampling locations inside the Void have been nominally shown in **Figure 6.1**. The sample numbers presented in **Figure 6.1** correspond with those in the sampling location column in **Table 6.1**. The conditions prevailing in the Void at the time of the Audit is presented in **Photo 6.1**;

- As presented in **Table 6.2**, the mean SOER results for the Active Tipping Area (SC21147 – SC21150) in the Audit is 3.2 ou.m^3/m^2.s, representing a modest decrease since the previous 2019 IOA (5.2 ou.m^3/m^2.s). The odour character of the active tipping face samples collected in the Audit was reported as 'garbage, pineapple', representing a similar finding from previous IOAs. Based on previous IOA results for this source, this variation is considered to reflect normal variation from the active tipping face activity inside the Void; and

- The Waste Covered Area samples (SC21142 – SC21147) were collected from covered areas within the Void, including 150 mm and 300 mm VENM cover, at strategic locations designed to quantify the general emissions emanating from the Void. The SOER results are low and suggest fugitive emission release and cover condition at the sampled locations was effective at the time.

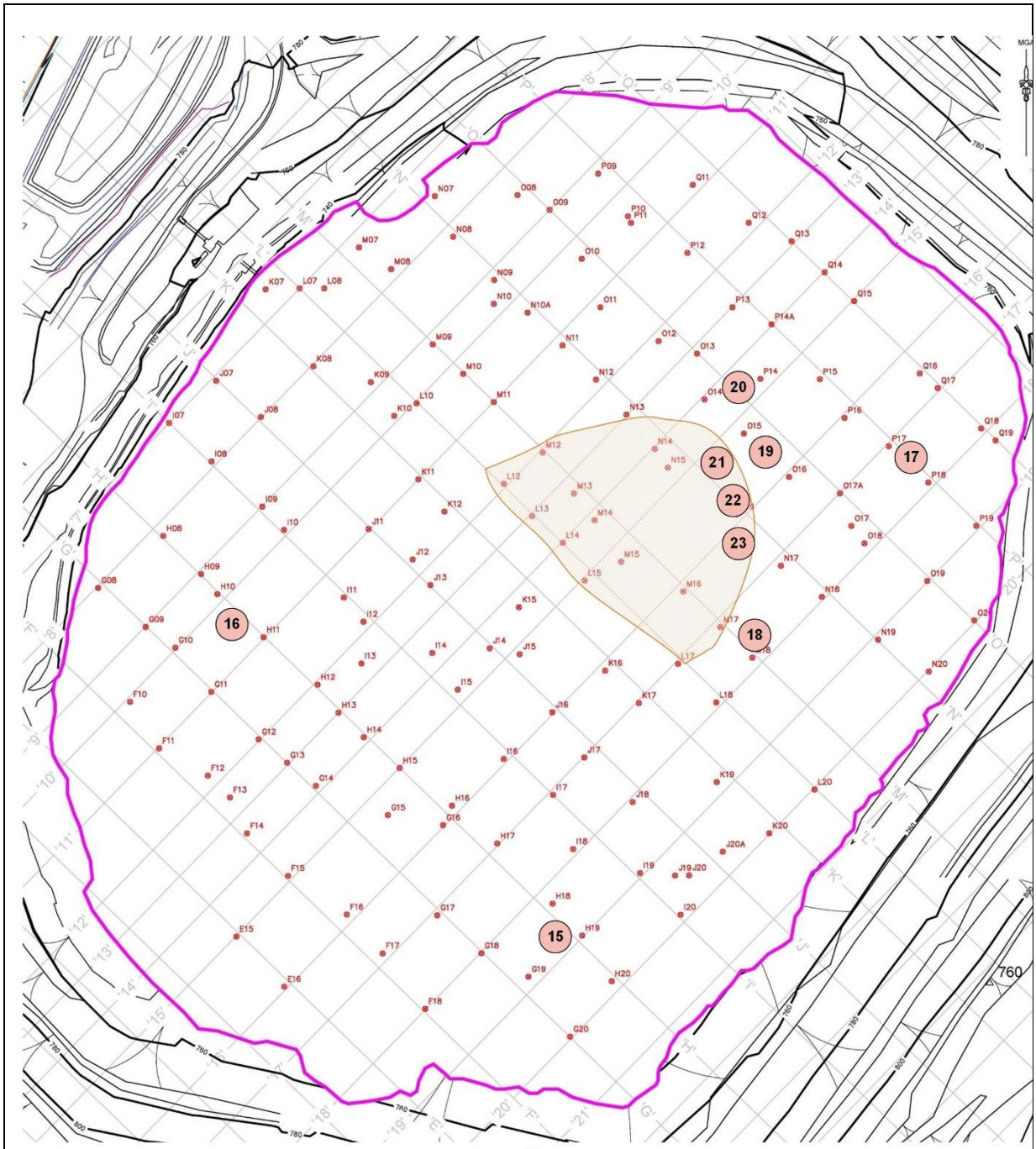


Figure 6.1 - Nominal sampling locations within the Void: 10 March 2021

Photo 6.1 – Conditions prevailing in the Void during the Audit on 10 March 2021

6.1.2 Pond Source Samples – ED3N Pond System

The following comments are made based on the ED3N Pond System samples collected in the Audit:

- ED3N-1 was empty, and therefore no samples were collected;
- All samples from the ED3N system were collected from the bank of the dams. The nominal sampling locations are shown in **Figure 6.2**; and
- All samples collected and tested from the ED3N Pond system (i.e. SC21124 – SC21132) were found to be below the EA 2010 SOER model inputs for each dam, with the exception of an individual result for ED3N-4 at 1.1 ou.$m^3/m^2/s$ (SC21126). Notwithstanding this, with the exception of SC21127, the majority of SOER values for all ponds are low (0.029 – 0.268 ou.m^3/m^2.s) and consistent with previous IOA results. These results indicate that the leachate treatment quality continues to be optimum and that the LMS at the Site is performing well from an odour emissions viewpoint.

6.1.3 Pond Source Samples – ED3S Pond System

The following comments are made based on the ED3S Pond System samples collected in the Audit:

- No leachate is stored in ED3S Pond System. As such, this source was not sampled as it represents a stormwater dam and has been consistently shown in previous IOAs to be a negligible source at the Site.

6.1.4 Pond Source Samples – ED3S-S Pond System

The following comments are made based on the ED3S-S Pond System samples collected in the Audit:

- The SOER results for ED3S-S were found to be slightly elevated compared with previous IOAs. This may be related to the increase in chemical oxygen demand (**COD**) and nitrate loadings observed in the leachate quality data since October 2020 given the odour character (rotten, dirty, rendering); and
- The SOER input from the LMS May 2016 Report used a SOER of 0.159 ou.m^3/m^2.s for the modelling of ED3S-S. The mean result derived from the Audit is 2.2 ou/m^3/m^2.s (see **Table 6.2**). This result is above the modelled value; however, as will be demonstrated in **Section 9.5**, this is unlikely to cause any adverse impact beyond the boundary of the Site.

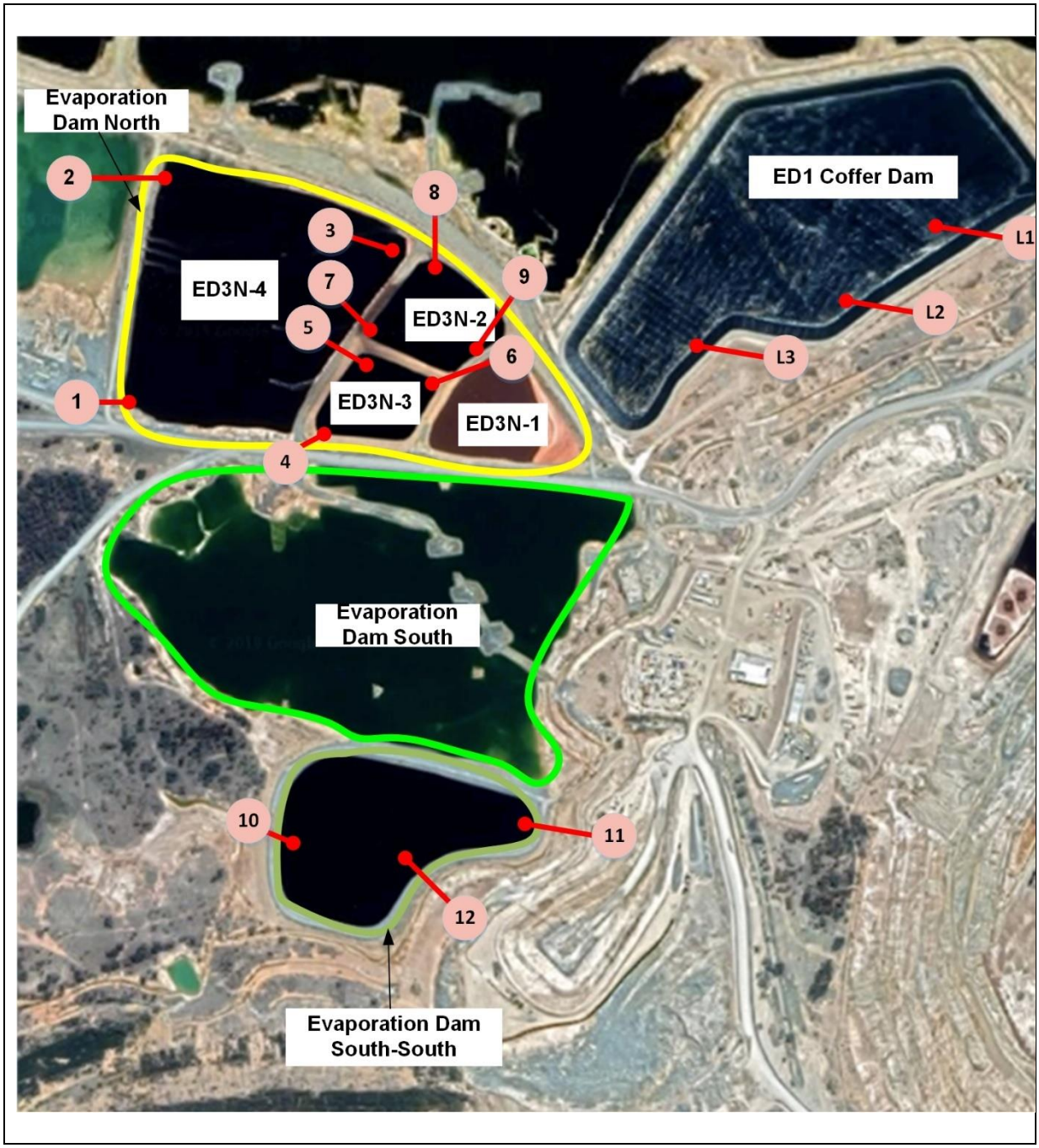


Figure 6.2 – Pond sources nominal liquid & gas sampling locations: 8 March 2021 to 11 March 2021

6.1.5 Leachate Treatment Dam Samples

The following comments are made based on the LTD samples collected in the Audit:

- The LTD was found to be operating under normal operating conditions at the time of the Audit. There are clearly now two treatment zones in the LTD, including an anoxic zone and an aerobic zone. Both zones were sampled as part of the Audit;
- The SOER results suggest that the anoxic zone of the LTD is elevated compared to previous IOAs;

- The aerobic zone is consistent with previous IOAs;
- The mean SOER result derived in the Audit for the LTD is 3.1 ou.m^3/m^2.s, presenting a decrease since the previous IOA (9.2 ou.m^3/m^2/s). This value is below the EA 2010 SOER value of 3.6 ou.m^3/m^2.s for the LTD and consistent with previous IOA results;
- The liquid odour measurement results represent the odour that would be released if the sample were evaporated, either by natural or mechanical means. For this Audit the mechanical and natural evaporation has been used in calculations;
- The natural evaporation rate shown is based on the mean rate at the Site between May 2007 to June 2012;
- An extensive number of liquid samples were collected from ED3N-2, ED3N-3, ED3N-4, ED3S-S and ED1 coffer dam in the Audit. As such, the dataset obtained in the Audit provides a good level of confidence in relation to the leachate quality and odour potential when evaporated;
- The natural evaporation mean OER for ED3N-2, ED3N-3 and ED3N-4 were relatively similar, supporting the SOER data in **Table 6.1**, which infers that the quality of effluent stored is consistent across these three dams (with the exception of a couple of outliers as discussed in **Section 6.1.2**;
- All collected liquid samples analysed via the LOM method were found to be low in odour, with only a 'musty, muddy water' odour recorded. A 'musty, muddy water' odour is typically a reliable indicator of optimum pond health and minimal odour release conditions from a treated leachate dam, even at high OERs (i.e. the odour emission is of a treated quality odour). As such, despite the apparent high OERs as shown in **Table 6.5**, the quality of treated leachate in ED3N and ED3S-S continue to pose a minimal odour risk at the Site and supports the field odour data (refer to **Section 7**);
- The liquid sample results are consistent with previous IOAs and very unlikely to be problematical with respect to off-site impacts. This outcome is consistent with the results from the collected gas samples from the area source sampling (refer **Section 6.1.2**). The implication of this result is discussed in **Section 8.2.1.4;** and
- The liquid samples from ED1 coffer dam indicate that the LTP was performing in an optimum condition at the time of the Audit, despite being in the process-proving phase.

6.1.6 Landfill Gas Samples

The following comments are made based on the landfill gas samples collected in the Audit:

- The Audit determined that it was not necessary to collect an inlet landfill gas sample to the Void based on the testing carried out during the 2020 Emissions Testing Report (see **Appendix C**).

6.1.7 Liquid Odour Measurement Samples

The following comments are made based on the liquid samples collected in the Audit:

6.1.8 MBT Facility

The following comments are made based on the MBT Facility samples collected in the Audit:

Biofilter System

- The odour testing results for Biofilter 1 indicated a lower inlet odour emission rate compared to the previous IOA (85,300 ou.m^3/s to 27,000 ou.m^3/s). This is likely reflective of the operating conditions prevailing at the time. The biofilter outlet results were below the desirable performance target of 1,000 ou;

- The odour testing results for Biofilter 2 indicated a modest higher inlet odour emission rate compared to the previous IOA (188 ou.m^3/s to 231 ou.m^3/s). This is likely reflective of the operating conditions prevailing at the time. The biofilter outlet results are above the desirable performance target of 1,000 ou; and

- Broadly, the biofilter outlet results indicate that at the time of sampling the biofilter bed moisture was low and requires further optimisation to enable improvement. This applies to both Biofilter 1 and Biofilter 2 at the MBT Facility. The effect of this operating circumstances has meant that the biofilter outlet emissions are higher than the desirable target or the outlet character continues to consist of the inlet character;

MBT Maturation Pad

- The samples from the MBT Maturation Pad were collected to represent the age profile of the stockpile material present at the time; and

- The SOER range was between 0.14 – 3.0 ou.m^3/m^2/s and reflect the quality of the stockpile material sampled at the time. This range is modestly comparable to the previous IOA and reflects the potential variability in the externally stored stockpile material at any given time.

7 FIELD AMBIENT ODOUR ASSESSMENT SURVEY

A series of FAOA surveys were conducted as part of the Audit. It is understood that the completion of these FAOA surveys was required at specific times over the course of the Audit, as requested by NSW EPA. Specifically, the FAOA surveys were required to be undertaken during the following time periods:

- Before 0730 hrs;
- Midday; and
- After 2100 hrs.

The FAOA surveys are beneficial in assessing any potential fugitive emission release from the Bioreactor operations and its impact off-site, particularly when conducted during these hours. The FAOA were conducted over the period between 8 March 2021 and 9 March 2021. All surveys were carried out by calibrated and experienced TOU field assessors. The following section summarises the methodology and results from the FAOA surveys conducted as part of the Audit. The FAOA survey logsheets are provided in **Appendix E**.

7.1 FAOA SURVEY SCHEDULE

The FAOA survey schedule undertaken for the Audit is summarised in **Table 7.1**.

Table 7.1 – FAOA survey schedule: 8 March 2021 – 9 March 2021

FAOA Survey Session No.	Survey Date	Survey Time
1 of 3	8 March 2021	Evening, 2103 hrs – 2225 hrs
2 of 3	9 March 2021	Morning, 0530 hrs – 0718 hrs
3 of 3	9 March 2021	Midday, 1202 hrs – 1335 hrs

7.2 PREAMBLE

At present, no Australian Standard exists for FAOA surveys. Consequently, TOU utilises a method for assessing the ground-level impacts of odour emissions using a modified version of the German Standard VDI 3940 (1993) – '*Determination of Odorants in Ambient Air by Field Inspections'*. This standard prescribes the methods by which field technicians (or assessors) determine, define and document observed ground level odours and the manner in which the determination of these odours is defined in relation to odour character, the frequency of odours observed and the odour intensity of those individual observations as a quantitative scale of measure.

FAOA surveys are considered a valuable odour impact assessment tool as previous experience with ambient odour sampling and subsequent olfactometry testing suggests that accurate and useful ambient odour concentration data is difficult to obtain. Therefore, TOU has adopted a more practical approach based on the field measurement of odour intensity. With this method, calibrated and experienced odour assessor/s traverse the general area and downwind surrounds of odour sources in a strategically mapped pattern, assessing the presence, character and intensity of any odours encountered and recording these observations along with wind speed and

direction (when applicable). For the FAOA surveys conducted at the Site, all accessible downwind areas were assessed. The assessed areas were based on the wind conditions prevailing at the time of the FAOA Survey.

7.3 FAOA SURVEY MEASUREMENTS METHODOLOGY

The techniques employed in the FAOA surveys conducted during the Audit were able to quantify and/or qualify the following:

- Odour intensity:
- Odour character;
- Frequency;
- Extent of odour plume; and
- Likely source of odours detected near and far-field from the Site.

For the surveys undertaken at the Site, each TOU assessor spent five- to ten-minutes at each Measurement Location Point (**MLP**) in order to gauge the effects of any odour impact. Each measurement cycle comprised of 30 individual 'grab' assessments of odour, one every ten seconds for a single measurement cycle of five minutes. When plotted each grab measurement resulted in a single data point.

Overall, each survey utilised one or two assessors, with each assessor undertaking measurements over the assessment area at different MLPs over the duration of each survey session. The derived results of the surveys were then illustrated visually on odour impact maps.

At each MLP, wind velocity and direction was checked using a vane anemometer. In the event of a positive detection of odour at an MLP, the TOU assessor attempted to evaluate the odour intensity, odour character and likely source (whenever possible). In this way, the FAOA method enables the determination and extent of the impact of odour around the area of interest, rank their intensity and likely source.

7.3.1 Odour Intensity Categories

The ranking scale for the observed off-site odours detected beyond the facility boundary was quantified according to the *German Standard VDI 3940 'Determination of Odorants in Ambient Air by Field Inspections'.* The standard's ranking system is based on the following 7-point intensity scale, as shown in **Table 7.2**.

The MLP assigned an odour intensity score of '0' (not detectable) were still be recorded in order to outline the presence and extent of the odour present at the MLP. The 'distinct' level is that at which the odour character (e.g. bin juice, fermented garbage, putrid) is clearly definable.

Table 7.2 - VDI 3882 (Part 1) odour intensity categories		
Odour Strength	**Intensity Rank (code)**	**TOU Interpretation (meaning)**
Not detectable	0	No odour detected
Very Weak	1	Odour recognised and where possible assigned to the odour source
Weak	2	Odour is weak but not yet distinct
Distinct	3	Odour is clearly distinct
Strong	4	Strong odour detectable
Very Strong	5	Very strong odour detectable
Extremely Strong	6	Extremely strong odour detectable

7.3.2 Odour intensity and frequency criterion.

Although outside the scope of work for the Audit, and referring to the Odour Intensity Categories listed and described in **Table 7.2** above, a particular odour intensity level can often be linked to a possible odour impact from an assessed facility. This criterion, whether it is Category 2 (Weak) or Category 3 (Distinct), will be dependent upon the sensitivity of the receptor areas, the nature/offensiveness of the odours present, and the frequency of exposure. Odour Intensity Category 1 (very weak) would rarely, if ever, correspond to adverse odour impacts.

As previously mentioned in **Section 7.3**, the FAOA surveys conducted downwind of the Site resulting in two assessors generating 30 sniffs per measurement cycle per MLP. From this, the data was benchmarked against a suitable frequency impact criterion of 10%, i.e. a positive detection of an odour is measured for more than or equal to 10% of the time (equivalent to 3 sniffs over 5 minutes) during the measurement cycle at an odour intensity of 1 or greater. This criterion was selected based on previous FAOA studies conducted by TOU and considered to be the event in which adverse odour impact is likely.

7.3.3 FAOA Key Odour Descriptors

The odour sources at the Site have their origins from the processes occurring in each key area, such as the Void, LMS, and MBT Facility. Based on TOU's extensive experience at the Site, key odour descriptors were allocated and subsequently standardised to represent the quality of odours detected within the assessed area. The odour descriptors used in the surveys enabled for the characterisation of the detected odour/s and determination of likely source by strategically undertaking the surveys upwind, downwind and closer to the Site boundary, when required.

The definition for each odour character/descriptor used in the FAOA surveys are as follows:

- **Odour Character A – bin juice, fermented garbage, putrid**: based on the observations and findings made in the Audit, the likely source for this odour descriptor is the Void, specifically fugitive gas emissions.

7.3.4 Survey Meteorological Conditions

Ideally, FAOA surveys should be carried out over a range of meteorological conditions, from near-calm to moderate to strong wind speeds, and under differing wind directions. The result of each FAOA survey would then determine the impact range within that assessment area for that survey, and the overall findings representing a broader picture of possible adverse odour impacts. For the FAOA Surveys conducted as part of the Audit, the focus was on the times of the day when calm to light winds are prevalent, i.e. early mornings and late evenings and cooler temperatures. These meteorological conditions are suspected to be the most problematic, based on logged odour complaints.

The general prevailing local wind conditions at the time of conducting the FAOA surveys were broadly calm to light wind speeds with westerly, north-westerly, east-north easterly, and easterly wind directions encountered. There was some rainfall encountered infrequently during the day, prior to the surveys being conducted.

7.3.5 Recording of Meteorological Conditions

Local meteorological conditions prevailing over the duration of the FAOA surveys were recorded using a Kestrel 4500 Pocket Weather Tracker Anemometer (see **Photo 7.1** for an illustrated setup). At each MLP assessed, the assessors would set up the anemometer apparatus enabling for a grab measurement of wind speed and direction at an MLP. This was undertaken during every survey at each MLP.

Photo 7.1 - Illustrated setup of the Kestrel Anemometer apparatus in operation (**Source**: The Odour Unit Pty Ltd)

7.3.6 Interpretation of Survey Findings

Each map plot result consists of several features. These are generally depicted on a pie chart and wind vane indicator on each map plot. The features include:

- **A measurement location point (MLP)**: these are strategic points on the map were designed to enable assessors to pursue upwind and downwind effects from the Site;

- **Location wind conditions**: the local wind direction and speed at each MLP has been indicated by a yellow arrow. In the event a wind direction has not been indicated, the conditions at the time were calm (i.e. < 0.5 m/s) and wind direction was unable to be accurately determined. The recorded wind conditions at each MLP may have varied at the time of the assessment from the prevailing wind conditions that existed in the general Tarago precinct recorded by local meteorological stations. Given the complex meteorological dynamics that can occur arising (such as local terrain, topography, katabatic channelling and effects from natural and built environments) affecting wind direction and speed, the local wind conditions experienced at some MLP varied from the prevailing wind condition; and

- **Odour descriptors:** at each MLP where a measurement cycle is undertaken, key parameters are recorded where an odour is detected. The key descriptors shown on the maps include the intensity of odour (how strong the smell is) based on the VDI 3882 German Odour Intensity Scale. In addition, the odour character is also recorded based on an odour character inventory developed by TOU to describe the range of odours encountered throughout the course of the surveys.

7.4 FAOA SURVEY RESULTS

The FAOA survey results are presented on odour impact map plots, as follows:

- **FAOA Survey Map Plot 1** – Session 1 (Evening): 8 March 2021 between 2103 hrs and 2225 hrs;

- **FAOA Survey Map Plot 2** – Session 2 (Morning): 9 March 2021 between 0530 hrs and 0718 hrs; and

- **FAOA Survey Map Plot 3** – Session 3 (Midday): 9 March 2021 between 1202 hrs and 1335 hrs.

7.4.1 Commentary on FAOA Results

Based on the FAOA survey map plot results, the following comments are made:

- **FAOA Survey Map Plot 1:** A ‘bin juice, fermented garbage, putrid’ odour was intermittently detectable at MLPs 1-7 at an odour intensity of very weak (1) to distinct (3). The likely source was determined to be the Site, specifically the Void. The assessment area included the Braidwood Road and Lumley Road;

- **FAOA Survey Map Plot 2**: A ‘bin juice, fermented garbage, putrid’ odour was detectable at MLPs 2,5 & 4/9 at an odour intensity of very weak (1) to distinct (3).

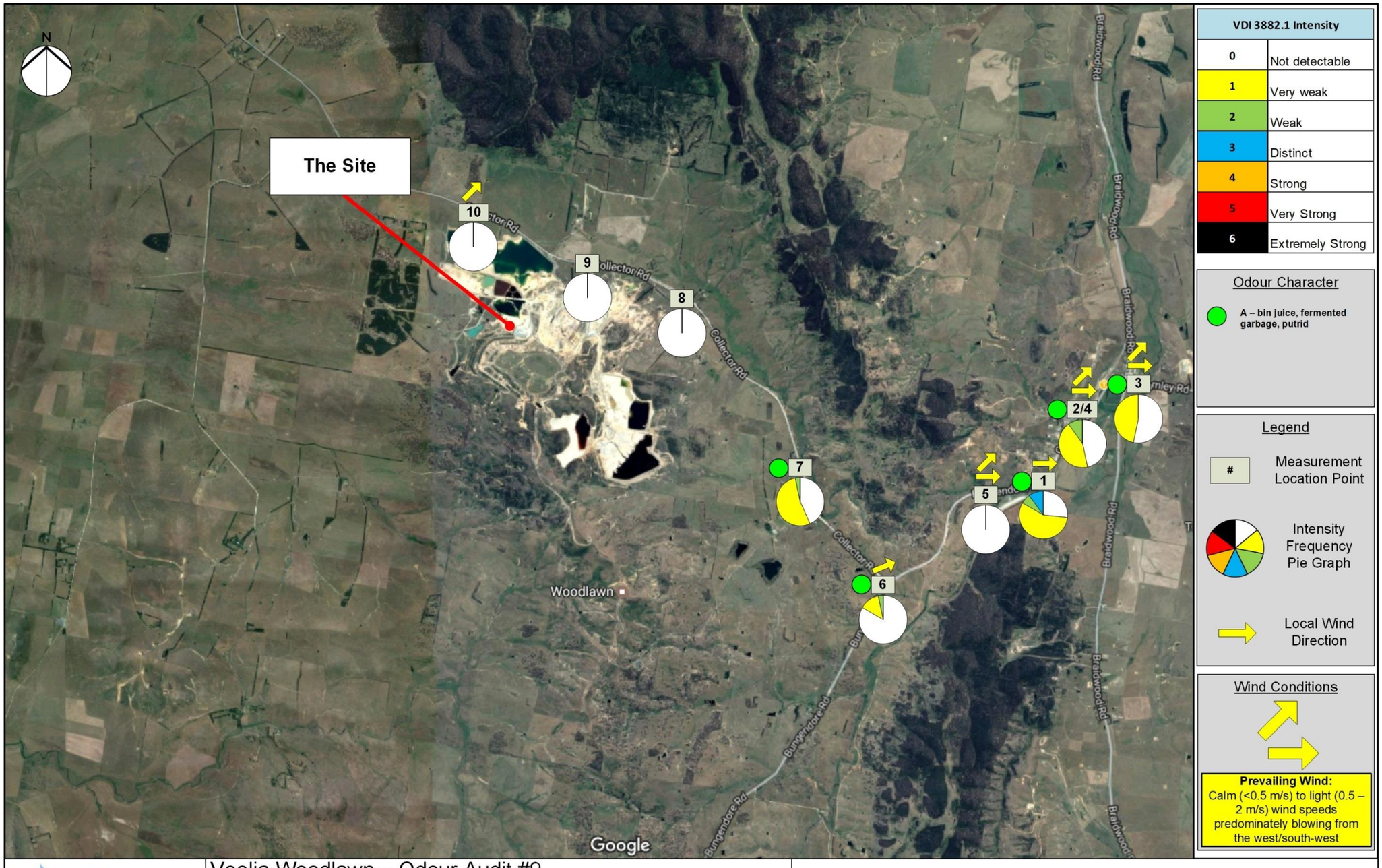
The likely source was determined to be the Site, specifically the Void. No odour was detectable at Tarago at the time;

- **FAOA Survey Map Plot 3**: A 'bin juice, fermented garbage, putrid' odour was intermittently detectable at MLP 3 at an odour intensity of very weak (1) to weak (2). The likely sources were determined to be the Site, specifically the Void. There was no other odour detectable at any other MLPs at the time;

- The FAOA survey findings are broadly consistent with the odour modelling predictions documented in **Section 9**. In view of the FAOA surveys and modelling plots (refer to **Section 9.5**), it is unlikely that the sampled source areas as found during the Audit had the potential to adversely impact the nearest sensitive receptor to the Void and the Tarago Community. Instead, it is possible that the observed impact found during the FAOA surveys is related to fugitive emissions from the Void (refer to **Section 8.2.1.10** and **Section 10.2.1** for further context); and

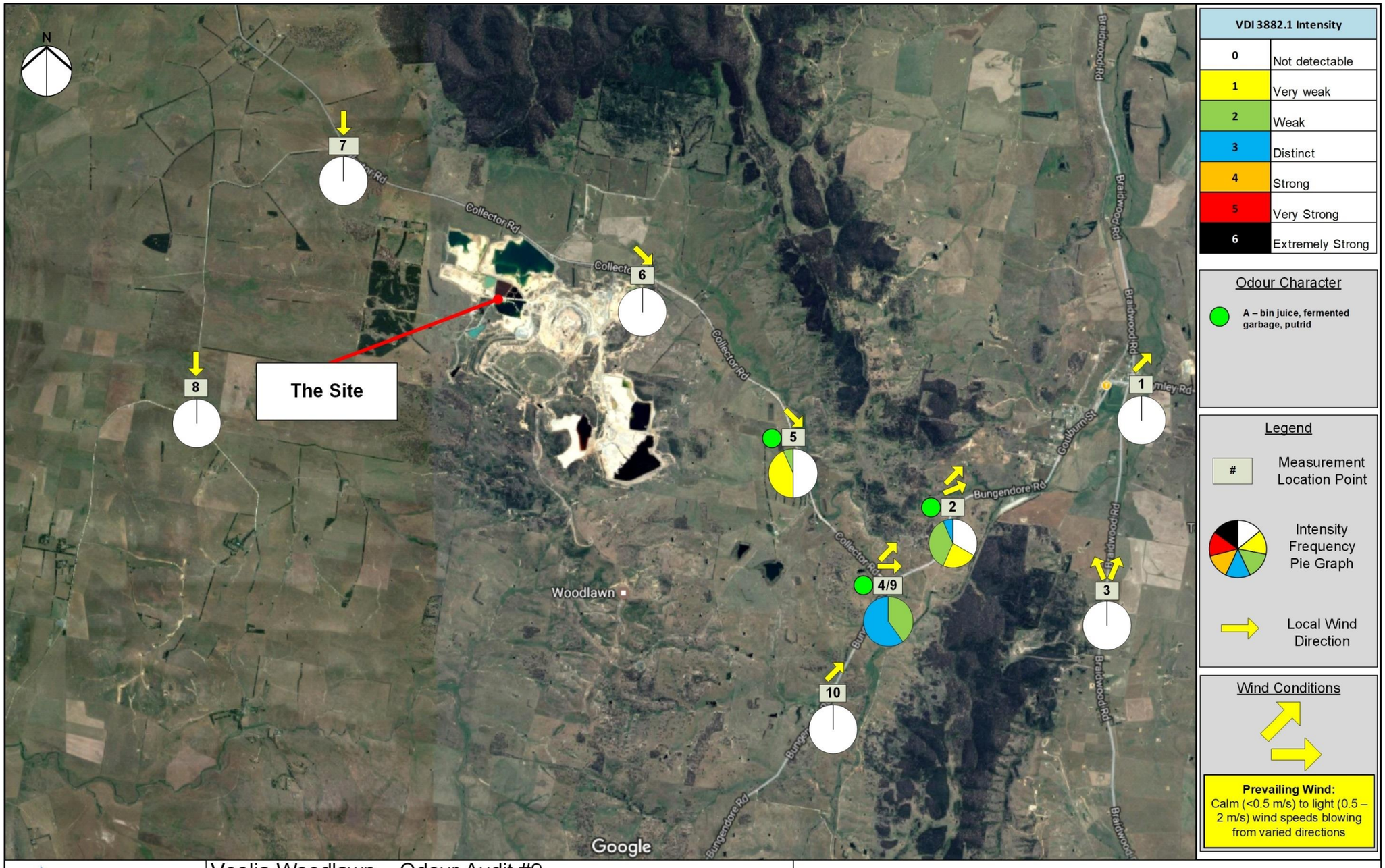
- No pond related sources, including ED3N Pond System, ED3S-S Pond System, LTD, LTP and were detectable over the course of the FAOA surveys conducted in the Audit. This supports the derived odour emissions results found in the Audit, which continue to show that all pond sources at the Site are unlikely to lead to off-site impacts under the current treatment and storage conditions (despite the observed outliers, refer to **Section 6.1.2** – **Section 6.1.4**).

Overall, an odour that can be traced back to the Site were detectable downwind at moderate distances during the FAOA Surveys conducted in the Audit. The major odour that was intermittently detectable was garbage-based at odour intensities that varied between very weak (1) and distinct (3). Based on the derived odour measurements, extensive experience gained by the Audit team of the Site, and at other landfill operations, this odour is likely related to fugitive gas emission pathways originating from the surface of the Void, which is judged to be the major contributor to the risk of odour emission release from the Void. This supports Veolia continued strategies as documented in the WIP 2020 (refer to **Section 10.2.1**) and previous audit recommendations promoting striving for operational excellence and continuous improvement in this area.



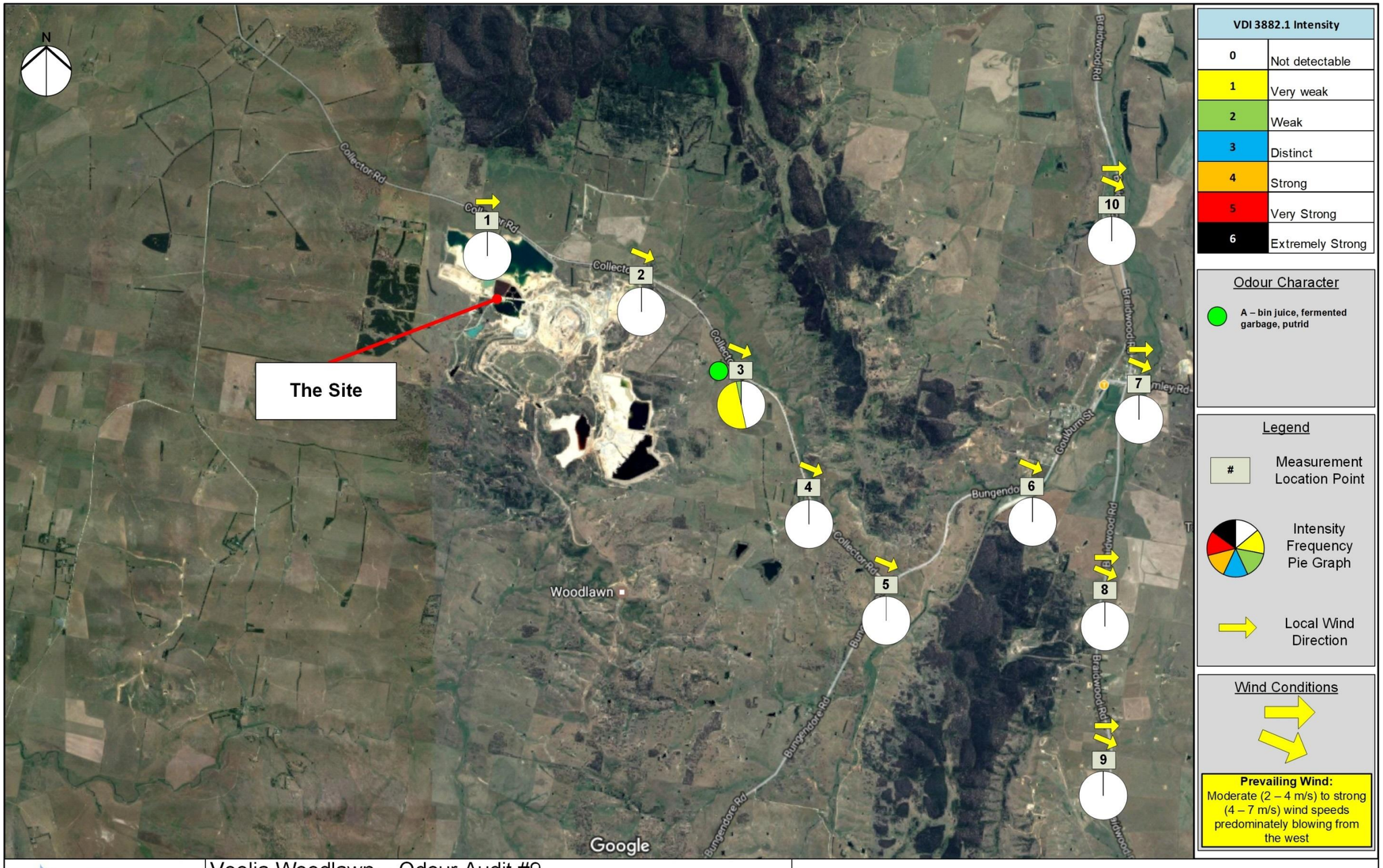
THE ODOUR UNIT	Veolia Woodlawn – Odour Audit #9 Field Ambient Odour Assessment Survey Session #1 of 3 - Evening Odour Impact Map	**Field Ambient Odour Assessment Survey** Session Date: 08/03/2021 Session Time: 2103 hrs – 2225 hrs Area: 1 Odour Impact Criterion: Intensity ≥ 1 Frequency ≥ 10% Drawn By: I. Farrugia Revision: 1 Drawn Date: 11/03/2021

FAOA Survey Map Plot 1 – Session 1 (Evening): 8 March 2021 between 2103 hrs and 2225 hrs



THE ODOUR UNIT	Veolia Woodlawn – Odour Audit #9 Field Ambient Odour Assessment Survey Session #2 of 3 - Morning Odour Impact Map	**Field Ambient Odour Assessment Survey** Session Date: 09/03/2021 Session Time: 0530 hrs – 0718 hrs Area: 1 Odour Impact Criterion: Intensity ≥ 1 Frequency ≥ 10% Drawn By: I. Farrugia Revision: 1 Drawn Date: 11/03/2021

FAOA Survey Map Plot 2 – Session 2 (Morning): 9 March 2021 between 0530 hrs and 0718 hrs



THE ODOUR UNIT	Veolia Woodlawn – Odour Audit #9 Field Ambient Odour Assessment Survey Session #3 of 3 - Midday Odour Impact Map	**Field Ambient Odour Assessment Survey** Session Date: 09/03/2021 Session Time: 1202 hrs – 1335 hrs Area: 1 Odour Impact Criterion: Intensity ≥ 1 Frequency ≥ 10% Drawn By: I. Farrugia Revision: 1 Drawn Date: 11/03/2021

FAOA Survey Map Plot 3 – Session 3 (Midday): 9 March 2021 between 1202 hrs and 1335 hrs

8 AUDIT DISCUSSION

8.1 PREVIOUS AUDIT RECOMMENDATIONS

Table 8.1 & **Table 8.2** outline the mandatory and non-mandatory recommendations documented in the previous IOA, respectively, and Veolia's response to those recommendations since that time.

It is important to note that some of these recommendations are, and will continue to remain, an integral part of the on-going process operations and plans at the Site. The WIP 2020 is a comprehensive and technically focused document aimed at educating management, operators and relevant stakeholders on the operational philosophy and continuous improvement and infrastructure development plans for the BWMS. These on-going process operations and plans are part of the WIP 2020 and include, but are not limited to:

- Planned infrastructure instalments within each waste lift.
- Landfill gas collection system including:
    - The design philosophy for the system of wells beneath the waste profile in the Void;
    - Well extensions; and
    - Horizontal infrastructure and condensate management.
- Continuous monitoring of leachate and gas extraction.
- Remediation actions in the event of equipment failure and process upset in the Void. It also documents the contingency measures implemented to ensure the sustained operation of the Void in the event of equipment failure and process upset.
- The implementation of operational management programs, including:
    - Leachate management;
    - Pumps and pumping solutions; and
    - The expansion of wells in the Void to optimise and improve landfill gas extraction and minimise leachate generation.
- Specific management techniques for:
- H_2S management;
- Covering of waste;

- The design, location, and implementation of the biofiltration cover material along the perimeter of the Void, where required;
- Intensification of the management of stormwater events as to minimise the generation of leachate;
- Management of leachate eruptions and power failures;
- Application of biocover material to manage fugitive gas emission pathways from the surface of the Void; and
- Details on current issues and long-term plan for the Site.

The above on-going process operations (and others) are comprehensively documented in previous Woodlawn Infrastructure Plan (**WIP**), with the latest details provided in the WIP 2020. The Audit notes that the WIP is a 'live' document that is constantly updated as the volume of waste into the Void increases over time.

Veolia made the full document of the WIP 2020 available for review in the Audit. As previously mentioned in **Section 1.3**, the relevant components of the WIP 2020 are incorporated into the Audit report, where required, as this is a commercial-in-confidence document.

8.1.1 Mandatory Recommendations

The mandatory recommendations from the previous IOA are summarised in **Table 8.1** and include the follow-up response to those recommendations since that time.

8.1.2 Non-Mandatory Recommendations

The non-mandatory recommendations from the previous IOA are summarised in **Table 8.2** and include the follow-up response to those recommendations.

Table 8.1 – The 2019 IOA Mandatory Recommendations and Veolia's Response

No.	The 2019 IOA Mandatory Recommendations	Follow-up Response to Recommendation
1	*Fugitive landfill gas emissions* Veolia should continue to improve landfill gas capture from the Bioreactor. This continuation is underway with Veolia completing its WIP 2020, which outlines a comprehensive plan that is being implemented to increase gas capture. It also seeks to address current areas of concern and the potential solution outcomes that can be implemented. This is an active (and effective) management approach that will result in a continual improvement in gas capture efficiency and ultimately reduce odour/landfill gas emissions from the Void. The Audit endorses this strategy as the primary measure to reduce odour emissions from the Void and recommends that Veolia continues the implementation of the gas systems detailed in the WIP 2020, including: The augmentation of additional pipe work and booster/flare/engine to the current capacity at the Site. In principle, the addition of the power station engines will increase landfill gas usage capacity, further facilitate in the optimisation and minimisation of fugitive landfill gas release from the Void surface; ▪ the planned infrastructure instalments within each waste lift; ▪ the continuous improvement to leachate extraction, treatment performance, capacity and efficiency. This supported by the implementation of the long-term leachate solution in the form of the LTP that is the process-proving phase of operation; ▪ the continuous improvement in the waste tipping profile, covering and expansion and optimisation of the landfill gas infrastructure; ▪ the continuous monitoring of leachate and gas extraction; ▪ Remediation actions in the event of equipment failure and process upset in the Void; ▪ The implementation of operational management programs, including: o Leachate management; o Pumps and pumping solutions; and o The expansion of wells in the Void for improved/minimisation of leachate recirculation and landfill gas extraction. It should be noted that the WIP 2020 is a live document that will be continually updated. Therefore, it will continue to remain a part of the IOA.	The improvement in gas capture from within the Void is an on-going planning and operational exercise that Veolia will continue to be implemented. This is evident from the WIP 2020, an updated plan for the current and future operations at the Site. Similar to previous versions of the WIP, the WIP 2020 outlines the operational issues and plans to: ▪ improve and optimise leachate flow, treatment, and recirculation; ▪ Intensification of the management of stormwater events as to minimise the generation of leachate; ▪ the process-proving of the long-term leachate strategy in the form of the LTP; ▪ improve gas capture through leachate management and infrastructure setup and configuration, ▪ reduce fugitive gas emission to minimise odour. This includes the use of biocover material on the surface of the Void; ▪ optimise tipping strategy; ▪ Application of biocover material to manage fugitive gas emission pathways from the surface of the Void; and ▪ The connection of more wells/trenches. The WIP 2020 document is 'live' and designed around both a proactive and reactive approach in addressing infrastructure and operational issues. The WIP 2020 also has clearly defined goals on targets with respect to gas performance and leachate management.

Table 8.1 continued **–** The 2019 IOA Mandatory Recommendations and Veolia's Response		
No.	**The 2019 IOA Mandatory Recommendations**	**Follow-up Response to Recommendation**
2	*Leachate Management System* *Continue to adequately maintain and manage the upgraded LMS to ensure it is operating in an optimum state and meeting the leachate quality monitoring targets as outlined in the Leachate Treatment Operation Manual and recommended by Veolia Water. Moreover, continue the implementations planned in the WIP 2020. Both the manual and WIP 2020 should be considered as a 'live' document to reflect any variation in quality and operational demands and identifications of new constraints and/or issues. This should continue to attenuate the potential for significant odour generation from the leachate stored in ED3N & ED3S Pond Systems both now and in the future.* *The Audit finds that the LTP has provided additional leachate treatment capacity at the Site. Moreover, the treated leachate flowing to ED1 coffer dam from the LTP is of a very high quality, as supported by the LOM results. The inclusive of additional leachate treatment capacity will have a significant effect on the minimisation of odour from the Void and LMS in the medium to long-term. In collaboration with Veolia, the next Audit will make provisions for safe access to enable sampling of the ED1 coffer dam.*	It is clear from the on-site observations, odour emissions data collected during the Audit, and the WIP 2020 that Veolia continues to actively manage and improve the LMS. This is also evident in Veolia's implementation of long-term leachate management solution where an LTP is in the process proving phase of operation, resulting in high-quality effluent stored in ED1 coffer dam, which is supported by the LOM results (refer to **Section 6.1.7**). This infrastructure is critical in navigating through the high rainfall condition as noted in the Audit period (refer to **Section 8.2.1.10.1**).
3	*Active Tipping Face* *Veolia should continue to develop strategies for the minimising of the exposed active tipping face surface area. It should also proceed and continue with the details in the WIP 2020.*	Based on the WIP 2020, disposed waste is covered daily and at intermediate stages of operation to minimise dust, litter, the presence of scavengers and vermin, fire risk, rainwater infiltration into the waste (and therefore the amount of leachate generated) and the emission of landfill gas at the Site. The active tipping face activities are regularly reviewed and configured to minimise the working surface area.

Table 8.2 - The 2019 IOA Non-mandatory recommendations		
No.	**The 2019 IOA Non-Mandatory Recommendations**	**Follow-up Response to Recommendation**
1	*<u>Refine investigation of odour issues in the community</u>* *Given the significant improvement in landfill gas extraction in the Void and expansion and improvement in the leachate management system through optimisation of surface water catchments, landfill gas infrastructure design, active tipping practices and increased leachate treatment capacity via the commissioning of the LTP, the odour complaints trend appears to have realised the benefits from the continuous improvement plans implemented at the Site. This is an excellent outcome for a complex operation such as the Site.* *Notwithstanding the substantial reduction in odour complaints, the Audit recommends that Veolia continue its active engagement with the community through its existing odour complaints and response management strategy. The handling and management of odour complaints will be reassessed in the next IOA to evaluate the need for additional forms of community engagement, given that the number of complaints remains historically low. As such, the refinement in community engagement remains as a non-mandatory recommendation in the Audit to ensure this matter is provided with the opportunity of continuous improvement. Specifically, Veolia should consider refining its investigation of odour issues in the community, particularly surrounding the most common complainants, as to assess the extent to which odour is present in the community. Such an investigation could include:* ▪ potential odour transport pathways; ▪ undertaking of field odour surveys; ▪ assess the topography of surrounding land and analysis of climatic data; and ▪ a detailed review of odour complaint data.	Odour complaints have significantly increased since the previous IOA (refer **Section 8.4.1**). From a qualitative viewpoint, this increase appears to be related to the observed reduction in landfill gas extraction in the Void and related impacts associated with the high rainfall conditions over the Audit period. Given this outcome, the Audit recommends that Veolia enhance and continue its active engagement with the community through its existing odour complaints and response management strategy and reinstatement of the odour diary program (refer to **Section 10.2.4**). The handling and management of odour complaints will be reassessed in the next IOA to evaluate the need for additional forms of community engagement, given that the number of complaints remain historically low (refer to **Section 8.4.1**).
2	*<u>IMF and Waste Transport Activities</u>* *Based on TOU observations, the Audit suggests that Veolia continue to review the following aspects relating to the use of the IMF and waste transport activities to further improve its odour performance as a minor and transient source of odour:* ▪ The washing practice associated with the sealed containers; and ▪ The maintenance of the sealed containers.	Veolia continues to implement and optimise its extensive container management plan to ensure that all waste containers are in a good condition and not at risk of being a source of odour.

Table 8.2 (continued) - The 2019 IOA Non-mandatory recommendations		
No.	**The 2019 IOA Non-Mandatory Recommendations**	**Follow-up Response to Recommendation**
3	*<u>Odour Mitigation from the MBT Facility</u>* *The Audit recommends a heightened awareness of the operability and maintenance of the biofilter-based odour control system at the MBT Facility, which should be consistent with the Biofilter Manual to ensure optimal and sustained odour removal performance. Given that the MBT Facility operation is a recent addition to the Audit, a benchmark process will be developed and reviewed as part of subsequent IOAs to assess the operability and odour performance of the biofilter-based odour control system with the objective of continuous improvement in odour mitigation and optimisation.*	The MBT Facility operations continue to undergo continuous improvement in mitigation and optimisation of the product quality stored on the MBT Maturation Pad. Moreover, the MBT Facility has assigned dedicated personnel to manage and maintain the biofilter system (refer to **Section 10.3.2**).

8.2 DISCUSSION OF AUDIT FINDINGS

The following discussion examines the results of the Audit against each of the conditions of consent relating to the Woodlawn Waste Expansion Project.

8.2.1 Condition 7 (B & D)

Condition 7 (B & D) of the Audit requirements stipulate that the following will be carried out in the IOA:

- *Audit the effectiveness of the odour controls on-site in regard to protecting receivers against offensive odour; and*
- *Review the relevant odour sections of the Air Quality and Greenhouse Gas Management Plan for the project and assess the effectiveness of odour control.*

As mentioned in the previous IOAs and complemented by the Audit's on-site experience and discussions with Veolia personnel, there continues to be a range of current and on-going odour controls implemented at the Site designed to mitigate off-site impacts arising from its waste management operations. These revolve around:

1. The leachate recirculation method (refer to **Section 8.2.1.1**);
2. Optimisation and continuous treatment of excess leachate from the Void (refer to **Section 8.2.1.1**);
3. Improvement of landfill gas extraction from the Bioreactor (refer to **Section 8.2.1.2**);
4. Adequate combustion of landfill gas (refer to **Section 8.2.1.3**);
5. Improve evaporation capability (refer to **Section 8.2.1.4**);
6. The continued implementation of biofilter cover material, particularly in know high-risk areas such as the Void perimeter where shrinkage effects are pronounced and cracks in surface cover (refer to **Section 8.2.1.5**);
7. Using the minimal active tipping face as practically possible (refer to **Section 8.2.1.6**);
8. Water cart to control dust (refer to **Section 8.2.1.7**);
9. Transportation of waste in sealed containers until unloading at the Bioreactor (refer to **Section 8.2.1.8**);
10. The minimisation of leachate generation during stormwater events through improved surface catchment management (refer to **Section 8.2.1.10**);
11. The effectiveness of the current odour control infrastructure at the MBT Facility (refer to **Section 8.2.1.11**); and

12. Quality of compost product stored in the Maturation Storage Pad Area (refer to **Section 8.2.1.12**).

8.2.1.1 Leachate Management Method

8.2.1.1.1 Operational status of leachate recirculation

To increase the landfill gas capture through the covered waste surfaces, leachate generated within the Bioreactor is removed when it becomes excess to the field capacity or interferes with gas extraction infrastructure. Any excess leachate that is extracted from the Void flows directly to the LTD for primary leachate treatment (see **Section 2.4** for further details).

The leachate recirculation method currently practised within the Void continues to be via direct injection techniques when required (refer to **Section 2.3.2**). As explained in previous IOAs, this has the effect of minimising the potential exposure of leachate partitioning from the liquid phase to the gas phase, through aerosol generation and/or evaporation pathways, and subsequently leading to the generation of odorous emissions. The 2012 IOA indicated that Veolia's adoption of this recirculation technique is more effective at minimising odours than previously utilised techniques (such as spray sprinklers). The previous 2013 IOA concurred with this finding.

As previously mentioned in **Section 2.3.2** and based on the WIP 2020, the leachate recirculation has been stopped due to leachate problems and the restriction of the landfill gas extraction caused by the leachate. As such, there is only one reinjection infrastructure being kept as a contingency leachate management method when the leachate transfer system experiences any failure. The re-injection point is currently located in the eastern wall of the void, with a 110 mm high-density polyethylene pipe placed into the waste during the previous two lifts. The re-injection point is connected to the ring main and normally in the close position. In the circumstance of leachate transfer system failure, e.g. pump failure or pipe damage, the valve between the re-injection point and the ring main will be opened to allow the extracted leachate to be re-injected to the waste.

8.2.1.1.2 Optimisation and continuous treatment of excess leachate from the Void

<u>The LTD</u>

The Audit understands that there is no longer a need to store untreated leachate in the evaporation dams following the upgrade improvements made to the LTD system since April 2013 (refer to **Section 2.4.5** for background details) and the growing waste volumes in the Bioreactor. Moreover, since the 2014 IOA, Veolia has further modified the leachate treatment process by dividing the LTD into two treatment zones, namely (in order of process flow):

- an anoxic zone; and
- an aerobic zone.

The splitting into these zones appears to suggest that the Site has converted the LTD into an activated sludge treatment process, which is aimed at optimising COD reduction and/or nitrification/denitrification processes. This modification reflects Veolia's on-going

efforts in optimising the treatment process. From an odour emissions viewpoint, the optimisation of leachate treatment has significantly improved the Site's odour emissions profile from a pond-related source (refer to **Section 8.5.1**).

Based on the details above, the Audit continues to support this modification from a leachate treatment perspective, provided that optimum conditions in the LTD are sustained and continue to result in good quality treated leachate that contains none of the original odour characteristics of untreated leachate. It is understood that Veolia continues to regularly monitor the treated leachate quality and performance.

The LTP

The Site has constructed and commissioned an MBR-based facility (i.e. the LTP) as the long-term leachate management strategy. As indicated in the WIP 2020, the LTP is in the process proving stage which includes, but is not limited to, biomass growth, biological process tuning, and process optimisation. The LTP MBR-based system has been designed as a modified activated sludge biological process to treat the main parameters found in the raw leachate extracted from bioreactor to a higher quality effluent. The LTD and LTP are currently operated simultaneously at the Site, providing an improved capability in leachate management and treatment capacities from the Void.

Based on the above analysis, no further action is required by Veolia on this matter. If, however, there are future operational issues with the LMS, Veolia should take the precautionary measures of notifying the NSW EPA (and any other relevant stakeholders) until the issue is rectified.

8.2.1.2 Improvement of landfill gas extraction from the Bioreactor

Landfill gas extraction at this Site is an on-going operational process. The WIP 2020 indicates that there is a comprehensive plan by Veolia to increase gas capture by undertaking the following key items:

1. The continuous expansion of the new capture system to promote gas collection; and

2. Management of leachate via minimising surface water flow, leachate recirculation, improvement in landfill gas infrastructure design and condensate management, and improvement in continuous treatment capacity and efficiency (achieved via the installation of the LTP).

Further information regarding the design and operation of the landfill gas extraction system has been previously documented in extensive detail in the 2012 IOA Report. As such, it has not been documented in the Audit.

8.2.1.2.1 Landfill gas extraction and fugitive emissions

As outlined in the previous IOAs, it is difficult to calculate a representative odour emission rate from the Void given the dynamic virtue of the surface layout. Therefore, as per previous IOA, an alternative approach has been taken where improvement in landfill gas capture efficiency is used as an indicator of reduced potential for fugitive gas emissions from the Void surface.

Table 8.3 summarises the average monthly landfill gas extraction results over the period between February 2020 and March 2021 compares this result to that obtained in the 2019 IOA. As can be derived from the results in **Table 8.3**, the monthly averaged landfill gas extraction over the period between February 2020 and March 2021 was approximately 2,689,206 m^3 (gas to generators plus flared). In comparison to the gas extraction result obtained from the previous period in the 2019 IOA (i.e. 2,948,953 m^3), this represents a decrease of approximately 9.7% in total gas extraction volume (equivalent to 259,747 m^3). This decrease may be a contributing factor to the observed FAOA survey results (refer to **Section 7.4.1**) and high number of odour complaints (refer to **Section 8.4.1**).

Table 8.3 – Monthly landfill gas extraction between 2019 IOA & the Audit

Summary table	Values
2019 IOA landfill gas extraction (m^3/month)	2,948,953
The Audit landfill gas extraction (m^3/month)	2,689,206
Improvement performance	**-9.7%**

The landfill gas trend between February 2020 and March 2021 is illustrated in **Figure 8.1**.

8.2.1.2.1.1 Fugitive landfill gas emissions

As noted in the previous 2019 IOA, the Audit understands that gas capture is measured against a calculated emissions model issued by the *Australian Government – Clean Energy Regulator*. This aspect is outside the scope of the Audit and is therefore not discussed further. Nevertheless, as demonstrated in previous IOAs, it remains clear that fugitive landfill gas emissions emitted from the Void surface can have a very high odour emission potential if gas capture efficiency declines. Therefore, the Audit continues to endorse Veolia's plan to actively improve gas extraction capability from the Bioreactor and the items addressed in the WIP 2020 to achieve this, including:

- Gas field balancing, where individual gas extraction wells in the gas extraction network are monitored routinely for gas composition and pressure. This monitoring aims to achieve the following operational objectives:
- Adjust wells to optimise landfill gas extraction;
- Determine if any wells are damaged or malfunctioning
- Determine average and highest H_2S exposure;
- Occupational, health and safety concerns regarding H_2S exposure; and
- Odour management.
- Condensate management;
- Monitoring of leachate extraction and treatment, as this improves gas extraction capacities;

- Biofilter cover material on high-risk areas prone to fugitive emissions, particularly in around the Void perimeter (refer to **Section 8.2.1.5** for further details) and cracks in the surface cover of the Void;

- Optimise tipping strategy, as this ultimately affects the efficiency of landfill gas and leachate;

- The connection of more wells/trenches;

- The implementation of the long-term leachate strategy via the commissioning of the LTP; and

- Consider the undertaking of a trial for an alternative daily cover to identify potential operational benefits compared with current practices. This trial was completed in December 2020 and is understood to be awaiting review and approval by NSW EPA at the time of the Audit. The trial indicated that the alternative daily cover via the application of mixed waste organic material (**MWOO**) was effective and had the potential to improve the odour performance outcome from the surface operations of the Void and to manage fugitive odour emission release in conjunction with the existing biocover material. The trial outcomes are documented in a report titled *Veolia Environmental Services (Australia) Pty Ltd - Alternative Daily Cover – Odour Trial Study: December 2020 – Final Report*, 16 December 2020 (the **December 2020 ADC Report**).

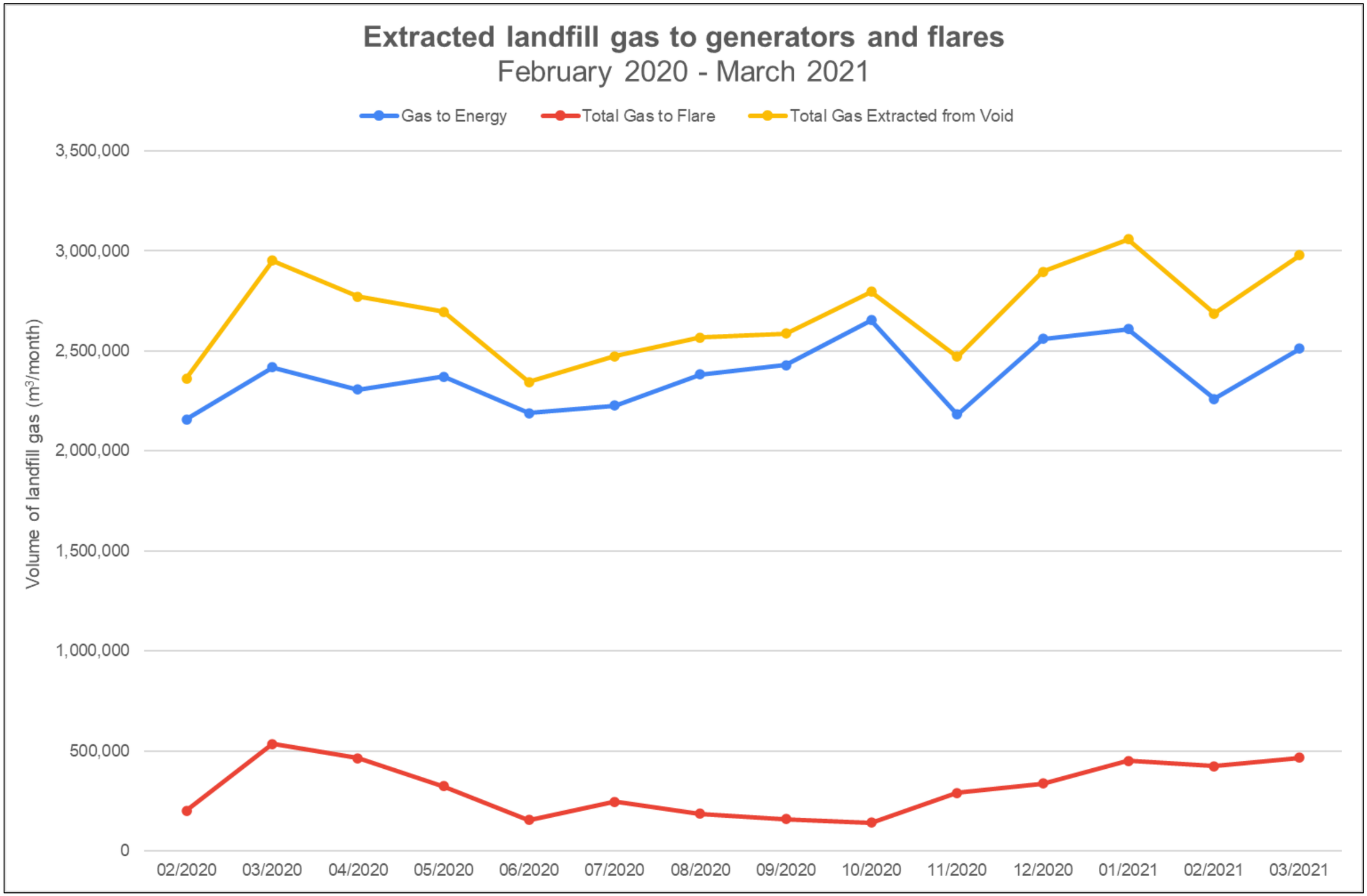


Figure 8.1 – Landfill gas trend between February 2020 and March 2021

8.2.1.3 Landfill gas combustion exhaust quality

According to the 2020 Emissions Testing Report (refer to **Appendix C**), all combusted gas emissions analysed on NSW EPA Point 8 - Generator No. 2 Exhaust Stack complied with the EPL Limits for NO_x, SO_3/H_2SO_4 and H_2S. The engine load at the time was reported to be 1,057.9 kilowatts (**kW**). The total hydrocarbon destruction efficiency was found to be 99.5%, indicating efficient combustion of the landfill gas supply to the generators.

Given the outcomes reported in the 2020 Emissions Testing Report and provided the landfill gas engines continue to operate under optimal conditions, and there is no significant deterioration in combustion performance and operating temperature, the landfill gas engine exhaust stacks are not considered to be significant odour emission sources at the Site. These results are consistent with the judgements made in the previous IOAs in that the engine stacks are a minor source of odour (given the operating combustion temperatures) and highly unlikely to result in adverse odour impact beyond the Site boundary. This finding continues to remain valid in the Audit.

8.2.1.4 Improve evaporation capability

Veolia could recommence mechanical evaporation since this activity ceased following the 2012 IOA finding of the odorous quality of the leachate previously stored in ED3N lagoons. The background for this is well documented in the previous IOAs. The Audit observed that the mechanical evaporators are now active and automated to operate under specific ambient and wind conditions (refer to **Section 2.4.2.1**).

8.2.1.4.1 ED3N Pond System evaporation and odour potential

The Audit finds that the quality of the treated leachate currently stored in ED3N pond system is modestly comparable to that observed previous IOA, where it was found to contain minimal odour emission potential and no evidence of untreated leachate character present in any of the samples collected (refer **Section 6.1.2**). This outcome indicates that the leachate treatment quality continues to be optimum and that the LMS at the Site is performing very well from an odour emissions viewpoint. This finding is also consistent with the liquid test results that indicate the liquid odour potential if the liquid was to partition to gas phase either by natural or mechanical evaporation processes. This is further discussed in **Section 8.2.1.4.2** and **Section 8.2.1.4.3**.

8.2.1.4.2 ED3S Pond System evaporation and odour potential

The SOER input from the LMS May 2016 Report used a SOER of 0.159 ou.m^3/m^2.s for the modelling of ED3S-S. The mean result derived from the Audit is 2.19 ou/m^3/m^2.s (refer to **Table 6.2**). This result is above the modelled value but unlikely to cause any adverse impact beyond the boundary of the Site, as demonstrated in the modelling documented in **Section 9**. This effect may be related to the increase in COD and nitrate loadings observed in the pond since October 2020 (refer to the *Leachate Quality Data* in **Appendix B**) given the odour character (rotten, dirty, rendering).

8.2.1.4.3 Status of evaporation capability from an odour viewpoint

The results derived using the LOM testing is summarised in **Table 6.5** The odour testing results found in the Audit, through conventional area source sampling and the liquid odour measurement potential techniques, indicate very low SOERs and odour concentration values, respectively. Also, the evaporation liquid odour character as

determined by the panellists during laboratory testing indicated an 'muddy water, musty' character across all samples, suggesting that there is no original, untreated leachate character and favourable treatment of the stored effluent in the ED3N, ED3S-S and ED1 Coffer Dam.

Overall, the Audit deduces that the pond sources at the Site continue to be a minor source of odour at the Site and are unlikely to cause adverse odour impacts beyond the boundary. Moreover, the stored contents in ED3N Pond System continues to be suitable for mechanical evaporation and is unlikely to result in adverse odour impact, provided the effluent quality continues to remain of high quality as found in the Audit. However, close monitoring of the COD and nitrates in ED3S-S should be undertaken by the Site and will be reassessed as part of the next IOA. The adequate management of the LMS continues to be in the Audit as a mandatory recommendation (refer to **Section 10.2.2**).

8.2.1.5 The implementation of improved capping material in the form of a biofilter trial program

The Audit found that the biofilter trial program has been extended and continues to be used as a means of managing odour emissions from the Void surface. The biofilter medium cover has shown that it can be effective at attenuating odour from fugitive emission pathways. However, proper management of the biofilter medium is necessary. This includes the regular watering and topping-up of biofilter medium as required. To achieve this, Veolia has developed an action strategy to streamline the management of this material. This is detailed in the Biofilter Trial Report and WIP 2020. The Audit endorses its continued use around high-risk areas prone to fugitive gas emission leaks, where required. Moreover, the use of alternative daily cover via the application of MWOO can also be utilised as it has the potential to improve the odour performance outcome from the surface operations of the Void and to manage fugitive odour emission release in conjunction with the continued use of biocover material.

8.2.1.6 Using the minimal active tipping face as practically possible

As identified in the previous IOAs, the active tipping face can vary depending on the tonnage input and how the waste is managed. Since the 2015 IOA, the exposed active tipping face was revised to reflect more realistic conditions that are prevalent in the Void (discussed further below). In addition to this, minimising the active tipping face continues to be one of the key performance indicators at the Site for the following reasons (as outlined in previous IOAs):

1. Reduces the surface area of potential odour source;
2. Minimises temporary decommissioning of gas extraction infrastructure;
3. Minimises fuel usage, particularly in dozer and compactor; and
4. To meet NSW EPA benchmark techniques.

Photo 8.1 provides a visual indication of the active tipping face area size at the time of the Audit field visit. The original value adopted in the EA 2010 for the active tipping face was 40,000 m^2. This value was later revised to between 4,000 m^2 and 6,000 m^2 in the

2013 IOA to reflect realistic and previous operating conditions occurring at the time. As of the Audit, the current active tipping area is now approximately between 1,000 m^2 and 2,000 m^2, reflecting Veolia's continued efforts at minimising the active tipping face in the Void.

Photo 8.1 - A distant view of the active tipping face area size as found on 9 March 2021

The SOER value determined during this Audit was approximately 3.2 ou.m^3/m^2.s. This is lower than the SOER value used in the EA 2010 modelling of 7.6 ou.m^3/m^2.s. Based on these results and the outcome of the modelling study (refer to **Section 9**), there is a very low risk that the active tipping face will result in downwind odour impact on the nearest sensitive receptor. Moreover, this variation is considered to reflect normal variation from the active tipping face activity inside the Void. Notwithstanding this, it should be noted that:

- Fugitive landfill gas emissions are still judged to be the major contributor to odour emissions from the Void, as previously highlighted in **Section 8.2.1.2**; and
- Veolia has optimised operational practices such as the active tipping surface area is being kept to a minimum. This practice has a significant effect on the rate of emission from this source. That is, any reduction in the exposed waste surface area will result in a proportional decrease in emissions from the active tipping face, and vice versa.

The Audit finds that current practices at the Site relating to the active tipping face are conducive to the minimisation of odour from this source

8.2.1.7 Water cart to control dust

The use of the water cart is an ongoing operational activity, which is effective at minimising dust generation. This was visually evident during the fieldwork component of the Audit. The Audit observed that the operating practice of using a water cart to control dust continues to be an on-going practice at the Site. On the above basis, no further action is required by Veolia for this component of the Site's operations.

8.2.1.8 The use of the truck wash bay

The use of the truck wash bay at the Site was observed to be consistently used by trucks upon exiting the Void. The consistent use of the truck wash bay is good practice at minimising potential odour emissions off-site that may be related to truck vehicle movement. Since the previous IOA, the truck wash bay has been optimised as follows:

- Wheel wash is continuously used for the clean the trucks coming out of the void and the performance of the wheel wash was monitored during operation; and
- Several of the spray nozzles have been modified and changed the spray angle to achieve better coverage (especially the tail of the truck) and washing performance, as shown in **Photo 8.2.** This optimisation will minimise transient levels of odour that may be detectable and associated with truck movement in the community.

Photo 8.2 – Truck wash bay nozzle optimisation (**Source:** Previous IOA)

8.2.1.9 Transportation of waste in sealed containers until unloading at the Bioreactor

Similar to the previous IOAs, the Audit has found that the current measures used for waste transport operations are very effective at mitigating any odour emissions. The Audit team inspected the IMF and conducted a brief downwind olfactometry assessment to determine any presence of waste-based odour. The inspection did not find any evidence of any waste-based odour being emitted at the IMF. On this basis, the Audit determines that there is still no need to sample the IMF as it is very unlikely to generate problematical odour emissions. This is provided that the waste containers used in the process continue to be adequately maintained and remain fully sealed during waste transportation. As such, current practices should be continued and monitored. A photo of the IMF as found during the Audit on 11 March 2021 is shown in **Photo 8.3** and **Photo 8.4.**

Based on TOU observations, the Audit suggests that Veolia continue to review the following aspects relating to the transportation of waste in sealed containers to facilitate in the minimisation of odour from this area/activity:

- The washing practice associated with the sealed containers; and
- The maintenance of the sealed containers.

Photo 8.3 - The IMF facing south-west as observed during the Audit inspection visit on 11 March 2021

Photo 8.4 - The IMF facing south-east as observed during the Audit inspection visit on 11 March 2021

8.2.1.10 The minimisation of leachate generation during stormwater events

As indicated in **Section 2.5.2,** the WIP 2020, the surface water in the Void is managed in sub-catchments, as shown in **Figure 2.11.** Each sub-catchment has either a natural or engineered drainage and flow control infrastructure, such as concrete dish drains, clay berms, pumps, and pipes, to manage surface water. These sub-catchment areas are intended to minimise the amount of surface water flow from the Bioreactor walls onto the waste. This aims to minimise the potential generation of excess leachate from surface water flows.

8.2.1.10.1 Management of high rainfall events

As previously mentioned in **Section 2.5.2.2**, any stormwater into the Void, especially the portion that directly falls on the waste surface of the Void and the runoff from the upper benches, is one major source of excess leachate generation. As documented in the WIP 2020, it is indicated that leachate generation is very sensitive to high rainfall events due to the large, influencing catchment area and partial stormwater interception.

During high rainfall events, large volumes of rainwater fall onto the waste surface. Currently, stormwater is not 100% intercepted from the surface of the waste before becoming contaminated. Following high rainfall events, the leachate extraction system prioritises the extraction of surface water over leachate collected from the sub-surface (i.e. within the Bioreactor). As leachate extraction rate is limited to up to 4 L/s at the

LTP, owing to the leachate treatment system capacity, these rainfall events result in further accumulation of leachate in the Bioreactor, potential reducing the efficiency of the landfill gas capture infrastructure and management of fugitive landfill gas emissions from the Void. Given this treatment capacity, if a suitable monitoring and performance metric protocol is established, the capability of diverting diluted contaminated stormwater to one of the evaporation dams (i.e. ED3S and ED3N) will present an opportunity to mitigate the adverse impacts associated with high rainfall events on the landfill gas capture infrastructure and provide an improved odour outcome for the Site under such circumstances.

It should be noted, however, that the leachate extraction rate represents normal operation but not the peak treatment capacity that can be managed by the LTD/LTP. Under normal operating conditions, the Site can maintain a certain freeboard in the LTD to be able to handle a peak flow event from the Void. Nevertheless, given the importance of the management of high rainfall events in the Void, the WIP 2020 indicates that an upgrade to the stormwater management system has been undertaken at the Site to minimise excess leachate generation so that stormwater can be diverted to ED3S. The high rainfall conditions over the Audit period have impacted the efficiency of landfill gas containment and extraction, which has increased the formation of o fugitive landfill gas emission pathways from the Void surface.

This feature will continue to be examined as part of the IOA.

8.2.1.11 Effectiveness of odour controls at the MBT Facility

The MBT Facility consists of an extensive odour collection and control system to manage odour emissions throughout the composting process cycle. It was found that the biofilter performance was effective in substantially reducing odour prior to atmospheric discharge. However, it is known that biofiltration of this modern design can achieve further reduction if optimised. As such, the Audit notes that Veolia should operate and maintain the biofilter-based odour control system to the Biofilter Manual as part of best practice. As such, the Audit completed the following measurement of key performance metrics (as recommended in the previous IOA, including:

- Biofilter airflow;
- Inlet humidity levels and performance of the inlet air humidification system;
- Biofilter outlet performance (refer to **Section 6.1.8**); and
- Biofilter back-pressure.

8.2.1.11.1 Biofilter Physical Performance

The physical performance of the biofilter system at the MBT Facility was assessed during the Audit. The measurement results obtained in the Audit are as follows:

Biofilter 1

Inlet airflow: 44,300 m^3/hr, actual

Temperature (Dry/Wet Bulb): 30.8ºC / 16ºC

Relative Humidity: 20.9%

Moisture Content: 5.8 g H_2O per kg of dry air

Biofilter Back-Pressure: +782 Pa

Comments: The inlet airflow and temperature for Biofilter 1 is within the design loading of 81,200 m^3/hr and less than or equal to 40^oC (based on the Biofilter Manual). However, the relative humidity level was significantly below the required performance target of 85% or higher. This low moisture condition can lead to bed dryness and sub-optimal odour removal performance.

Biofilter 2

Inlet airflow: 149,000 m^3 /hr, actual

Temperature (Dry/Wet Bulb): 35.9^oC / 26.4^oC

Relative Humidity: 47.4%

Moisture Content: 17.8 g H_2O per kg of dry air

Biofilter Back-Pressure: +227 Pa

Comments: The inlet airflow and temperature for Biofilter 2 are within the design loading of 175,500 m^3/hr and less than or equal to 40^oC (based on the Biofilter Manual). However, the relative humidity level was significantly below the required performance target of 85% or higher. This low moisture condition can lead to bed dryness and sub-optimal odour removal performance.

Notwithstanding the above physical measurements and given the outcomes of the odour modelling study (refer to **Section 9**), the effectiveness of the odour controls at the MBT Facility will continue to be reviewed as part of the IOA to ensure operational excellence and continuous improvement is maintained at the MBT Facility.

8.2.1.12 Quality of compost product in the Maturation Storage Pad Area

The quality of compost product stored in the maturation storage pad area appeared to vary, with aged and screened material relatively lower in odour compared with aged and unscreened material. This suggests that compost product in the maturation storage pad area should be screened to minimise odour emission release from this area, or as a trigger response strategy under atypical scenarios as may be noticed by the operators. The requirement to further optimise and improve the storage practices at the Maturation Storage Pad Area of the MBT Facility will be reviewed in the context of the active alternative daily cover trial program completed in December 2020. Notwithstanding this, the odour modelling predictions (see **Section 9**) indicates that the odour outcome is satisfactory under the conditions found in the Audit.

8.3 CONDITION 7 (C)

Condition 7 (C) of the Audit requirements stipulates that the following will be carried out in the IOA:

- *Review the proponents' production data (that are relevant to the odour audit) and complaint records.*

The production data that is relevant to the Audit include:

- Waste throughput to the Bioreactor;
- On-site evaporation data (from the 2012 IOA); and
- Landfill gas consumption in the generators and flare system.

This Audit obtained updated data relating to waste throughput to the Bioreactor, complaint records, and evaporation data from Veolia for the Site since the previous 2016 IOA. These were reviewed as part of the Audit and are appended as **Appendix C.** Complaint log records indicate that the necessary fields required by the *EPL Condition M4 Recording of pollution complaints* are being documented by Veolia.

On the above basis, the Audit is satisfied that all relevant record-keeping duties continue to be adequately maintained.

8.4 CONDITION 7 (F)

Condition 7 *(F)* of the Audit requirements stipulates that the following will be carried out in the IOA:

- *Determine whether the project is complying with the requirements in this approval to protect receivers against offensive odour.*

This Audit has examined compliance or otherwise with *Condition 7(F)* from three perspectives, namely:

- Odour complaints data review and analysis and associated response from Veolia (discussed in **Section 8.4.1**); and
- Compliance with the modelling-based, project-specific odour performance goal of 6 ou (discussed in **Section 9**).

The above points have been discussed in **Section 8.4.1** and **Section 9,** respectively.

8.4.1 Odour Complaints Analysis and Response from Veolia

The odour complaints data logged by Veolia and associated response letters were reviewed and analysed in the Audit. **Figure 8.2** illustrates the seasonal distribution of logged odour complaints between 1 April 2019 and 31 March 2020.

The odour complaints analysis indicated the following:

- Since the previous 2019 IOA, over the period of 1 April 2020 and 31 April 2021, there were ninety-eight (98) logged odour complaints, equivalent to a significant increase in logged complaints;
- There were minimal complaints in summer or spring, with the majority of logged complaints occurring in the winter and autumn periods. This was a similar finding in previous IOAs;

- Veolia responded to each logged complaint over the period between 1 April 2020 and 31 April 2021. All responses can be found in **Appendix C**; and

- Veolia initiated the odour diary community feedback process in February 2021 in response to the high incidence of odour complaints.

Despite the significant improvement in landfill gas extraction in the Void and expansion and improvement in the leachate management system through optimisation of surface water catchments, landfill gas infrastructure design, active tipping practices and increased leachate treatment capacity via the commissioning of the LTP, the odour complaints trend appear to reflect the operational challenges associated with the high rainfall conditions over the Audit period (refer to **Section 8.2.1.10.1**). As a result, the Audit recommends that Veolia has intensified engagement with the community through its existing odour complaints and response management strategy. The handling and management of odour complaints will be reassessed in the next IOA to evaluate the need for additional forms of community engagement. As such, the refinement in community engagement remains as a non-mandatory recommendation in the Audit to ensure this matter is provided with the opportunity of continuous improvement (refer to **Section 10.2.4** for more details).

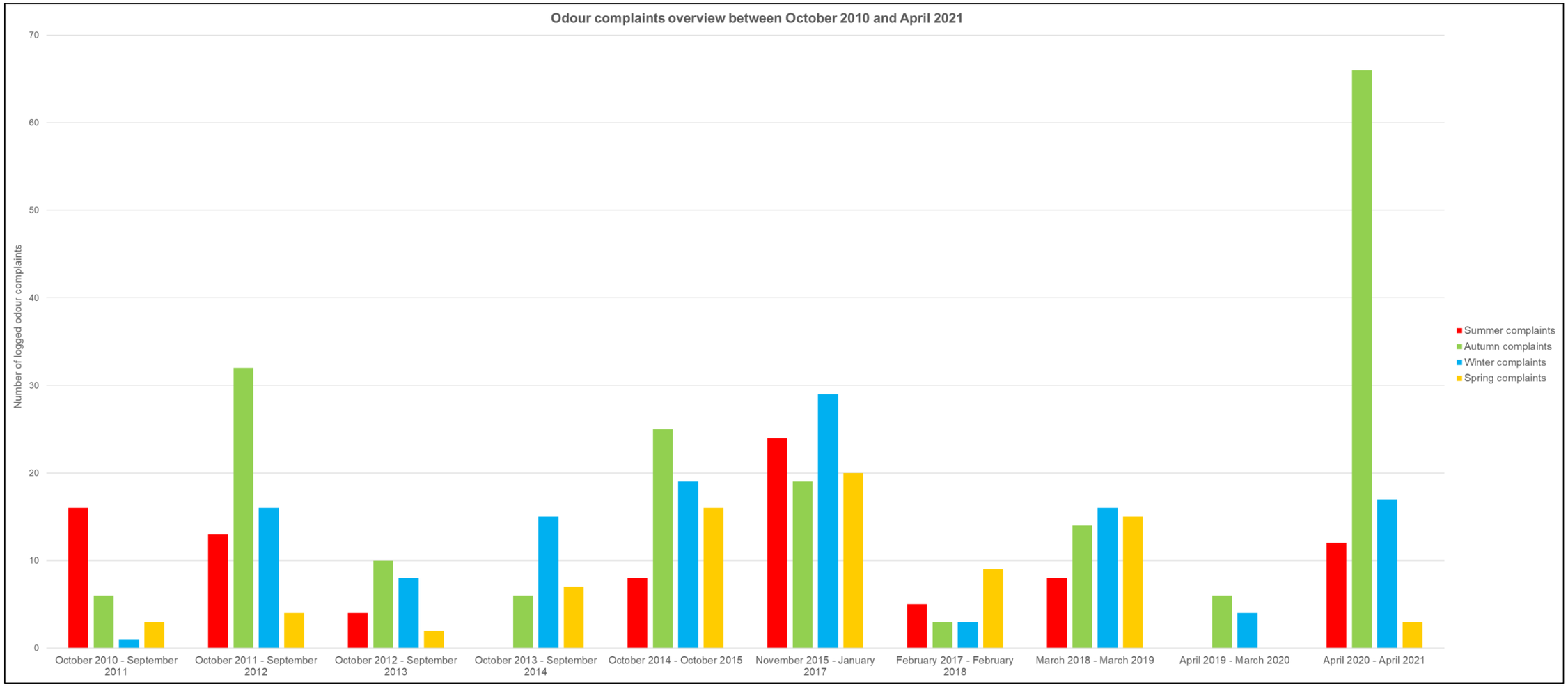


Figure 8.2 - Number of logged odour complaints between October 2010 and April 2021

8.5 ODOUR EMISSIONS INVENTORY DISCUSSION

As per the recommendation of the previous IOAs, the Audit recommends using an overall odour emissions inventory for the Site and examined it as to place into context the emissions from any single source.

Table 8.4 details the odour emission inventory for the Site as determined by the testing carried out in the Audit and compares these results with predictions of emissions contained in the EA. It also makes a comparison with the impact of the revised areas (where applicable) for each odour emission source as found in the Audit.

It is acknowledged that there are odour emissions not listed in this inventory, emanating mostly from sources where quantitative measurement or even estimates are difficult. These include the fugitive odour releases from the Void, previously described as potential gas pathways, arising from gas leakages from the covered areas and around the walls of the Void and leachate recirculation air pressure relief vent. Despite these omissions, it is considered that the incomplete inventory remains to have real value and is discussed later (refer to **Section 8.5.2**).

Table 8.4 - Measurable odour emission rates for the Site ^

Parameters						The Audit		2019 Audit		2018 Audit		2017 IOA		2016 IOA		2015 IOA		2014 IOA		2013 IOA			2012 IOA		EA		
Location	**Current Area (m^2)**	**2018 Area (m^2)**	**2016 Area (m^2)**	**2014 Area (m^2) ^^**	**2012 Area (m^2)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)^**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER 2012 Area ($ou.m^3/s$)**	**OER - Current Area ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER ($ou.m^3/s$)**	**SOER ($ou.m^3/m^2.s$)**	**OER ($ou.m^3/s$)**	**OER - Current ($ou.m^3/s$)**
ED3N-1	n/a	7,500	6,000	6,000	7,000	n/m	n/m	n/a	n/a	0.356	2,670	0.132	792	0.130	780	0.132	794	0.017	104	0.30	2,100	1,800	394	2,760,000	8.8	61,600	52,800
ED3N-2 & 3 ^^^	12,300	12,400	11,000	11,000	13,000	0.361	4,440	0.0745	1,060	0.102	1,260	0.129	1,420	0.175	1,930	0.118	1,300	0.049	543	11.6	150,000	127,000	0.29	3,800	7.4	96,200	81,400
ED3N-2	6,080	7,000	5,500	5,500	6,500	0.0867	527	0.0881	710	0.169	1,180	0.120	660	0.148	811	0.145	797	0.066	365	20.1	131,000	111,000	0.21	1,350	n/a^^^		
ED3N-3	6,230	5,400	5,500	5,500	6,500	0.635	3,960	0.0609	379	0.035	190	0.139	765	0.20	1,110	0.091	500	0.032	178	0.2	1,010	852	0.37	2,430			
ED3N-4	36,600	39,000	25,000	25,000	16,000	0.522	19,100	0.0856	3,440	0.095	3,710	0.163	4,080	0.248	6,200	0.269	6,720	0.023	575	0.0604	966	1,510	0.41	6,600	0.7	11,200	17,500
ED3S	n/d	89,400	89,435	n/a		n/m	n/m	0.094	0.094	7,250	5,190	0.116	10,400	0.277	24,700	No previous measurements available as ED3S & ED3S-S are new sources									0.5	44,700	24,700
ED3S-S"	20,100	19,000	1,420			2.19	44,000	0.554	0.554	10,600	2,550	1.97	44,700	0.437	621										0.159	4,510	226
Active Tipping Face	2,000	2,000	6,000	6,000	40,000 *	3.24	6,480	5.26	10,500	7.59	15,200	9.52	14,300	8.16	49,000	7.51	45,100	4.28	25,700	3.04	122,000	18,200	8.36	334,000	7.3	292,000	43,800
Leachate Treatment Dam	4,090	5,000	5,000	5,000	2,000	3.07	12,600	9.19	38,300	0.186	930	0.243	1,220	0.27	1,350	0.276	1,380	0.026	129	0.323	647	1,620	0.46	920	3.6	7,200 #	18,000
Construction and Demolition Tip Face	900	900	900	500	900	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.326	294	n/a^	n/a	0.293	264	147	n/a	n/a	n/a	n/a	n/a
Storage Pond 7	n/a	n/a	n/a	n/a	1,200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/m^^	n/a	n/m	n/m	n/m	85	102,000	n/m	n/m	n/m

n/a = not applicable. Note: ED3N-1 is empty
n/m = not measured
^ All odour emission rates represent the derived mean SOER values for each location
^^ As advised by Veolia
^^^ reported in the EA 2010 as a single emission source i.e. ED3N-2 & ED3N-3 as a single area
* as reported in the EA 2010
** Target SOER not obtained from the EA. Source of emission data is the LMS May 2016 Report: Table 2.1. For ED3S-S the current surface area as of the Audit is reported to be 82% of total capacity (20,100 m^2)

Based on the result in **Table 8.4**, the following comments are made (excluding the MBT Facility and LTP):

- The total measurable odour emission rate from the Site found in the Audit was 91,100 ou.m^3/s, representing a moderate increase since the 2019 IOA (72,200 ou.m^3/s). The dominant contributor to this result appears to be the increase in OER for the ED3S-S and ED3N-4;
- The active tipping face is within normal trends for total measurable odour emissions, without consideration of fugitive landfill gas emissions (see **Section 8.2.1.2**);
- The LMS continues to operate under low odour emission conditions and is unlikely to be contributing to any significant odour impact beyond the Site boundary, despite the observed increase in ED3S-S and ED3N-4 (refer to **Section 9**);
- From a comparative viewpoint, the SOER results show moderately close agreement between the Audit results and the EA 2010 value for all emission sources (refer to **Table 6.1**), with the exception of a single result for ED3N-4 (refer to **Section 6.1.2**). This is a significant result as it shows that the SOER predictions in the EA 2010 continue to be suitable for current and future operations at the Site. This is supported by the odour modelling study conducted in the Audit (see **Section 9**); and
- Like the previous IOAs, ED3N-2 & ED3N-3 have been reported both as separate emission sources and a single source (as per the EA 2010) to determine the relative contribution of odour emission from each pond separately.

The following sections discuss the results from the odour emissions inventory and Audit in the context of the pond and non-pond sources (refer to **Sections 8.5.1** & **8.5.2,** respectively).

8.5.1 Pond sources

All pond sources at the Site sampled in the Audit are considered area sources, including:

- ED3N Pond System: this includes ED3N-1, 2, 3 and 4;
- ED3S Pond System: this includes ED3S & ED3S-S; and
- LTD.

The following sections discuss each of the above pond sources.

8.5.1.1 ED3N Pond System

In the context of the odour emissions inventory for the Site, the Audit finds that at the current and above performance targets for leachate quality, leachate effluent stored in ED3N represents very low odour emissions since the IOAs began in 2011. The derived mean SOER's for ED3N-2, 3 & 4 in the Audit is 0.0867 ou.m^3/m^2.s, 0.635 ou.m^3/m^2.s,

and 0.522 ou.m^3/m^2.s, respectively. At these values, the stored contents of ED3N continue to be a minor odour emission source at the Site.

On the above basis, the Audit finds that the leachate performance targets set by Veolia are appropriate in attenuating odour emissions from pond-related sources. It can be considered that any significant deviation of the leachate quality monitoring targets would be a reasonable indicator that there will be an increase in risk potential for odour emission generation from the ED3N Pond System. This risk potential is significantly mitigated with the commissioning of the LTP.

8.5.1.2 ED3S Pond System

8.5.1.2.1 ED3S

In the context of the odour emissions inventory for the Site, the Audit finds that at the current and above performance targets for stormwater quality stored in ED3S represents very low odour emissions since the IOAs began in 2011. As such, it was not sampled as part of the IOA, unless operational conditions were to be vary in the future.

8.5.1.3 ED3S-S

The SOER input from the LMS May 2016 Report used a SOER of 0.159 ou.m^3/m^2.s for the modelling of ED3S-S. The mean result derived from the Audit is 2.19 ou.m^3/m^2.s (refer to **Table 6.2**). This result is higher than the modelled value but unlikely to cause any adverse impact beyond the boundary of the Site given the odour modelling analysis and results of the FAOA surveys conducted as part of the Audit.

8.5.1.4 Leachate Treatment Dam

The LTD was found to have returned to normal operation following a failure of an aerator as documented in the previous IOA. As such, the SOER derived in the Audit from this source was found to be 3.07 ou.m^3/m^2.s, which is consistent with the EA 2010 value of 3.6 ou.m^3/m^2.s. Furthermore, given the odour modelling results and nature of the source, the LTD continues to be unlikely to lead to adverse impacts downwind of the Site at nearby sensitive receptors to the Site.

8.5.2 Non-pond sources

The activities within the Void were judged to be similar regarding process operations to those found in the 2016 IOA, except for the landform adopted for the active tipping face within the Void (refer to **Section 8.2.1.5** for details) . The Audit endorses the continued use of biofiltration cover material around high-risk areas prone to fugitive gas emission leaks, where required. If possible, alternative cover material can also be adopted via the use of MWOO material.

The Audit odour testing results indicate that the Void continues to remain the major contributor to odour emissions at the Site, through fugitive gas emissions, if gas extraction is not effectively maintained. The fugitive landfill gas emissions that arise due to wall effects and cracks in the capping of waste, particularly near landfill gas extraction wells and Void perimeter, are an on-going operational issue at the Site. A reduction in leachate extraction can also impact the effectiveness of landfill gas extraction. The reduction observed in landfill gas capture during the Audit period suggests that fugitive emission may have increased since the previous IOA.

Furthermore, high rainfall events are a contributing factor to this effect, and the Site continues to optimise and enhance its stormwater catchment and diversion system (refer to **Section 8.2.1.2.1** and **Section 8.2.1.10.1**).

8.5.3 Active Tipping Face

For reasons discussed in **Section 8.2.1.6**, the mean SOER result of 3.24 ou.$m^3/m^2.s$) from the active tipping face as found in the Audit is not considered significant from an odour impact viewpoint but demonstrates the importance of continued efforts to minimise the active tipping face as much as practically possible. Overall, the Audit finds that current practices at the Site in relation to the active tipping face are conducive to the minimisation of odour from this source.

9 ODOUR MODELLING STUDY

9.1 PREFACE

As part of the Audit's scope of work, TOU was requested to deliver a re-run of the site-specific odour dispersion model initially done in the EA 2010 with the current operational factors and odour audit emissions data. As previously mentioned in **Section 8.4**, the purpose of the re-run is to demonstrate compliance with the modelling-based, project-specific odour performance goal of 6 ou and *Condition 7 (F)* of the Audit requirements.

9.1.1 Relevant Modelling Background Information

To enable the undertaking of the modelling re-run, TOU was supplied the original odour dispersion model used in the EA 2010 developed by the former Heggies Pty Ltd, now operating under SLR Consulting. TOU updated the original CALMET meteorology for its initial assessment of the addition of the ED3S dam to the leachate management system (refer to the LMS May 2016 Report). The preparation methodology has been reproduced in **Section 9.3**. For the CALPUFF odour dispersion modelling and under strict instructions, the ED3S study and subsequent studies involved the addition of new sources without modification to existing sources within the original EA odour model (the **Previous Model**). The original configuration and odour emission rates can be found in *Section 5* of the EA 2010 titled *Odour and Dust Impact Assessment (Rev 5) Report* dated 2 August 2010.

9.1.2 Scope of Works

The scope of the Audit required the update of the previous IOA odour dispersion model with current operational factors and odour audit emissions data measured as part of the current IOA. This involved the modification and removal of odour sources from the previous IOA odour dispersion model to best represent the present operations during the Audit period.

The following report details the methodology and findings of the odour modelling study.

9.2 ODOUR DISPERSION MODELLING METHODOLOGY

9.2.1 Odour Emissions Testing Results Summary

The results of the odour emissions testing carried out for the Audit containing the source areas, SOERs and OERs are summarised in **Table 9.1.** The tabulated odour emission inventories for the EA and each of the annual odour audits, along with the individual sample results for the current and previous odour audits, can be provided upon request.

Table 9.1 – A summary of odour emissions data used in the modelling study				
Location	**Area (m^2)**	**SOER ($ou.m^3/m^2.s$)**	**OER ($ou.m^3/s$)**	**Comments**
ED3N1	0	0	0	Empty at the time from the Audit
ED3N2 & 3	12,300	0.361	4,400	Mean value of six (6) samples from the Audit
ED3N4	36,600	0.522	19,100	Mean value of three (3) samples from the Audit
ED3S	71,500	0.094	6,720	Not measured. Previous IOA data used.
ED3SS	20,100	2.19	44,000	Mean value of three (3) samples from the Audit
Active Tipping Face	2,000	3.24	6,480	Mean value of three (3) samples from the Audit
Leachate Treatment Dam	4,090	3.07	12,600	Mean value of anoxic and aeration zone samples from the Audit
Waste Covered Area	159,000	0.166	26,400	75^{th} percentile of twelve samples from previous IOA and the Audit to improve statistical confidence
MBT Maturation Pad (unscreened - various ages)	11,400	0.198	2,250	Mean value of four measured stockpiles.
MBT Maturation Pad (final screened material)	1,450	2.67	3,870	Single measurement from screened stockpile.
MBT Maturation Pad (screened material - July 2020)	798	0.198	158	Very old material. Assumed inactive and similar to unscreened stockpiles.
MBT Biofilter 1	--	--	5,300	Sum of measured OER from three (3) samples from the Audit
MBT Biofilter 2	--	--	59,900	Sum of measured OER from six (6) samples from the Audit

The exclusion for the modelling exercise is as follows:

- The contribution of the spray evaporation system (as described in **Section 2.4.2.1**) and reported in **Table 6.5**. There is no evidence to suggest that the mechanical spray evaporation is a problematical activity from an odour viewpoint given the outcome of the LOM analysis undertaken in the Audit (refer to **Section 6.1.7**); and

- The MBT leachate pond was not measured in the Audit and will be assessed in the next IOA when safe access is possible. It is not expected to be a significant contributor to the overall OER for the MBT Facility and the Site. Notwithstanding this, the Audit has assumed the LTD SOER for this source, which is considered to be modestly representative in view of historical datasets in previous IOAs (refer to **Section 8.5.1.4**).

9.2.2 Odour Source and Emission Rate Configurations

Sources from the previous IOA model had their location and areas corrected (most by minor SOER adjustments), defunct sources were removed, and new sources were added to best represent the present operations reflected in the latest iteration of odour emissions testing for the Audit. The result is illustrated in **Figure 9.1**. It should be noted that odour sources from the MBT Facility and the LTP have been added to the Audit model, shown in **Figure 9.2** and **Figure 9.3**, respectively.

The Audit model source areas and emission rates are provided in **Table 9.2**, respectively.

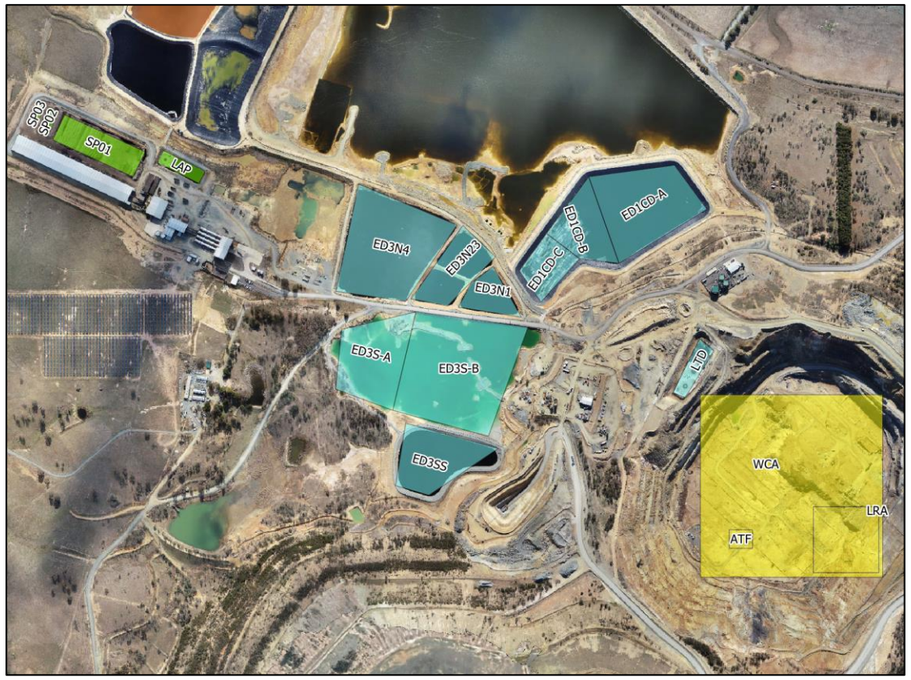


Figure 9.1 – Layout of sources in the Audit

Figure 9.2 – Layout of MBT sources in the Audit

Figure 9.3 – Layout of the LTP sources in the Audit

Table 9.2 – The Audit model source areas and emission rates					
Source ID	**Description**	**Area (m^2)**	**SOER ($ou.m^3/m^2.s$)**	**OER ($ou.m^3/s$)**	**Comment**
Bioreactor and Leachate Evaporation System					
ATF	Active Tipping Face	2,000	3.24	6,480	None.
LRA	Leachate Recirculation Area (ceased)	0	0.000	0	Leachate recirculation ceased (WIP 2020).
WCA	Waste Covered Area (fugitives)	159,000	0.166	26,400	None.
ED3N1	Leachate Evaporation Dam 3 North 1	0	0.000	0	Empty at time of audit.
ED3N23	Leachate Evaporation Dam 3 North 2 & 3	12,300	0.361	4,440	Embankment separating sections 2 & 3 included in area.
ED3N4	Leachate Evaporation Dam 3 North 4	36,600	0.522	19,100	None.
ED3S	Leachate Evaporation Dam 3 South System (Sections A & B)	71,500	0.0940	6,720	None.
ED3SS	Leachate Evaporation Dam 3 South-South System	20,100	2.19	43,900	None.
LTD	Leachate Treatment Dam	4,90	3.07	12,600	None.
Sub-total OER				**120,000**	To three significant figures.
MBT Maturation Pad, Leachate and Biofilters					
LAP	Leachate Aeration Pond	2,960	3.07	9,100	Not measured. LAP SOER assumed due to safety access constraints during IOA. This will be resolved and validated as part of the next audit.
SP01	MBT Maturation Pad Unscreened Stockpiles	11,400	0.198	2,250	None.
SP02	MBT Maturation Pad Final Screened Stockpiles	1,450	2.67	3,870	None.
SP03	MBT Maturation Pad Old Screened Stockpile	798	0.198	158	None.
BF1	Biofilter 1 (Cells 1, 2 & 3)	--	--	5,300	None.
BF2	Biofilter 2 (Cells 1, 2, 3, 4, 5 & 6)	--	--	59,900	None.
SUB-TOTAL OER				**80,600**	To three significant figures.
Leachate Treatment Plant					
BT1	Balance Tank 1	227	2.05	465	77 h residence time (Note 1)
AX1	Anoxic Tank 1	28	1.30	123	163 h residence time (Note 1)
AX2	Anoxic Tank 2	28	1.17	75	182 h residence time (Note 1)
AE1	Aeration Tank 1	141	0.871	36	238 h residence time (Note 1)
AE2	Aeration Tank 2	141	0.531	33	332 h residence time (Note 1)
ED1CD	ED1 Coffer Dam (Sections A, B & C)	60,100	0.414	24,900	Sources moved to Leachate Treatment Plant group.
SUB-TOTAL OER				**25,600**	To three significant figures.
IOA #8 MODEL TOTAL OER				**226,000**	To three significant figures.

Note 1 - SOER of LTP process units in series estimated by exponential decay of measured SOER from LTD to mean of ED3 system as a function of residence time based on flowrate of 282 m3/d through the LTP as advised at time of previous IOA.

9.3 ODOUR DISPERSION MODELLING METHODOLOGY

9.3.1 NSW Odour Criteria and Dispersion Model Guidelines

Regulatory authority guidelines for odorous impacts of gaseous process emissions are not designed to satisfy a 'zero odour impact criteria', but rather to minimise the nuisance effect to acceptable levels of these emissions to a large range of odour sensitive receptors within the local community.

The odour impact assessment for this project has been carried out in accordance with the methods outlined by the documents:

- Environment Protection Authority, 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*;
- Environment Protection Authority, 2006, *Technical Framework (and Notes): Assessment and Management of Odour from Stationary Sources in NSW*; and
- Barclay & Scire, 2011. Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the '*Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'*.

The documents specify that the odour modelling for Level 3 impact assessments, upon which this study has been conducted, be based on the use of:

- The 99.0th percentile dispersion model predictions;
- 1-hour averaging times with built-in peak-to-mean ratios to adjust the averaging time to a 1-second nose-response-time;
- Odour emission rates multiplied by the peak-to-mean ratios as outlined in **Table 9.3**;
- The far-field distance is typically defined as greater than ten (10) times the largest source dimension, either height or width; and
- The appropriate odour impact assessment criterion (**IAC**), based on the population of the affected community near the development.

Table 9.3 – NSW EPA peak-to-mean factors			
Source type	**Pasquill-Gifford stability class**	**Near-field P/M60***	**Far-field P/M60***
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A-F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

* Ratio of peak 1-second average concentrations to mean 1-hour average concentrations
Source: Environment Protection Authority, 2005 – Table 6.1

The IAC for complex mixtures of odours is designed to include receptors with a range of sensitivities. Therefore, a statistical approach is used to determine the acceptable ground level concentration of odour at the nearest sensitive receptor. This criterion is determined by the following equation:

$$IAC = \frac{\log_{10}(p) - 4.5}{-0.6}$$ **Equation 9.1**

where,
IAC = Impact Assessment Criteria (ou)
***p* =** population

Source: NSW EPA, 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales – Equation 7.2*

Based on **Equation 9.1**, **Table 9.4** outlines the odour performance criteria for six different affected population density categories. It states that higher odour concentrations are permitted in lower population density applications.

Table 9.4 – Odour IAC under various population densities	
Population of affected community	**Odour performance criterion (ou)**
Urban Area (≥ ~2000)	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤ ~2)	7.0

Source: NSW EPA, 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales – Table 7.5*

The original odour impact assessment contained in the EA 2010 had adopted the IAC of **6 ou** "*given the low number of sensitive receptor locations in the vicinity of the*

Woodlawn site". TOU has maintained consistency with this approach as conditions have not significantly changed.

9.3.2 Odour Dispersion Model Selection

The odour dispersion modelling assessment was carried out using the CALPUFF System (Version 6.42). CALPUFF is a puff dispersion model that can simulate the effects of time- and space-varying meteorological conditions on pollutant transport. CALMET is a meteorological model that produces three-dimensional gridded wind and temperature fields to be fed into CALPUFF. The primary output from CALPUFF is hourly pollutant concentrations evaluated at gridded and/or discrete receptor locations. CALPOST/CALRANK processes the hourly pollutant concentration output to produce tables at each receptor and contour plots across the modelling domain. For further technical information about the CALPUFF modelling system refer to the document *CALPUFF Modeling System Version 6 User Instructions*.

The CALPUFF system can account for a variety of effects such as non-steady-state meteorological conditions, complex terrain, varying land uses, plume fumigation and low wind speed dispersion. CALPUFF is considered an appropriate dispersion model for impact assessment by NSW EPA in their document - *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* in one or more of the following applications:

- complex terrain, non-steady-state conditions;
- buoyant line plumes;
- coastal effects such as fumigation;
- high frequency of stable calm night-time conditions;
- high frequency of calm conditions; and
- inversion break-up fumigation conditions.

In the case of this odour modelling study in the Audit, CALPUFF was required to handle the complexity of surrounding terrain features. Under calm and very light winds, non-steady-state conditions such as accumulation of odour and/or downslope movement with drainage airflow would almost certainly occur.

For the odour modelling study in the Audit, the air contaminant was odour and ground-level concentrations in odour units (**ou**) have been projected.

9.3.3 Geophysical and Meteorological Configuration

A CALMET hybrid three-dimensional meteorological data file for Woodlawn was produced that incorporated of gridded numerical meteorological data supplemented by surface observation data, topography, and land use over the domain area.

9.3.4 Terrain configuration

Terrain elevations were sourced from 1 Second Shuttle Radar Topography Mission (**SRTM**) Derived Smoothed Digital Elevation Model (**DEM-S**). The SRTM data was

treated with several processes including but not limited to removal of stripes, void filling, tree offset removal and adaptive smoothing. The DEM-S was used as input into TERREL processor to produce 20 kilometres (**km**) by 20 km grid at 0.15 km resolution. A map of the terrain is illustrated in **Figure 9.4.**

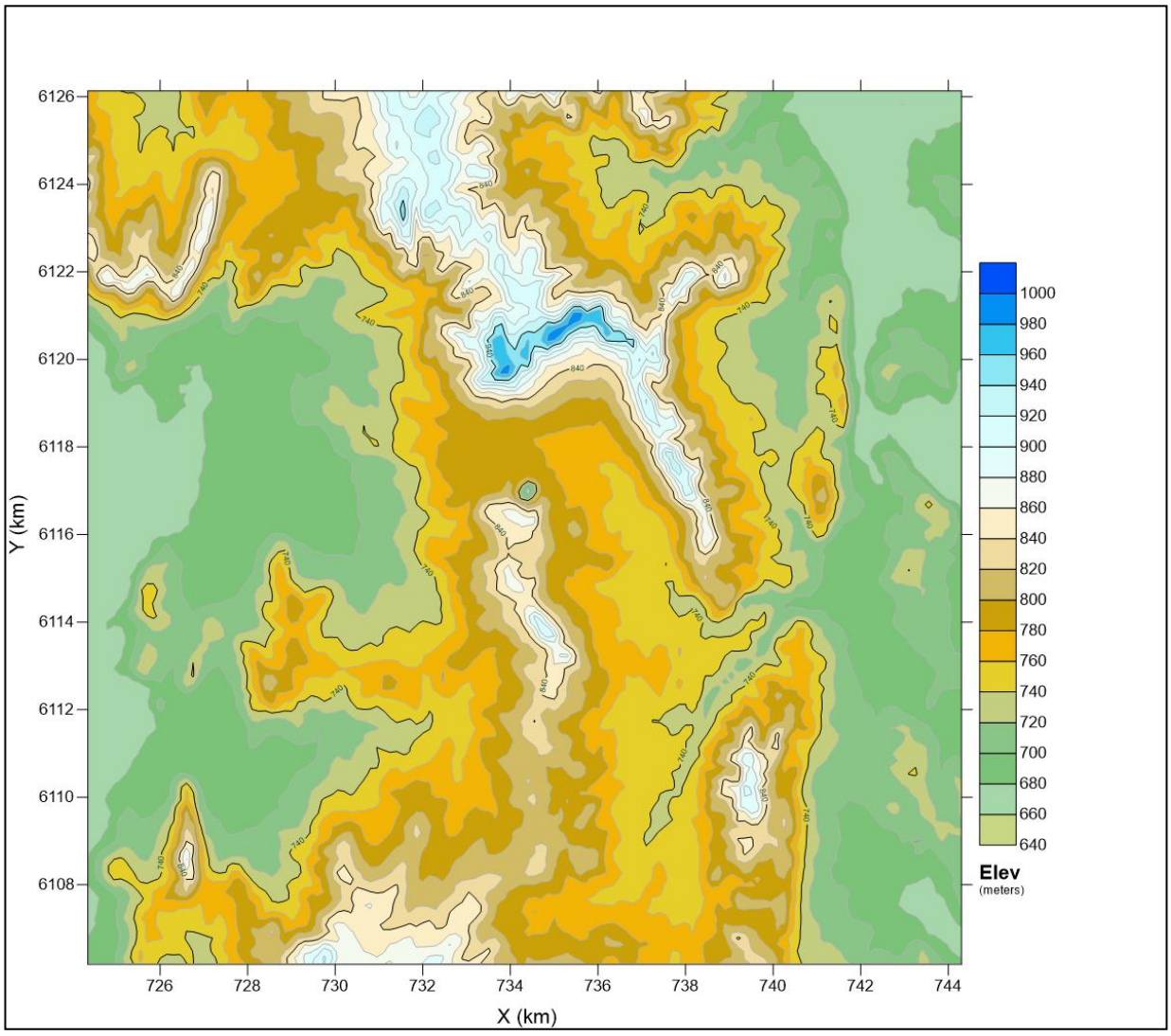


Figure 9.4 - Terrain map of Woodlawn and surrounds

9.3.5 Land use configuration

Land use was sourced from the United States Geological Survey (**USGS**) Global Land Cover Characteristics Data Base for the Australia-Pacific region. The data was used as input into CTGPROC processor to produce a 20 km by 20 km grid at 0.15 km resolution. A map of the land use is illustrated in **Figure 9.5**.

9.3.6 Geophysical configuration

The geophysical data file was created using the MAKEGEO processor. Land use data from CTGPROC and terrain data from TERREL was used as input to produce a 20 km by 20 km geophysical grid at 0.15 km resolution.

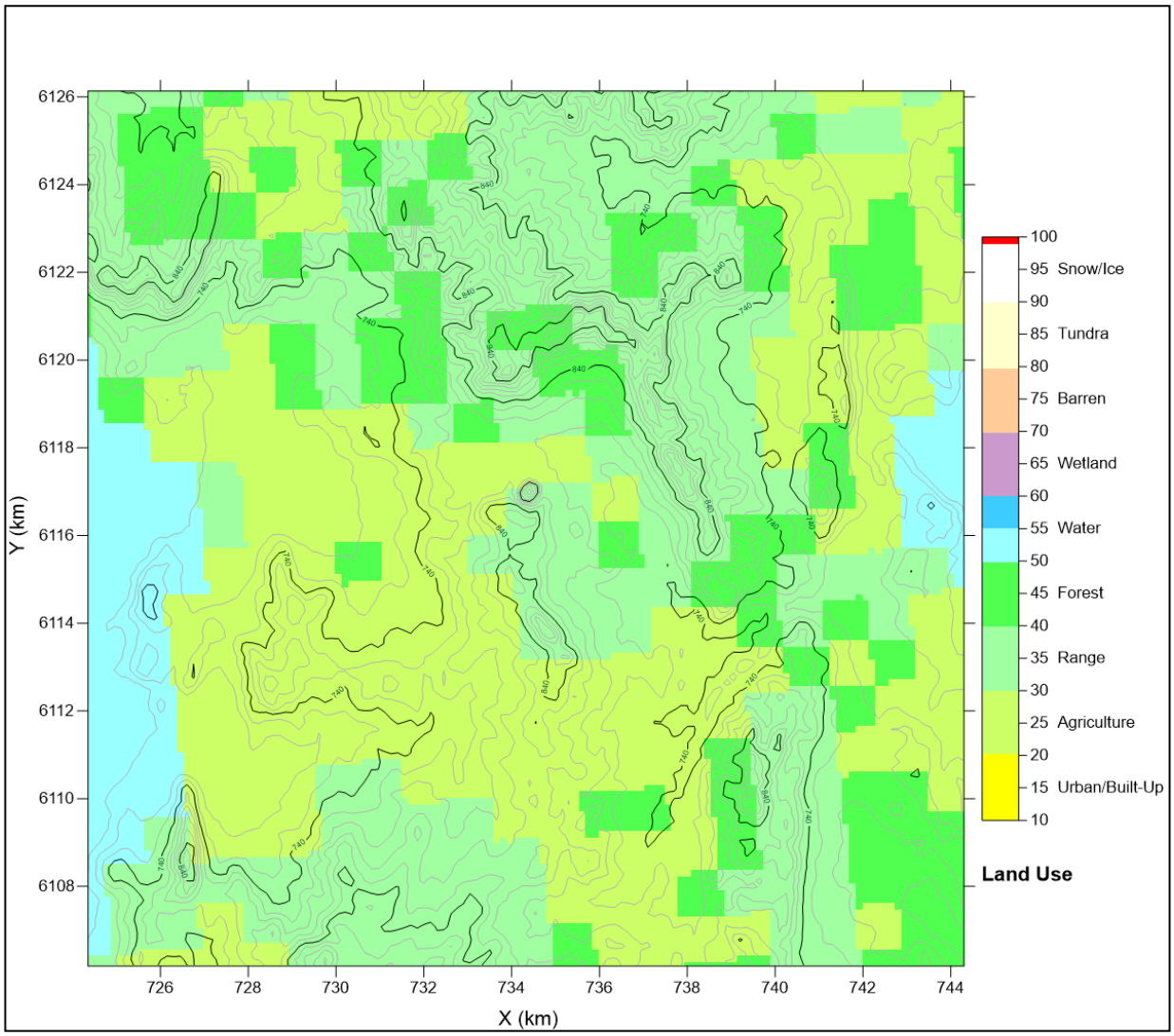


Figure 9.5 – Land use map of Woodlawn and surrounds

9.3.7 Meteorological configuration

9.3.7.1 Input data

One-hour average observed meteorological surface data for a representative year (2015) was sourced from Goulburn Airport that is maintained by the Bureau of Meteorology (**BOM**). The BOM data was formatted into a generic format and was processed with SMERGE to produce a surface meteorological data file.

Numerical meteorological data was produced as a 3D data tile from The Air Pollution Model (v4.0.5) and processed it with CALTAPM (v7.0.0) into a suitable format. TAPM was run using multiple nested grids, at least three nests and 35 vertical levels centred over the Woodlawn site. TAPM innermost nest was 33 km by 33 km at 1 km resolution. The nested grid resolutions were close to a ratio of three as possible.

9.3.7.2 CALMET meteorological model configuration

CALMET was run using the hybrid option that uses geophysical data, surface station data from Bundaberg Airport and upper-air data from the TAPM 3D data tile. The data

was used to initialise the diagnostic functions of the CALMET module to produce a full 3D meteorology data for input into CALPUFF. **Table 9.5** shows the key variable fields selected.

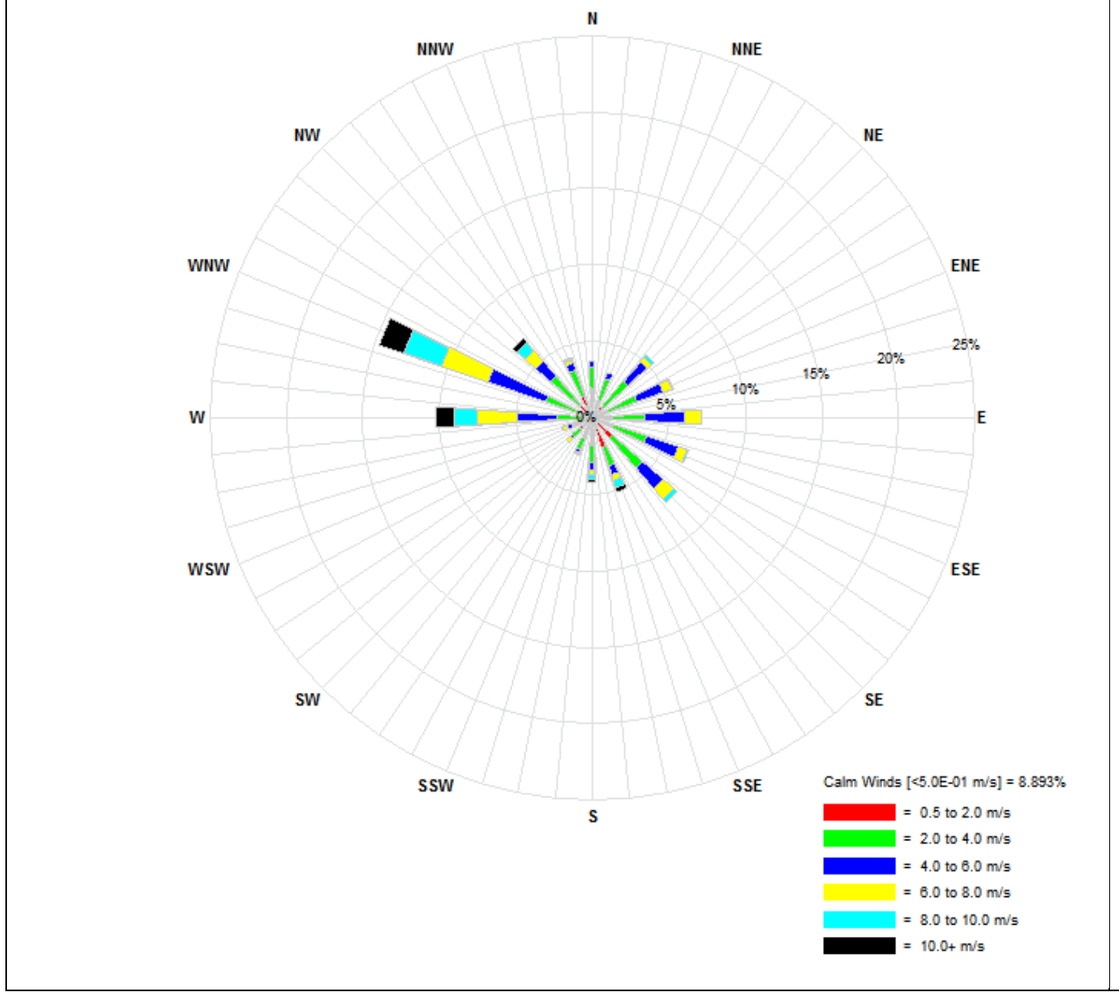
9.3.7.3 Meteorological data analysis

Observed 2015 BOM surface data was compared with longer-term climate (2011 – 2015) from Goulburn Airport to gauge how representative and suitable the year is for air quality dispersion modelling. For reference, meteorological data were also extracted from the CALMET model for the location directly near the Woodlawn site office. The annual windroses for Goulburn Airport show very good agreement with west to northwest winds dominating (**Figure 9.6**). The Woodlawn windroses (**Figure 9.7**) show bias to lighter winds and greater frequency of east to south-easterly winds, perhaps due influences from the nearby valley and ridgelines. A more conservative bias is expected relative to the observations at Goulburn Airport.

Both monthly average (**Figure 9.8**) and diurnal temperature (**Figure 9.9**) profiles for the long term and 2015 are in very good agreement. Diurnal mixing heights and stability class frequencies over the Woodlawn site are shown in **Figure 9.10** and **Figure 9.11**, respectively.

Table 9.5 – CALMET key variable fields												
Grid Configuration (WGS-84 UTM Zone 55S)												
134												**NX Cells**
134												**NY Cells**
0.15												**Cell Size (km)**
724.277					6106.107							**SW Corner (km)**
11												**Vertical Layers**
ZFACE (m)	0	20	40	80	160	320	640	1000	1500	2000	2500	3000
LAYER	1	2	3	4	5	6	7	8	9	10	11	
MID-PT (m)	10	30	60	120	240	480	820	1250	1750	2250	2750	

Critical Wind Field Settings			
Value	**Found**	**Typical**	**Values**
TERRAD	4	None	Terrain scale (km) for terrain effects
IEXTRP	-4	4,-4	Similarity extrap. of wind (-4 ignore upper stn sfc)
ICALM	0	0	Do Not extrapolate calm winds
RMAX1	6	None	MAX radius of influence over land in layer 1 (km)
RMAX2	8	None	MAX radius of influence over land aloft (km)
R1	3	None	Distance (km) where OBS wt = IGF wt in layer 1
R2	4	None	Distance (km) where OBS wt = IGF wt aloft



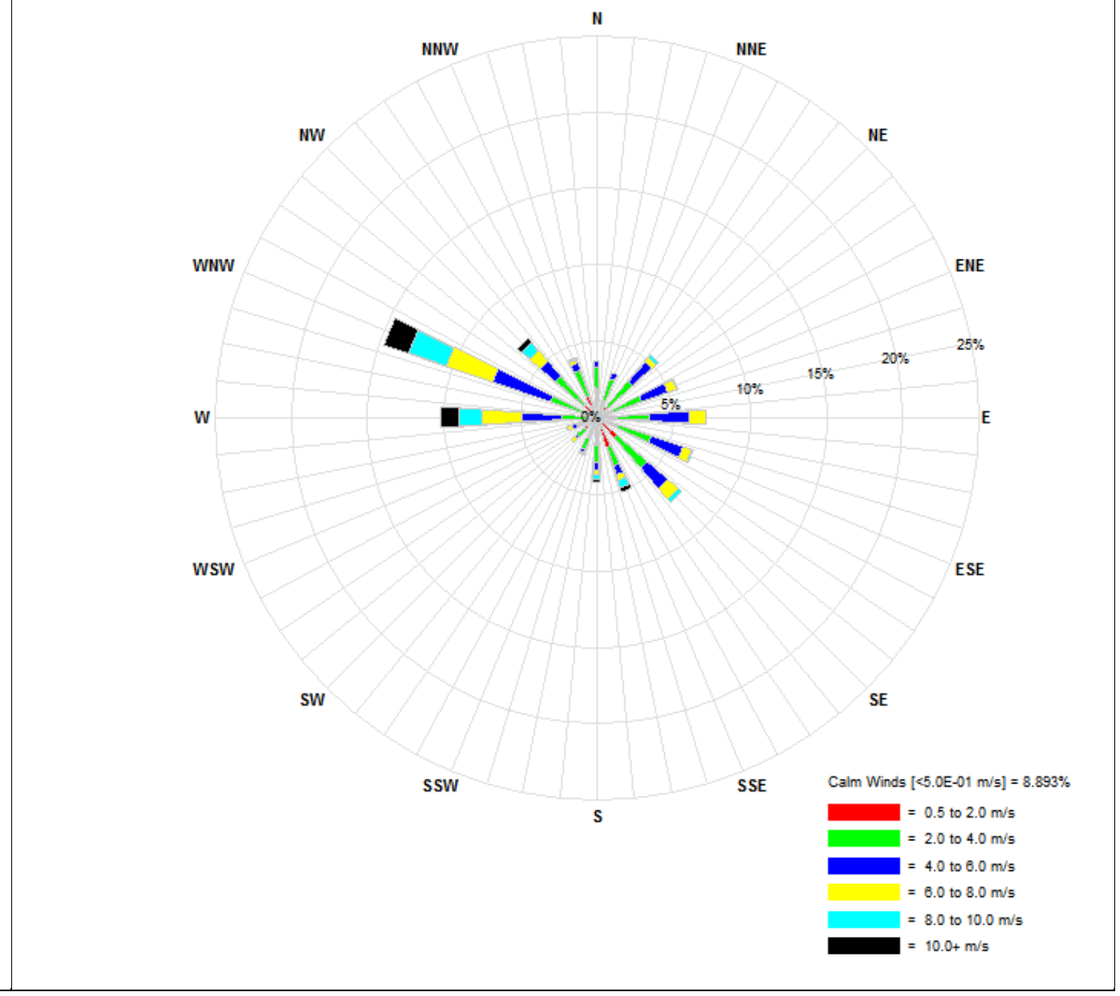
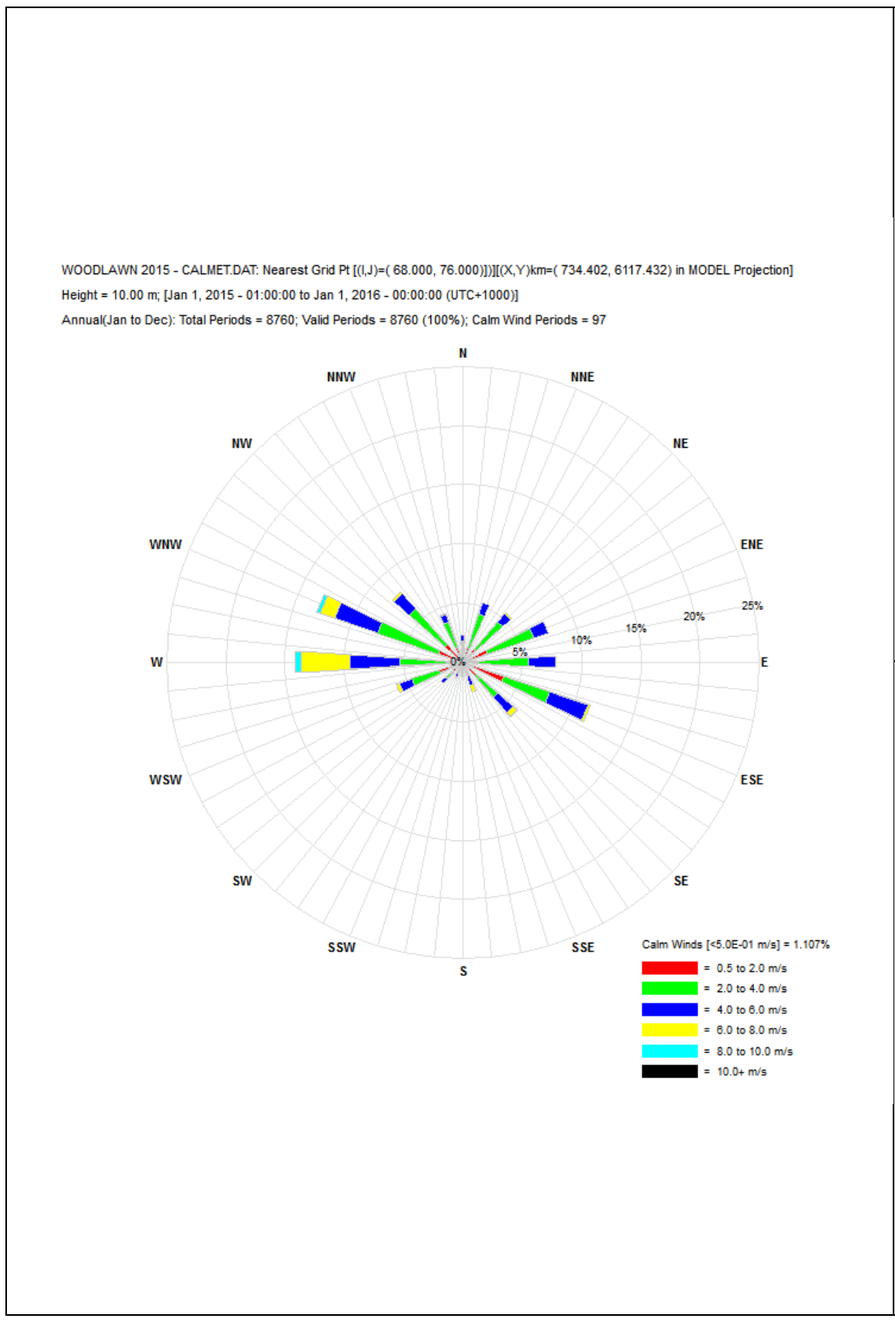
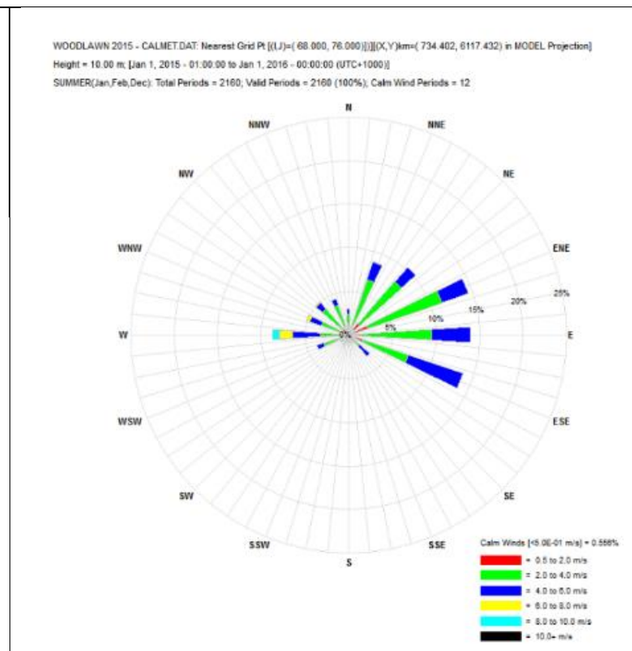
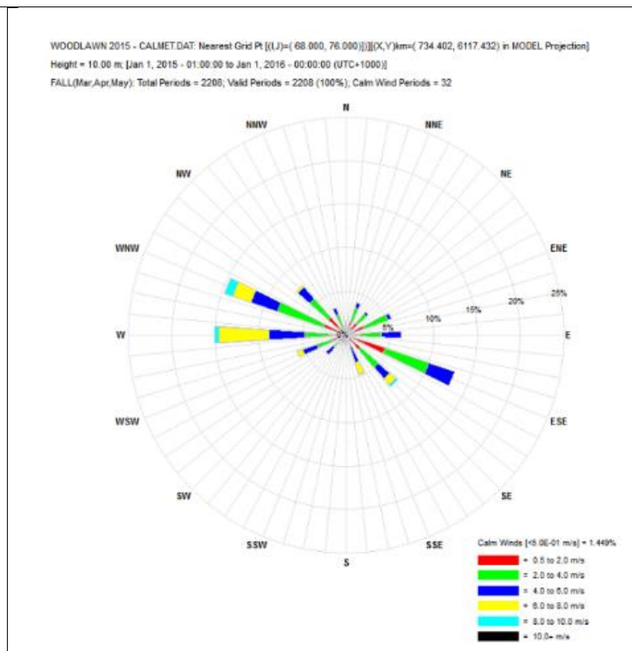
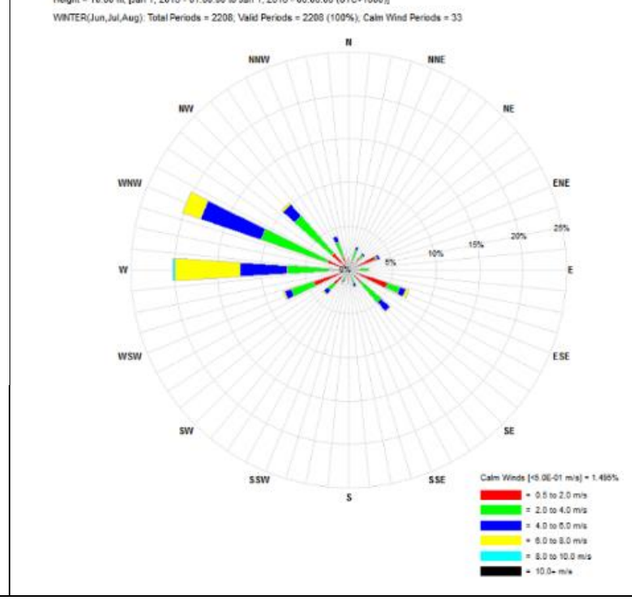


Figure 9.6 – Annual windroses for Goulburn Airport 5 years and 2015 only









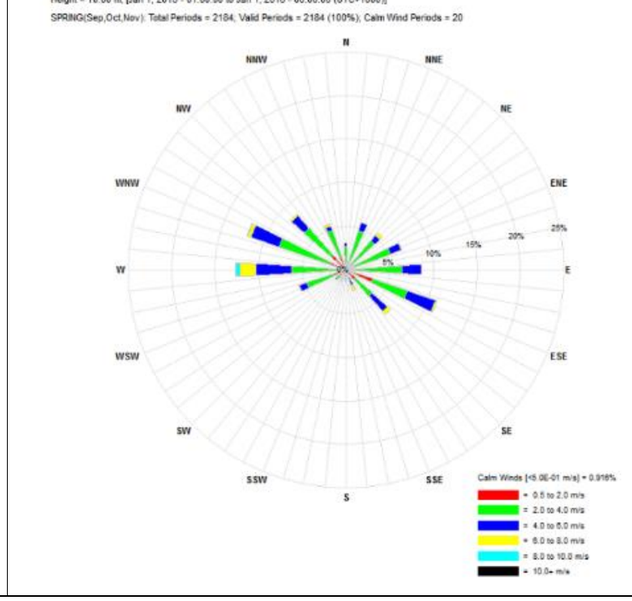


Figure 9.7 – Annual and seasonal windroses for Woodlawn 2015 (modelled)

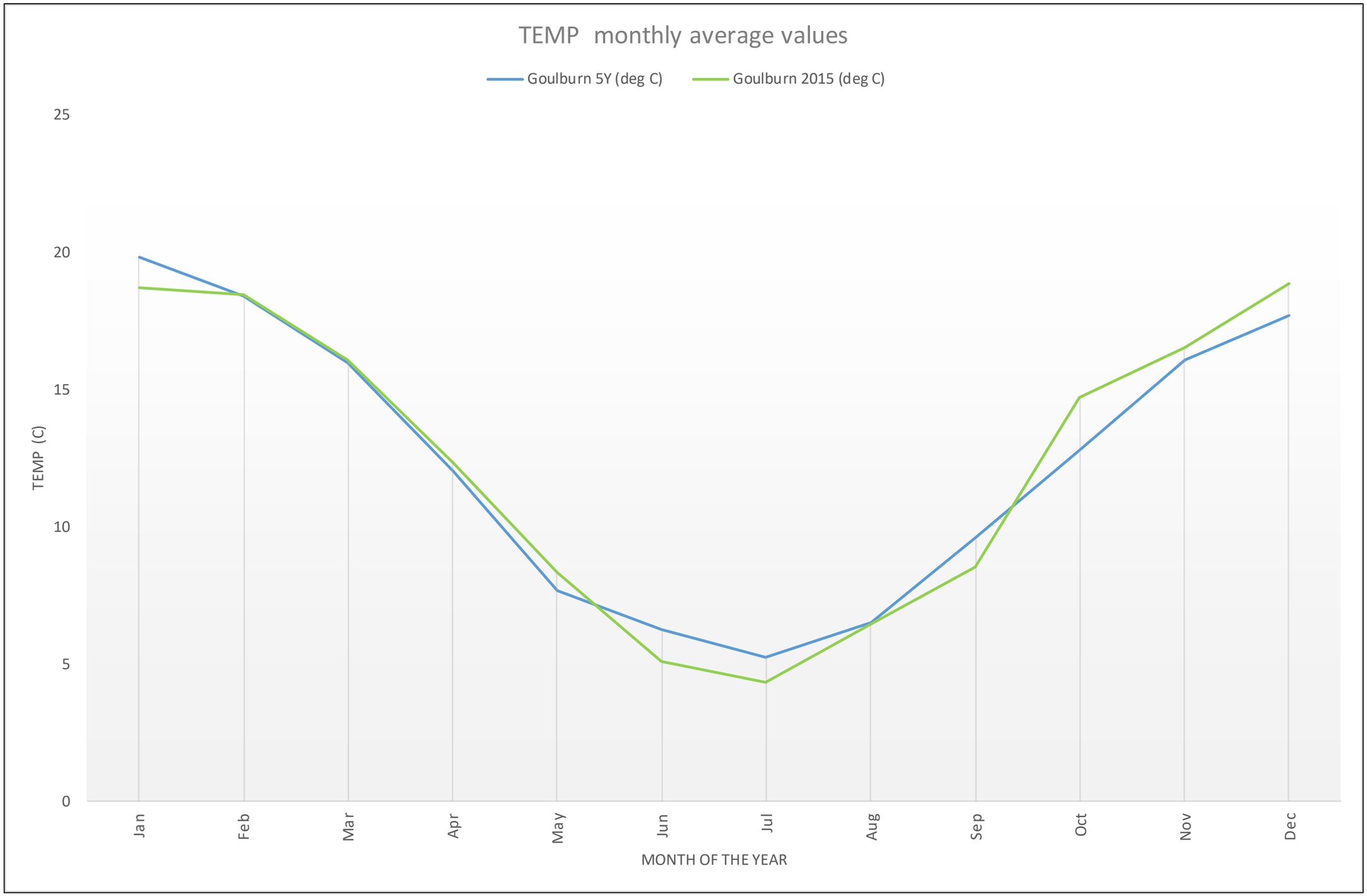


Figure 9.8 – Monthly average temperatures for Goulburn Airport 5 years and 2015 only

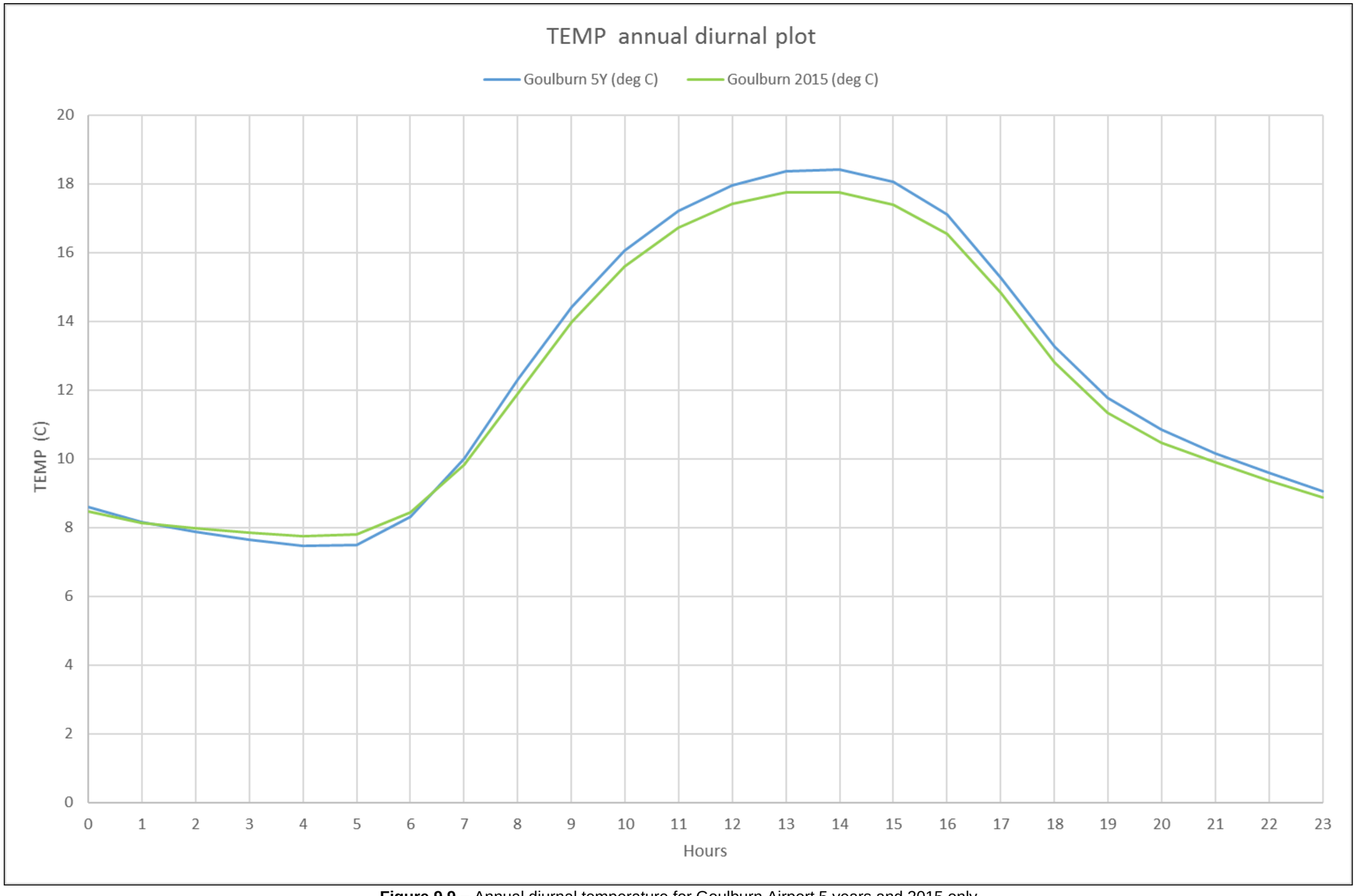


Figure 9.9 – Annual diurnal temperature for Goulburn Airport 5 years and 2015 only

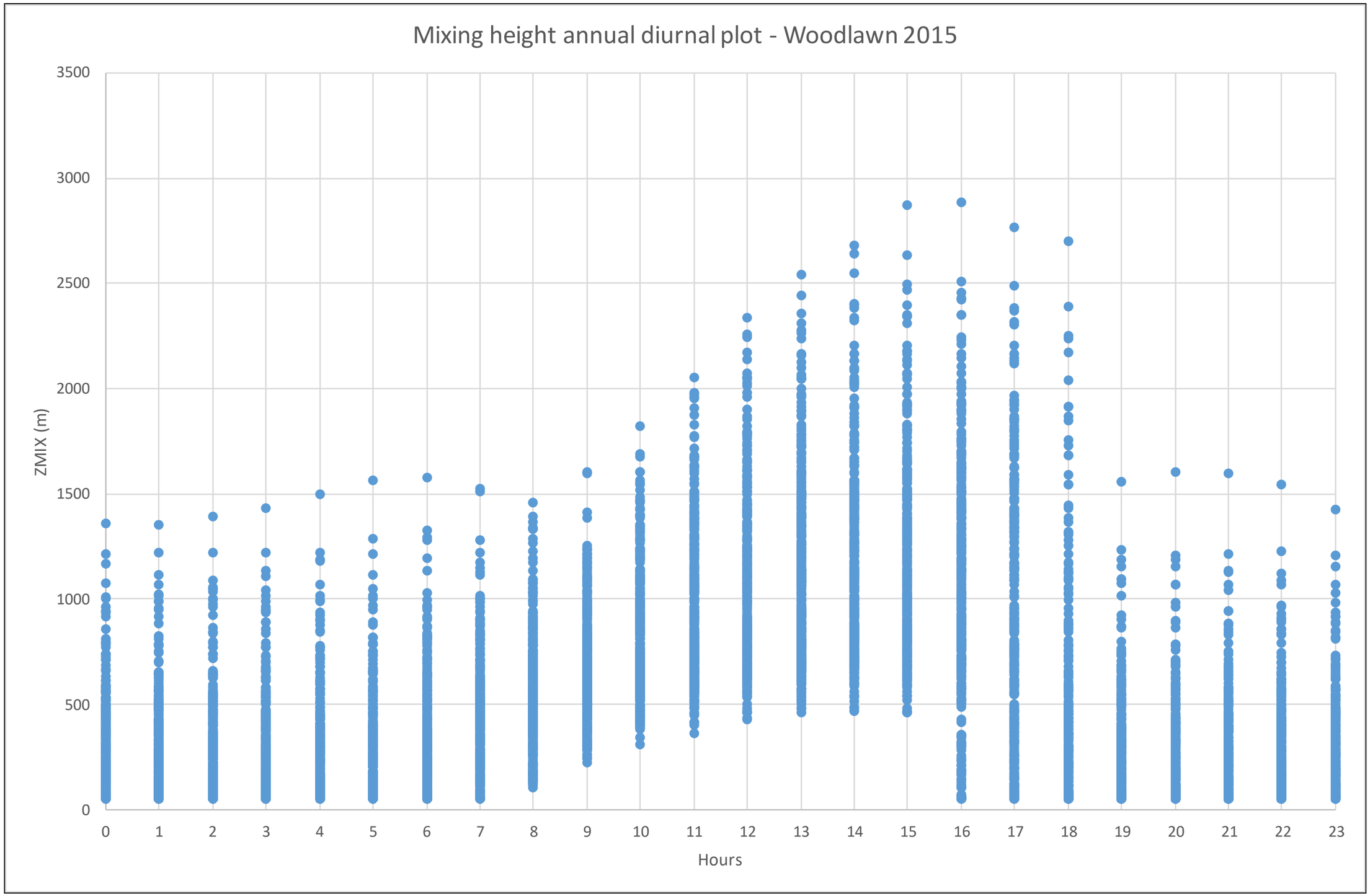


Figure 9.10 – Annual X-Y scatter plot diurnal mixing height for Woodlawn 2015 (modelled)

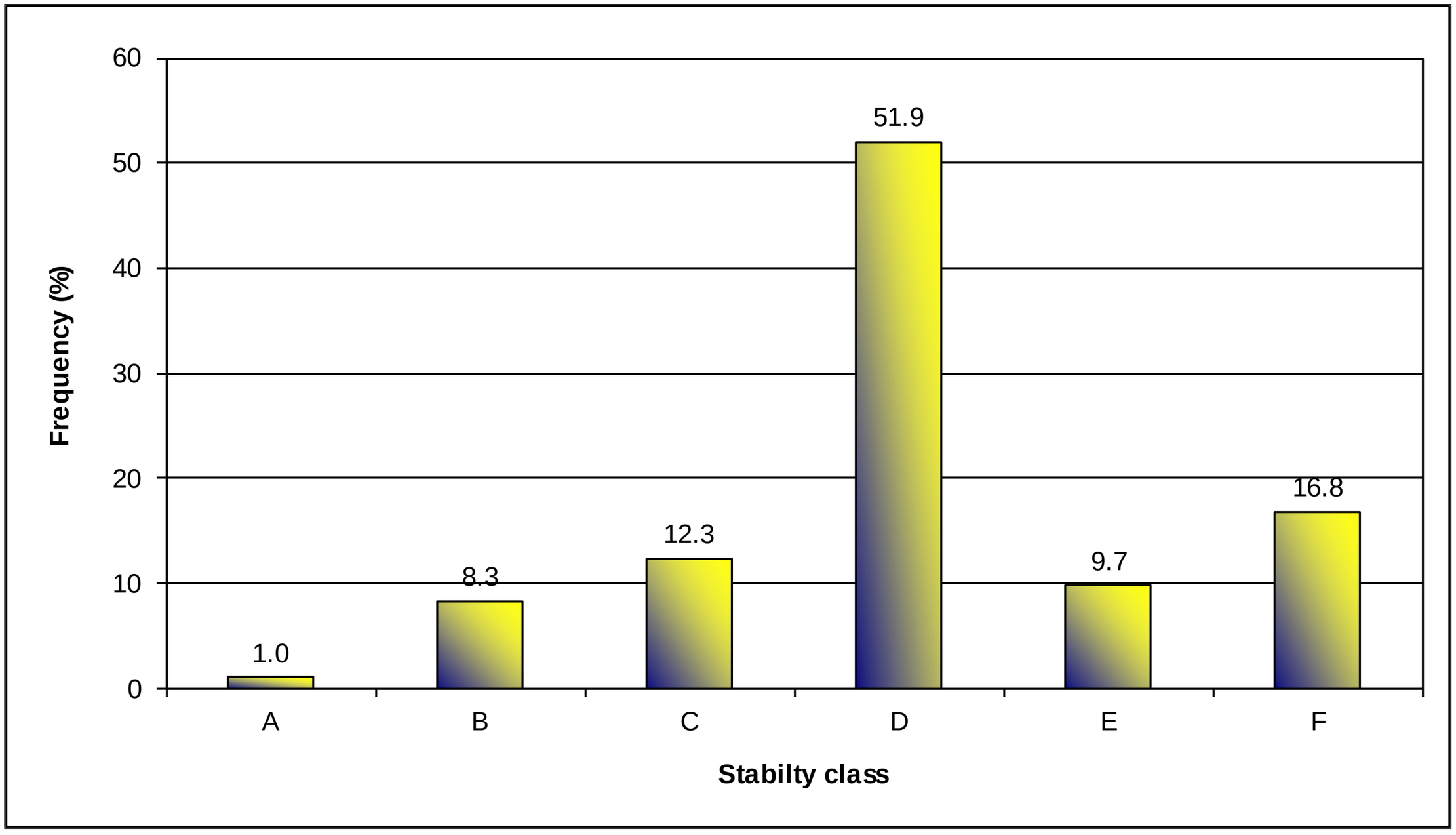


Figure 9.11 – Annual stability class frequency for Woodlawn 2015 (modelled)

9.3.8 CALPUFF Dispersion Model Configuration

9.3.8.1 Computational domain

The computational domain was set to the same parameters as the meteorological domain.

9.3.9 Receptor configuration

Three groups of arbitrary discrete receptors were configured over the modelling domain. A receptor grid was created with a fine resolution inner nest of 9.6 km by 9.6 km by 0.15 km spacing; and an outer nest of 19.35 km by 19.35 km by 0.45 km spacing. A sensitive receptor was placed over the location of the main dwelling at the Torokina property to the southwest of the Site operations. The discrete receptors over properties to the north and east of the Site have been removed from the updated model as they are project-related residences and not considered relevant to the Audit.

9.3.10 Source Configuration and Emission Rates

Full odour source and emission rate configurations are available upon request.

9.3.11 CALPUFF Model Options

CALPUFF default model options were set except for the following as recommended in *Table A*-4 contained and explained within *Barclay and Scire (2011)*:

- Dispersion coefficients (MDISP) = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (2);
- Probability Density Function used for dispersion under convective conditions (MPDF) = Yes (1); and
- Minimum turbulence velocities sigma v for each stability class over land and water (SVMIN) = 0.2 m/s for A, B, C, D, E, F (0.200, 0.200, … , 0.200).

9.4 ODOUR EMISSIONS SCENARIO

The odour emissions scenario used for the modelling was for what was observed during the Audit, except for the Waste Covered Area that used a dataset from the previous IOA and the Audit. This scenario represents TOU's best estimate of total odour emissions from normal operations during 2020. This scenario does not consider abnormal conditions or upset events.

9.5 ODOUR DISPERSION MODELLING RESULTS

The odour dispersion modelling results are visually shown as contour plots that illustrate the contour plot of the ground level odour IAC of 6.0 ou (99%, P/M60) for the following source groups:

- **Figure 9.12** - Predicted odour impact from all odour sources of Woodlawn operations;
- **Figure 9.13** - Predicted odour impact from Bioreactor/Leachate and MBT source groups;

- **Figure 9.14** - Predicted odour impact from Leachate, LTP + ED1CD, and Void source groups; and
- **Figure 9.15** - Predicted odour impact from the MBT Pad + MBT LAP and MBT Biofilter source groups.

The predicted odour concentration at the Torokina property is provided in **Table 9.6** below, which indicates that the ground level odour concentration has not significantly changed since the previous model.

Table 9.6 – Sensitive receptor location and predicted odour impact result

Receptor	UTM East (km)	UTM North (km)	Elevation (m)	Ground level odour concentration (ou)
Torokina	731.336	6114.923	717	0.9

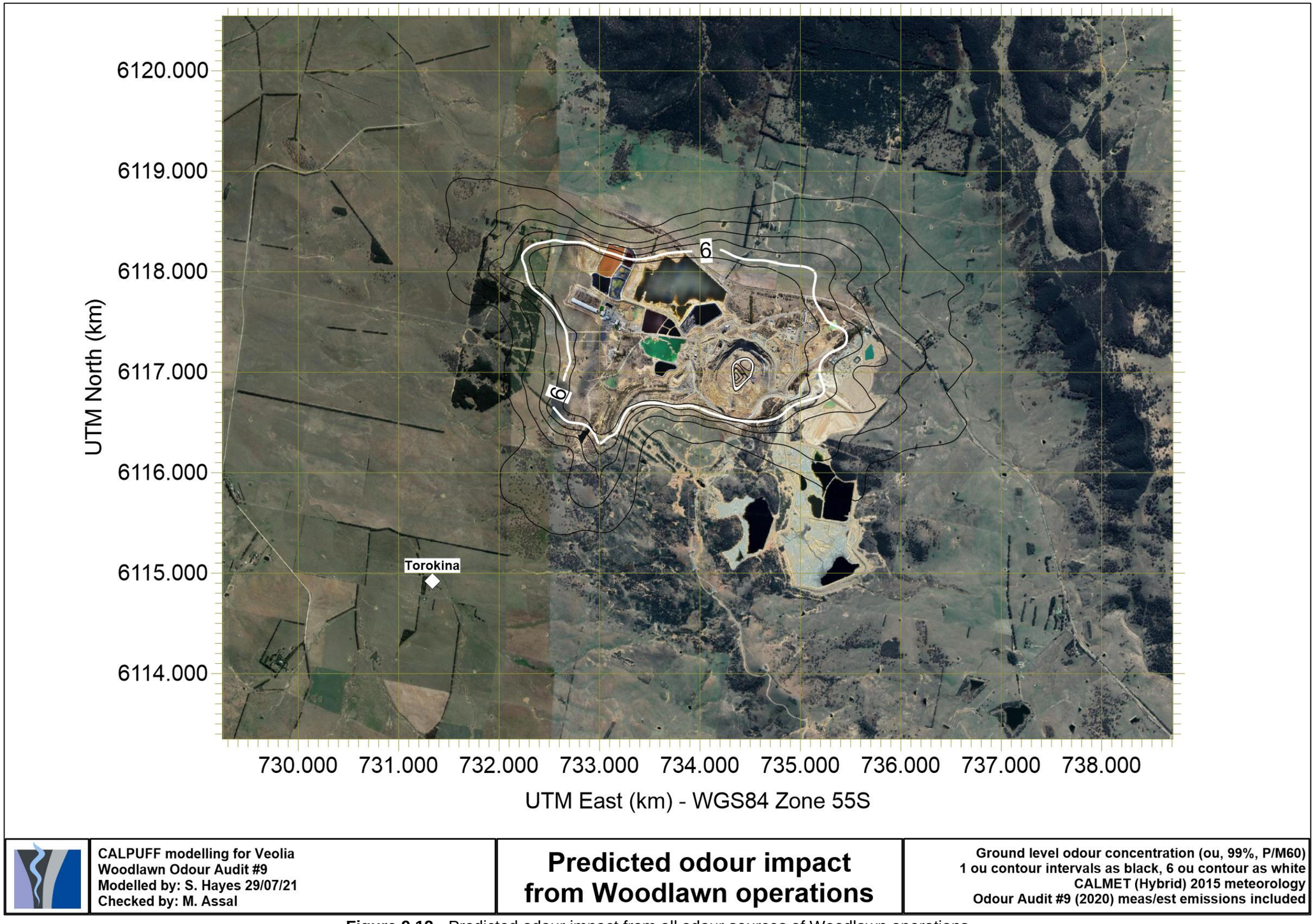


Figure 9.12 - Predicted odour impact from all odour sources of Woodlawn operations

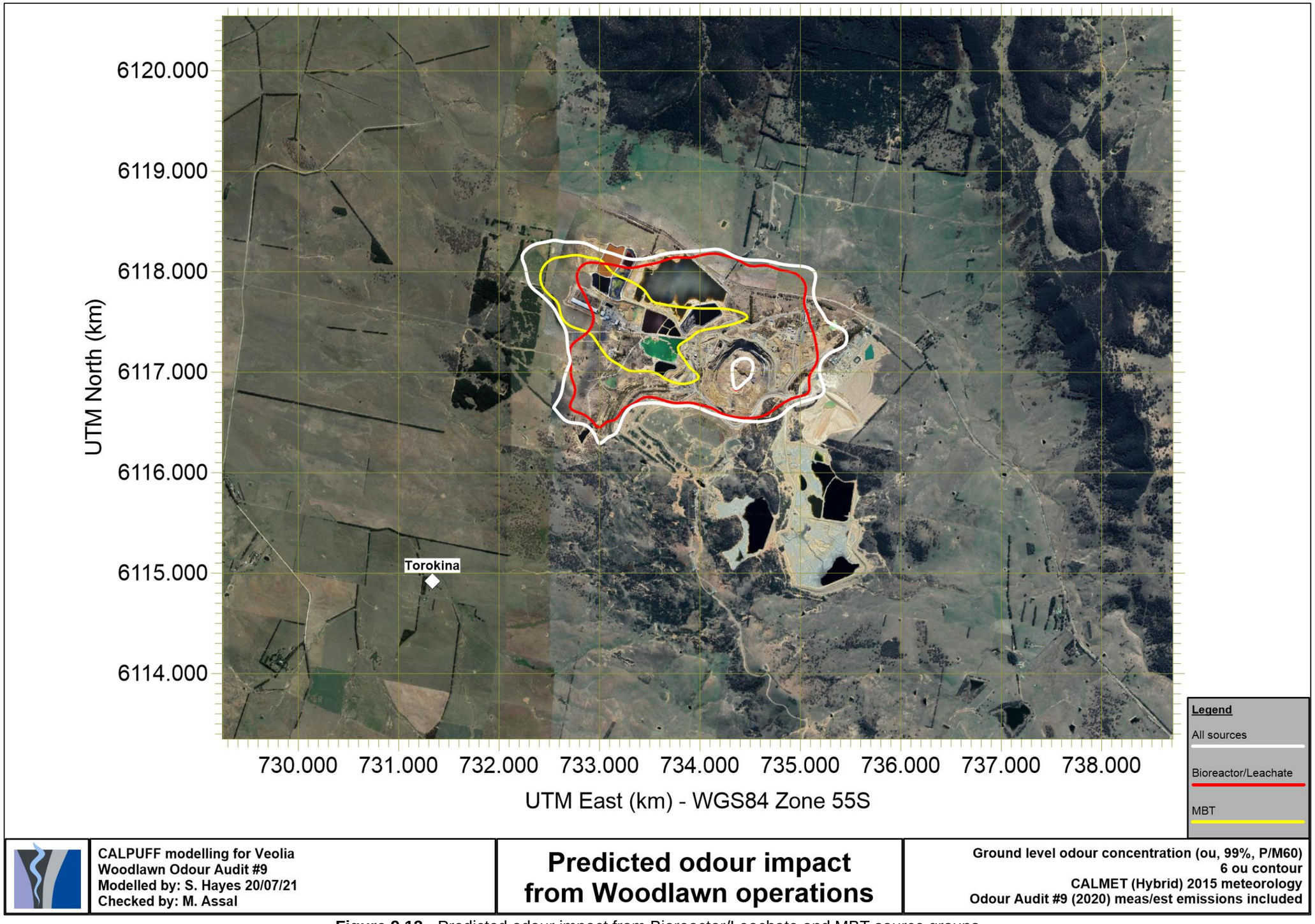


Figure 9.13 - Predicted odour impact from Bioreactor/Leachate and MBT source groups

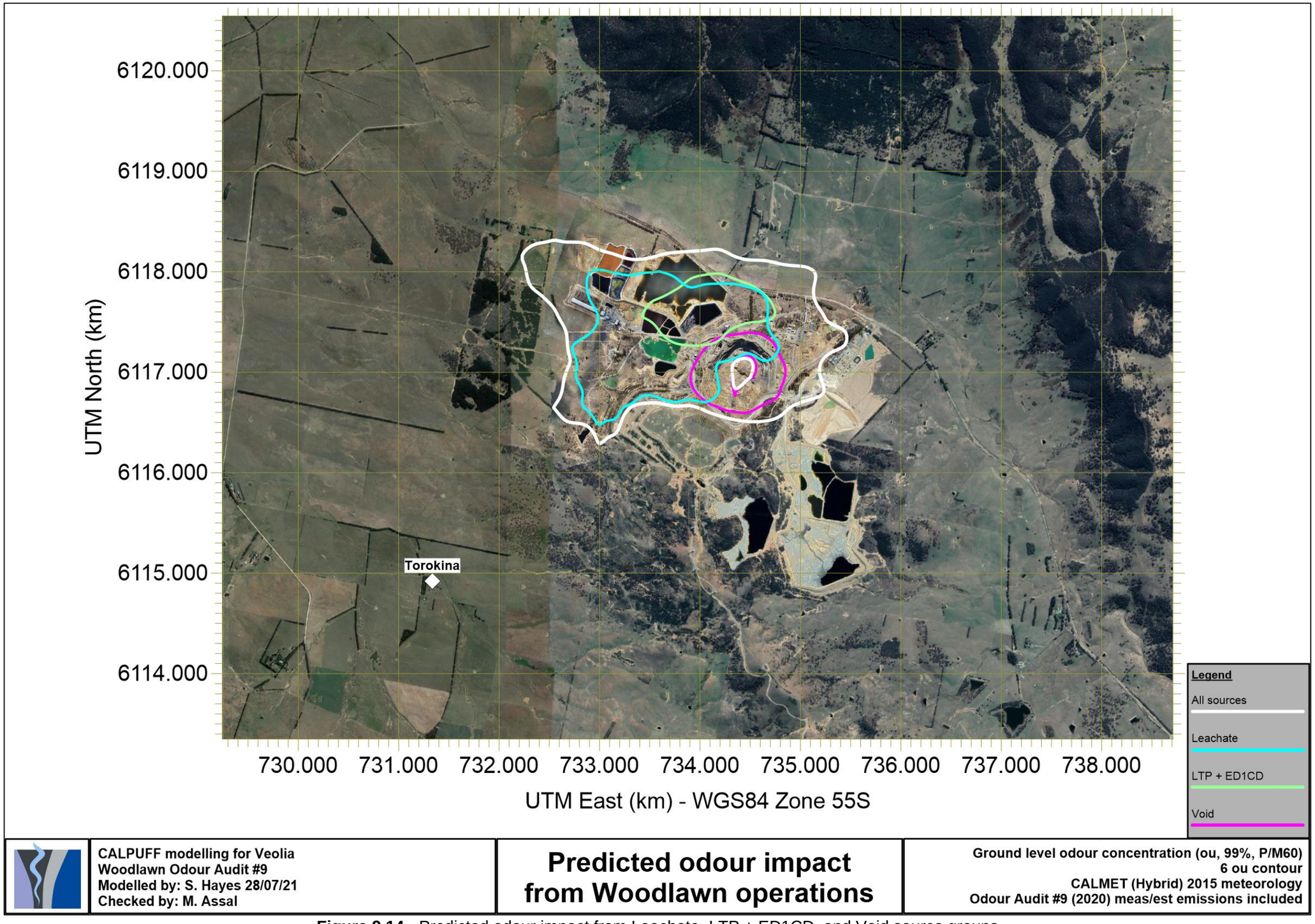


Figure 9.14 - Predicted odour impact from Leachate, LTP + ED1CD, and Void source groups

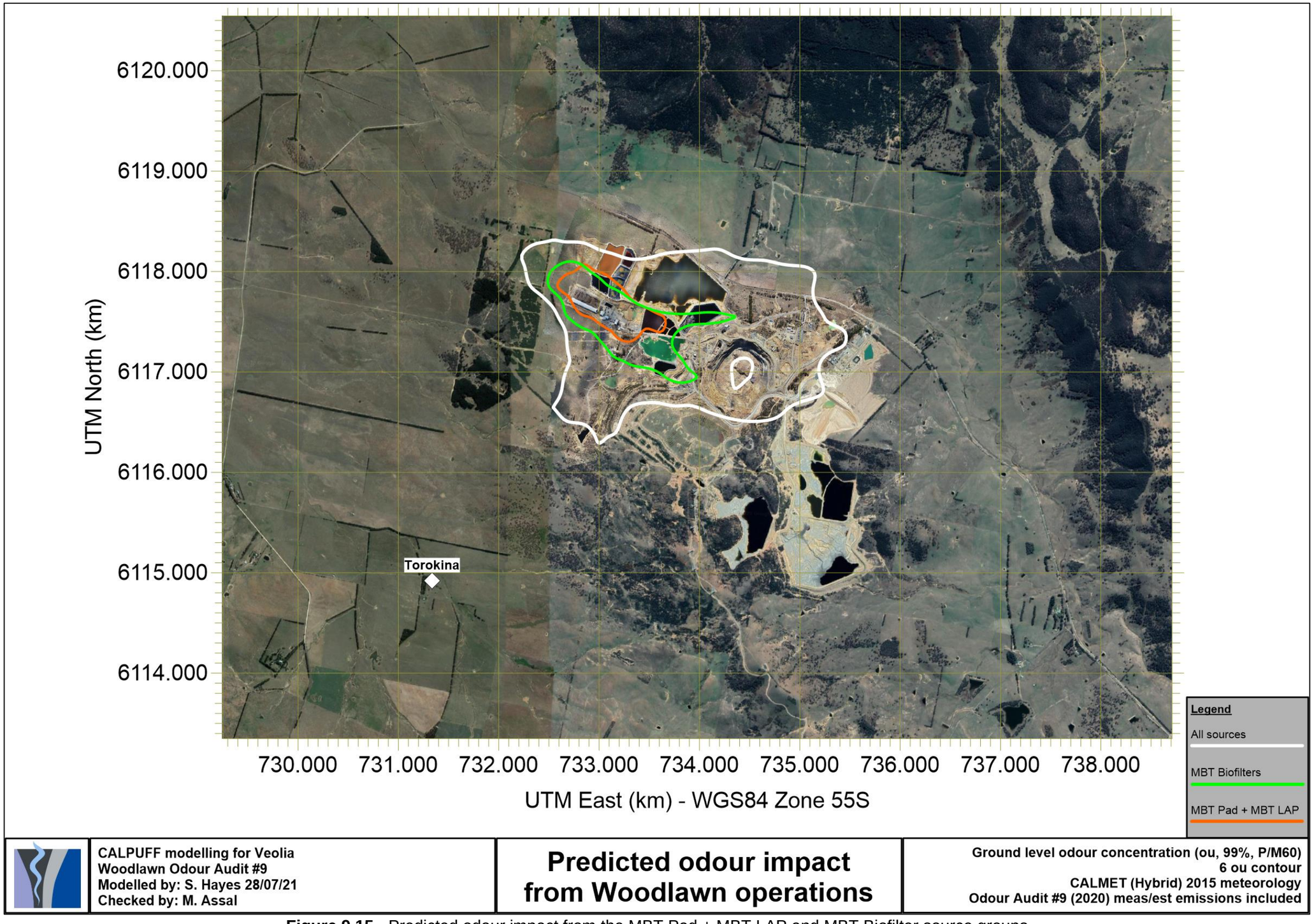


Figure 9.15 - Predicted odour impact from the MBT Pad + MBT LAP and MBT Biofilter source groups

9.6 MODELLING STUDY FINDINGS

An odour dispersion modelling study of the Site in March 2021 was completed as part of the Audit. This involved the modification of the previous IOA model to best represent the present operations during the Audit period, i.e. calendar year 2020.

The odour emissions scenario used for the modelling was that observed during the Audit. This scenario represents TOU's best estimate of total odour emissions from normal operational conditions for the Woodlawn Bioreactor during 2020. This scenario does not consider abnormal conditions or upset events.

It has been found that the Bioreactor, LTP and Leachate sources contribute the most to the overall odour profile of the Site, primarily due to the increase in SOER from the LMS. The MBT operations are the second-largest contributor, mainly from the biofilters, but overall, the impact has reduced significantly since the previous IOA. The Audit has made commentary regarding the on-going management and monitoring of fugitive gas emissions in **Section 10.2.1**.

Notwithstanding the above observations, the modelling has found that the ground level concentration at the nearest sensitive receptor (i.e. the Torokina property dwelling) is predicted to be well below the NSW EPA odour IAC of 6.0 ou (99%, P/M60). Therefore, it can be concluded that adverse odour impacts are unlikely to be caused by the sampled odour sources evaluated in the Audit.

9.6.1 Modelling Study Concluding Remark

The modelling outcome outlined in the Audit is consistent with the previous IOA findings, where compliance was deemed likely given that the majority of the SOER and corresponding OER results were within the ranges used in the EA 2010 (refer to **Table 8.4**). However, it does not consider the unquantifiable impact as associated with fugitive gas emission pathways and operational impacts on the Void operations from high rainfall events over the Audit period (assessed via the undertaking of the FAOA survey monitoring program conducted in the Audit). Furthermore, the Audit finds that Veolia continues to actively undertake measures to minimise odour emissions from the Site, including participation in a community consultation process designed to provide the necessary odour impact feedback. This feedback will continue to be important in the management of odour complaints/issues, particularly as a means of managing the increased number of complaints as observed in **Section 8.4.1**. The Audit recommends that this continues in the future as a means of determining compliance or otherwise with the project-specific goal.

10 AUDIT RECOMMENDATIONS

10.1 CONDITION 7 (G & H)

The following section is designed to address the following Audit requirement:

- *Outline all reasonable and feasible measures (including cost/benefit analysis, if required) that may be required to improve odour control at the site; and*
- *Recommend and prioritise (mandatory and non-mandatory) recommendations for their implementations*.

Based on the findings from this Audit, the following mandatory and non-mandatory measures have been recommended. In addition to these measures, Veolia should enhance its 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 (given the increase in the number of logged odour complaints in the Audit period). Veolia should also continue to log and monitor odour complaints in the current odour complaints register.

The Audit team understands that the odour diary project has been reinstated since February 2021 the active engagement between Veolia and the affected community as well as the significant reduction in odour complaints noted in the Audit since the previous IOA (refer to **Section 8.4.1**).

10.2 MANDATORY RECOMMENDATIONS

The mandatory recommendations in this Audit revolve around the increase in the number of odour complaints, the leachate management system, the continuation of odour mitigation from the Void and optimisation of the odour control infrastructure servicing the MBT Facility. These have been discussed in the following sections.

10.2.1 Odour Mitigation from the Void

Fugitive landfill gas emissions

As mentioned in the Audit, the high rainfall conditions over the assessed period have impacted the efficacy of gas emissions containment and capture, with fugitive emissions pathways anecdotally more prevalent than the previous IOA. This is supported by the ingress of rainfall into the Void surface, reduction in landfill gas emissions since the previous IOA, the increase in complaints and results of the FAOA surveys in the Audit. As such, Veolia should continue to manage fugitive landfill gas pathways from the surface using the existing toolkit such as biocover material. Moreover, Veolia should enhance and accelerate its improvement to landfill gas capture from the Bioreactor as reasonably practicable. This continuation is apparent in the WIP 2020, which outlines a comprehensive plan that is being implemented to increase gas capture. The WIP 2020 also clearly seeks to address current areas of concern and the potential solution outcomes that can be implemented. This is an active (and effective) management approach that will result in a continual improvement in gas capture efficiency and ultimately reduce odour/landfill gas emissions from the Void. It will also assist Veolia in navigating through the high incidence of odour complaints and impacts from fugitive

emissions from the Void surface. As such, the Audit endorses this strategy as the primary measure to reduce odour emissions from the Void and recommends that Veolia continues the implementation of the gas systems detailed in the WIP 2020, including:

- The augmentation of additional pipework and booster/flare/engine to the current capacity at the Site. In principle, the addition of the power station engines will increase landfill gas usage capacity, further facilitate the optimisation and minimisation of fugitive landfill gas release from the Void surface;
- the planned infrastructure instalments within each waste lift;
- the continuous improvement to leachate extraction, treatment performance, capacity, and efficiency. This is supported by the implementation of the long-term leachate solution in the form of the LTP that is the process-proving phase of operation;
- the continuous improvement in the waste tipping profile, covering and expansion and optimisation of the landfill gas infrastructure;
- the continuous monitoring of leachate and gas extraction;
- remediation actions in the event of equipment failure and process upset in the Void;
- continuous awareness of condense management;
- The implementation of operational management programs, including:
    - Leachate management;
    - Pumps and pumping solutions; and
    - The expansion of wells in the Void for improved/minimisation of leachate recirculation and landfill gas extraction.
- application of biocover material to manage fugitive landfill gas emissions, as outlined in the WIP 2020.

It should be noted that the WIP 2020 is a live document that will be continually updated. Therefore, it will continue to remain a part of the IOA.

10.2.2 Leachate Management System

Veolia should continue to adequately maintain and manage the upgraded LMS to ensure it is operating in an optimum state and meeting the leachate quality monitoring targets as outlined in the *Leachate Treatment Operation Manual* and recommended by Veolia Water. Moreover, continue the implementations planned in the WIP 2020. Both the manual and WIP 2020 should be considered as a 'live' document to reflect any variation in quality and operational demands and identifications of new constraints and/or issues. This should continue to attenuate the potential for significant odour generation from the leachate stored in ED3N & ED3S Pond Systems both now and in

the future. Furthermore, given the current treatment capacity in managing high rainfall events, if a suitable monitoring and performance metric protocol are established, the capability of diverting diluted contaminated stormwater to one of the evaporation dams (i.e. ED3S and ED3N) will present an opportunity to further mitigate the potential adverse impacts on the landfill gas capture infrastructure and ultimately provide an improved odour outcome under such circumstances.

The Audit finds that the LTP has provided additional leachate treatment capacity at the Site. Moreover, the treated leachate flowing to ED1 coffer dam from the LTP is of a very high quality, as supported by the LOM results. The inclusive of additional leachate treatment capacity will have a significant effect on the minimisation of odour from the Void and LMS in the medium to long-term. In collaboration with Veolia, the next Audit will attempt to make provisions for safe access to enable sampling of the ED1 coffer dam, if practicable. Moreover, Veolia should closely monitor the following aspects of the LMS, including:

- COD and nitrate loading into the LTD and ED3S-S; and
- Effects of the continued volume reduction on ED3N-2, ED3N-3, and ED3N-4 from an odour perspective through regularly field odour spot checks downwind of each pond area.

10.2.3 Active Tipping Face

Veolia should continue to develop strategies for the minimising of the exposed active tipping face surface area. It should also proceed and continue with the details in the WIP 2020.

10.2.4 Refine Investigation of Odour Issues in the Community

Given the significant increase in odour complaints documented in the Audit, the Audit recommends that Veolia enhance its community engagement and liaison process. It is understood this has already commenced via the reinstatement of the odour diary program in February 2021. As such, the refinement and enhancement of community engagement is a mandatory recommendation in the Audit. Furthermore, Veolia should consider refining its investigation of odour issues in the community, particularly surrounding the most common complainants, to assess the extent to which odour is present in the community. Such an investigation could include:

- potential odour transport pathways;
- the undertaking of field odour surveys;
- assess the topography of surrounding land and analysis of climatic data; and
- a detailed review of odour complaint data.

10.3 NON-MANDATORY RECOMMENDATIONS

The non-mandatory recommendations in this Audit revolve around odour mitigation strategies for the Void, odour complaints, and fugitive gas emissions from the Void. This has been discussed in the following sections.

10.3.1 IMF and Waste Transport Activities

Based on TOU observations, the Audit suggests that Veolia continue to review the following aspects relating to the use of the IMF and waste transport activities to further improve its odour performance as a minor and transient source of odour, namely:

- The washing practice associated with the sealed containers; and
- The maintenance of the sealed containers.

10.3.2 Odour Mitigation from the MBT Facility

The Audit recommends a heightened awareness of the operability and maintenance of the biofilter-based odour control system at the MBT Facility, which should be consistent with the Biofilter Manual to ensure optimal and sustained odour removal performance. Given that the MBT Facility operation is a recent addition to the Audit, a benchmark process will be developed and reviewed as part of subsequent IOAs to assess the operability and odour performance of the biofilter-based odour control system with the objective of continuous improvement in odour mitigation and optimisation. It is recommended that the MBT Facility improve its overall management of biofilter bed moisture to ensure optimum odour removal performance. This can be achieved by an intensification of the surface drip irrigation system and/or optimisation of the current spray humidification system. Furthermore, it is understood that the MBT Facility has assigned dedicated personnel to manage and maintain the biofilter system – this will facilitate in the effective execution of continuous improvement and optimisation works.

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REPORT SIGNATURE PAGE

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Veolia Australia & New Zealand

Woodlawn Bioreactor Expansion Project

Independent Odour Audit #9

August 2021

Appendices

APPENDIX A:

RECORD OF CORRESPONDENCE WITH NSW EPA & DPE

Michael Assal

Subject: FW: Veolia Woodlawn Bioreactor Odour Audit #9 (DA 10_0012) - Consultation
Attachments: Veolia Woodlawn - Odour Audit #9 Proposal [20210217 - EPA + DPIE].pdf

Importance: High

From: Michael Assal
Sent: Wednesday, 17 February 2021 10:53 AM
[redacted]
Subject: Veolia Woodlawn Bioreactor Odour Audit #9 (DA 10_0012) - Consultation
Importance: High

Dear [redacted]

RE: Woodlawn Bioreactor Facility Odour Audit #9

Relevant Background

We, The Odour Unit (**TOU**), have been engaged by Veolia Environmental Services (**Veolia**) to conduct the ninth (9th) independent odour audit (**the Odour Audit**) at the Woodlawn Bioreactor Facility, Tarago, NSW (**the Woodlawn Facility**). In accordance with the project approval requirements outlined in *Condition 7* of *Schedule 4* in the *Specific Environmental Conditions - Landfill sites* (DA 10_0012), which states that we need to *Consult with the Environment Protection Authority (EPA) and the Department of Planning, Industry and Environment (DPIE),* please regard this email as our formal notification for consultation with the relevant regulatory departments for the Odour Audit.

The Odour Audit Proposal

Please find **attached** our proposal as addressed and issued to Veolia for the undertaking of the Odour Audit at the Woodlawn Facility. The attached proposal details our scope of works, the audit team, deliverables, timeframe and other details relating to the undertaking of the Odour Audit.

Consultation Timing

As you will gather from the attached proposal, we have scheduled the fieldwork component of the Odour Audit to be completed between **8 March 2021** and **11 March 2021** . As such, it will be appreciated if we can receive any advice or feedback on or before **Wednesday, 3 March 2021.**

We look forward to hearing from you soon. Please do not hesitate to contact us if you have any enquiries.

Regards,

Michael Assal MEngSc, B. Eng (Hon)/B.Sc, AMIChemE, MIEAust, CAQP
Operations Manager, Senior Engineer & Consultant

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Michael Assal

From: EPA Regulatory Operations Metro Regulation Mailbox <RegOps.MetroRegulation@epa.nsw.gov.au>
Sent: Wednesday, 17 February 2021 10:54 AM
To: Michael Assal
Subject: Automatic reply: Veolia Woodlawn Bioreactor Odour Audit #9 (DA 10_0012) - Consultation

Thank you for your enquiry.

The NSW Environment Protection Authority (EPA) Regulatory Operations Metropolitan Division acknowledges receipt of your email and your enquiry will be sent to the appropriate EPA officer for their action.

The EPA will respond to your request as soon as possible.

For enquiries or requests that are more involved or technical, a longer response time may be necessary.

The NSW EPA website contains a lot of useful information, If you have not already visited our website and wish to do so, please go to: https://www.epa.nsw.gov.au/

If you're reporting a pollution incident, please contact the Environment Line on 131 555.

Michael Assal

Subject: RE: Veolia Woodlawn Bioreactor Odour Audit #9 (DA 10_0012) - Consultation

From: [redacted]
Sent: Monday, 8 March 2021 8:24 AM
To: Michael Assal <massal@odourunit.com.au>
Subject: FW: Veolia Woodlawn Bioreactor Odour Audit #9 (DA 10_0012) - Consultation

Hi Michael

Sorry for the late reply, in relation to the independent odour audit (the Odour Audit) at the Woodlawn Bioreactor Facility, Tarago, NSW (the Woodlawn Facility) the Department provides the following advice and/or feedback.

The Odour Audit needs to ensure that it addresses all the requirements outlined in Schedule 4 Condition 7.

Furthermore, the audit should consider the number of complaints that were received in relation to odour and compare it to previous years.

The environmental parameters associated for these complaints should also be assessed, for example:

- what were the prevailing winds when the complaint was made;
- was the complaint due to a system breakdown at Woodlawn or the Intermodal;
- was there a leachate incident that lead to an increase in complaints; and
- did the biroreactor process a certain type or waste/high processing capacity at the time the complaint was made.

An analysis of whether the leachate treatment plant has led to a reduction in complaints should also be considered.

Consideration should also be given as to which residents are making the complaints and what operational changes Veolia Environmental Services can make to reduce the odour impacts to those residents.

Should you require any further clarification in relation to above, please contact me on the details below.

Kind regards,

[redacted]

www.dpie.nsw.gov.au

NSW GOVERNMENT | Planning, Industry & Environment

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

If you are submitting a compliance document or request as required under the conditions of consent or approval, please note that the Department is no longer accepting lodgement via compliance@planning.nsw.gov.au.

The Department has recently upgraded the Major Projects Website to improve the timeliness and transparency of its post approval and compliance functions. As part of this upgrade, proponents are now requested to submit all post approval and compliance documents online, via the Major Projects Website. To do this, please refer to the instructions available here.

APPENDIX B:

ODOUR CONCENTRATION LABORATORY TESTING RESULT SHEETS

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

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Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	IFH	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	T. Schulz

Investigated Item
Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification
The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method
The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range
The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment
The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.

Measuring Dates
The date of each measurement is specified with the results.

Instrument Used
The olfactometer used during this testing session was:
TOU-OLF-001.

Instrumental Precision
The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3.
$r = 0.280$ (October 2019) Compliance – Yes

Instrumental Accuracy
The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3.
$A = 0.076$ (October 2019) Compliance – Yes

Lower Detection Limit (LDL)
The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.

Traceability
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Thursday, 11 March 2021

Panel Roster Number: SYD20210309_019

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210309_019

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Sample 1 ED3N-4	SC21124	08/03/2021 1344 hrs	09/03/2021 1025 hrs	4	8	332
Sample 2 ED3N-4	SC21125	08/03/2021 1346 hrs	09/03/2021 1054 hrs	4	8	430
Sample 3 ED3N-4	SC21126	08/03/2021 1410 hrs	09/03/2021 1137 hrs	4	8	1,720
Sample 4 ED3N-3	SC21127	08/03/2021 1435 hrs	09/03/2021 1225 hrs	4	8	2,050
Sample 5 ED3N-3	SC21128	08/03/2021 1525 hrs	09/03/2021 1302 hrs	4	8	664
Sample 6 ED3N-3	SC21129	08/03/2021 1605 hrs	09/03/2021 1412 hrs	4	8	279
Sample 7 ED3N-2	SC21130	08/03/2021 1455 hrs	09/03/2021 1442 hrs	4	8	58
Sample 8 ED3N-2	SC21131	08/03/2021 1442 hrs	09/03/2021 1514 hrs	4	8	45
Sample 9 ED3N-2	SC21132	08/03/2021 1531 hrs	09/03/2021 1550 hrs	4	8	304

Samples Received in Laboratory – From: T. Schulz Date: 09/03/2021 Time: 09:00 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210309_019	51,400	$20 \leq \chi \leq 80$	724	71	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21124	dusty, dirt
SC21125	dusty, dirt
SC21126	cement, dusty
SC21127	mildly sour, dusty
SC21128	sour, dusty
SC21129	sour
SC21130	dirty, faecal
SC21131	dirty, faecal
SC21132	dirty

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	11/03/21	I. Farrugia	-	-	-
Final	1.0	01/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

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Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	IFH	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: TOU-OLF-001.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.280$ (October 2019) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.076$ (October 2019) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.
Traceability	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Thursday, 11 March 2021

Panel Roster Number: SYD20210310_020

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210310_020

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Sample 10 EDSS	SC21133	09/03/2021 1019 hrs	10/03/2021 1006 hrs	4	8	3,160
Sample 11 EDSS	SC21134	09/03/2021 0924 hrs	10/03/2021 1038 hrs	4	8	4,100
Sample 12 EDSS	SC21135	09/03/2021 0936 hrs	10/03/2021 1110 hrs	4	8	3,760
Sample 13 LTD - anoxic	SC21136	09/03/2021 1053 hrs	10/03/2021 1141 hrs	4	8	9,740
Sample 14 LTD - aerobic	SC21137	09/03/2021 1057 hrs	10/03/2021 1312 hrs	4	8	664
Sample M13 Biofilter 1 – west	SC21138	09/03/2021 1336 hrs	10/03/2021 1335 hrs	4	8	431
Sample M14 Biofilter 1 – middle	SC21139	09/03/2021 1346 hrs	10/03/2021 1413 hrs	4	8	470
Sample M15 Biofilter 1 – east	SC21140	09/03/2021 1357 hrs	10/03/2021 1439 hrs	4	8	664
Sample M16 Biofilter 1 – inlet	SC21141	09/03/2021 1413 hrs	10/03/2021 1506 hrs	4	8	2,660

Samples Received in Laboratory – From: A. Schulz Date: 10/03/2021 Time: 09:00 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210310_020	51,400	$20 \leq \chi \leq 80$	861	60	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21133 rotten, mild rendering
SC21134 rotten, dirty, mild rendering
SC21135 rotten, dirty
SC21136 ammonia, dirty, rotten
SC21137 ammonia, dirty, rotten
SC21138 pine, fermented garbage
SC21139 fermented garbage
SC21140 fermented garbage, dirt, soil
SC21141 garbage

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	11/03/21	I. Farrugia	-	-	-
Final	1.0	02/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

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Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	IFH	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz

Investigated Item
Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification
The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method
The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range
The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment
The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.

Measuring Dates
The date of each measurement is specified with the results.

Instrument Used
The olfactometer used during this testing session was:
TOU-OLF-001.

Instrumental Precision
The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3.
$r = 0.280$ (October 2019) Compliance – Yes

Instrumental Accuracy
The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3.
$A = 0.076$ (October 2019) Compliance – Yes

Lower Detection Limit (LDL)
The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.

Traceability
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Date: Monday, 15 March 2021

Panel Roster Number: SYD20210311_021

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210311_021

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Sample 15 WCA 300mm	SC21142	10/03/2021 0921 hrs	11/03/2021 1000 hrs	4	8	70
Sample 16 WCA 300mm	SC21143	10/03/2021 0948 hrs	11/03/2021 1059 hrs	4	8	166
Sample 17 WCA 300mm	SC21144	10/03/2021 1000 hrs	11/03/2021 1125 hrs	4	8	59
Sample 18 WCA 150mm	SC21145	10/03/2021 1014 hrs	11/03/2021 1146 hrs	4	8	181
Sample 19 WCA 150mm	SC21146	10/03/2021 1115 hrs	11/03/2021 1300 hrs	4	8	256
Sample 20 WCA 150mm	SC21147	10/03/2021 1130 hrs	11/03/2021 1334 hrs	4	8	91
Sample 21 ATP (1 of 3)	SC21148	10/03/2021 1115 hrs	11/03/2021 1354 hrs	4	8	4,100
Sample 22 ATP (2 of 3)	SC21149	10/03/2021 1200 hrs	11/03/2021 1426 hrs	4	8	5,310
Sample 23 ATP (3 of 3)	SC21150	10/03/2021 1200 hrs	11/03/2021 1554 hrs	4	8	7,510

Samples Received in Laboratory – From: A. Schulz Date: 11/03/2021 Time: 09:00

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210311_021	51,400	$20 \leq \chi \leq 80$	861	60	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21142 dirty, soil, mild garbage
SC21143 grain, dirt
SC21144 dirt
SC21145 dirt, soil
SC21146 garbage
SC21147 dirt, soil
SC21148 garbage, pineapple
SC21149 garbage, pineapple
SC21150 garbage, pineapple

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	15/03/21	I. Farrugia	-	-	-
Final	1.0	02/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

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Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	IFH	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz

Investigated Item
Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification
The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method
The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range
The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment
The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.

Measuring Dates
The date of each measurement is specified with the results.

Instrument Used
The olfactometer used during this testing session was:
TOU-OLF-001.

Instrumental Precision
The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3.
$r = 0.280$ (October 2019) Compliance – Yes

Instrumental Accuracy
The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3.
$A = 0.076$ (October 2019) Compliance – Yes

Lower Detection Limit (LDL)
The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.

Traceability
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Monday, 15 March 2021

Panel Roster Number: SYD20210312_022

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210312_022

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Sample M1 MBT Maturation Pad - screened	SC21151	11/03/2021 1101 hrs	12/03/2021 1000 hrs	4	8	6,320
Sample M2 MBT Maturation Pad – Sep 2020	SC21152	11/03/2021 1108 hrs	12/03/2021 1035 hrs	4	8	558
Sample M3 MBT Maturation Pad – Nov 2020	SC21153	11/03/2021 1114 hrs	12/03/2021 1111 hrs	4	8	332
Sample M4 MBT Maturation Pad – Jan 2021	SC21154	11/03/2021 1148 hrs	12/03/2021 1142 hrs	4	8	470
Sample M5 MBT Maturation Pad – Feb 2021	SC21155	11/03/2021 1157 hrs	12/03/2021 1214 hrs	4	8	279

Samples Received in Laboratory – From: A. Schulz Date: 12/03/2021 Time: 09:00 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210312_022

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration ((ou)
Sample M6 Biofilter 2 – southwest	SC21156	11/03/2021 1208 hrs	12/03/2021 1332 hrs	4	8	558
Sample M7 Biofilter 2 – west	SC21157	11/03/2021 1217 hrs	12/03/2021 1358 hrs	4	8	1,450
Sample M8 Biofilter 2 - northwest	SC21158	11/03/2021 1228 hrs	12/03/2021 1431 hrs	4	8	2,230
Sample M9 Biofilter 2 – northeast	SC21159	11/03/2021 1234 hrs	12/03/2021 1457 hrs	4	8	2,900
Sample M10 Biofilter 2 – east	SC21160	11/03/2021 1242 hrs	12/03/2021 1534 hrs	4	8	2,230
Sample M11 Biofilter 2 - southeast	SC21161	11/03/2021 1248 hrs	12/03/2021 1625 hrs	4	8	1,330
Sample M12 Biofilter 2 – inlet	SC21162	11/03/2021 1304 hrs	12/03/2021 1656 hrs	4	8	6,890

Samples Received in Laboratory – From: A. Schulz Date: 12/03/2021 Time: 09:00 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210312_022	51,400	$20 \leq \chi \leq 80$	861	60	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21151	compost, blood, ammonia	SC21158	dirt, soil, compost, fermented
SC21152	dirt, soil, ammonia	SC21159	compost, dirt, fermented, sour
SC21153	dirt, soil, ammonia	SC21160	dirt, soil, compost, fermented
SC21154	dirt, soil	SC21161	dirt, soil, compost, fermented
SC21155	dirt, soil	SC21162	garbage, dirt, compost
SC21156	dirt, compost, fertiliser, sweet		
SC21157	dirt, soil, compost, fermented		

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	15/03/21	I. Farrugia	-	-	-
Final	1.0	02/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

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Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	LOM	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz

Investigated Item
Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification
The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method
The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range
The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment
The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.

Measuring Dates
The date of each measurement is specified with the results.

Instrument Used
The olfactometer used during this testing session was:
TOU-OLF-001.

Instrumental Precision
The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3.
$r = 0.280$ (October 2019) Compliance – Yes

Instrumental Accuracy
The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3.
$A = 0.076$ (October 2019) Compliance – Yes

Lower Detection Limit (LDL)
The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.

Traceability
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Thursday, 18 March 2021 Panel Roster Number: SYD20210315_023

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210315_023

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Liquid #1 ED3N-4	SC21163	15/03/2021 0830 hrs	15/03/2021 1011 hrs	4	8	166
Liquid #2 ED3N-4	SC21164	15/03/2021 0835 hrs	15/03/2021 1056 hrs	4	8	91
Liquid #3 ED3N-4	SC21165	15/03/2021 0859 hrs	15/03/2021 1125 hrs	4	8	45
Liquid #4 ED3N-3	SC21166	15/03/2021 0909 hrs	15/03/2021 1151 hrs	4	8	49
Liquid #5 ED3N-3	SC21167	15/03/2021 1130 hrs	15/03/2021 1306 hrs	4	8	38
Liquid #6 ED3N-3	SC21168	15/03/2021 1111 hrs	15/03/2021 1348 hrs	4	8	45
Liquid #7 ED3N-2	SC21169	15/03/2021 1243 hrs	15/03/2021 1533 hrs	4	8	38
Liquid #8 ED3N-2	SC21170	15/03/2021 1247 hrs	15/03/2021 1503 hrs	8	8	38

Samples Received in Laboratory – From: A. Schulz Date: 09/03/2021 Time: 08:30 hrs - Liquid

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210315_023	51,400	$20 \leq \chi \leq 80$	724	71	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21163 dirty water, muddy
SC21164 dirty water
SC21165 musty, muddy water
SC21166 musty water
SC21167 dirty water
SC21168 dirty water
SC21169 dirty water
SC21170 dirty water

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	18/03/21	I. Farrugia	-	-	-
Final	1.0	02/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

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Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Veolia Environmental Services	Telephone	+61 411 345712
Contact	M. Rakete	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	marea.rakete@veolia.com
Sampling Method	LOM	Sampling Team	TOU (TS, AS, IF, JS & MA)

Order details:

Order requested by	M. Rakete	Order accepted by	M. Assal
Date of order	March 2021	TOU Project #	N1806L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: TOU-OLF-001.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.280$ (October 2019) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.076$ (October 2019) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.
Traceability	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Thursday, 18 March 2021 Panel Roster Number: SYD20210316_024

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20210316_024

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Liquid #9 ED3N-2	SC21173	16/03/2021 0857 hrs	16/03/2021 1137 hrs	4	8	32
Liquid #10 ED3SS	SC21174	16/03/2021 0902 hrs	16/03/2021 1212 hrs	4	8	99
Liquid #11 ED3SS	SC21175	16/03/2021 1113 hrs	16/03/2021 1321 hrs	4	8	45
Liquid #12 ED3SS	SC21176	16/03/2021 1116 hrs	16/03/2021 1349 hrs	4	8	49
Liquid #L1 ED1 - Coffer	SC21177	16/03/2021 1247 hrs	16/03/2021 1409 hrs	4	8	16
Liquid #L2 ED1 - Coffer	SC21178	16/03/2021 1251 hrs	16/03/2021 1430 hrs	4	8	16
Liquid #L3 ED1 - Coffer	SC21179	16/03/2021 1337 hrs	16/03/2021 1450 hrs	4	8	16

Samples Received in Laboratory – From: A. Schulz Date: 09/03/2021 Time: 08:57 hrs - Liquid

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210316_024	51,400	$20 \leq \chi \leq 80$	724	71	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21173	dirty water
SC21174	dirty water, slight ammonia
SC21175	dirty water
SC21176	dirty water
SC21177	musty
SC21178	musty
SC21179	musty

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	18/03/21	I. Farrugia	-	-	-
Final	1.0	02/07/21	S. Hayes	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

APPENDIX C:

TECHNICAL DOCUMENTATION RELEVANT TO THE AUDIT

ODOUR COMPLAINTS REGISTER:

1 APRIL 2020 AND 31 APRIL 2021

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
30/4/2021	Not Specified	EPA Environmental Line	Odour	Collector Road, Tarago	The complainant said the odour is overpowering, disgusting and extremely unpleasant and it is noticeable almost every morning.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
29/4/2021	7:00:00 am	Phone (Direct)	Odour	Braidwood Road, Tarago	The complainant reported noticing the odour inside his home when he awoke the morning at 7:00am. The complainant reported noticing the odour for the last 10 years but the last 2 years had been worse, and the odour seems to dissipate when the sun comes up.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
29/4/2021	7:00:00 am	Community Feedback Line	Odour	Mulwaree Street, Tarago	The complainant reported noticing the odour inside their home at around 7am and noticed the smell was stronger when going outside. The smell was described as a rubbishy smell and a gas bottle smell. Similar to the odour added to gas bottles so you know if it is leaking. It had a hint of rotten egg, but that was overpowered by the gassy smell.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
29/4/2021	6:30:00 am	Community Feedback Line	Odour	Mooneys Road, Currawang	The complainant reported a sickly sweet odour that was more like rotten egg than a gassy smell. The complainant reported that they only used to notice it when driving past the Bioreactor, but recently they have started to detect it at their home.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
29/4/2021	8:30:00 am	Phone (Direct)	Odour	Between Lake Bathurst & Tarago	The complainant reported noticing the odour between Lake Bathurst and Tarago on their way to work. The odour was described as a rotten, gassy smell.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
29/4/2021	Not Specified	EPA Environmental Line	Odour	Lumley Road, Tarago	The complainant reported the odour is an ongoing problem and it smells like rotten eggs and has been getting worse in foggy conditions.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
29/4/2021	9:00:00 am	EPA Environmental Line	Odour	Tarago Public School	The complainant reported being impacted by an offensive odour when dropping their children off at Tarago Public School at approx. 9am that morning.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
28/4/2021	11:00:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant stated that there was “putrid rotting vegetation odour” in the air outside their home at 2pm on 28/4/21 . They said the odour is ‘awful’ when there is a SW wind and on Saturday (24/4/21) it was particularly bad.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
27/4/2021	Not Specified	EPA Environmental Line	Odour	Collector Road, Tarago	The complainant said the odour is an ongoing problem and it smells like sulphur, and it has been getting worse over time. The caller alleged that the odour was coming from the Woodlawn Bioreactor, and Crisps Creek Transfer station.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
27/4/2021	12:00:00 pm	EPA Environmental Line	Odour	Collector Road, Tarago	The complainant stated the odour is an ongoing problem and it smells like rotting household garbage smell with the odour being incredibly strong at 12:00 pm.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/04/2021	11:00:00 am	EPA Environmental Line	Odour	Lake Bathurst	The complainant contacted the EPA’s Environment Line to complain about an odour allegedly coming from the Bioreactor. They have generally described the odour as being offensive with a strong sulphur-like, rotting garbage smell.	In consultation with the NSW EPA, amendments have been made to conditions of Veolia’s EPL aimed at improving odour management at the premises, the majority of which have already been implemented.
26/4/2021	12:02:00 pm	Community Feedback Line	Odour	Mulwaree Street, Tarago	The complainant reported a rotten odour as he was driving past Collector Rd on his way home and it was also present at his home. The complainant reported that the odours had been getting worse of late.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
26/4/2021	10:20:00 am	Community Feedback Line	Odour	King Street, Tarago	The complainant reported an acidic smell like vinegar, not sewerage.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/4/2021	10:00:00 am	EPA Environmental Line	Odour	Braidwood Road, Tarago	The complainant stated that several members of a local club on Braidwood Road Tarago had noticed an odour at 10am which was still very strong, sickly and exceedingly unpleasant at 11.20am.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/4/2021	9:00:00 am	EPA Environmental Line	Odour	Collector Road, Tarago	The caller said it is an extremely strong odour and noticed a slight breeze coming from the West.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/04/2021	8:45:00 am	EPA Environmental Line	Odour	Currawang	The complainant reported rotten sour garbage type odour they have been experiencing.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
26/4/2021	11:06:00 am	EPA Environmental Line	Odour	King Street, Tarago	The complainant reported being affected by an offensive odour attributed to the Woodlawn landfill.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/4/2021	Not Specified	EPA Environmental Line	Odour	King Street, Tarago	The complainant said the odour is offensive and it is an ongoing problem.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/4/2021	7:00:00 am	EPA Environmental Line	Odour	Mooney's Road, Currawang	The complainant reported rotten rubbish and off egg odours from 7am. The complainant said they had been impacted by landfill odours 3 to 5 times last month and it seems to be worse on still foggy mornings. The complaint said it had become worse over the last 6-12 months.	Site Management explained that several improvement projects are currently underway to reduce odour and that a report would be submitted to the EPA based on the information being provided. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
26/04/2021	Various	EPA Environmental Line	Odour	Mooneys Road, Currawang	The complainant reported multiple dates and times for when they have experienced the odour. They have described the odour as an open sewer and rotten egg smell, and have said they got a runny nose and itchy eyes from it.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. A series of operational improvements have already been identified and are being progressively acted upon. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting on Monday 10th May, 2021.
26/04/2021	12:00:00 pm	EPA Environmental Line	Odour	Tarago	The complainant reported a rotten garbage/egg smell they have been experiencing.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
26/4/2021	10:30:00 am	Community Feedback Line	Odour	Tarago	The complainant reported a sewer smell today.	Site Management tried to call the complainant back on several occasions to get some more information about the location at which the odour was detected. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
26/4/2021	10:30:00 am	Phone (Direct)	Odour	Tarago Public School	The complainant reported a gassy horrible smell that sticks in the back of your throat.	It was explained to the complainant that operational improvements have been identified and are being progressively acted upon. Site Management attended Tarago Public School immediately following the complaint and was unable to meet the complainant at the school as they had left following the report being made. No odour was detected on the school grounds upon arrival. On entering Tarago from Bungendore Road, an odour was evident that was not similar to odours experienced at the site and was unable to be identified the source as it dissipated very quickly. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
25/4/2021	1:52:00 am	Community Feedback Line	Odour	Mulwaree Street, Tarago	The complainant advised that he had experienced intermittent landfill odours during that evening of 24th April. The complainant could not provide specifics of intensity or duration of the odours.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
25/04/2021	10:00:00 am	EPA Environmental Line	Odour	Tarago	The complainant reported an odour generally described as offensive, rotten-egg like, and smelling like dead animals.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
25/04/2021	11:00:00 am	EPA Environmental Line	Odour	Tarago	The complainant reported a rotten garbage/egg smell they have been experiencing.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
24/4/2021	10:00:00 am	EPA Environmental Line	Odour	Braidwood Road, Tarago	The complainant reported they experienced a strong sickly smell.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
24/4/2021	8:35:00 am	EPA Environmental Line	Odour	Not Supplied	The complainant reported odour travelling through the window and doors of their property at 8:35am that morning. The reporter described the odour as an excrement and bile smell. The caller explained that this issue is ongoing and present all day.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
24/04/2021	10:00:00 am	EPA Environmental Line	Odour	Tarago	The complainant reported an odour generally described as offensive, rotten-egg like, and smelling like dead animals.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
24/04/2021	10:00:00 am	EPA Environmental Line	Odour	Tarago	The complainant reported a rotten garbage/egg smell they have been experiencing.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
23/4/2021	Various	EPA Environmental Line	Odour	Hilltop Close, Tarago	The complainant detected odour on the 23/04, 24/04 & 28/04. The caller was concerned that the odours are being detected more frequently in recent weeks and months.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
22/4/2021	8:00:00 am	EPA Environmental Line	Odour	Rosebery Street, Tarago	The complainant reported odours had been affecting him at home that morning and for the previous four days. He said the odours were intermittent and the strength varied from mild to overpowering.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
22/4/2021	6:30:00 am	EPA Environmental Line	Odour	Goulburn Street, Tarago	The complainant reported being affected by strong, offensive odour that morning, which continued until the wind picked up. They also experienced the odour the day before on 21 April 2021, in the morning and night (no times specified). The caller reported that the odour is typically present when there is little wind and noted an increase in frequency and strength of the odour in recent months.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
22/4/2021	10:00:00 pm	EPA Environmental Line	Odour	Leahys Lane, Tarago	The complainant reported a strong odour outside and inside her home. The caller rated the odour a 5 out of 6 and could not be outside of their property more than a few seconds. The description of the odour was rotten-egg and rotten garbage. The caller said that the conditions at the time of the incident were cold and still, but windy before that.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
21/4/2021	2:27:00 pm	EPA Environmental Line	Odour	Braidwood Road, Lake Bathurst	The complainant reported she was being affected by an offensive sour, sulphurous odour from around 2pm that day. She said there was a light westerly wind. She said that the odour has been present for the last few days.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
21/4/2021	6:00:00 am	EPA Environmental Line	Odour	Lake Bathurst	The complainant advised that they had experienced landfill odours in the village on very rare occasions in the past, but had been impacted by strong landfill odours each morning over the past two weeks from around 6am when out for their morning walk. The odour was first noticed from 6am and had become even more intense by 8am when they left their house to go to work.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
20/4/2021	8:00:00 am	Phone (Direct)	Odour	Tarago Public School	The complainant advised that a "pungent, gassy" smell appeared to be coming for the Bioreactor this morning. She mentioned that it could be a train and checked the gas tank for any odour prior to calling.	Site Management explained to the complainant that operational improvements have been identified and are being progressively acted upon. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
19/4/2021	10:57:00 am	Community Feedback Line	Odour	Willow Glen Road, Tarago	The complainant reported smelling an odour coming from the Woodlawn Bioreactor fairly regularly in the mornings. They described the odour as having a distinct "ripe" or "rotten" character.	Site Management explained to the complainant that operational improvements have been identified and are being progressively acted upon. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
19/4/2021	9:50:00 am	EPA Environmental Line	Odour	The Loaded Dog, Tarago	The complainant reported that they had detected a strong garbage odour as they drove into Tarago village on Braidwood Road a few minutes before their call. They said they were driving in past the Loaded Dog Hotel with their windows up and smelt the odour come in to the car through the air vents.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon.
19/4/2021	7:00:00 am	Community Feedback Line	Odour	Hilltop Close, Tarago	The complainant reported that they had smelt an odour coming for the Bioreactor whilst she was outside her residence at 7am on 19/4/21. They stated that they do smell the odour on the odd occasion but it wasn;t until recent discussions in a community group that she was told that Veolia would appreciate being told to assist in they're onsite investigations.	Site Management explained to the complainant that operational improvements have been identified and are being progressively acted upon. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
18/4/2021	4:00:00 pm	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported that they were being affected by offensive landfill odour at their home.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
17/4/2021	10:59:00 am	EPA Environmental Line	Odour	Steeepers Lane, Mt Fairy	The complainant reported that they had woken up to a strong garbage smell in the air that morning. They said the air was very still at the time. The caller said the smell is rare at their location but is becoming more regular. They said the last time they had noticed it before Saturday was 2 weeks prior.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site. Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon.
17/4/2021	9:23:00 am	Community Feedback Line	Odour	Taylors Creek Road, Tarago	The complainant reported detecting an odour allegedly coming from the Woodlawn Bioreactor. They stated that they don't smell it very often however it was stronger than usual that morning.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
15/4/2021	6:46:00 am	Phone (Direct)	Odour	Mayfield Road, Tarago	The complainant reported “a rotten food smell” allegedly coming from the Woodlawn Bioreactor. The odour was reported as being similar to what they occasionally smell when driving past the Bioreactor on their way to work.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
15/4/2021	7:00:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported a strong odour experienced at 7am this morning at their house. They rated the smell a 7-8. The odour had the character of 'rotten food', which lingered for a couple of hours. They mentioned that they smell the landfill every couple of days.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
13/4/2021	4:30:00 pm	Community Feedback Line	Odour	Braidwood Road, Tarago	The complainant reported that an odour from the Woodlawn Bioreactor was detected at his property from around 4.30pm yesterday that became particularly strong between 8pm and 9pm.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
13/4/2021	8:00:00 pm	EPA Environmental Line	Odour	Braidwood Road, Tarago	The complainant reported that a "stench" was coming into their house last night and having previously made numerous reports to the EPA, was very upset that previous promises about controlling the odour have not been realised.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
13/4/2021	8:00:00 pm	EPA Environmental Line	Odour	Bungendore Road, Tarago	The complaint reported experiencing a strong odour whilst travelling past the Intermodal Facility and also on Collector Road on Tuesday 13 April 2021 at 8:00pm, then again on Wed 14 April 2021 at 4:00am. They rated the smell a 10/10. The odour had the character of “rotten rubbish” not like the usual “rotten egg” smell.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
12/4/2021	9:15:00 am	EPA Environmental Line	Odour	Braidwood Road, Tarago	The complainant reported noticing a strong odour outside her home at 9:15am. The odour did not stay around the property for long. The odour was not a waste smell, more like a rotten egg/ processing smell. The conditions were clear with a gentle breeze.	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
12/4/2021	7:30:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported that there was an odour that “smells like rotting garbage” in the air outside their home when they went outside at 7:30am that morning. They also reported that they had detected the same odour outside their home at 9am on 10th of April, 2021	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
10/04/2021	7:00:00 pm	EPA Environmental Line	Odour	Loaded Dog Hotel, Tarago	The complainant reported that they had been “greeted by a putrid smell that was nauseating” when they got out of their car outside the Loaded Dog Hotel in Tarago on Saturday night (10 April 2021).	Veolia recently attended a TADPAI meeting where the community was presented with a detailed audit of the biogas extraction system. The presentation was around how biogas is generated, the composition and odorous compounds that exist. A series of operational improvements have been identified and are being progressively acted upon. These include additional wells in areas identified in recent waste placement occurred on the western side of the site, and expansion of the biofiltration media to the void wall/waste interface. Veolia will provide an update on the progress and effect of these actions in the next TADPAI meeting.
08/04/2021	6:15:00 pm	Other	Odour	Mulwaree Street, Tarago	The complainant reported a dreadful smell coming off the Woodlawn Bioreactor. They stated that the odour started first thing in the morning and lasted until the afternoon. It had a rotten egg smell to it.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
04/04/2021	1:30:00 pm	EPA Environmental Line	Odour	Lake Bathurst	The complainant contacted the EPA’s Environment Line to complain about an odour allegedly coming from the Bioreactor. They have generally described the odour as being offensive with a strong sulphur-like, rotting garbage smell.	In consultation with the NSW EPA, amendments have been made to conditions of Veolia’s EPL aimed at improving odour management at the premises, the majority of which have already been implemented.
03/04/2021	10:16:00 am	E-mail	Odour	Coghill Road, Tarago	The complainant reported that they reside 15kms past Tarago off Willow Glen Road and can smell Veolia. They advised that they often smell the stench particularly first thing in the morning or later in the evening.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
31/03/2021	6:50:00 am	EPA Environmental Line	Odour	Rosebery Street, Tarago	The complainant reported there was a mild landfill odour outside his house when he went outside at 6:45am. He said the same odour has been present around this time for the last 3-4 days.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
31/03/2021	7:15:00 am	E-mail	Odour	Rosebery Street, Tarago	The complainant reported that this was the fourth day in a row that they have smelled the bio odour and felt that it should be reported.	The Eco-Precinct Environmental Officer was in the vicinity of the complainants location approximately 20mins after the report was received however was unable to detect or identify any odour at the time. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
31/03/2021	8:00:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported that there was a “strong smell of methane /garbage” in the air outside their home when they went outside at 7am this morning. They said they regularly smell landfill odours outside their house on cold foggy mornings like today. They said they smell the odour a few times each week and it is usually much worse following heavy rain.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
29/03/2021	8:04:00 am	EPA Environmental Line	Odour	Leahys Lane, Tarago	The complainant reported that there was “a smell of rotten garbage” at their house allegedly coming from the Woodlawn Bioreactor. They said they first noticed it at 7:30am. They rated the strength of the odour as 5 out of 6.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
29/03/2021	8:37:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported that they had experienced “a very strong methane smell” at their house from about 8am. They said it was a particularly foggy morning.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. No further contact or follow-up can be made due to the anonymity of the complainant.
29/03/2021	2:15:00 pm	EPA Environmental Line	Odour	Roseberry Street, Tarago	The complainant reported that there was “an unbelievably pungent landfill odour” in the air outside their home at around 5: 30am this morning. They said they regularly smell landfill odours outside their house on foggy mornings but this morning’s odour was the worst they have ever smelt.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. No further contact or follow-up can be made due to the anonymity of the complainant.
28/03/2021	9:34:00 am	EPA Environmental Line	Odour	Glenoval Road, Lake Bathurst	The complainant reported that there was “a very strong methane smell” in the air outside their home at around 8am. They said they smelt the odour when they went outside their house at 8am and it was still present but dissipating at the time of their call. They said it was very foggy at 8am but that the fog was lifting at the time of their call. The complainant also reported that a similar odour was present again at the same time on Monday 29th March but not as strong as the previously reported.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. No further contact or follow-up can be made due to the anonymity of the complainant.
08/03/2021	5:19:00 pm	Phone (Direct)	Odour	Braidwood Road, Lake Bathurst	The complainant reported that there was a strong smell on his property present at the time of his call.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
02/03/2021	4:13:00 pm	EPA Environmental Line	Odour	Leahys Lane, Tarago	The complainant reported “a very strong odour of dirty nappies and sour milk” at their house and the odour was also “a little bit swampy”. They said they first noticed it at 7:30am and that there was no wind and a very thick fog present. The caller said they were unable to put washing out and had to lock their house up. The odour was still present at the time of the call at 8:40am.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
02/03/2021	4:32:00 pm	EPA Environmental Line	Odour	Mulwaree Road, Tarago	The complainant reported “a very strong putrid odour” inside their house at about 7:30am. They said they had left their bathroom window ajar overnight and when they went into the bathroom they noticed the odour. The odour had permeated in from outside and that they had to close the window to stop it coming in.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
01/03/2021	8:16:00 am	Community Feedback Line	Odour	Mayfield Road, Tarago	The complainant reported a “smell that would make you vomit”. The resident stated that her partner had noticed an odour yesterday morning. They advised that the odour is typically evident on mornings where fog was present and dissipated when the fog lifted.	Site Management attended the residents property in an attempt to identify the odour immediately on receipt of the odour complaint. On arrival, no odour was evident and fog was lifting. The complainant was invited to a site visit to help identify the possible odour source. The invitation was accepted.
01/03/2021	7:25:00 pm	E-mail	Odour	Goulburn Street, Tarago	The complainant reported “a very strong smell of rubbish” was throughout the house when they woke up that morning and was evident again that same afternoon.	The complainant has been invited to keep an odour diary that will be considered as part of the Independent Odour Audit. The invitation was accepted. Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
25/02/2021	8:38:00 am	EPA Environmental Line	Odour	Mulwaree Street, Tarago	The complainant reported that they have previously experienced regular “garbage odours” in the mornings at their location, but that the last 1-2 months have been particularly bad. They said yesterday’s odour was amongst the worst they have detected in the past 18 months. They said they had left their lounge room window open overnight and when they went into the room at 7:30am that morning, the whole room was filled with the garbage odour.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
25/02/2021	8:30:00 am	Community Feedback Line	Odour	Wallace Street, Tarago	The complainant reported noticing an “off fruit” or “bitter” smell outside her house this morning. She has also noticed a smell of diesel in previous days. Having only lived in the area for a few months, it wasn’t until she noticed recent activity on Facebook, that she was informed that the source would most likely be from the Bioreactor.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. The complainant was invited to a site visit to help identify the possible odour source.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
20/02/2021	11:08:00 am	Community Feedback Line	Odour	Taylors Creek Road, Tarago	The complainant reported smelling an odour for the first time in 7 years, allegedly coming from the Bioreactor.	Based on the complaint's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
20/02/2021	Not Specified	EPA Environmental Line	Odour	Bungendore Road, Tarago	The complainant reported that a strong garbage smell was coming from the Woodlawn premises from about 7:30am that morning. They advised the smell had occurred 3 times in the last 2 weeks but was particularly strong at the time of their call.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
20/02/2021	11:29:00 am	EPA Environmental Line	Odour	Goulburn Street, Tarago	The complainant reported that there was “a strong rotten gas smell” detectable outside his home from about 7am that morning. They said odour issues seem to have improved over the past couple of years, but have deteriorated again over the past two months.	Based on the complainant's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
11/02/2021	8:01:00 am	Phone (Direct)	Odour	Duralla Place, Mount Fairy	The complainant reported noticing a bad rubbish smell at 7.20am which was still evident at the time of the report (8.01am).	The complainant has been invited to site to familiarise themselves with the site and help identify the odour profile that the complainant is experiencing. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
11/02/2021	11:16:00 am	E-mail	Odour	Bungendore Road between Tarago and Mt Fairy Road	The complainant reported noticing a smell of garbage in Tarago that was evident on the Bungendore Road from Tarago to Mt Fairy Road at 7.30am.	Based on the complaint's information, an assessment of meteorological data and operational activity has been completed in order to investigate the potential source or cause of odour.
01/02/2021	10:12:00 pm	E-mail	Odour	Tarago Township	The complainant reported a strong smell of garbage in Tarago at 10.05pm which seems to be coming from Woodlawn Bioreactor.	Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
17/1/2021	9:19:00 am	Community Feedback Line	Odour	Tarago Police Station, Tarago	The complainant reported that the smell was similar to other odours detected previously and smelled of ‘old garbage’.	Site Management contacted the complainant on Monday 18th January to obtain further information. The complainant confirmed their initial complaint and advised that an odour was detected again at 4pm on the same day. The strength and duration of the smell varied from that of earlier in the day however was the same smell of ‘old garbage’. The complainant was invited to the site for the purpose of identifying the odour source. A site visit was agreed for the week ending 30th January 2021.

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Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
17/1/2021	9:12:00 am	EPA Environmental Line	Odour	Tarago Township	The complainant reported that there is a strong smell of garbage which started about 9:12am on 17/1 which seems to be coming from Woodlawn Bioreactor.	Further investigations found that the same complainant had contacted both the EPA Environmental Line and the Community Feedback Line. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
15/1/2021	4:28:00 pm	EPA Environmental Line	Odour	Taylors Creek Road, Tarago	The complainant reported that they had been affected by an offensive odours allegedly emanating from the Woodlawn Bioreactor. The complainant said that the odour had affected them on the following dates and times: 10th January at 7am and 8pm 11th January at 7pm 12th January at 10.30pm; and 13th January at 6am.	Site Management contacted the complainant to obtain further information and they reported detecting the odour on multiple occasions over the past 6 months. The complainant stated the odour travelled in a very narrow band which may be detected at a certain point along the property. A site visit was agreed for the week ending 30th January 2021.
18/12/2020	3:30:00 pm	Phone (Direct)	Road Traffic	Bungendore Road, Tarago-Bungendore	The complainant reported that a white truck with grey container was tailgating her from Collector Road to Merrigan Cottage where she pulled over to let it pass when it attempted to overtake in a dangerous manner.	The Eco-Precinct Site manager was notified who contacted the suspected sub-contractor to notify of drivers behaviour and investigate incident.
20/9/2020	6:57:00 am	Phone (Direct)	Odour	Taylors Creek Road, Tarago	The complainant reported he and his wife had been woken at 6: 15am by a smell of garbage. As the house was closed up they investigated and found the odour to be coming under the front door.	Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
17/9/2020	1:00:00 pm	Phone (Direct)	Road Traffic	Tarago Township	The complainant reported that a white truck blew horn at her at stop sign, then proceeded to overtake her in the 60km zone just past the school.	Veolia was unable to identify truck based on details provided therefore no further action was taken.
15/9/2020	7:45:00 am	Phone (Direct)	Odour	Taylors Creek Road, Tarago	The complainant reported that he noticed odour inside his residence at 7:15am this morning and stated that the smell was very strong outside the house. He described the odour smelling like garbage.	Site Management tried to obtain further information about the type of odour from the complainant but the phone conversation was cut short. A follow up text message was sent to the complainant stating that a report would be compiled and investigation commenced. Veolia will investigate this report of odour and provide the complainant with an update once we have collated our findings by mail.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
28/8/2020	2:25:00 pm	EPA Environmental Line	Odour	Lumley Road, Tarago	The complainant said she lives a considerable distance from the waste facility and was concerned that the odour was able to travel so far. The caller also noted the odour at about 7:45am on Tuesday morning (25/8) when driving near the Woodlawn facility. The caller noted that residents of a new subdivision are mentioning being affected by the odour on a local Facebook page.	The complainant was at her property on Lumley Road, Tarago which is approximately 8km East South East of the Woodlawn Bioreactor at its closest point. Due to the length of Lumley Road and the fact that the complainant mentioned that they were some distance from site, we are unable to ascertain the complainants exact location or distance. Veolia are aware of the increase in odour complaints over the past month and efforts are concentrated on identifying the related cause. We will thoroughly investigate the complaint, and continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
25/8/2020	6:45:00 pm	EPA Environmental Line	Odour	Mulwaree St, Tarago	The complainant reported a “very strong offensive garbage odour” allegedly coming from the Woodlawn Bioreactor. The complainant said she first noticed the odour at approximately 6: 45pm when she went outside her home to collect the mail. She said she has noticed an odour intermittently over the previous few weeks, but last night’s odour was the worst she has detected. She said odours usually intensify around sundown and are worst in cold weather. She said last night was particularly cold.	Veolia has completed the majority of works around the installation of the new Stormwater Management System. This system vastly improves our ability to remove stormwater from the void before it has a chance to interact with any waste. This project is expected to reach full completion in 2020. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
20/8/2020	12:37:00 pm	Phone (Direct)	Road Traffic	Bungendore Road, Tarago	The complainant advised that a container truck travelling on Bungendore Road towards Canberra had foam and plastic flying out of the top.	The suspected driver was conatcted via mobile and advised to pull over immediately to check/secure tarp.
14/8/2020	12:15:00 pm	Community Feedback Line	Odour	Taylors Creek Road, Tarago	The complainant reported a “garbage smell” allegedly coming from the Woodlawn Eco-precinct. He advised that it was quite mild in comparison to previous experience of odour.	Site Management explained the recent challenges experienced at the Eco-Precinct caused by excessive rainfall. The complainant was invited to a site visit at which point the was declined. Veolia will investigate this report of odour and provide the complainant with an update once we have collated our findings by mail.
12/8/2020	8:00:00 am	Phone (Direct)	Odour	Duralla Place, Mt Fairy	The complainant reported a smell of “fermented rubbish” allegedly coming from the Woodlawn Eco-precinct. He said the odour was more evident very early on very still mornings, or late in the evening.	On receipt of the complaint, Site Management attended the complainants property to meet in person and attempt to determine the source of the odour. Unfortunately, the odour had dissipated prior to arrival. The complainant has been invited to the Woodlawn Eco-Precinct to tour the site to understand what Veolia does at the Eco Precinct.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
12/8/2020	9:30:00 am	Community Feedback Line	Odour	Duckfield Road, Boro	The complainant reported a smell of "rotten eggs" allegedly coming from the Woodlawn Eco-precinct. She advised she had only smelt this odour approximately ½ dozen times in the past 3 years.	All Eco-Precinct facilities were carrying out usual operations at this time. Recent rainfall events have tested the recently completed stormwater management system. The system operated as expected for a rainfall event exceeding 150mm. Veolia will continue to assess the operation to better understand what improvements can be made to the performance of the site in order to minimise any impact on the community.
11/8/2020	9:10:00 am	Community Feedback Line	Odour	Taylors Creek Road, Tarago	The complainant reported a "smell of waste" allegedly coming from the Woodlawn Eco-precinct. On a scale from 1 to 10, he rated the odour about 4.5 noticeable.	All Eco-Precinct facilities were carrying out usual operations at this time. Recent rainfall events have tested the recently completed stormwater management system. The system operated as expected for a rainfall event exceeding 150mm. Veolia will continue to assess the operation to better understand what improvements can be made to the performance of the site in order to minimise any impact on the community.
6/8/2020	1:37:00 pm	Phone (Direct)	Odour	Braidwood Road, Lake Bathurst	The complainant reported an odour allegedly coming from the Woodlawn Eco-precinct. The smell was evident whilst he was carrying out work on his property today and was likened to the smell of "fermented silage" or what he thought might be "Leachate".	On receipt of the complaint, Site Management attended the complainants property to meet in person and attempt to determine the source of the odour. The odour was unable to be detected at the property at this time, despite visiting various locations of property. The complainant has been invited to the Woodlawn Eco-Precinct to tour the site to understand what Veolia does at the Eco Precinct. We look forward to his visit.
23/7/2020	10:50:00 am	Community Feedback Line	Odour	Braidwood Road, Tarago	The complainant reported an odour allegedly coming from the Woodlawn Eco-precinct. It was evident this morning and over the past months, and is particularly evident on still evenings, mornings and when the breeze comes then dissipates quickly.	All efforts are concentrated on investigating the cause of the recent spike in odour related complaints, and intend on undertaking a full review of our current systems in relation to leachate management. Veolia will continue to assess the operation to better understand what improvements can be made to the performance of the site in order to minimise any impact on the community.
21/7/2020	8:45:00 am	Phone (Direct)	Odour	Braidwood Road, Lake Bathurst	The complainant reported an odour allegedly coming from the Woodlawn Eco-precinct. She advised that the odour was similar to that of her last complaint on Monday 13th July 2020. The odour could not be detected in the town, but was evident in the back paddock.	Veolia are aware of the increase in odour complaints over the past month and efforts are concentrated on identifying the related cause. Veolia will thoroughly investigate the complaint, and continue to assess the operation to understand what improvements can be made to the operation and performance of the site.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
13/7/2020	4:12:00 pm	EPA Environmental Line	Odour	Braidwood Road, Lake Bathurst	The complainant reported a “dreadful strong tip smell” allegedly coming from the Woodlawn Eco-precinct. She said that she first noticed the odour when she went outside her house at 3:10pm. She said she has lived at the address for 12 years but hadn't noticed any odours until about one year ago. Since then she has detected odours on a handful of occasions, today’s being particularly strong.	On receipt of the complaint, Site Management attended the complainants property to meet in person and attempt to determine the source of the odour. Unfortunately, the odour had dissipated prior to arrival. The complainant has been invited to the Woodlawn Eco-Precinct to tour the site to understand what Veolia does at the Eco Precinct.
11/7/2020	4:01:00 pm	EPA Environmental Line	Odour	Braidwood Road, Tarago	The complainant reported a “very strong odour” allegedly coming from the Woodlawn Eco-Precinct. He said it smelt like “rotten egg gas/sulphide”. He said he had to keep his windows and doors shut to prevent the odour permeating the house.	As part of this investigation, a review of the gas extraction infrastructure indicates that all available wells are currently connected. Site Management also attended a TADPAI Community Meeting on Monday 13th of July and discussed the operation and the recent quantity of complaints. The conversation was focussed on recent climatic conditions and that our gas extraction performance is always under review. Also discussed was the gas extraction failure event in June and what was in place now to ensure that these types of events are mitigated. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
11/7/2020	4:11:00 pm	EPA Environmental Line	Odour	Rosebery Street, Tarago	The complainant reported an “odour of rotten rubbish” allegedly coming from the Woodlawn Bioreactor. He said “it has been smelling all week and it has now been smelling again for about an hour and a half”.	As part of this investigation, a review of the gas extraction infrastructure indicates that all available wells are currently connected. Site Management also attended a TADPAI Community Meeting on Monday 13th of July and discussed the operation and the recent quantity of complaints. The conversation was focussed on recent climatic conditions and that our gas extraction performance is always under review. Also discussed was the gas extraction failure event in June and what was in place now to ensure that these types of events are mitigated. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site."

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
10/7/2020	1:28:00 am	E-mail	Odour	Barnet Drive, Mt Fairy	Last week the complainant reported a smell of garbage or rubbish, describing the odour as "sometimes smelling like death (rotting animal carcasses) and other times like rubbish" on Tuesday 30th July 2020. The complainant has now reported at 1.28am this morning that "It's doing it again now has been all night".	A consultant engaged to assess odour for the trial use of MWOO as an ADC was onsite the 8th and 9th of July to assess odour emission from the Bioreactor Facility. Odour was measured onsite and at downwind locations. We are currently waiting for the formal report from this visit however, initial indications appear favourable. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site
9/7/2020	4:08:00 pm	EPA Environmental Line	Odour	Braidwood Road, Lake Bathurst	The complainant reported a "foul rotting garbage odour" allegedly coming from the Woodlawn Eco-precinct. He said the odour also had a hint of "bleach aid chemicals" to it.	Veolia will investigate this report of odour and provide the complainant with an update once we have collated our findings by mail and will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
3/7/2020	9:50:00 am	Community Feedback Line	Odour	Barnet Drive, Mt Fairy	The complainant reported noticing an increase in odour at their property in the last 4-6 months. He described the odour as "sometimes smelling like death (rotting animal carcasses) and other times like rubbish". He also reported a smell of garbage/tip at 7.30pm a couple nights ago.	Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
3/6/2020	10:33:00 am	EPA Environmental Line	Odour	Braidwood Road, Lake Bathurst	The complainant reported a "rotten refuse smell" allegedly coming from the Woodlawn Bioreactor. She said her husband was in the back paddock when the odour was detected at 10:33am. She said that other than today she has only noticed the odour at her property on a couple of previous occasions.	Veolia will be conducting a formal review of the landfill gas extraction failure. The aim of the review will be to assess Veolia's internal response to the incident and identify measures to prevent future landfill gas extraction outages at the Bioreactor. Findings of the review will be documented in the incident report to be provided to the EPA.
28/5/2020	8:15:00 am	EPA Environmental Line	Odour	Main road approaching Tarago Public School	The complainant reported to the Environmental Line through EPA that there was a "strong odour of rotting kitchen garbage" was coming from the Woodlawn Bioreactor. She said she first noticed the odour on the main road approaching the school, and it was very strong on her arrival at school 8:15am. She advised that the school keeps an odour diary and that until today there had been no smells recorded since 2 March 2020. At 9:35am this morning the complainant said the odour was still present but it was only faint and very much reduced since her arrival at 8:15am. She said it was "really pungent" at 8:15am.	Veolia made contact with the complainant on Friday 29th May to discuss the investigation and findings. Details surrounding the odour complaint, duration and odour profile was obtained to assist potential source identification. Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.
20/3/2020	6:30:00 am	EPA Environmental Line	Odour	Leahys Lane, Tarago	The complainant reported through the EPA Environmental Line that they had been impacted by offensive odours allegedly coming from the Woodlawn Bioreactor on the mornings of 9/3/20, 18/3/20 and 19/3/20 from about 6:30 to about 9:30am. The caller noted that the odour is regularly present on still, foggy mornings.	Veolia will continue to assess the operation to understand what improvements can be made to the operation and performance of the site.

Date	Time	Method	Type	Location	Description	Response/action taken to resolve the complaint
19/3/2020	8:21:00 am	EPA Environmental Line	Odour	Rosebery Street, Tarago	The complainant reported to the Environmental Line through EPA that there was “a strong smell of rotting garbage. The odour has been strong for the past 3 days. Odour is worse in the morning. Odour is coming into the house.”	Veolia has identified an opportunity to improve the way in which we attend to any future gas sensor failures. This has been communicated with all new power station staff to ensure that the gas extraction system, in its entirety, is monitored with any discrepancies identified, investigated, and rectified in a timely manner ensuring it is operating at maximum efficiency. Veolia is in the final stages of installing a Stormwater Management System that will vastly improve our ability to remove stormwater from the void before it has a chance to interact with any waste.
19/3/2020	8:01:00 am	EPA Environmental Line	Odour	Mulwaree St, Tarago	The complainant reported to the Environmental Line through EPA that they smelt as a “rotting vegetable smell and terrible stench”. The resident did not wish to pass their details on.	Veolia has identified an opportunity to improve the way in which we attend to any future gas sensor failures. This will be communicated with all new power station staff to ensure that the gas extraction system, in its entirety, is monitored with any discrepancies identified, investigated, and rectified in a timely manner ensuring it is operating at maximum efficiency. Veolia is in the final stages of installing a Stormwater Management System that will vastly improve our ability to remove stormwater from the void before it has a chance to interact with any waste.

EMISSIONS TESTING REPORT: WOODLAWN BIOGAS POWER STATION (R009352):

30 SEPTEMBER 2020

REPORT NUMBER R009352

Emission Testing Report
Veolia Environmental Services (Australia) Pty Ltd
Woodlawn Biogas Power Station, Tarago

Document Information

Template Version; 030620

Client Name:	Veolia Environmental Services (Australia) Pty Ltd
Report Number:	R009352
Date of Issue:	30 September 2020
Attention:	Sureka Withanage
Address:	619 Collector Rd Tarago NSW 2580
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

NATA Accredited Laboratory
No. 14601

Scott Woods
Client Manager

Steven Cooper
Ektimo Signatory

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 EXECUTIVE SUMMARY

1.1 *Background*

Ektimo was engaged by Veolia Environmental Services (Australia) Pty Ltd to perform emission testing at their Tarago plant. Testing was carried out in accordance with Environmental Protection Licence 11436.

1.2 *Project Objectives*

The objectives of the project were to conduct a monitoring programme to quantify emissions from 3 monitoring points to determine compliance with Veolia Environmental Services (Australia) Pty Ltd's Environmental Licence.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 8 – Engine 2 Exhaust Stack	4 September 2020	Hydrogen sulfide Sulfuric acid mist and sulfur trioxide (as SO_3) Nitrogen oxides, carbon monoxide, sulfur dioxide, carbon dioxide, oxygen Volatile organic compounds (VOCs) Destruction efficiency
EPA 5 – LFG Supply	8 July 2020	Siloxanes
	4 September 2020	Carbon dioxide, oxygen Volatile organic compounds (VOCs)
LFG Supply (Before Chiller)	8 July 2020	Siloxanes

* Flow rate, velocity, temperature, molecular weight, dry gas density and moisture were also determined.

All results are reported on a dry basis at STP.

At EPA 5 (LFG Supply) temperature and flowrate parameters were supplied by Veolia personnel.

Plant operating conditions have been noted in the report.

1.3 *Licence Comparison*

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the NSW EPA as per licence 11436 (last amended on 4 March 2020).

EPA No.	Location Description	Pollutant	Units	Licence Limit	Detected Values
8	Engine 2 Exhaust Stack	Hydrogen Sulfide	mg/m^3	5	**<2**
		Sulfuric acid mist and sulfur trioxide (as SO_3)	mg/m^3	100	**1.1**
		Nitrogen Oxides	mg/m^3 @ 7% O_2	450	**370**
		Volatile organic compound destruction efficiency	%	≥ 98	99.5

*Please note that the measurement uncertainty associated with the test results **was not** considered when determining whether the results were compliant or non-compliant.*

Refer to the Test Methods table for the measurement uncertainties.

2 SAMPLING PLANE COMPLIANCE

Ektimo assessed the engine exhaust stack sampling plane criteria and selection of sampling points outlined in NSW TM-1 (Australian Standard 4323.1 -1995). In this method, the selection of sampling plane position calls for an Ideal sampling plane to be located in a straight, preferably vertical section of stack or duct away from any flow obstructions which may cause a disturbance or other instability to the gas flow. This position will be found to exist at 7-8 hydraulic diameters downstream and 2-3 hydraulic diameters upstream from a flow disturbance. In the case of the EPA point 8 engine exhaust stack, the sampling plane is located 4 hydraulic diameters downstream of a junction and 2 hydraulic diameters from the exit. See table 1 for details.

TABLE 1

CRITERIA FOR SELECTION OF SAMPLING PLANES

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (*D*)	Minimum distance downstream from disturbance, diameters (*D*)
Bend, connection, junction, direction change	>2*D*	>6*D*
Louvre, butterfly damper (partially closed or closed)	>3*D*	>6*D*
Axial fan	>3*D*	>8*D* (see Note)
Centrifugal fan	>3*D*	>6*D*

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

In addition the following criteria must be met.

a) The gas velocity is basically in the same direction at all points along each sampling traverse.

b) The gas velocity at all sampling points is greater than 3 m/s.

c) The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane

d) The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.

e) The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1

f) The gas temperature at the sampling plane should preferably be above the dewpoint.

If the criteria of items (a) to (f) cannot be achieved a new sampling position shall be selected. The EPA point 8 engine exhaust stack meets all criteria of (a) to (f) and is suitable, therefore a new sampling position is not required, although an increased number of sampling points shall be used in accordance with clause 4.2 (non-ideal sampling positions) of AS 4323.1-1995.

Clause 4.2 proposes that if the criteria of table 1 cannot be met then a greater number of points shall be used in order to retain as much accuracy as is practicable, by applying the appropriate sampling point factors from *table 2*. The product of both the upstream and downstream factors multiplied by the total number of sampling points from *table 3* should then be raised to the next even number of sampling points for each sampling traverse.

TABLE 2

SAMPLING POINT FACTORS

Non-ideal situation	Sampling point factors
Sampling plane downstream from disturbance:	
Diameters less than Table 1	
0	1.00
1	1.05
2	1.10
3	1.15
4 or more	1.20
Sampling plane upstream from disturbance:	
Diameters less than Table 1	
0	1.00
0.5	1.05
1.0	1.10
1.5 or more	1.15

TABLE 3

MINIMUM NUMBER OF SAMPLING POINTS FOR CIRCULAR SAMPLING PLANES

Sampling plane diameter m	Minimum number of sampling traverses	Minimum number of access holes	Minimum number of sampling points per radius	Minimum total number of sampling points
>0.20 ≤0.35	2	2	1	4
>0.35 ≤0.70	2	2	2	8
>0.70 ≤1.50	2	2	3	12
>1.50 ≤2.50	2	4	4	16
>2.50 ≤4.00	2	4	6	24
>4.00 ≤6.00	3	6	5	30
>6.00	3	6	6	36

By example, the EPA point 8 engine exhaust stack has a sampling plane diameter of 350mm. If an ideal sampling plane was available the total number of sampling points would equate to 4. For this location, we have used a sampling point factor of 1.10 which yields a total number of sampling points of 8.

3 RESULTS

3.1 *EPA 8 – Engine 2 Exhaust Stack*

Date	4/09/2020	**Client**	Veolia Environmental Services (Australia) Pty Ltd
Report	R009352	**Stack ID**	EPA Point 8 - Engine 2 Exhaust Stack
Licence No.	11436	**Location**	Tarago
Ektimo Staff	Scott Woods and Steven Cooper	**State**	NSW
Process Conditions	Load 1057.9kW		200916

Sampling Plane Details	
Sampling plane dimensions	350 mm
Sampling plane area	0.0962 m²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Elevated work platform 10 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 2 D
Upstream disturbance	Junction 4 D
No. traverses & points sampled	2 8
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	13	
Gas molecular weight, g/g mole	28.7 (wet)	30.2 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.35 (dry)
% Oxygen correction & Factor	7 %	1.11
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1430 & 1545	
Temperature, °C	450	
Temperature, K	723	
Velocity at sampling plane, m/s	48	
Volumetric flow rate, actual, m³/s	4.6	
Volumetric flow rate, actual, m³/hour	17000	
Volumetric flow rate (wet STP), m³/s	1.6	
Volumetric flow rate (wet STP), m³/hour	5700	
Volumetric flow rate (dry STP), m³/s	1.4	
Volumetric flow rate (dry STP), m³/hour	5000	
Mass flow rate (wet basis), kg/hour	7300	

Gas Analyser Results	Average			Minimum			Maximum		
Sampling time	1436 - 1537			1436 - 1537			1436 - 1537		
	Concentration mg/m³	Corrected to 7% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 7% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 7% O2 mg/m³	Mass Rate g/min
Combustion Gases									
Nitrogen oxides (as NO_2)	330	370	28	240	270	20	380	420	32
Sulfur dioxide	170		14	100		8.6	190		16
Carbon monoxide	850		71	520		43	900		75
	Concentration % v/v			Concentration % v/v			Concentration % v/v		
Carbon dioxide	11			8.2			11.4		
Oxygen	8.4			8			10.6		
Sampling time	1435-1544			1435 - 1544			1435-1544		
	Concentration mg/m³		Mass Rate g/min	Concentration mg/m³		Mass Rate g/min	Concentration mg/m³		Mass Rate g/min
Total Volatile Organic Compunds (VOCs)									
VOC (as n-propane)	45		3.7	<4		<0.3	89		7.4

Testing Parameter	Total Hydrocarbons (g/min)		
	LFG Inlet	Stack Outlet	Destruction Efficiency %
EPA Point 8 (Engine 2) Stack	800	3.7	99.5

Date	4/09/2020	**Client**	Veolia Environmental Services (Australia) Pty Ltd
Report	R009352	**Stack ID**	EPA Point 8 - Engine 2 Exhaust Stack
Licence No.	11436	**Location**	Tarago
Ektimo Staff	Scott Woods and Steven Cooper	**State**	NSW
Process Conditions	Load 1057.9kW		200916

Hydrogen Sulfide	Results	
Sampling time	1440-1540	
	Concentration mg/m³	Mass Rate g/min
Hydrogen sulfide	<2	<0.2

Isokinetic Results	Results	
Sampling time	1435-1540	
	Concentration mg/m³	Mass Rate g/min
Sulfur trioxide and/or sulfuric acid (as SO3)	1.1	0.092
Isokinetic Sampling Parameters		
Sampling time, min	64	
Isokinetic rate, %	101	
Velocity difference, %	5	

3.2 *EPA 5 – LFG Supply*

Date	8/07/2020	**Client**	Veolia Environmental Services (Australia) Pty Ltd
Report	R009352	**Stack ID**	EPA Point 5 - LFG Supply
Licence No.	11436	**Location**	Tarago
Ektimo Staff	Aaron Davis / Joel Micale-David	**State**	NSW
Process Conditions	Please refer to client records		*200623*

Sampling Plane Details		
Sampling plane dimensions	370 mm	
Sampling plane area	0.108 m²	
Sampling port size, number	1" BSP (x1)	
Access & height of ports	Ground level	1.5 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Change in dia	2.2 D
Upstream disturbance	Connection	1.3 D
No. traverses & points sampled	1	1
Comments		
Temperature & Flow data supplied by Veolia personnel		

Stack Parameters		
Moisture content, %v/v	0.47	
Gas molecular weight, g/g mole	34.2 (wet)	34.3 (dry)
Gas density at STP, kg/m³	1.53 (wet)	1.53 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1245 & 1350	
Temperature, °C	3	
Temperature, K	276	
Velocity at sampling plane, m/s	9	
Volumetric flow rate, actual, m³/s	0.97	
Volumetric flow rate, discharge, m³/hour	3500	
Volumetric flow rate (wet STP), m³/s	0.89	
Volumetric flow rate (wet STP), m³/hour	3200	
Volumetric flow rate (dry STP), m³/s	0.89	
Volumetric flow rate (dry STP), m³/hour	3200	
Mass flow rate (wet basis), kg/hour	4900	
Velocity difference, %	1	

Siloxane	Results	
Sampling time	1400-1405	
	Concentration mg/m³	Mass Rate g/min
Trimethylsilanol	32	1.7
Hexamethyldisiloxane	11	0.58
Octamethyltrisiloxane	2.8	0.15
Hexamethylcyclotrisiloxane	1.9	0.1
Octamethylcyclotetrasiloxane	6	0.32
Decamethylcyclopentasiloxane	11	0.6

Date	4/09/2020	**Client**	Veolia Environmental Services (Australia) Pty Ltd
Report	R009352	**Stack ID**	EPA 5 - LFG Supply
Licence No.	11436	**Location**	Tarago
Ektimo Staff	Scott Woods and Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		200916

Sampling Plane Details		
Sampling plane dimensions	370 mm	
Sampling plane area	0.108 m²	
Sampling port size, number	1" BSP (x1)	
Access & height of ports	Ground level 1.5 m	
Duct orientation & shape	Horizontal Circular	
Downstream disturbance	Change in diameter 2.2 D	
Upstream disturbance	Connection 1.3 D	
No. traverses & points sampled	1 1	
Comments		
Temperature & Flow data supplied by Veolia personnel		

Stack Parameters		
Moisture content, %v/v	0.48	
Gas molecular weight, g/g mole	34.2 (wet)	34.3 (dry)
Gas density at STP, kg/m³	1.53 (wet)	1.53 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1430 & 1545	
Temperature, °C	2	
Temperature, K	276	
Velocity at sampling plane, m/s	9	
Volumetric flow rate, actual, m³/s	0.97	
Volumetric flow rate, discharge, m³/hour	3500	
Volumetric flow rate (wet STP), m³/s	1	
Volumetric flow rate (wet STP), m³/hour	3700	
Volumetric flow rate (dry STP), m³/s	1	
Volumetric flow rate (dry STP), m³/hour	3700	
Mass flow rate (wet basis), kg/hour	5600	
Velocity difference, %	<1	

Gas Analyser Results	Average		Minimum		Maximum	
Sampling time	1436 - 1537		1436 - 1537		1436 - 1537	
	Concentration %v/v		Concentration %v/v		Concentration %v/v	
Carbon dioxide	38.4		38.1		38.9	
Oxygen	1.5		1.5		1.5	
Sampling time	1435-1544		1435 - 1544		1435-1544	
Total Volatile Organic Compunds (VOCs)	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
VOC (as n-propane)	13000	800	1500	93	27000	1700

3.3 *LFG Supply – Before Chiller*

Date	8/07/2020	**Client**	Veolia Environmental Services (Australia) Pty Ltd
Report	R009352	**Stack ID**	LFG Supply (Before Chiller)
Licence No.	11436	**Location**	Tarago
Ektimo Staff	Aaron Davis / Joel Micale-David	**State**	NSW
Process Conditions	Please refer to client records		

Sampling Plane Details	
Sampling plane dimensions	370 mm
Sampling plane area	0.108 m²
Sampling port size, number	1" BSP (x1)
Access & height of ports	Ground level 1.5 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Valve 1 D
Upstream disturbance	Valve 1 D
No. traverses & points sampled	1 1

Siloxanes	Results
Sampling time	1410-1415
	Concentration mg/m³
Trimethylsilanol	25
Hexamethyldisiloxane	14
Octamethyltrisiloxane	4.5
Hexamethylcyclotrisiloxane	2.5
Octamethylcyclotetrasiloxane	6
Decamethylcyclopentasiloxane	16

4 PLANT OPERATING CONDITIONS

On the day of sampling the Engine Load was 1057.9kW. See Veolia Environmental Services (Australia) Pty Ltd's records for complete process conditions.

5 TEST METHODS

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	NA	✓	NA
Flow rate, temperature and velocity	NA	NSW TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW TM-22	NSW TM-22	19%	✓	✓
Carbon dioxide	NSW TM-24	NSW TM-24	13%	✓	✓
Carbon monoxide	NSW TM-32	NSW TM-32	12%	✓	✓
Nitrogen oxides	NSW TM-11	NSW TM-11	12%	✓	✓
Oxygen	NSW TM-25	NSW TM-25	13%	✓	✓
Total organic compounds	NSW TM-34	USEPA 25A	not specified	✓	✓
Siloxanes	Ektimo 200	Ektimo 345b	not specified	✓	×†
Hydrogen sulfide	NSW TM-5	NSW TM-5	not specified	✓	✓†
Sulfur dioxide	NSW TM-4	NSW TM-4	12%	✓	✓†
Sulfuric acid mist and/or sulfur trioxide	NSW TM-3	Ektimo 235	16%	✓	✓†

200708

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601. Results were reported on
16 July 2020 in report number R009352 TO15 - Siloxanes.
17 September 2020 in report number R009352-SOx.
8 September 2020 in report number R009352 - H2S

6 QUALITY ASSURANCE/QUALITY CONTROL INFORMATION

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

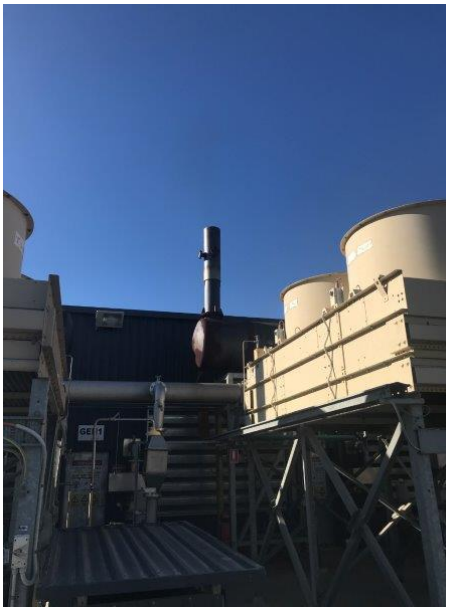
NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised worldwide.

7 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
Lower Bound	Defines values reported below detection as equal to zero.
Medium Bound	Defines values reported below detection are equal to half the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative Accuracy Test Audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration will be determined by matching the integrated area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test Method
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity Difference	The percentage difference between the average of initial flows and afterflows.
Vic EPA	Victorian Environment Protection Authority
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray Diffractometry
Upper Bound	Defines values reported below detection are equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

8 APPENDIX 1. SITE LOCATIONS



EPA Point 8 - Engine 2 Exhaust Stack

EPA Point 5 - LFG Supply

LFG Supply (Before Chiller)

Address (Head Office)
7 Redland Drive
Mitcham VIC 3132

Postal Address
52 Cooper Road
Cockburn Central WA 6164

Office Locations
VIC NSW WA QLD

Freecall: 1300 364 005
www.ektimo.com.au
ABN 86 600 381 413

EVAPORATION DATA SUPPLIED BY VEOLIA:

MAY 2007 TO JUNE 2012

Evaporation	2006								2006				2007					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.60	6.80	5.00	3.00	1.50	1.41
2	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	2.20	2.60	4.80	3.60	2.40	1.04
3	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	2.60	5.00	3.80	3.80	3.19	1.16
4	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.00	6.40	7.60	2.80	4.52	1.30
5	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.80	7.40	6.60	3.00	2.68	0.69
6	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	8.20	3.60	4.60	2.52	1.00
7	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.60	7.00	5.00	2.40	2.43	0.67
8	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.80	4.60	3.60	1.40	1.87	0.83
9	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.60	6.80	5.00	2.40	1.37	0.48
10	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.40	5.20	4.80	2.00	1.41	0.73
11	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.60	3.60	5.40	3.20	1.48	1.24
12	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	11.40	2.20	7.00	3.60	1.74	0.77
13	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	13.40	3.80	3.60	2.60	2.19	1.23
14	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	4.40	2.80	3.00	1.51	1.02
15	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.80	5.80	4.80	3.60	2.03	0.43
16	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	6.20	6.20	4.00	2.09	0.64
17	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.80	3.80	4.60	2.80	1.47	0.84
18	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	5.60	2.40	3.40	1.49	0.75
19	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.00	1.60	2.00	3.80	0.72	0.63
20	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.60	3.60	0.20	2.20	1.53	0.43
21	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	11.00	6.80	2.20	2.60	2.14	1.13
22	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	7.40	3.40	2.60	2.21	1.12
23	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.60	5.60	4.40	2.60	1.69	1.35
24	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	9.40	5.20	4.80	1.80	1.59	1.11
25	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	4.60	4.00	0.60	1.81	1.16
26	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.00	4.20	2.60	1.20	1.75	0.57
27	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	12.40	3.60	2.80	2.40	1.56	0.27
28	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	10.60	3.00	2.80	1.40	2.20	0.42
29	8.20		4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.80		4.20	1.40	1.75	0.79
30	8.20		4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.00		3.00	1.80	2.65	1.27
31	8.20		4.10		1.70		1.20	1.90		3.90		6.20	10.00		3.40		1.24	
Total Month	**203.8**	**151.2**	**127.1**	**78**	**52.7**	**33**	**37.2**	**58.9**	**84**	**120.9**	**150**	**192.2**	**246.8**	**141**	**126.4**	**79.6**	**60.68**	**26.47**
Accumulated Year	**204**	**355**	**482.1**	**560.1**	**612.8**	**645.8**	**683**	**741.9**	**825.9**	**946.8**	**1096.8**	**1289**	**246.8**	**387.8**	**514.2**	**593.8**	**654.48**	**681**

Evaporation data recorded from the Goulburn Tafe W

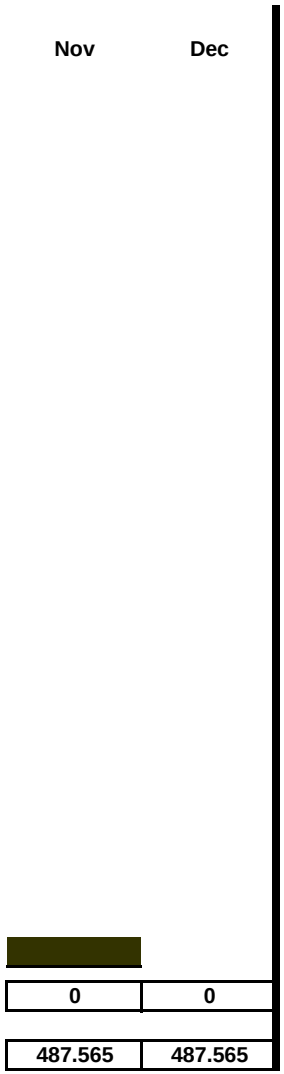
						2008												2009	
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1.21	1.13	4.17	4.49	2.73	2.82	7.058	4.079	4.42	3.876	2.082	1.889	2.563	2.158	1.339	3.822	8.25	5.487	6.915	7.353
0.82	1.27	2.87	5.04	4.66	2.286	7.126	2.908	4.566	3.485	1.918	0.485	1.146	0.953	2.667	4.838	2.408	7.579	8.11	6.754
1.21	2.29	3.26	5.41	4.31	5.675	7.446	4.000	4.257	5.316	1.977	0.828	1.139	1.469	2.828	6.486	3.711	6.729	6.339	6.712
1.75	0.94	2.94	8.39	1.49	4.147	2.006	4.788	4.536	2.663	2.314	0.46	1.32	1.967	1.616	6.588	3.963	6.955	5.254	5.055
1.18	1.59	2.46	5.05	3.30	4.956	7.4	1.496	4.274	3.13	2.225	0.771	0.847	1.659	1.006	1.318	5.035	5.046	6.369	4.618
0.72	1.67	1.44	5.48	2.40	1.109	6.6	1.512	4.457	3.239	2.423	0.76	1.387	1.263	1.288	2.328	3.928	5.442	8.86	6.982
1.06	1.65	1.87	5.68	4.5	4.2	6.883	4.498	5.111	2.656	2.177	1.026	1.22	1.656	1.162	3.205	6.31	7.507	8.46	7.344
1.02	1.71	1.38	3.90	2.097	3.395	6.251	3.381	3.829	2.231	2.323	1.351	1.312	1.147	2.65	3.387	3.199	6.765	8.21	8.81
0.70	2.11	1.61	3.89	2.106	4.31	6.6	2.689	4.053	1.712	2.209	0.5	1.227	1.663	2.508	4.196	3.801	6.172	3.146	8.3
0.90	2.39	2.04	3.91	2.929	6.974	5.175	2.861	4.623	1.81	2.056	1.211	0.51	1.35	3.038	4.017	5.71	6.895	4.802	2.73
1.19	3.15	2.55	4.12	4.648	3.645	6.945	4.415	4.768	2.685	2.026	0.588	0.875	0.664	2.896	4.264	5.541	3.662	4.78	1.038
1.44	3.09	1.69	4.89	5.543	1.426	7.747	4.853	4.954	3.052	1.296	0.865	1.079	1.452	3.56	3.963	5.464	1.874	4.981	4.292
1.09	2.27	2.29	3.87	5.421	5.00	5.179	3	4.862	2.614	1.532	1.672	1.215	1.511	4.341	4.769	6.244	0.951	4.415	1.801
1.02	1.69	3.53	4.15	6.033	4.40	7.447	1.161	4.992	2.11	1.757	1.089	1.621	1.801	5.149	4.463	6.274	4.303	6.69	3.05
0.86	1.02	4.08	4.78	6.794	5.362	1.344	3.54	4.861	2.854	1.874	1.572	2.064	1.693	2.177	1.793	6.243	3.726	9	2.4
1.06	1.08	3.46	6.31	6.455	5.385	6.369	5.299	5.892	2.901	1.997	1.141	1.281	1.726	4.05	3.63	6.192	5.567	9.69	2.225
1.04	1.87	3.82	7.67	5.901	0.933	4.194	5.042	4.894	2.611	1.468	0.794	1.247	1.834	2.663	4.097	4.685	6.225	7.435	3.11
1.34	0.82	2.25	4.52	6.297	4.659	4.4	4.186	4.841	1.902	1.245	1.042	1.28	2.186	2.098	4.755	5.378	3.919	6.079	2.313
1.30	0.95	3.21	4.95	5.31	4.40	2.054	4.73	5.056	2.09	1.432	1.056	1.051	1.361	3.326	4.845	3.55	4.689	6.418	3.187
1.52	0.78	4.30	5.30	6.444	2.116	1.72	4.48	2.672	1.27	1.881	0.842	1.652	2.009	4.809	5.672	2.603	5.48	7.43	5.529
1.49	0.94	1.92	5.45	6.425	1.79	3.779	5.237	4.843	1.596	1.602	0.297	1.258	2.209	5.661	4.572	3.418	4.656	7.28	3.265
1.15	1.14	3.13	7.20	6.425	5.306	2.357	2.445	1.335	2.494	1.74	1.192	1.394	2.44	4.423	3.561	5.702	5.765	7.637	4.303
0.78	0.88	3.23	6.92	0.573	2.921	4.681	5.397	1.763	1.229	1.673	1.271	1.551	1.138	4.422	3.28	2.389	6.683	5.991	3.535
1.51	1.16	3.62	4.15	1.268	4.309	5.547	6.058	3.212	2.211	1.193	1.118	1.17	1.594	2.527	3.602	2.16	3.337	6.481	4.391
1.60	1.70	4.87	1.97	2.786	4.859	6.208	5.649	1.777	1.685	1.456	1.126	1.146	2.284	2.461	4.178	5.332	1.37	7.481	6.763
1.99	2.03	4.68	1.29	5.691	5.20	4.636	4.078	0.872	1.569	1.499	1.623	1.547	2.553	3.68	5.96	4.286	6.181	4.449	5.653
1.86	2.98	3.07	2.36	4.37	6.216	6.022	5.26	2.734	3.338	1.253	1.242	1.2	2.669	4.221	5.949	3.299	7.006	6.364	5.124
1.30	3.73	3.92	4.32	6.6	3.844	6.413	3.85	3.058	2.642	1.484	1.607	0.866	2.212	5.675	8	5.683	4.365	4.688	4.802
1.73	4.86	5.73	4.75	5.35	6.515	5.972	0.894	2.139	1.338	1.37	1.198	1.235	1.744	6.15	5.297	3.178	5.461	6.868	[redacted]
1.18	3.51	3.62	5.87	3.106	6.941	6.752	[redacted]	3.646	2.208	1.425	1.927	1.503	1.283	3.495	1.819	5.458	7.121	7.29	[redacted]
1.56	3.98	[redacted]	5.56	[redacted]	7.736	6.868	[redacted]	3.861	[redacted]	1.726	[redacted]	1.703	2.13	[redacted]	5.019	[redacted]	6.405	7.182	[redacted]
38.56	**60.372**	**92.97**	**151.606**	**131.946**	**132.835**	**169.179**	**111.786**	**121.158**	**74.517**	**54.633**	**32.543**	**40.609**	**53.778**	**97.886**	**133.673**	**139.394**	**163.323**	**205.09**	**131.44**
719.5	**779.88**	**872.8**	**1024.45**	**1156.4**	**1289.23**	**169**	**280.965**	**402.123**	**476.64**	**531.273**	**563.816**	**604.425**	**658.203**	**756.089**	**889.762**	**1029.16**	**1192.48**	**205**	**336.533**

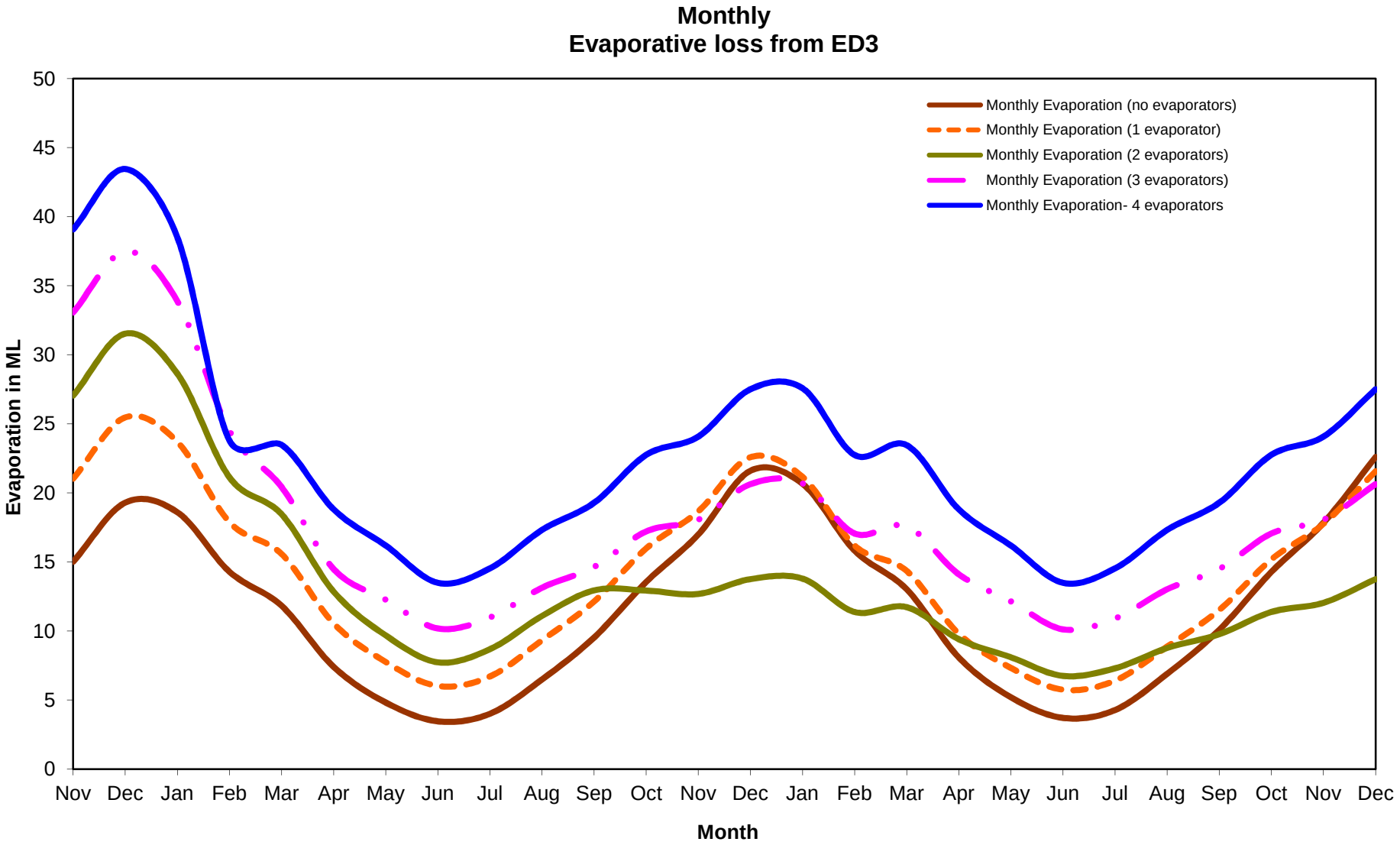
eather Station

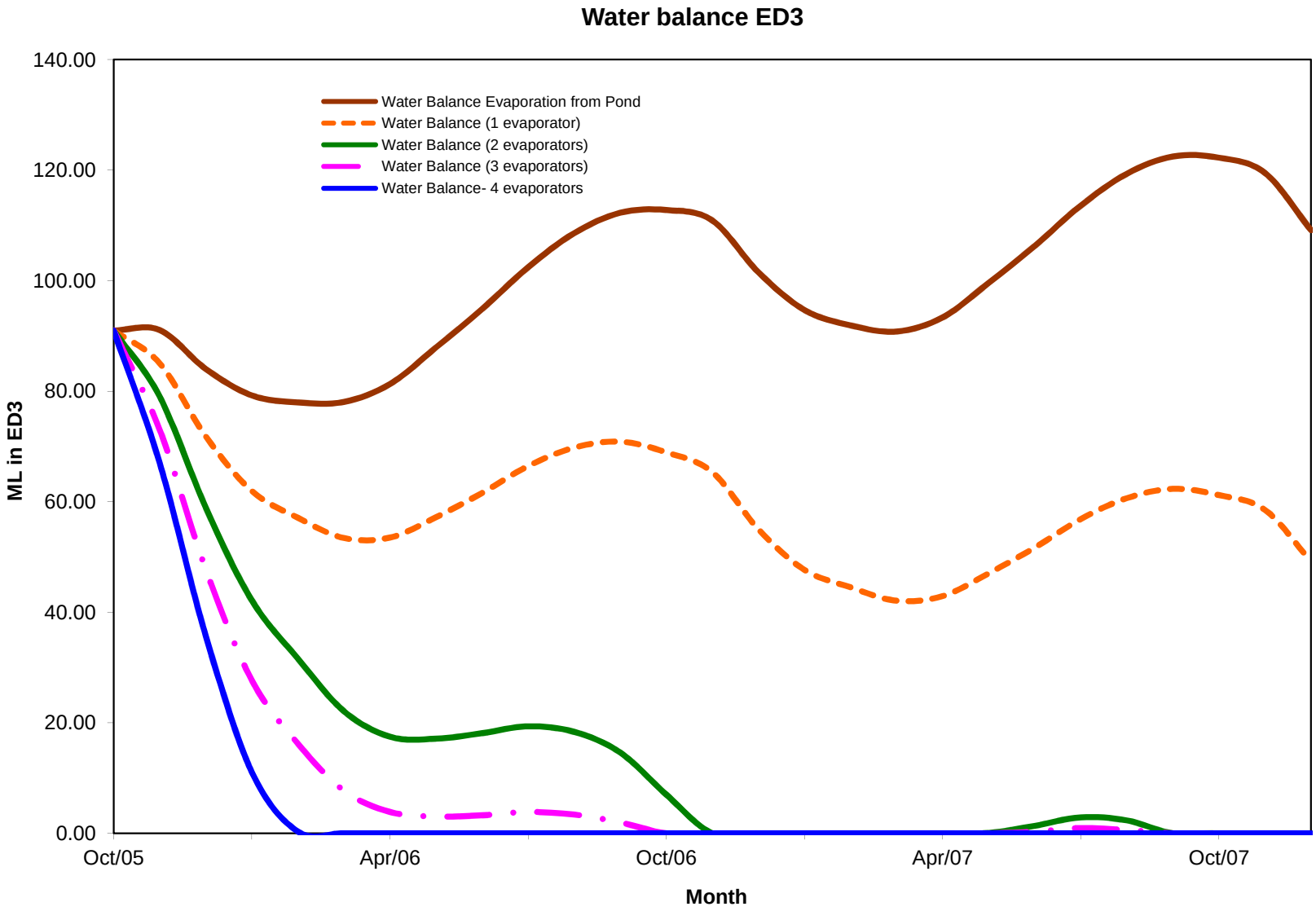
										2010					
Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
6.917	2.423	1.755	1.077	1.847	1.551	1.984	4.057	4.662	2.028	3.998	5.099	3.148	2.332	1.695	0.878
4.472	1.71	2.372	0.801	1.384	1.814	2.912	6.426	5.645	5.513	6.6	6.074	1.88	3.354	1.916	1.125
3.878	1.453	1.88	0.787	1.089	1.202	2.841	1.895	5.112	5.577	4.735	5.207	2.762	2.975	2.831	1.087
3.498	3.908	2.072	0.56	1.165	2.058	1.365	0.766	7.929	7.173	4.158	3.146	3.891	2.655	1.683	0.855
5.725	2.928	2.129	0.701	1.104	1.529	2.454	1.152	5.29	6.583	4.044	3.664	4.055	2.152	2.958	0.907
4.923	3.621	1.981	1.211	1.493	1.623	3.174	2.186	1.641	6.23	5.176	2.508	1.321	3.063	1.433	1.303
4.612	2.546	2.117	1.313	0.921	1.996	3.339	2.677	2.032	6.638	7.148	2.434	3.007	1.81	2.05	1.055
4.945	2.97	2.058	0.786	1.202	2.192	1.115	1.318	4.208	7.695	3.889	1.551	1.534	1.5	1.903	1.346
2.91	3.12	1.763	1.105	0.611	2.206	2.108	3.38	5.156	7.358	5.272	1.77	3.112	3.291	1.955	1.332
3.338	3.284	2.182	0.895	0.771	1.865	1.68	2.502	6.205	4.17	7.378	5.177	3.092	2.66	1.906	0.827
3.617	1.841	1.215	1.285	0.927	1.887	2.787	2.709	6.607	6.303	7.771	4.201	2.743	3.463	2.485	1.431
4.376	2.073	1.848	1.049	0.982	1.502	3.644	2.501	6.865	6.729	7.485	6.063	3.919	3.058	3.087	1.381
3.763	2.514	1.946	0.691	2.192	1.643	5.067	1.654	6.934	7.03	9.3	4.934	2.812	3.207	1.911	1.201
1.961	0.469	2.119	1.578	1.559	2.055	6.87	3.239	4.736	6.693	5.012	0.81	3.277	2.865	2.033	1.074
3.811	1.969	1.581	1.521	0.818	1.996	2.964	2.22	6.605	3.489	2.788	0.918	2.577	3.386	1.734	1.141
4.779	4.187	1.602	1.015	1.049	2.365	3.78	2.346	5.514	6.185	3.759	3.496	3.634	2.66	1.728	1.179
4.66	3.699	1.789	0.784	1.013	3.062	3.287	3.11	7.546	8	3.442	4.03	4.26	2.696	1.379	1.443
4.282	2.983	1.842	1.059	1.434	2.581	3.727	3.306	5.807	11.73	6.841	5.162	4.197	2.758	0.917	0.864
4.783	2.608	1.432	1.027	1.474	2.222	2.763	3.298	5.604	1.331	4.313	4.24	4.181	2.507	1.724	1.379
3.871	1.738	1.076	1.456	1.814	2.725	3.061	4.18	6.838	6.966	6.507	3.96	3.73	2.511	1.701	0.776
4.548	1.094	1.284	1.107	2.203	2.918	3.498	5.517	8	3.649	7.994	4.726	4.999	2.921	0.885	1.32
4.535	1.638	1.287	0.589	2.459	1.673	3.687	5.776	4.833	7.337	7.766	6.52	4.999	2.688	1.165	1.185
4.201	1.488	0.719	1.161	2.013	2.523	2.501	4.272	6.697	6.719	9.95	6.017	3.975	2.918	1.664	0.491
5.067	1.991	1.288	0.863	0.761	2.127	1.283	5.039	0.884	7.524	9.65	5.734	4.213	3.392	1.157	1.154
6.118	1.73	1.478	0.824	1.547	1.984	3.13	5.359	1.841	8.85	4.516	4.929	3.705	1.498	0.839	0.983
5.434	1.438	1.413	1.087	1.784	2.257	4.556	1.522	6.292	0.754	6.134	4.726	4.034	2.387	0.64	1.076
3.611	1.52	0.777	0.838	0.859	2.071	1.988	1.903	5.591	0.895	7.369	4.487	4.923	2.272	0.491	0.995
2.982	1.68	1.037	1.244	1.546	3.473	1.579	2.641	4.326	3.024	6.039	4.945	4.015	1.531	0.891	1.21
3.861	1.917	0.689	0.798	1.562	4.048	2.576	4.087	8.2	4.501	3.961	[redacted]	4.129	2.867	1.166	1.24
4.352	1.667	0.843	0.898	1.621	1.767	3.663	2.571	3.657	6.765	6.124	[redacted]	1.592	2.643	0.628	1.417
2.855	[redacted]	0.777	[redacted]	1.283	2.321	[redacted]	5.037	[redacted]	6.318	3.125	[redacted]	0.785	[redacted]	0.27	[redacted]
132.69	**68.21**	**48.35**	**30.11**	**42.49**	**67.24**	**89.38**	**98.65**	**161.26**	**179.76**	**182.24**	**116.53**	**104.50**	**80.02**	**48.83**	**33.66**
469.218	**537.425**	**585.776**	**615.886**	**658.373**	**725.609**	**814.992**	**913.638**	**1074.895**	**1254.652**	**182**	**298.77**	**403.27**	**483.29**	**532.12**	**565.77**

						2011							
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
1.268	1.296	2.57	3.375	4.13	1.186	7.051	7.012	2.274	1.106	1.672	0.987	1.048	1.254
1.044	1.432	3.342	2.595	1.913	1.338	7.866	9.26	4.678	3.107	1.878	1.056	0.911	2.284
0.452	1.033	0.811	2.4	2.259	3.215	3.502	5.421	3.477	3.304	0.655	1.016	1.027	1.942
1.215	1.468	1.109	1.091	4.22	2.258	0.963	3.908	5.296	3.294	1.914	1.53	1.616	3.34
1.111	1.031	0.862	2.602	1.355	3.228	2.593	2.614	5.187	3.215	2.064	0.861	1.293	3.226
1.077	1.714	1.645	4.097	1.948	4.476	5.333	6.545	3.419	1.963	2.11	1.51	1.004	3.188
0.573	1.737	1.99	3.927	2.165	3.351	3.727	1.692	3.268	1.802	1.676	1.527	0.864	1.604
1.348	1.679	2.243	3.864	4.228	5.486	3.458	4.228	4.416	2.223	2.087	1.093	1.247	1.912
1.326	1.577	2.275	3.793	4.414	4.11	4.247	3.948	4.142	3.183	2.375	0.862	1.228	0.946
0.814	1.94	1.779	2.713	3.68	1.728	2.307	3.324	3.978	3.395	1.6	1.092	1.16	1.769
0.855	0.94	2.288	2.238	3.89	4.773	2.736	4.659	1.385	1.308	2.051	1.078	1.079	1.23
0.7	0.917	1.423	2.36	5.513	5.854	1.677	2.874	1.6	2.148	1.193	1.34	1.41	0.462
1.493	0.976	1.389	3.446	5.371	5.957	4.233	2.073	3.28	1.747	1.684	0.956	1.458	1.427
0.631	2.024	1.307	1.812	6.154	5.745	3.408	1.502	4.49	1.923	1.434	0.744	0.815	1.582
1.03	1.39	0.437	3.58	3.953	4.113	3.981	4.138	0.749	2.724	1.743	0.804	1.333	1.771
1.381	1.588	1.027	1.264	1.957	6.395	5.885	3.005	2.157	2.568	1.959	0.557	1.19	1.495
1.225	1.2	3.789	2.281	4.89	3.684	6.391	1.15	2.357	2.236	1.344	0.813	0.589	1.994
1.302	1.883	2.998	3.349	4.525	5.331	7.255	3.479	1.534	2.029	1.467	1.074	1.178	0.561
1.433	1.683	2.743	3.847	6.084	3.731	5.497	2.893	0.69	2.608	1.735	1.222	0.831	0.867
0.826	1.684	2.645	3.02	2.109	3.686	4.004	3.746	1.547	2.338	1.71	1.208	0.475	0.819
1.377	1.882	2.91	3.964	5.642	2.636	4.759	4.729	1.814	1.341	1.56	1.517	1.369	0.957
1.379	1.539	3.202	4.17	6.288	5.074	6.263	4.947	0.758	2.355	1.738	0.914	0.853	1.532
1.336	2.092	2.737	4.903	5.996	5.285	4.855	4.657	3.055	2.246	1.803	0.864	0.721	1.235
1.201	1.533	2.271	3.476	4.515	6.343	6.291	4.763	2.44	2.209	0.854	1.412	1.208	1.695
1.573	1.865	3.718	2.227	5.96	2.143	5.118	4.651	2.026	2.329	1.129	1.207	0.621	2.437
1.431	1.816	2.922	2.794	5.9	5.442	6.436	4.057	3.047	1.251	1.797	1.25	0.674	3.024
1.326	1.186	4.061	4.945	4.33	3.951	7.204	5.033	2.824	1.474	1.694	1.653	1.431	3.163
1.452	1.803	3.858	4.318	5.672	3.478	6.509	2.284	2.365	1.764	1.191	1.369	1.506	2.636
0.515	2.243	3.876	3.221	1.734	5.219	5.086	[redacted]	3.328	1.206	1.303	0.969	2.089	2.91
0.838	2.186	3.174	4.233	1.189	6.065	5.724	[redacted]	2.678	1.313	1.275	0.918	2.003	2.894
0.86	1.966	[redacted]	4.17	[redacted]	6.422	6.781	[redacted]	3.709	[redacted]	0.946	[redacted]	2.083	1.518
34.39	**49.30**	**71.40**	**100.08**	**121.98**	**131.70**	**151.14**	**112.592**	**87.968**	**65.709**	**49.641**	**33.403**	**36.314**	**57.674**
600.17	**649.47**	**720.87**	**820.94**	**942.93**	**1074.63**	**151.14**	**263.732**	**351.7**	**417.409**	**467.05**	**500.453**	**536.767**	**594.441**

				2012									
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
2.471	2.435	4.777	2.325	5.891	5.284	0.9	3.54	1.227	1.373	1.384			
2.241	1.588	4.316	4.913	6.209	2.501	1.154	2.845	2.177	0.793	0.822			
2.59	1.69	3.187	3.823	6.572	0.926	0.938	2.605	1.285	0.278	1.289			
3.132	3.258	2.896	5.667	7.179	1.351	0.919	3.164	2.134	0.594	1.277			
3.208	3.717	5.035	2.502	3.869	5.308	1.289	2.861	1.909	1.126				
2.879	2.781	6.021	4.276	5.369	6.111	4.487	2.241	1.845	0.44				
3.472	1.184	5.481	2.521	4.112	3.608	2.485	3.182	1.434	1.351				
2.624	1.667	4.105	4.129	6.458	1.226	1.009	3.775	1.077	1.279				
2.148	2.349	3.484	1.996	2.415	1.754	1.291	3.02	2.012	1.112				
1.354	2.354	4.679	5.002	6.068	2.106	3.155	2.901	2.752	1.18				
2.113	3.671	3.949	4.417	5.436	4.055	4.215	2.367	3.317	1.241				
1.992	2.976	4.623	3.436	3.858	2.691	3.676	2.476	2.556	0.629				
3.06	3.96	5.283	2.506	5.435	3.405	1.858	2.471	2.095	0.589				
2.947	3.783	4.932	2.187	6.049	3.371	3.285	2.797	1.384	1.253				
3.867	2.61	7.31	4.185	2.996	4.062	2.97	1.622	1.75	1.101				
3.495	3.47	6.555	5.44	2.083	4.704	4.013	2.658	1.504	1.735				
4.641	4.797	1.852	2.785	4.367	5.012	3.449	2.979	1.687	0.388				
4.808	4.456	4.183	5.786	5.552	3.774	2.386	1.349	1.343	1.027				
5.481	4.215	5.886	3.902	6.141	3.874	3.566	1.094	1.883	1.354				
5.343	4.925	7.084	1.302	6.487	4.644	2.513	2.241	1.763	1.264				
2.999	5.604	2.288	4.018	4.825	2.77	3.803	2.089	0.999	1.125				
3.491	5.794	4.966	2.69	4.856	4.255	4.005	1.749	1.613	1.895				
4.132	4.353	1.416	4.248	4.142	3.313	1.574	1.236	2.124	0.979				
5.552	5.458	2.959	5.868	3.036	4.821	3.37	2.224	2.66	1.068				
0.677	6.477	1.808	6.049	4.872	5.508	3.169	1.13	1.581	1.355				
1.441	0.997	0.889	6.216	2.176	5.785	2.475	0.934	1.061	1.264				
2.871	1.547	4.708	2.701	3.709	2.374	3.162	1.885	0.925	0.88				
3.301	2.761	4.889	4.081	2.485	2.673	1.564	1.73	1.416	0.587				
1.057	4.003	5.752	4.757	4.831	1.274	1.226	2.061	0.983	1.278				
1.649	2.008	5.654	6.255	5.77	[redacted]	3.304	1.868	1.428	1.283				
[redacted]	4.498	[redacted]	3.977	2.548	[redacted]	3.262	[redacted]	1.146	[redacted]			[redacted]	
91.036	**105.386**	**130.967**	**123.96**	**145.796**	**102.54**	**80.472**	**69.094**	**53.07**	**31.821**	**4.772**	**0**	**0**	**0**
685.477	**790.863**	**921.83**	**1045.79**	**145.796**	**248.336**	**328.808**	**397.902**	**450.972**	**482.793**	**487.565**	**487.565**	**487.565**	**487.565**


Nov
Dec
0
0
487.565
487.565


Monthly
Evaporative loss from ED3
Monthly Evaporation (no evaporators)
Monthly Evaporation (1 evaporator)
Monthly Evaporation (2 evaporators)
Monthly Evaporation (3 evaporators)
Monthly Evaporation- 4 evaporators
Evaporation in ML
0
5
10
15
20
25
30
35
40
45
50
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month


Water balance ED3
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
ML in ED3
Water Balance Evaporation from Pond
Water Balance (1 evaporator)
Water Balance (2 evaporators)
Water Balance (3 evaporators)
Water Balance- 4 evaporators
Oct/05
Apr/06
Oct/06
Apr/07
Oct/07
Month

	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
	30	31	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	31	31	30	31	30	31
	58.7	46.1	59.8	51.2	55.6	49.3	47.5	37.9	52.4	47.6	65.2	61.9	58.7	46.1	59.8	51.2	55.6	49.3	47.5	37.9	52.4	47.6	65.2	61.9	58.7	46.1
	1.9	1.5	1.9	1.8	1.8	1.6	1.5	1.3	1.7	1.5	2.2	2.0	1.9	1.5	1.9	1.8	1.8	1.6	1.5	1.3	1.7	1.5	2.2	2.0	1.9	1.5
Average Monthly Pan Evaporation (mm- total)	0.1725	0.22165	0.2232	0.1778	0.1488	0.093	0.0589	0.0405	0.04495	0.06975	0.099	0.13795	0.1725	0.22165	0.2232	0.1778	0.1488	0.093	0.0589	0.0405	0.04495	0.06975	0.099	0.13795	0.1725	0.22165
Estimated monthly evaporation (M3) attributed to 1 evaporator (350 l/min)	6019	6875	6895	5686	5862	4701	4046	3371	3632	4330	4820	5687	6019	6875	6895	5686	5862	4701	4046	3371	3632	4330	4820	5687	6019	6875
Estimated monthly evaporation (M3) attributed to 2 evaporators (350 l/min)	12037	13751	13789	11372	11725	9402	8093	6742	7264	8659	9640	11375	12037	13751	13789	11372	11725	9402	8093	6742	7264	8659	9640	11375	12037	13751
Estimated monthly evaporation (M3) attributed to 3 evaporators (350 l/min)	18056	20626	20684	17058	17587	14103	12139	10113	10895	12989	14460	17062	18056	20626	20684	17058	17587	14103	12139	10113	10895	12989	14460	17062	18056	20626
Estimated monthly evaporation (M3) attributed to 4 evaporator(s) (350 l/min)	24075	27502	27578	22744	23449	18804	16186	13484	14527	17318	19280	22750	24075	27502	27578	22744	23449	18804	16186	13484	14527	17318	19280	22750	24075	27502
Estimated Evaporation (M3) attributed to surface evaporation (no evaporator)	15006.3	19291.2	18596.0	14286.3	11827.1	7397.5	4816.0	3457.6	4001.9	6488.1	9529.3	13544.4	16982.3	21601.0	20657.1	15814.9	13016.6	8081.2	5197.2	3706.7	4272.1	6895.5	10083.4	14273.9	17829.0	22594.3
Estimated Evaporation (M3) attributed to surface evaporation (1 evaporator)	15006.3	18586.8	16798.5	12188.2	9715.6	5845.2	3705.0	2647.1	3070.1	4994.2	7313.1	10292.7	12643.1	15705.6	14263.7	10500.7	8482.3	5096.7	3274.3	2374.8	2773.1	4542.8	6698.9	9492.6	11738.3	14684.1
Estimated Evaporation (M3) attributed to surface evaporation (2 evaporator)	15006.3	17777.3	14847.0	9755.6	6725.4	3443.3	1581.8	988.8	1414.3	2427.2	3296.7	1550.3	643.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	32.2	107.1	123.3	0.0	0.0	0.0
Estimated Evaporation (M3) attributed to surface evaporation (3 evaporator)	15006.3	16861.3	13193.4	7424.1	2837.6	382.6	121.3	65.6	78.0	143.4	178.4	144.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	35.5	30.9	0.0	0.0	0.0	0.0
Estimated Evaporation (M3) attributed to surface evaporation (4 evaporator(s))	15006.3	15950.5	10922.7	1049.4	25.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evaporator evaporation as % of Surface Evaporation (1 evaporator)	40.1%	35.6%	37.1%	39.8%	49.6%	63.5%	84.0%	97.5%	90.8%	66.7%	50.6%	42.0%	35.4%	31.8%	33.4%	36.0%	45.0%	58.2%	77.9%	90.9%	85.0%	62.8%	47.8%	39.8%	33.8%	30.4%
Evaporator evaporation as % of Surface Evaporation (2 evaporators)	80.2%	71.3%	74.2%	79.6%	99.1%	127.1%	168.0%	195.0%	181.5%	133.5%	101.2%	84.0%	70.9%	63.7%	66.8%	71.9%	90.1%	116.3%	155.7%	181.9%	170.0%	125.6%	95.6%	79.7%	67.5%	60.9%
Evaporator evaporation as % of Surface Evaporation (3 evaporator(s))	120.3%	106.9%	111.2%	119.4%	148.7%	190.6%	252.1%	292.5%	272.3%	200.2%	151.7%	126.0%	106.3%	95.5%	100.1%	107.9%	135.1%	174.5%	233.6%	272.8%	255.0%	188.4%	143.4%	119.5%	101.3%	91.3%
Evaporator evaporation as % of Surface Evaporation (4 evaporator(s))	160.4%	142.6%	148.3%	159.2%	198.3%	254.2%	336.1%	390.0%	363.0%	266.9%	202.3%	168.0%	141.8%	127.3%	133.5%	143.8%	180.1%	232.7%	311.4%	363.8%	340.0%	251.2%	191.2%	159.4%	135.0%	121.7%
Evaporation from Pond	15006.33158	19291.2246	18595.96903	14286.305	11827.0785	7397.5361	4815.98473	3457.57676	4001.9273	6488.09051	9529.31306	13544.40844	16982.28	21600.97867	20657.05538	15814.9363	13016.6113	8081.18995	5197.22556	3706.71156	4272.10208	6895.50571	10083.4006	14273.9441	17829.0205	22594.3205
Incident Rainfall	10081.5	7243.5	8819.25	8027.25	6913.5	5626.5	6435	5395.5	6575.25	7656	8217	9050.25	10081.5	7243.5	8819.25	8027.25	6913.5	5626.5	6435	5395.5	6575.25	7656	8217	9050.25	10081.5	7243.5
Water Pumped In	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Initial Volume stored in ED3																										
Progressive Water Balance (no evaporators)	90976	91051	84003	79226	77967	78054	81283	87902	94840	102413	108581	112268	112774	110874	101516	94678	91891	90787	93333	99571	106259	113562	119323	122457	122233	119485	109135
Progressive RL of dam	789.09	789.02	788.96	788.95	788.95	788.99	789.06	789.13	789.21	789.27	789.31	789.31	789.29	789.20	789.13	789.10	789.09	789.11	789.18	789.25	789.32	789.38	789.41	789.41	789.38	789.27
Progressive Water Balance (1 evaporator)	90976	85032	71813	61939	57093	53428	53509	57192	61569	66443	69775	70859	68929	65349	55011	47672	44513	42082	42911	47025	51674	56845	60628	62327	61197	58521	49205
Progressive RL of dam	789.09	789.03	788.87	788.73	788.67	788.62	788.62	788.67	788.73	788.79	788.84	788.85	788.83	788.78	788.64	788.55	788.50	788.46	788.48	788.54	788.60	788.67	788.72	788.74	788.73	788.69	788.57
Progressive Water Balance (2 evaporators)	90976	79013	58919	42151	31618	22091	17471	17108	18114	19355	18358	14622	7005	0	0	0	0	0	0	68	1346	2885	2339	0	0	0	0
Progressive RL of dam	789.09	788.96	788.70	788.46	788.26	788.07	787.81	787.75	787.93	788.02	787.98	787.28	785.83	784.50	784.50	784.50	784.50	784.50	784.50	784.51	784.76	785.05	784.94	784.50	784.50	784.50	784.50
Progressive Water Balance (3 evaporators)	90976	72995	47751	27693	16238	7727	3868	3042	3259	3861	3385	1963	0	0	0	0	0	0	0	0	282	955	587	0	0	0	0
Progressive RL of dam	789.09	788.88	788.55	788.18	787.58	785.97	785.23	785.08	785.12	785.23	785.14	784.87	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.55	784.68	784.61	784.50	784.50	784.50	784.50
Progressive Water Balance- 4 evaporators	90976	66976	35767	11085	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Progressive RL of dam	789.09	788.80	788.34	786.60	784.56	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50

	1/11/2005	1/12/2005	1/01/2006	1/02/2006	1/03/2006	1/04/2006	1/05/2006	1/06/2006	1/07/2006	1/08/2006	1/09/2006	1/10/2006	1/11/2006	1/12/2006	1/01/2007	1/02/2007	1/03/2007	1/04/2007	1/05/2007	1/06/2007	1/07/2007	1/08/2007	1/09/2007	1/10/2007	1/11/2007	1/12/2007
Monthly Evaporation (no evaporators)	15.006	19.291	18.596	14.286	11.827	7.398	4.816	3.458	4.002	6.488	9.529	13.544	16.982	21.601	20.657	15.815	13.017	8.081	5.197	3.707	4.272	6.896	10.083	14.274	17.829	22.594
Monthly Evaporation (1 evaporator)	21.025	25.462	23.693	17.874	15.578	10.546	7.752	6.018	6.702	9.324	12.133	15.980	18.662	22.581	21.158	16.187	14.345	9.798	7.321	5.746	6.405	8.872	11.519	15.180	17.757	21.560
Monthly Evaporation (2 evaporators)	27.044	31.528	28.636	21.127	18.450	12.845	9.675	7.731	8.678	11.086	12.937	12.925	12.681	13.751	13.789	11.372	11.725	9.402	8.093	6.744	7.296	8.766	9.763	11.375	12.037	13.751
Monthly Evaporation (3 evaporators)	33.063	37.487	33.877	24.482	20.425	14.485	12.261	10.179	10.973	13.132	14.638	17.207	18.056	20.626	20.684	17.058	17.587	14.103	12.139	10.113	10.902	13.024	14.491	17.062	18.056	20.626
Monthly Evaporation- 4 evaporators	39.081	43.452	38.501	23.793	23.475	18.804	16.186	13.484	14.527	17.318	19.280	22.750	24.075	27.502	27.578	22.744	23.449	18.804	16.186	13.484	14.527	17.318	19.280	22.750	24.075	27.502

Net pan evaporation (inches/month)	Percentage of volume pumped by evaporator	Net pan evaporation (inches/month)	Percentage of volume pumped by evaporator
1.5	20	7.0	40
2.0	28	7.5	41
2.5	29	8.0	42
3.0	30	8.5	43
3.5	32	9.0	44
4.0	34	9.5	45
4.5	35	10	46
5.0	36	10.5	47
5.5	37	11	48
6.0	38	11.5	49
6.5	39	12	50
7.0	40	12+	up to 85

Net pan evaporation	Percentage of volume pumped by evaporator (from manufacturer specifications)			
1.5	20%	38.1	21.8%	21.8%
2	28%	50.8	24.4%	24.4%
2.5	29%	63.5	26.7%	26.7%
3	30%	76.2	28.7%	28.7%
3.5	32%	88.9	30.5%	30.5%
4	34%	101.6	32.2%	32.2%
4.5	35%	114.3	33.8%	33.8%
5	36%	127	35.2%	35.2%
5.5	37%	139.7	36.6%	36.6%
6	38%	152.4	37.9%	37.9%
6.5	39%	165.1	39.1%	39.1%
7	40%	177.8	40.3%	40.3%
7.5	41%	190.5	41.4%	41.4%
8	42%	203.2	42.5%	42.5%
8.5	43%	215.9	43.5%	43.5%
9	44%	228.6	44.6%	44.6%
9.5	45%	241.3	45.5%	45.5%
10	46%	254	46.5%	46.5%
10.5	47%	266.7	47.4%	47.4%
11	48%	279.4	48.3%	48.3%
11.5	49%	292.1	49.1%	49.1%
12	50%	304.8	50.0%	50.0%
12+	up to 86			

MONTHLY WASTE TONNAGE DATE:

FEBRUARY 2020 – MARCH 2021

	February	March 1st - 15th	March 16th - 31st	April	May	June	July	August	September	October	November	December	January	February	March 1st - 15th	March 16th - 31st
Southern Region	7,384.880	1,757.160	2,031.520	8,155.030	9,521.480	13,601.560	23,189.620	12,884.370	12,386.100	12,219.320	10,622.760	10,602.290	7,924.900	9,895.520	4,927.620	5,705.680
Northern Region	2,911.050	1,482.350	1,736.760	9,401.488	26,706.268	20,247.900	3,884.770	3,239.050	3,676.780	2,590.370	3,163.740	3,418.480	1,729.280	1,465.400	290.640	402.920
Internal Waste																
Waste direct to Bioreactor	57,462.040	28,516.914	31,866.230	47,453.080	44,795.840	49,672.900	46,254.570	42,966.560	48,374.670	49,434.010	47,992.340	55,975.040	46,180.380	47,387.300	23,953.400	26,173.000
Waste direct to MBT	8,683.040	4,277.240	5,434.660	9,532.632	9,194.460	9,869.370	12,736.825	10,225.020	11,221.240	11,989.640	10,034.260	11,210.435	11,838.460	10,780.570	6,575.280	6,740.820
MBT to Woodlawn	8,371.480	2,364.700	4,047.880	4,693.780	4,372.780	5,009.560	5,915.900	5,115.440	5,264.080	4,840.690	5,591.300	5,815.880	5,854.160	6,042.560	3,639.090	3,799.020
Net MBT (recovery (Metals and MWOO	311.560	1,912.540	1,386.780	4,838.852	4,821.680	4,859.810	6,820.925	5,109.580	5,957.160	7,148.950	4,442.960	5,394.555	5,984.300	4,738.010	2,936.190	2,941.800
Total Tonnes	68,069.53	33,668.96	37,021.29	69,848.45	85,845.27	88,382.17	80,149.89	64,199.56	70,394.71	71,392.65	66,221.80	75,390.37	61,818.86	63,486.23	32,107.85	35,223.40

APPENDIX D:

LIQUID ODOUR MEASUREMENT METHODOLOGY

Methodology

The Liquid Odour Method (**LOM**) is comprised of the following components:

- Evaporation of a known amount of liquid in a known volume of dry nitrogen contained in a Nalophan odour sample bag;
- Determination of the odour concentration of the gaseous sample by Dynamic Dilution Olfactometry following AS4323.3:2001; and
- Calculation of the odour concentration in the liquid from the gaseous odour concentration (ou/m^3) and the volume of liquid evaporated to produce the gaseous sample.

Procedure

Liquid Sample Storage

The liquid samples analysed from the Woodlawn Bioreactor Facility were collected from stored leachate in lagoons ED3N-1, ED3N-2, ED3N-3, ED3N-4 and ED3S-S. These were refrigerated prior to testing. A liquid sample was extracted immediately from the refrigerated sample bottle and not allowed to warm to room temperature. This is the general procedure when carrying out the liquid odour measurement method for aqueous samples.

Liquid Sample Size

The volume of liquid is determined by the requirement to produce a gaseous sample with a relative humidity of less than 100%. This equates to less than 2.3% v/v water at 20º C, or for a 20 L sample, 413 µL of aqueous sample. The method development work carried out to date has shown that 413 µL of liquid sample in 20 L dry nitrogen will evaporate in approximately 30 mins. The nominal liquid sample size required for the Liquid Odour method can be specified as 340-413 µL, which provides a gaseous sample with 80-100% RH. For the liquids samples collected at the Woodlawn Bioreactor Facility, 413 µL of liquid sample was used in 20 L dry nitrogen.

Table D1 details a range of liquid volumes and approximate evaporation times observed from the method development work carried out to date.

Table D1 - Liquid sample volumes, evaporation and equilibration time

Volume µL (% saturation)	Approximate evaporation time (in 20 L dry nitrogen)	Recommended equilibration time (in 20 L dry nitrogen)
280 µL (60%)	~30 min	60 min
340 µL (80%)	~40 min	60 min
413 µL (100%)	~60 min	60 min

Sample Equilibration and Ageing

The development work to date has shown that condensate derived odour samples are not stable and degrade significantly over time. However, the degradation appears insignificant in the first 2-4 hours after preparation of the gaseous samples. Therefore, samples must be tested within that time period after preparation. For samples prepared at 100% saturation or below, the equilibration time can be standardised to 1 hour.

Sample Preparation and Odour Testing Procedure

The gaseous sample for odour testing is prepared as follows:

1. Dispense 20 L of dry nitrogen into a conditioned Nalophan bag.

2. Place a piece of clear packaging tape (approximately 100 mm long) onto the wall of the bag halfway between the ends. Ensure that the a least a 1 cm^2 section of tape completely adheres to the bag with no air bubbles trapped between the tape and bag that could allow a leak of gas to the edge of the tape.

3. Remove the liquid sample from cold storage.

4. Rinse the microlitre syringe (5 x) with the liquid sample.

5. Draw up the required volume of liquid sample (see **Liquid Sample Size** and **Table D1**) and record the exact volume in the syringe.

6. Inject the liquid through the tape and wall of the bag at the point where the tape has completely adhered to the bag. Tap the syringe to displace residual drop that adheres to the needle and withdraw the syringe from the bag.

7. Place the second piece of packaging tape over the first piece such that the puncture hole is sealed. Ensure no air bubbles are trapped between the layers of tape such that a leak could occur.

8. Vigorously shake the bag to disperse the liquid droplets inside the bag (to aid in the evaporation rate).

9. Store the bag in the laboratory for the prescribed equilibration time (see **Sample Equilibration and Ageing** and **Table D1**) to allow all the liquid to evaporate.

10. At the completion of the equilibration time, carry out the measurement of odour concentration using AS4323.3:2001.

Calculation of Liquid Odour Concentration

The odour concentration from a liquid (ou per mL) is calculated from the gaseous sample odour concentration, the volume of liquid used to prepare the gaseous sample and the volume of dry nitrogen:

$$[odour]_{liquid} = \frac{\left(\frac{OU}{m^3} \times \frac{litres_{Nitrogen}}{1000}\right)}{mL_{liquid}}$$

An example of the calculation is presented in **Table D2**.

Table D2 – Example calculation of liquid odour concentration for ED3N-4

Parameter	Value	Unit
Volume of liquid from ED3N-4	0.413	mL
Volume of dry N_2	20	L
Measured odour concentration	166^	ou
Calculated liquid odour concentration	= (166 x 20/1000)/0.413 = 8.04	ou.m^3/mL

^ TOU Sample Number SC21163– see **Table 6.5** in Main Report

Calculation of Odour Emission Rates from Evaporation of Liquids

A primary driver for the development of a liquid odour measurement is the requirement to predict odour emission rates from liquids area sources (such as storage ponds) as well as condensates. In particular, evaporation of condensates or other odorous refinery waters in cooling towers has been implicated as a significant contributor to refinery odour. With a measurement of the odour from liquids now available, the estimation of emission rates can be considered.

An example is presented below for treated leachate stored in ED3N-4 (SC21163) which returned a measured odour concentration of 8.04 ou.m^3/mL (see **Table D2**) with an evaporation rate of 1.291 L/s (based on on-site evaporation data collected by Veolia between May 2007 and June 2012 and current pond surface area):

Odour concentration = 8.04 ou.m^3/mL

Ambient pond evaporation rate = 1.291 L/s

Odour emission rate = 8.04 ou.m^3/mL x 1,291 mL/s
= 10,400 ou.m^3/sec (see **Table 6.5** in Main Report)

APPENDIX E:

FAOA SURVEY LOGSHEETS

FAOA Survey 1 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 8/03/2021 **Start Time:** 9:03 PM **End Time:** 10:25 PM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	1		2		3		4		5		6	
Intensity	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%
0	8	27%	14	47%	16	53%	30	100%	30	100%	25	83%
1	17	57%	13	43%	14	47%	0	0%	0	0%	4	13%
2	2	7%	3	10%	0	0%	0	0%	0	0%	1	3%
3	3	10%	0	0%	0	0%	0	0%	0	0%	0	0%
4	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
5	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
6	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
≥ 1's	22	73%	16	53%	14	47%	0	0%	0	0%	5	17%
Freq Exceeded?	YES		YES		YES		NO		NO		YES	
≥ 2's	5	17%	3	10%	0	0%	0	0%	0	0%	1	3%
Freq Exceeded?	YES		YES		NO		NO		NO		NO	

FAOA Survey 1 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: M. Assal / A. Schulz **Member ID:** 1 & 2 **Date:** 8/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 9:03 PM **End Time:** 10:25 PM

Measurement Point: **1** W
Wind Speed and Direction: Calm
Start: 9:03 PM End: 9:08 PM

min-1	2	3	3	1	1	1
min-2	1	1	1	1	1	1
min-3	1	2	1	3	1	1
min-4	1	0	0	1	0	0
min-5	0	0	0	1	1	0

Descriptor(s): A B C D E / F G H I J

Measurement Point: **2** SW/WSW
Wind Speed and Direction: 0.5m/s
Start: 9:10 PM End: 9:15 PM

min-1	1	1	0	0	0	0
min-2	0	2	1	1	1	0
min-3	0	0	0	0	1	1
min-4	0	0	1	1	0	0
min-5	1	1	1	1	2	2

Descriptor(s): A B C D E / F G H I J

Measurement Point: **3** W/SW
Wind Speed and Direction: 0.5-1m/s
Start: 9:20 PM End: 9:25 PM

min-1	1	1	0	1	1	1
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	1	1	0	1	1
min-5	1	1	1	1	1	0

Descriptor(s): A B C D E / F G H I J

Field comments:

Measurement Point: **4** WSW
Wind Speed and Direction: 0.5-1m/s
Start: 9:26 PM End: 9:31 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Measurement Point: **5** WSW
Wind Speed and Direction: 0.5-1m/s
Start: 9:38 PM End: 9:43 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Measurement Point: **6** WSW
Wind Speed and Direction: 0.5-1m/s
Start: 9:42 PM End: 9:47 PM

min-1	1	0	1	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	2	1	0	0	1
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Weather conditions: 18-19°C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid

FAOA Survey 1 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 8/03/2021 **Start Time:** 9:03 PM **End Time:** 10:25 PM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	7		8		9		10					
Intensity	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%				
0	13	43%	30	100%	30	100%	30	100%				
1	16	53%	0	0%	0	0%	0	0%				
2	1	3%	0	0%	0	0%	0	0%				
3	0	0%	0	0%	0	0%	0	0%				
4	0	0%	0	0%	0	0%	0	0%				
5	0	0%	0	0%	0	0%	0	0%				
6	0	0%	0	0%	0	0%	0	0%				
≥ 1's	17	57%	0	0%	0	0%	0	0%				
Freq Exceeded?	YES		NO		NO		NO					
≥ 2's	1	3%	0	0%	0	0%	0	0%				
Freq Exceeded?	NO		NO		NO		NO					

FAOA Survey 1 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: M. Assal / A. Schulz **Member ID:** 1 & 2 **Date:** 8/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 9:03 PM **End Time:** 10:25 PM

Measurement Point: **7**
Wind Speed and Direction: Calm
Start: 9:56 PM End: 10:01 PM

min-1	2	1	1	0	0	1
min-2	1	1	1	1	1	1
min-3	1	1	1	0	0	0
min-4	1	0	0	0	0	0
min-5	0	1	0	1	0	1

Descriptor(s): A B C D E / F G H I J

Measurement Point: **8**
Wind Speed and Direction: Calm
Start: 10:06 PM End: 10:11 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Measurement Point: **9**
Wind Speed and Direction: Calm
Start: 10:13 PM End: 10:18 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Field comments:

Measurement Point: **10** SW
Wind Speed and Direction: 0.5-1m/s
Start: 10:20 PM End: 10:25 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s): A B C D E / F G H I J

Measurement Point:
Wind Speed and Direction:
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s): A B C D E / F G H I J

Measurement Point:
Wind Speed and Direction:
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s): A B C D E / F G H I J

Weather conditions: 18-19°C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid

FAOA Survey 2 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 9/03/2021 **Start Time:** 5:30 AM **End Time:** 7:18 AM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	1		2		3		4		5		6	
Intensity	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%
0	30	100%	10	33%	30	100%	0	0%	15	50%	30	100%
1	0	0%	7	23%	0	0%	0	0%	13	43%	0	0%
2	0	0%	11	37%	0	0%	23	77%	2	7%	0	0%
3	0	0%	2	7%	0	0%	7	23%	0	0%	0	0%
4	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
5	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
6	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
≥ 1's	0	0%	20	67%	0	0%	30	100%	15	50%	0	0%
Freq Exceeded?	NO		YES		NO		YES		YES		NO	
≥ 2's	0	0%	13	43%	0	0%	30	100%	2	7%	0	0%
Freq Exceeded?	NO		YES		NO		YES		NO		NO	

FAOA Survey 2 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: J. Schulz / I. Farrugia **Member ID:** 1 & 2 **Date:** 9/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 5:30 AM **End Time:** 7:18 AM

Measurement Point: **1** SW
Wind Speed and Direction 0-0.5 m/s
Start: 5:30 AM End: 5:35 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **2** SW/WSW
Wind Speed and Direction 0.5 m/s
Start: 5:39 AM End: 5:44 AM

min-1	1	2	2	2	2	1
min-2	2	2	0	0	0	2
min-3	3	3	2	2	1	1
min-4	2	2	0	0	0	0
min-5	1	1	1	0	0	0

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **3** SSE/SSW
Wind Speed and Direction 0-0.5 m/s
Start: 5:56 AM End: 6:01 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Field comments:

Measurement Point: **4** W/NW
Wind Speed and Direction Calm - 0-0.5m/s
Start: 6:07 AM End: 6:12 AM

min-1	2	2	2	2	2	2
min-2	2	3	3	2	2	2
min-3	2	3	2	3	3	2
min-4	2	3	2	2	2	2
min-5	2	2	2	3	2	2

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **5** NW
Wind Speed and Direction 0-1m/s
Start: 6:16 AM End: 6:21 AM

min-1	1	1	0	0	0	1
min-2	1	1	1	0	1	0
min-3	0	0	0	1	1	0
min-4	0	1	1	1	0	0
min-5	1	2	2	0	0	0

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **6** NW
Wind Speed and Direction Calm - 0-0.5m/s
Start: 6:23 AM End: 6:28 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):					
	A	B	C	D	E
	F	G	H	I	J

Weather conditions: 5-10^{o}C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid

FAOA Survey 2 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 9/03/2021 **Start Time:** 5:30 AM **End Time:** 7:18 AM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	7		8		9		10					
Intensity	1 & 2	%	1 & 2	%	1 & 2	%	1 & 2	%				
0	30	100%	30	100%	0	0%	30	100%				
1	0	0%	0	0%	0	0%	0	0%				
2	0	0%	0	0%	12	40%	0	0%				
3	0	0%	0	0%	18	60%	0	0%				
4	0	0%	0	0%	0	0%	0	0%				
5	0	0%	0	0%	0	0%	0	0%				
6	0	0%	0	0%	0	0%	0	0%				
≥ 1's	0	0%	0	0%	30	100%	0	0%				
Freq Exceeded?	NO		NO		YES		NO					
≥ 2's	0	0%	0	0%	30	100%	0	0%				
Freq Exceeded?	NO		NO		YES		NO					

FAOA Survey 2 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: J. Schulz / I. Farrugia **Member ID:** 1 & 2 **Date:** 9/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 5:30 AM **End Time:** 7:18 AM

Measurement Point: **7** N
Wind Speed and Direction 0.5-1m/s
Start: 6:33 AM End: 6:38 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **8** N
Wind Speed and Direction Calm - 0.5m/s
Start: 6:44 AM End: 6:49 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **9** NW/WNW
Wind Speed and Direction Calm - 0.5m/s
Start: 7:05 AM End: 7:10 AM

min-1	3	3	3	2	2	3
min-2	3	3	3	2	2	3
min-3	2	2	3	3	3	3
min-4	3	2	2	2	3	2
min-5	3	2	3	3	3	2

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Field comments:

Location 4 taken again, more odorous

Measurement Point: **10** SW
Wind Speed and Direction 0.5-1m/s
Start: 7:13 AM End: 7:18 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Weather conditions: 5-10^{0}C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid

FAOA Survey 3 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 9/03/2021 **Start Time:** 12:02 PM **End Time:** 1:35 PM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	1		2		3		4		5		6	
Intensity	1	%	1	%	1	%	1	%	1	%	1	%
0	30	100%	30	100%	14	47%	30	100%	30	100%	30	100%
1	0	0%	0	0%	15	50%	0	0%	0	0%	0	0%
2	0	0%	0	0%	1	3%	0	0%	0	0%	0	0%
3	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
4	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
5	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
6	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
≥ 1's	0	0%	0	0%	16	53%	0	0%	0	0%	0	0%
Freq Exceeded?	NO		NO		YES		NO		NO		NO	
≥ 2's	0	0%	0	0%	1	3%	0	0%	0	0%	0	0%
Freq Exceeded?	NO		NO		NO		NO		NO		NO	

FAOA Survey 3 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: J. Schulz **Member ID:** 1 **Date:** 9/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 12:02 PM **End Time:** 1:35 PM

Measurement Point: **1** W
Wind Speed and Direction 2 - 4 m/s
Start: 12:02 PM End: 12:07 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **2** WNW
Wind Speed and Direction 2 - 5 m/s
Start: 12:10 PM End: 12:15 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **3** WNW
Wind Speed and Direction 3 - 7 m/s
Start: 12:18 PM End: 12:23 PM

min-1	1	1	1	1	1	2
min-2	1	1	1	1	1	1
min-3	0	0	1	1	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	1	1

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Field comments:

Measurement Point: **4** WNW
Wind Speed and Direction 4 - 7 m/s
Start: 12:26 PM End: 12:31 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **5** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 12:37 PM End: 12:42 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **6** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 12:48 PM End: 12:53 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Weather conditions: 18-19^{o}C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid

FAOA Survey 3 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

Date: 9/03/2021 **Start Time:** 12:02 PM **End Time:** 1:35 PM

Assessment Area: Woodlawn, NSW **Intensity ≥** 1 **Frequency ≥** 10%

Location	7		8		9		10					
Intensity	1	%	1	%	1	%	1	%				
0	30	100%	30	100%	30	100%	30	100%				
1	0	0%	0	0%	0	0%	0	0%				
2	0	0%	0	0%	0	0%	0	0%				
3	0	0%	0	0%	0	0%	0	0%				
4	0	0%	0	0%	0	0%	0	0%				
5	0	0%	0	0%	0	0%	0	0%				
6	0	0%	0	0%	0	0%	0	0%				
≥ 1's	0	0%	0	0%	0	0%	0	0%				
Freq Exceeded?	NO		NO		NO		NO					
≥ 2's	0	0%	0	0%	0	0%	0	0%				
Freq Exceeded?	NO		NO		NO		NO					

FAOA Survey 3 of 3 - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: J. Schulz **Member ID:** 1 **Date:** 9/03/2021

Assessment Area: Veolia Woodlawn **Start Time:** 12:02 PM **End Time:** 1:35 PM

Measurement Point: **7** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 1:00 PM End: 1:05 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **8** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 1:10 PM End: 1:15 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **9** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 1:18 PM End: 1:23 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Field comments:

Location 4 taken again, more odorous

Measurement Point: **10** W/WNW
Wind Speed and Direction 3 - 7 m/s
Start: 1:30 PM End: 1:35 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Weather conditions: 18-19^{o}C, Atmospheric Pressure = 936 hPa

Key Odour Descriptors:

A = bin juice, fermented garbage, putrid