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Tumblong Non-Putrescible Waste Disposal Facility

Air Quality Management Plan

Addressee(s): MH Earthmoving Pty Ltd

Site Address: 68 Tumblong Reserve Road, Tumblong NSW

Report Reference: 25.1120.FR2V4

Date: 25 November 2025

Status: Final

Quality Control

Report	Reference	Status	Prepared by	Checked by	Authorised by
Tumblong Non-Putrescible Waste Disposal Facility - Air Quality Management Plan	25.1120.FR2V4	Final	Northstar	MD, MH, EH, AD	GCG

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R.x)	(V.x)
25	1120	Final	R2	V4
Based upon the above, the specific reference for this version of the report is:				25.1120.FR2V4

Final Authority

This report must be regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below. A draft report is a working document, is issued without prejudice and is subject to change.



G. Graham

25th November 2025

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1. INTRODUCTION

MH Earthmoving Pty Ltd (MHE) (the Applicant) has engaged Northstar Air Quality Pty Ltd (Northstar) to prepare an Air Quality Management Plan (AQMP) for Tumblong Non-Putrescible Waste Disposal Facility (Tumblong Landfill), located at Tumblong Reserve Road, Tumblong NSW (the Premises).

This AQMP provides the framework for managing landfill gas (LFG), odour and dust emissions generated by the Premises. MHE is committed to effective air quality management to ensure compliance with statutory obligations under Environmental Protection Licence (EPL) 21440.

1.1. Scope of this Report

This AQMP encompasses the requirement of a Landfill Gas Management Plan (LFGMP) and dust management to satisfy the requirements of conditions U2 and O3 of EPL 21440 as implemented through Notice of Variation 1647178, dated 2 May 2025, as reproduced below:

Condition U2 requires the following:

U2 Landfill Gas Management Plan

U2.1 The Licensee must submit to the EPA a Landfill Gas Management Plan that has been prepared for the Premises by a suitably qualified consultant with at least five (5) years' experience in the area of waste, landfills and landfill gas management. The Landfill Gas Management Plan must be prepared in accordance with the NSW EPA Environmental Guidelines: Solid Waste Landfills (April 2016) and must include the following:

Implementation of LFG Monitoring Program, to include:

- a) Items discussed in Section 7.2 of the Landfill Gas Risk Assessment (LGRA) prepared for the Premises by NorthStar [sic] Air Quality Pty Ltd, dated 29 November 2024:*
 - i. 7.2.1 - LFG surface emissions monitoring; and*
 - ii. 7.2.2 - Premises walkover; and*
 - iii. 7.2.3 - Odour monitoring (and recording); and*
 - iv. 7.2.4 - Complaints (handling and recording); and*
 - v. 7.2.5 - Leachate management; and*
 - vi. 7.3 - Other control measures.*

- b) *Items discussed in the risk analysis, Section 6.4.2 of the LGRA:*
- i. *Implementation of management controls to identify and remedy surface breaches and staff awareness of exposure risks; and*
 - ii. *Identify sulphurous waste accepted at the Premises and implement suitable limits and/or mitigation measures to limit Hydrogen Sulphide generation.*

U2.3 The Landfill Gas Management Plan must be completed and submitted to the EPA via electronic mail to info@epa.nsw.gov.au by no later than 5PM, 15 August 2025.

Condition O3 requires the following:

O3 Dust

O3.1 Activities occurring at the premises must be carried out in a manner that will minimise emissions of dust from the premises.

O3.2 Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.

O3.3 Drop heights when loading haul trucks must be minimised at all times.

O3.4 All internal roads up to the edge of the site boundary must be sealed.

O3.5 All internal haulage must be undertaken on sealed roads.

O3.6 No more than 0.5 Hectares of the temporary stockpile site is to be exposed to wind erosion at any one time.

O3.7 Hydromulch and hydroseeding must be used on 80% of the temporary stockpile.

The Variation Notice which also requires a Leachate Management Plan (LMP) as detailed in Condition U1, which is provided under separate cover.

1.2. Purpose of the Report

The purpose of this AQMP is to provide a comprehensive management plan to address the risks posed by LFG, odour and dust generated from the Premises.

The AQMP has been performed with reference to the following relevant statutory legislative guidelines and assessment documents (in no order):

- *Protection of the Environment Operations Act 1997* (POEO Act);
- Protection of the Environment Operations (Clean Air) Regulation 2022 (POEO CAR);
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2022a);
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (NSW EPA, 2022b);
- Technical Framework (NSW DEC, 2006a) and Technical Notes (NSW DEC, 2006b) – Assessment and Management of Odour from Stationary Sources in NSW; and
- Environmental Guidelines – Solid Waste Landfills (NSW EPA, 2016).

Appendix A contains a glossary of abbreviations, acronyms, and commonly used units referenced in this AQMP.

1.3. Relevant Legislation, Regulation and Guidance

The following outlines the legislation and air quality criteria which are applicable to the activities being performed at the Premises.

1.3.1. Protection of the Environment Operations Act 1997

The Premises is a prescribed site under Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act) for waste disposal activities by application to land and operates through EPL 21440 which was first issued in November 2020.

The following notices have been issued (by date):

- Licence variation 1604891 – 18 January 2021;
- Licence variation 1615176 – 20 December 2021;
- Licence variation 1617208 – 4 March 2022;
- Licence variation 1621459 – 6 December 2022;
- Licence variation 1629276 – 31 May 2023;
- Licence variation 1633336 – 16 October 2023;
- Licence variation 1639027 – 24 May 2024; and
- Licence variation 1644419 – 31 October 2024.

Landfill capacity and operational conditions in EPL 21440 are described as:

- Receive a maximum of 60 000 tonnes per year ($\text{t}\cdot\text{yr}^{-1}$) of non-putrescible waste material;
- Not exceed the total airspace capacity of 485 000 cubic metres (m^3) for waste disposal; and
- Not receive, store, handle or dispose of General Solid Waste or other classes of waste that are not authorised for receipt at the Premises.

Condition L3.2 of EPL 21440 states:

Only paper machine rejects, dregs and grits, boiler sand/fly ash and recrystallisation plant residue that has come from the Visy Pulp and Paper Mill, located at Tumut NSW and meets the definition of General Solid (non-putrescible) Waste can be accepted at the premises.

EPL 21440 contains a range of management, monitoring, and reporting conditions designed to ensure that waste disposal operations cause minimal impacts on the local community and surrounding environment. This includes monitoring and reporting of groundwater quality, leachate management and that operations at the Premises must not cause or permit the emission of offensive odour beyond the boundary.

1.3.2. Environment Protection Licence

Beyond the requirements of Condition U2 (see Section 1.1), EPL 21440 currently provides no requirement for the monitoring of LFG.

With regard to odour, EPL 21440 Condition 7.1 states:

O7.1 Odour

The licensee must not cause, permit or allow the emission of offensive odour beyond the boundary of the premises.

The accompanying LMP (InSitu Advisory, July 2025) prepared in response to EPL 21440 Condition U1.1 also includes components of odour control.

1.3.3. Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management and are generally not intended to achieve “no odour” but manage odour impacts to an acceptable level.

Odour control is a requirement of EPL 21440 Condition O7.3:

O7.1 Odour

The licensee must not cause, permit or allow the emission of offensive odour beyond the boundary of the premises.

The term “offensive odour” is defined under the POEO Act as:

offensive odour means an odour—

(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances—

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.

2. THE PREMISES

The following provides a description of the context, location and scale of the Premises, and a description of the processes and development activities on site. It also identifies the potential for generation of LFG associated with the operation of the Premises.

2.1. Environmental Setting

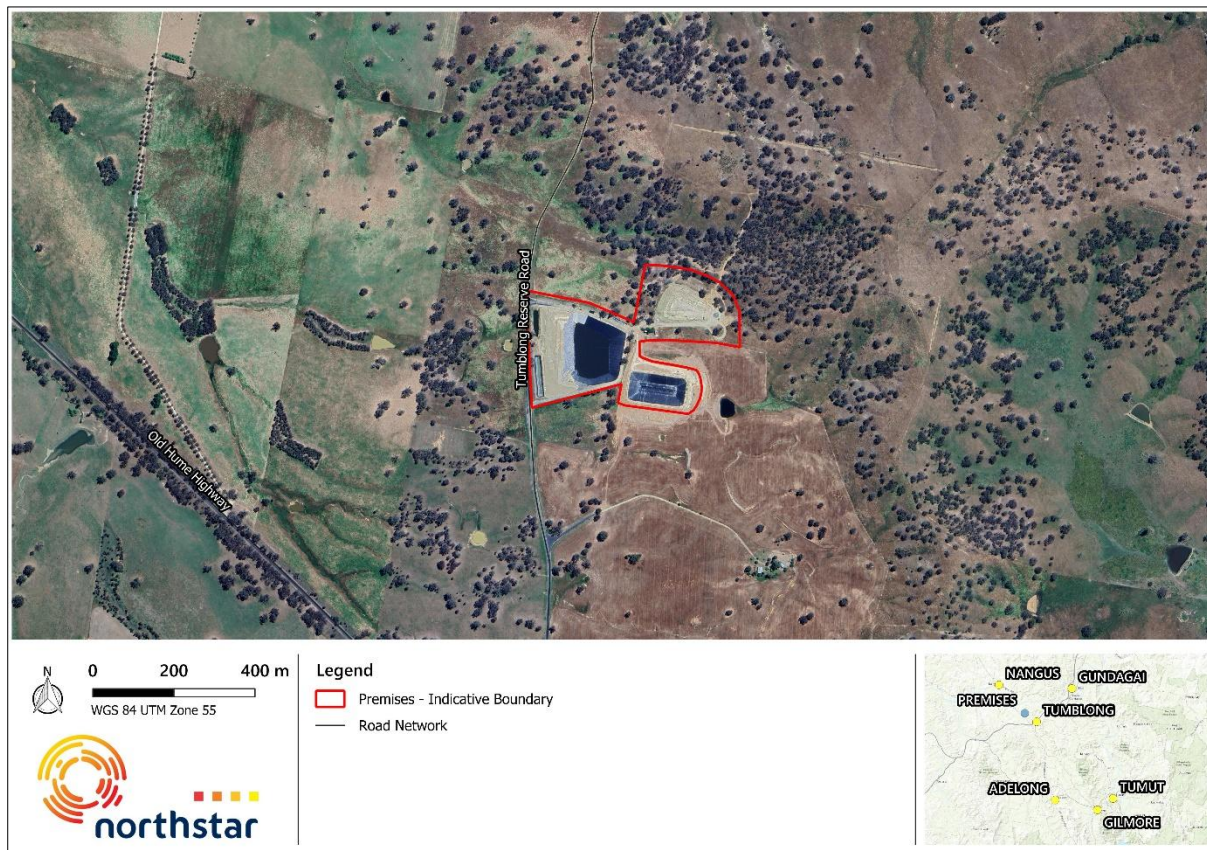
The Premises is located on Tumblong Reserve Road, approximately 3.5 kilometres (km) from the Tumblong community and 18 km from the Gundagai township in the South West Slopes region of NSW.

The Premises is located on Lot 7004 of Deposited Plan (DP) 1028797 and Lot 7300 of DP 1149008, part of Lot 10 of DP 1210362 and part Crown Road 282 Tumblong Reserve Road within the Cootamundra-Gundagai Regional Council Local Government Area (LGA).

Access to the Premises is gained via Tumblong Reserve Road.

The Premises location is shown in Figure 1.

Figure 1 Premises location



Source: Northstar

2.2. Premises Overview

The Premises operates as a general solid waste (non-putrescible) waste disposal facility for the purpose of committing waste materials associated with VISY industries, derived from the Visy Pulp and Paper Mill located approximately 23.7 km southeast of the Premises.

The Premises has been designed with reference to the Landfill Guidelines (NSW EPA, 2016) and comprises the following site infrastructure:

- Two waste landfill cells;
- Two leachate storage dams (one permanent and one temporary);
- Stormwater dam;
- Temporary stockpile area; and
- Ancillary site infrastructure.

Condition L5 of EPL 21440 notes the Premises' operational hours as:

- Monday to Friday - 7:00 am to 5:00 pm;
- Saturday – 7:00 am to 1:00 pm; and
- No operational activities on Sundays and Public Holidays.

With a total airspace (i.e. void) capacity of 485 000 m³ and landfill waste compacted to an average density of 1 tonne per cubic metre (t·m⁻³), landfilling operations are anticipated to last up to 8 years, depending on annual inputs. After this period, the Premises will be closed, capped and rehabilitated.

Ancillary structures are contained at the Premises, including a site office and staff amenities.

2.3. Waste Material Received

As stated in Section 2.3, the Premises is licenced under EPL 21440 to commit up to 60 000 t of non-putrescible waste per calendar year to landfill. At the time of writing this AQMP, a proposed DA modification has been submitted to increase annual allowance from 60 000 t·yr⁻¹ to 99 000 t·yr⁻¹. It is noted however that the total capacity remains as approved and unchanged as part of this DA modification i.e. 485 000 m³ over 10 years from the date the first load of waste was received.

Non-putrescible waste is defined in Clause 49, Schedule 1 of the POEO Act and typically comprises of inert materials such as glass, rubber, plasterboard, ceramics, bricks, concrete, and metals. Only waste streams complying with acceptable waste for general solid waste (non-putrescible) facilities and assessed to be inert waste or solid waste as outlined in the Waste Classification Guidelines (NSW EPA, 2014) are permitted to be landfilled at the Premises.

The Premises only accepts non-putrescible solid waste generated from the Visy Pulp and Paper Mill. Notably, Condition L3.2 of EPL 21440 states that, “*Only paper machine rejects, dregs and grits, boiler sand / fly ash and recrystallisation plant residue that has come from the Visy Pulp and Paper Mill, located at Tumut NSW and meets the definition of General Solid (non-putrescible) Waste can be accepted at the Premises.*”

All waste generated at the Visy Pulp and Paper Mill is pre-processed and sorted so the waste is within the physical and chemical requirements for, and formally classified as, General Solid Waste (Non-Putrescible) as per NSW EPA Waste Classification Guidelines: Part 1 Classifying Waste (NSW EPA, 2014).

Table 1 outlines the predominant waste streams produced from the Visy Pulp and Paper Mill and disposed of at the Premises since 2020, as reported by the Licensee. It shows that a total of 230 379 t of have been disposed of at the Premises, of which approximately 210 438 t (91.3 %w/w) consisted of paper machine rejects (PMR) and plastics.

Table 1 Waste materials committed to the Premises

Reporting year	Reported waste streams received at the Premises (t·yr ⁻¹)						Total (t·yr ⁻¹)
	Plastics	Dregs & grits	Ragger	PMR	Fly ash	Boiler sand	
2020 - 2021	18 372	3 084	1 493	7725	521	91	31 285
2021 – 2022	43 164	2 742	3 311	10742	29	0	59 989
2022 – 2023	49 322	1 989	3 094	5 597	0	0	60 001
2023 - 2024	49 676	48	2 616	7 660	0	0	60 001
2024 - 2025	16 003	0	921	2 178	0	0	19 102
Total	176 536	7 864	11 435	33 902	550	91	230 379
% total	76.6	3.4	5.0	14.7	0.2	0.0	100.0

The waste streams accepted at the Premises includes those outlined in the following sections.

2.3.1. Paper Machine Rejects (PMR)

The main components of PMR are paper, plastic, raggars (a twisted agglomeration of rags and plastic wrapped around a wire) and metals. The plastic component of PMR typically includes approximately 70 % rigid and 30 % soft / flexible plastics. The paper component consists of paper deemed to be too degraded to reprocess and is discarded. Metals include aluminium (Al), foil and other forms of metal. Raggars consist of cloth and fibre that cannot be processed.

2.3.2. Dregs and Grits (Lime Mud)

Dregs and grits are a mixture of sodium and calcium carbonates (lime mud), and a small fraction of unburnt organic matter that is derived in the process of removing lignin from virgin fibre raw material in the kraft pulping process.

Lime mud is generated in the chemical recovery and recirculation process and, aside from dregs and grits, is the only waste product derived from the kraft pulping process.

2.3.3. Boiler Sand, Fly Ash and Bottom Ash

High quality sand is used as material to transport fuel in the bed of the fluidised bed boiler (the 'Power Boiler'). Over time the bed material becomes degraded and contaminated and needs to be periodically replaced.

Fly ash is a fine light powdery material (wood ash) collected from the Power Boiler electrostatic precipitators.

Bottom ash is mainly comprised of sand and carbonaceous materials from the boiler bed.

2.3.4. Recrystallisation Plant Residue

Visy is a large generator of renewable energy, and the majority of this energy is generated by the consumption of 'black liquor' in the recovery boiler. The black liquor is generated in the pulping process which removes lignin from the timber raw material. During this process the recrystallisation plant also generates non-usable material.

Further information on the types of solid waste streams derived from the Visy Paper & Paper Mill can be found in the Visy Pulp & Paper Tumut Mill - Solid Waste Management Plan (Visy, 2023a).

Section 3.6 of Visy Annual Environmental Compliance and Monitoring Report (Visy, 2023b; Visy, 2024) states that several waste streams such as fly ash and boiler sand have been assessed for alternative reuse options under Resource Recovery Orders and Exemptions which diverted the waste stream from landfill, while also implementing process improvements to reduce fibre and moisture content in the PMR waste stream.

With reference to LFG generation, Section 2.1.2 of the Contaminated Land Guidelines (NSW EPA, 2020) notes that:

"Inert waste may consist predominantly of building and demolition rubble, excavation spoil and hard wastes, but it almost always contains some timber, paper, green waste, and other biodegradable materials. Sometimes inert waste landfills were used for casual or occasional disposal of putrescible wastes, or illegal disposal of industrial waste."

Therefore, inert waste landfills also produce landfill gas, but at a lower rate than putrescible waste landfills. However, because conditions for gas generation are not ideal, it may persist for extended periods. Where waste is deposited below the water table and there is little groundwater throughflow, as in former brick pits, degradation may be very slow, again extending the gas generation period.

Building and demolition waste frequently contains plasterboard (gyprock) waste, which may generate hydrogen sulfide (H₂S) under anaerobic conditions. Hydrogen may be generated when acidic groundwater reacts with galvanised iron roofing, guttering and pipe waste. A wide range of trace gases may also be present."

It is important to note that although the Premises is not licensed to accept putrescible wastes, the material which is permitted to be landfilled may contain some small residual fraction of organic material e.g. PMR, dregs and grits wastes. This organic material has the potential to degrade to result in emissions of methane (CH₄), H₂S and other gases that comprise LFG. Due to the presence of biodegradable waste in the landfill, there is the potential for LFG to be produced.

2.4. Landfill Design

2.4.1. Landfill Cells

Two landfill cells, repurposed from former quarrying activities, have been established at the Premises. Landfill cell 1 has been temporarily capped with interim cover, while landfill cell 2 is currently operational.

Each cell is lined with a geosynthetic clay liner (GCL) and topped with a 2-millimetre (mm) thick high-density polyethylene (HDPE) geomembrane, underlain by a minimum 200 mm compacted clay sub-base for effective containment. Additionally, both cells utilise protection (cushion) and separation (filter) geotextiles.

The active waste disposal area includes the waste unloading hopper and the associated working face. Once deposited into the hopper, waste is loaded by an excavator into a Moxy truck and delivered to the working face of the operating landfill cell. The waste is then spread and compacted using a compactor. The working face refers to the area that has been stripped back from the previous day's operations, making space for the placement and compaction of the daily waste deliveries.

2.4.2. Cover Materials

At the end of each working day, a layer of clayey virgin excavated natural material (VENM) soils is applied as a daily cover material across at a minimum depth of 150 mm, as stipulated in Condition O6.1 of EPL 21440.

A stockpile of daily cover material, comprised of clayey VENM, is located north east of both waste cells. This temporary stockpile provides materials for engineering, rehabilitation, and daily waste cover. The restoration and rehabilitation work at landfill cell 2 will use the clay material from the stockpile. Once these activities are finished, the remaining stockpile material will be reshaped, and the area will be rehabilitated.

2.4.3. Landfill Gas Production Estimate

In September 2024, the Licensee engaged LGI, a leading specialist in LFG and biogas extraction, to conduct a site inspection and provide a professional opinion on the potential for the installing a Landfill Gas Capture System at the Premises. LGI specialises in designing, building, owning, and operating best-practice renewable energy and carbon abatement facilities with a focus on collaboration, innovation, and safety.

Key details from LGI's professional advice are outlined below:

"Following the review of the waste input data you recently provided to us, along with the recent site inspection conducted by myself, I believe there is not enough current evidence of landfill gas (LFG) generation potential to justify the installation of gas capture infrastructure.

The waste type observed was uniform in consistency and was primarily of plastic derived inert materials. There were no noticeable signs of fugitive landfill gas or significant LFG generation.

However, my comments are based on limited observations, and you are much more familiar with the site. If you / your staff do observe future odour issues or other evidence of LFG generation, I would suggest proceeding with a 'LFG pumping trial', similar to the one conducted by LGI at the Tumut landfill, to better assess the potential LFG at the site."

While LGI's opinion underscores the need for effective LFG management, it relies on limited observations and the absence of LFG monitoring data may affect the accuracy of initial estimates, albeit based upon specialist professional advice. Comprehensive monitoring is essential for properly assessing and optimising LFG management strategies at the Premises.

Northstar evaluated LFG generation at the Premises using the NGER Technical Guideline on *Estimating emissions and energy from solid waste and landfill biogas management* (CER, 2024), the *NGER (Measurement Determination 2008* (DCCEEW, 2008) and the NGER SWC (Version 1.6). Initial estimates of LFG generation were based on a range of conservative assumptions and are provided in the Landfill Gas Risk Assessment (LFGRA) for the Premises (Northstar, 2024).

Significantly, the initial conservative estimates outlined in the LFGRA (Northstar, 2024) assumed that 100 % of the waste stream entering landfill is commercial and industrial (C&I), with the total quantity of PMR (refer Table

1) assumed to be paper and paper board, and the remainder of the committed material 'inert' waste. Given that the PMR is a combination of paper, plastics, and metal, the estimates in the LFGRA are likely to be highly conservative. The higher the inert component of the waste, the lower the LFG generation would be.

Details of the inputs into the estimated gas generation rates are provided in the LFGRA and are not replicated here. The output of the high-level gas generation estimate is that the peak potential generation rates for CH₄ and LFG are projected to occur in 2030, reaching 67.9 m³·hr⁻¹ and 135.9 m³·hr⁻¹, respectively. After 2030, both rates are anticipated to decline. For the financial year ending 2025, LFG and CH₄ generation rates are estimated at 34.0 m³·hr⁻¹ and 67.9 m³·hr⁻¹, respectively. The generation rates are forecasted to gradually increase until 2030, after which they will decrease as landfilling activities would have ceased at the Premises.

2.4.4. Leachate Management

Leachate management at the Premises involves two storage dams: "Leachate Dam 1" (being the permanent leachate dam to the west of landfill Cell 1); and "Leachate Dam 2" (being the temporary leachate dam to the east south-east of landfill Cell 2).

Reference should be made to the LMP (InSitu Advisory, July 2025).

The specifications for the two leachate dams are provided in Condition E1 of EPL 21440:

E1 Cell Design and Construction Quality Assurance Report

E1.1 The licensee must construct Cells 1 and 2 in accordance with the designs, specifications, methods and Construction Quality Assurance Plan contained in the Environmental Impact Statement titled 'Proposed Non-Putrescible Waste Disposal Facility (Landfill); Tumblong Reserve Road, Tumblong NSW 2729, Lot 7004 DP1028797 & Lot 7300 DP1149008 & Part Crown Road' (November, 2019) and report titled 'Proposed Landfill Development, Bangas Gravel Pit Landfill, Construction Quality Assurance (CQA) Plan Cell 1 & 2 Construction' prepared by InSitu Advisory Pty Ltd and dated 22 October 2019. This includes a leachate barrier on the cell floor and walls comprising, from bottom to top:

- a) a 200 millimetre (mm) thick compacted sub-base*
- b) a geosynthetic clay liner*
- c) a 2 mm thick high-density polyethylene liner*
- d) a protection geotextile*
- e) a leachate collection layer comprising 300 mm of drainage gravel and collection pipework*
- f) a separation geotextile.*

2.4.4.1. Leachate Dam 1 (Permanent Dam)

The 2020 DA approval for the Premises included provision for a single permanent leachate storage dam on the western boundary of the site, designed to service both landfill cells 1 and 2. This dam is lined with compacted clay, GCL, and a 2 mm HDPE geomembrane, forming a composite barrier.

The leachate pumped from landfill cell 2 to Leachate Dam 1 is mechanically aerated and chemically oxidised to minimise the odour generation potential of leachate.

Mechanical aeration is provided by two (2) floating water pumps that draw leachate from deeper in the leachate column and spray the leachate via diffusers onto the dam surface. Diffusers reduce the sprayed droplet size which increases the aeration potential by increasing the diffused surface area, which is an effective odour control.

The stored leachate is also dosed with hydrogen peroxide (H_2O_2). H_2O_2 is an effective oxidation agent, minimising the emission of reduced sulphur compounds including hydrogen sulphide (H_2S) and carbon disulphide (CS_2).

The mechanical aeration and chemical oxidation controls are performed in accordance with EPL 21440 variation notice 1621459).

A fraction of the treated leachate is pumped from Leachate Dam 1 to Leachate Dam 2.

2.4.4.2. Leachate Dam 2 (Temporary Dam)

To provide adequate storage capacity for leachate generated in landfill cells 1 and 2, a temporary engineered leachate storage dam is also operational at the Premises. In accordance with the DA consent, '*the temporary leachate pond on Lot 3 DP 702858 is to be decommissioned five (5) years from the date of the transfer of leachate from Cell 2 to the temporary leachate pond*'. The decommissioning of the temporary leachate dam will be 12 December 2028.

Leachate Dam 2 is fitted with an engineered, surface-floating linear low-density polyethylene (LLDPE) cover to reduce rainfall ingress, and to provide odour control by way of containment of the leachate stored in the dam. The cover is fitted with two (2) air displacement outlets, each connected to activated carbon filters to minimise the rate of odour emission from the leachate stored under the cover, operated in accordance with advice provided in (TOU, November 2022).

A layer of liquid above the cover assists the effective operation of the cover by minimising wind uplift of the cover from the leachate surface and also provides some UV resistance to the cover materials.

A fraction of the leachate that has been chemically treated and mechanically aerated in Leachate Dam 1 is pumped to Leachate Dam 2. The leachate may be stored beneath the floating cover or a smaller volume stored above the floating cover to fulfil the functions described above, and to facilitate evaporation.

Given that the leachate stored above the floating cover is chemically treated and mechanically aerated prior to pumping to Leachate Dam 2, the leachate poses a low odour risk under the following scenarios:

- a. the treatment in Leachate Dam 1 is insufficient to deal with the leachate loading rates, or
- b. the leachate stored becomes stagnant / anoxic, or
- c. the precipitated solids are allowed to build up which may cause an anaerobic layer which may become an odour source if disturbed.

The odour management measures for leachate dam is discussed in Section 4.

3. LANDFILL GAS MANAGEMENT

3.1. Landfill Gas Monitoring Plan

The Premises will implement a monitoring plan to periodically monitor LFG generation from the landfill cells in accordance with the Environmental Guidelines (NSW EPA, 2016).

The Environmental Guidelines outlines the required outcomes of an LFG monitoring plan comprising:

Landfill gas management practices must be adopted to:

- *minimise emissions of untreated landfill gas to air and through sub-surface strata and services*
- *minimise greenhouse gas emissions (methane, the major bulk component of landfill gas, is 20 to 25 times more potent than carbon dioxide)*
- *minimise emissions of offensive odour*
- *minimise the explosive risk to humans from gas build-up in confined spaces*
- *ensure that, wherever feasible, landfill gas is sustainably utilised for energy recovery*
- *minimise emissions of air pollutants from the combustion of landfill gas in flaring or electricity-generating equipment.*

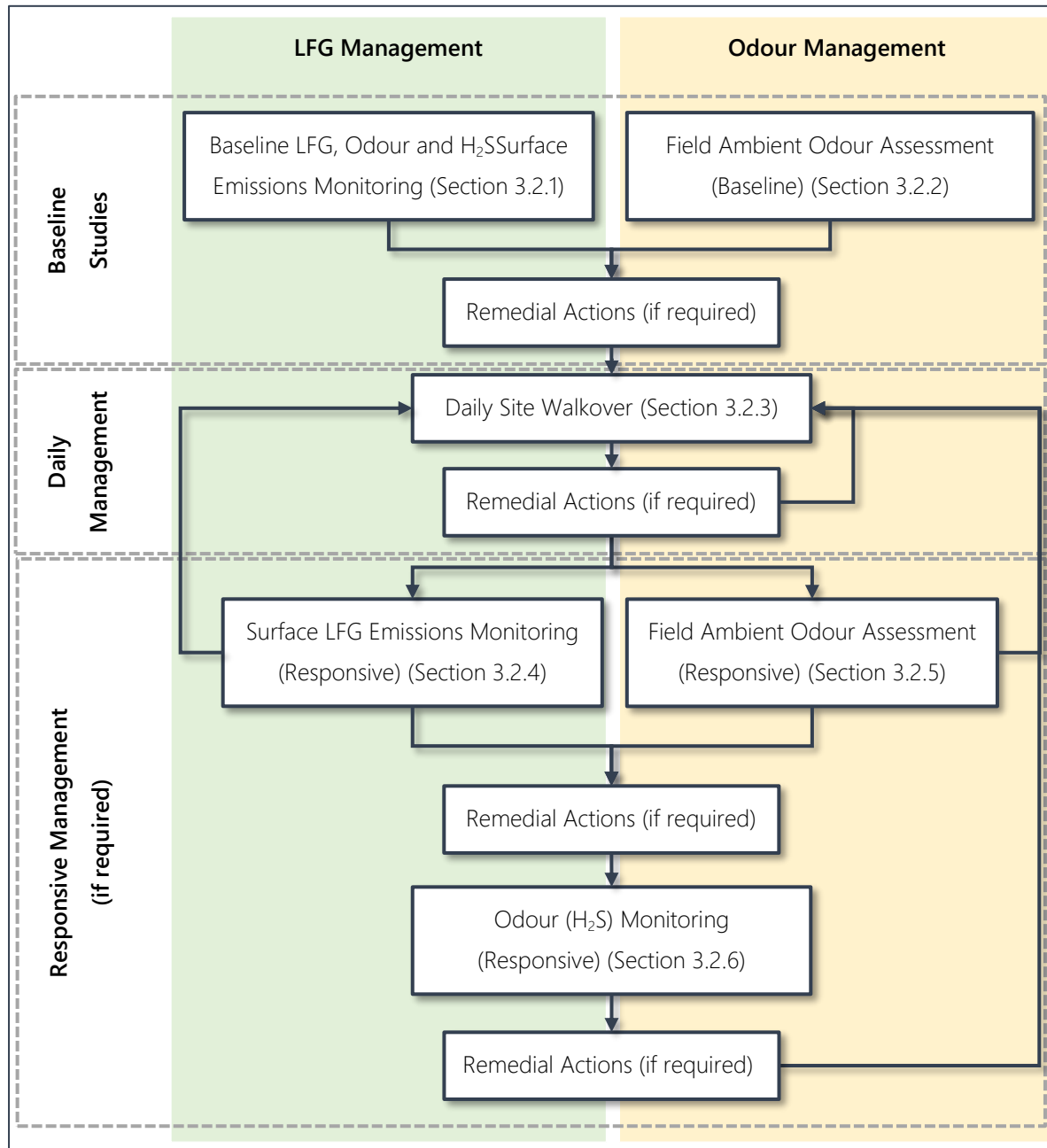
The LFG monitoring plan (provided below) has been designed to achieve the above mentioned outcomes.

3.2. Landfill Gas Monitoring Procedure

Based on the low potential for LFG generation at the Premises (refer Section 2.4.3), the following provides a hierarchy of LFG monitoring procedures to be implemented at the Premises.

The structure and hierarchy of the LFG monitoring procedure is illustrated in Figure 2. It is noted that this plan includes management of odour in addition to LFG. Odour may be associated with LFG emissions and also from leachate storage dams.

Figure 2 LFG monitoring plan structure



Source: Northstar

3.2.1. Baseline Studies – LFG, Odour and H₂S Surface Emissions Monitoring

3.2.1.1. Baseline LFG Surface Emissions Monitoring

A baseline LFG surface emissions monitoring survey will be performed as part of the baseline studies. The surface monitoring program will be performed in accordance with the requirements of Section 5.2 of NSW

EPA (2016) Environmental Guidelines – Solid Waste Landfills (NSW EPA, 2016), with the purpose of providing an initial quantitative condition assessment of the efficacy of LFG containment over the surface of the working areas, and providing an assessment where additional remedial actions should be prioritised.

The threshold for acceptable levels of surface CH₄ concentrations at capped landfills is 500 parts per million (ppm) in accordance with the Environmental Guidelines.

Section 5.2 of the Environmental Guidelines outlines the method for monitoring surface emissions of LFG as follows:

The landfill gas surface emissions monitoring program should be conducted in the following way:

Methane should be tested in the atmosphere 5 centimetres above the landfill surface in areas with intermediate or final cover/capping. Testing should be conducted in a grid pattern across the landfill surface at 25-metre spacings. Depressions in the cover material, or surface fissures away from the sampling grid, should also be investigated. The monitoring should be performed on calm days (winds below 10 kilometres/hour) and preferably during periods of relatively low and stable atmospheric pressure (e.g. less than 101.3 kPa).

Surface gas emissions monitoring should be done on a monthly frequency, or as varied by the EPA on the basis of site assessment or monitoring results indicating that landfill gas does not pose an environmental risk.

The landfill gas monitoring device should be capable of detecting methane gas in sufficiently low concentrations to ensure confidence in the results. For surface gas monitoring, this level is 20 parts per million. The device should be properly zeroed and calibrated according to the manufacturer's instructions before any measurements are made. A flame ionisation detector is usually used for this purpose.

If methane is detected at levels above 500 parts per million, investigation and corrective actions can include:

- *repair or replacement of the cover material*
- *flux (emissions) monitoring to quantify emission rates and help identify the extent of gas loss (surface scans give a concentration, not a flow rate)*
- *installation of sub-surface monitoring wells (if not already installed) to gauge the extent of any lateral migration of gas adjustment or installation of landfill gas controls to extract and treat gas.*

Any identified LFG hotspots (i.e. a CH₄ concentration of greater than 500 ppm) would be identified and appropriate remedial action taken to control that pathway.

3.2.1.2. Baseline Odour Monitoring

As previously discussed in Section 3.2, odour may be associated with the monitored LFG and leachate storage surface. To establish baseline surface odour flux at the Premises, odour will be monitored using isolation flux hood technique. Flux hoods are a common method for collecting emissions from solid and liquid surfaces such as landfill cells (intermediate, covered or capped) and leachate dams. The selection of sampling locations and the methodology of odour sampling will be undertaken in accordance with:

- AS/NZS 4323.1 - Stationary source emissions - Selection of sampling positions
- AS/NZS 4323.4 – Area source sampling – flux hood chamber technique

Odour flux samples will be taken in duplicate from the following, to represent a baseline assessment of odour emissions at the Premises:

- Landfill active tipping face;
- Intermediate cover landfill areas;
- Final (capped) landfill areas
- Leachate dams (1 and 2)

3.2.1.3. Baseline H₂S Monitoring

Baseline H₂S monitoring will be conducted using an appropriate hand-held H₂S monitor at the same time as the baseline odour monitoring (see Section 3.2.1.2). This will establish the numerical relationship between 'odour' (comprised of numerous odorants) and H₂S (likely to be the principal odorant). This relationship will be useful to estimate the link between any fence line H₂S monitoring requirement (see Section 3.2.6) and odour.

3.2.2. Baseline Studies – Field Ambient Odour Assessment

A baseline field ambient odour assessment (FAOA) will be performed at the same time as the baseline surface emissions monitoring program, to provide a comprehensive condition assessment of LFG and odour management at the premises. The FAOA will establish a baseline of potential presence and characterisation of odour at the site boundary and various downwind exposure locations.

In the absence of specific odour surveillance guidance for NSW, the methodology published by EPA VIC, *Guidance for field odour surveillance* (EPA VIC, 2021) will be adopted to perform a series of observations to detect potential odour impacts.

The general approach to performing a FAOA under the EPA VIC guidance is outlined below:

- **Prior to odour surveillance** – training and method selection. The FAOA should be undertaken by a qualified odour assessor under the Australian Standard (AS/NZS) 4323.3:2001 criteria.
- **In the field** – Observations should be performed at each location for a period of 5 minutes which at a minimum should recorded the following:
 - Observation point;
 - Odour intensity;
 - Odour character;
 - Odour presence; and
 - Meteorological conditions.
- **Surveillance method** – Observations should be performed close to the site, with subsequent observations performed gradually at further distances away from the site until no odour can be recognised (known as plume tracing).

The criteria for determining odour intensity are outlined in (EPA VIC, 2021) and have been reproduced below in Table 2.

Table 2 Odour intensity criteria

Descriptor	Description
Obvious (O)	Odour is easily recognised, can be described and may be attributed to a source. The assessor can smell it without any effort or focus on it.
Subtle (S)	Odour can be recognised only when focusing. For example, by standing still, inhaling slowly and concentrating.
No odour (N)	No odour, or odour is not strong enough to be recognised.

The odour presence is calculated to assess the frequency of odour experienced at each observation point. The categories of odour presence in accordance with (EPA VIC, 2021) are provided in Table 2. To calculate the percentage of odour presence at each observation point, the odour intensities should be recorded every 10 seconds for a 5-minute period, corresponding to 30 individual odour observations. However, it is noted that if no odour is detected in the first 2 minutes, then observations are discontinued, and odour surveys are performed at a new location.

Incidences of identified odour should then be calculated as an average of the total odour observations.

Table 3 Odour presence descriptors

Descriptor	Rating	Description of odour presence
Constant	C	Can smell it constantly or almost constantly (>80 % of the time).
Frequent/Repetitive	F	On and off extended periods with recognised odour (10–80 % of the time).
Transient	T	On and off with significant periods with no odour or no recognised odour (<10 % of the time).

Descriptor	Rating	Description of odour presence
None	N	No odour observed

Odour observations will be recorded in a manner consistent with the requirements of the guidance, such as presented in Appendix A of this AQMP.

Should the baseline FAOA identify any odour at or beyond the boundary of the Premises (as per EPL 21440, Condition O7.1), appropriate remedial action taken to control that pathway.

3.2.3. Daily Management - Daily Site Walkover

A daily site walkover inspection would be conducted on each working day to perform observations of potential LFG / odour generation, migration, and/or emission. This proactive approach would ensure timely detection of potential hazards, system failures, or changes in site conditions that may impact LFG / odour management.

The daily site walkover inspection would include the landfill surfaces, the leachate dams, and at the boundary of the Premises. Observations would be based on visible and olfactometric indicators, without the use of gas detection instruments.

The following outlines the inspection areas and indicators to be applied.

3.2.3.1. Landfill Surface

Examples of observations during the daily site walkover that would identify opportunities for improved LFG management would include:

- Cracks in the cap or cover material which may indicate gas pressure buildup, settlement and/or cap disturbance.
- Visible venting (e.g. vapor plumes, heat shimmer), which may indicate surface gas emissions.
- Bubbling in ponds, leachate sumps, or surface water, which may be indicative of surface gas emissions.
- Vegetation stress or dieback, which may be indicative of soil oxygen displacement in the root zone.

Remedial actions would include the control of the identified pathway, such as the application of additional cover materials, cover compaction, removal of roots penetrating cap materials etcetera.

3.2.3.2. Site Perimeter, Slopes and Batters

Examples of observations during the daily site walkover that would identify opportunities for improved LFG management at the perimeter, on slopes and batters would include:

- Erosion channels or cracks near perimeter, which may indicate potential pathways for gas migration.
- Signs of animal burrows or disturbances, which may provide pathways for LFG emissions.
- Odour-related behaviours (e.g. staff avoidance, localised insect swarms), which may provide visual signs that may indirectly indicate strong gas odours.

3.2.3.3. Leachate Dams

Examples of observations during the daily site walkover that would identify opportunities for improved odour control from the leachate dams would include:

- Odour observed near to Leachate Dam 1 and/or 2 may be indicative of ineffective chemical oxidative treatment by H_2O_2 and/or mechanical aeration, or release of odorants from the sedimented materials at the base of the dams.

If odour is observed at these locations that has the potential to be detectable at the boundary of the Premises, the following additional checks will be undertaken:

- Check that the H_2O_2 dosing system is operating at the rate required to treat the influent leachate load;
- Check that the mechanical aeration sprays are operating; and/or
- Check that there is not an excessive load of precipitated sediment, or that the sediment is not being disturbed or uncovered by the leachate so that it forms a pathway for odour to be emitted.

3.2.3.4. Odour Observations

Odour observations would be taken at locations representative of the active worked areas, around the leachate dams and at downwind locations representative of fence-line conditions. To facilitate odour observations, Table 4 includes a range of descriptive indicators of odour which may be useful to identify potential LFG emissions.

Table 4 Summary of visual / odour indicators

Gas	Odour character / description
Hydrogen sulphide (H_2S)	Rotten eggs
Methane-rich LFG	Sewage / decaying matter
Volatile organic compounds (VOC)	Solvent-like / sweet
Ammonia (NH_3)	Ammonia
Visual cue	Possible cause
Dead or discoloured vegetation	Sub-surface methane migration
Bubbling in leachate or standing water	LFG escaping
Cracks in landfill cover	Gas build-up below surface
Visible steam/vapour	Elevated gas/water temperatures

3.2.3.5. Buildings and Structures

- Look for signs of poor ventilation, condensation on windows, or cracking in any on-site structures.

3.2.3.6. Documentation

Observations from the daily site walkover would be recorded in a Daily Site Inspection Log, including:

- Date and time;
- Weather conditions (e.g. wind, temperature, barometric pressure);
- Surveyors name;
- Observations by location;
- Follow-up actions required (if any); and
- Sign-off by site manager.

If any signs of gas release or migration are noted, the site manager would be notified, who would initiate appropriate remedial actions.

In the event that significant LFG containment issues are identified, or significant odour from landfill areas are identified, a supplementary responsive LFG surface emissions monitoring study would be performed (see Section 3.2.4) and or responsive FAOA (see Section 3.2.5).

3.2.4. Responsive Management - LFG Surface Emissions Monitoring

The LFG monitoring plan will comprise of a baseline LFG surface emissions monitoring study (see Section 3.2.1) and responsive LFG surface emissions monitoring study as may be required to respond to:

- any deficiencies identified during the daily site walkover (see Section 3.2.3);
- to quantify the efficacy of remedial actions;
- persistent verified odour complaints received; and/or
- as reported by the EPA / Council.

The approach and methodology for the responsive LFG surface emission monitoring survey are as discussed in Section 3.2.1.

In the event that the responsive LFG surface emission monitoring survey identifies significant deficiency in LFG containment a responsive odour monitoring campaign will be implemented (see Section 3.2.6).

3.2.5. Responsive Management - Field Ambient Odour Assessment

Similar to the responsive LFG surface emissions monitoring studies, in the event that the daily site inspection indicates odour observations that are at an intensity that would be observed beyond the boundary of the Premises, or in response to persistent verified odour complaints, a responsive FAOA would be performed with the aim of identifying and rectifying the cause of any odour emissions.

The approach and methodology for the responsive LFG surface emission monitoring survey are as discussed in Section 3.2.2.

Odour observations will be recorded in a manner consistent with the requirements of the guidance, such as presented in Appendix A of this AQMP.

In the event that the responsive FAOA identifies significant potential odour observations, a responsive odour monitoring campaign will be implemented (see Section 3.2.6).

3.2.6. Responsive Management - Odour Monitoring

In the event that the responsive management actions require further action (see Section 3.2.4 and 3.2.5), an odour (H_2S) monitoring campaign will be implemented. The monitoring will be comprised of boundary H_2S measurements using a suitable, appropriate and calibrated monitoring device. The adopted *de facto* standard to be achieved beyond the site boundary is 8 parts per billion (ppb).

The location and number of monitoring points will be determined by the circumstances triggering the monitoring but will be sufficient to address the anticipated variance in prevailing meteorological conditions and/or the perceived off-site risk(s).

Should the H_2S monitoring identify any measured concentrations > 8 ppb, supplementary remedial actions will be implemented until the measured concentrations are less than the *de facto* standard.

4. LEACHATE DAM ODOUR MANAGEMENT

4.1. Odour Sources

As discussed in Section 2.4.4.2, a small volume of treated leachate from Leachate Dam 1 (Permanent Dam) will be used to stabilise the cover on Leachate Dam 2 (Temporary Dam). Although the leachate will be treated chemically (ie H₂O₂ dosed) and mechanically (ie aerated) before being stored on top of cover for Leachate Dam 2, it is considered to be is a low odour risk.

4.2. Odour Management

The leachate dams should be managed in accordance with the Leachate Management Plan (InSitu Advisory, July 2025).

Notwithstanding the low odour risk from the leachate dams, the odour mitigation measures for leachate dams to be implemented at the Premises are detailed in Table 5.

Table 5 Odour mitigation measures – Leachate dams

EPL 21440	Mitigation Measure
O7.5	Leachate must only be disposed of by: a) Evaporation; b) Irrigation within the active cell of the landfill; or c) Disposal at a facility licensed to accept such waste.
O7.6	Irrigation of leachate within an active cell must only be undertaken: a) During dry weather; and b) Such that ponding or run off within the active cell does not occur and if the active tipping face is enclosed by a 300mm high earthen bund.
O7.7	Use of leachate as a dust suppressant outside of the active cell is prohibited.
O7.8	Leachate in all waste cells must be kept at a level no greater than 300 millimetres above the upper surface of the base liner
General	Mitigation Measure
1	Inspect the rate of silting on the cover of Leachate dam 2. Where there is a silt build up and becomes an odour source, the silt from the covers should be either mechanically removed or pumped out (as practicable) and the silt appropriately managed.

5. DUST MANAGEMENT

5.1. Dust Sources

An Air Quality Impact Assessment (AQIA) was completed for the Premises by Northstar (Northstar, 2025), which identified and assessed the following key air emissions sources associated with the waste handling:

- Movement of vehicles in and around the Premises on paved and unpaved road surfaces;
- Placement (i.e. loading/unloading) of waste;
- Placement (i.e. loading/unloading) of cover material; and
- Wind erosion of exposed surfaces (i.e. excavated cell, stockpiled material and active/daily cover).

5.2. Dust Mitigation Measures

The onsite handling and movement of materials has potential to generate fugitive dust emissions. These potential dust emissions will be controlled through a range of mitigation measures, including good site management, good housekeeping measures, appropriate vehicle maintenance and applying appropriate dust mitigation measures where required.

The dust mitigation measures to be implemented at the Premises in accordance with Condition O3 of EPL 21440 are detailed in Table 6.

Table 6 Dust mitigation measures

EPL 21440	Mitigation Measure
O3.1	Activities occurring at the premises must be carried out in a manner that will minimise emissions of dust from the premises.
O3.2	Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.
O3.3	Drop heights when loading haul trucks must be minimised at all times.
O3.4	All internal roads up to the edge of the site boundary must be sealed
O3.5	All internal haulage must be undertaken on sealed roads
O3.6	No more than 0.5 hectares of the temporary stockpile site is to be exposed to wind erosion at any one time
O3.7	Hydromulch and hydroseeding must be used on 80% of the temporary stockpile
General	Mitigation Measure
1	Where silt on the leachate dam covers has become dry and becomes a dust risk, the silt should be mechanically removed or pumped out, or more leachate should be pumped on top of the covers (as practicable)

5.3. Daily Management

5.3.1. Dust Monitoring

EPL 21440 Condition P1 requires dust deposition monitoring at five locations (EPA monitoring locations 1-5). Dust monitoring using dust deposition gauges (DDG) will continue in accordance with EPL 21440.

5.3.2. Daily Site Walkover

In conjunction with the daily LFG / odour daily walkover, a daily site walkover inspection would be conducted on each working day to perform observations of potential dust generation and/or emission. This proactive approach would ensure timely detection of potential hazards, system failures, or changes in site conditions that may impact dust management.

The daily site walkover inspection would include the landfill surfaces, access roads, material stockpiles and at the boundary of the Premises. Observations would be based on visible dust indicators i.e. the identification of potential dust-generation sources that may require controls and visible dust plumes at or beyond the boundary of the Premises.

5.3.2.1. Documentation

Observations from the daily site walkover would be recorded in a Daily Site Inspection Log, including:

- Date and time;
- Weather conditions (e.g. wind, temperature, barometric pressure);
- Surveyors name;
- Observations by location;
- Follow-up actions required (if any); and
- Sign-off by site manager.

If any signs of dust release or migration are noted, the site manager would be notified, who would initiate appropriate remedial actions.

6. METEOROLOGY

A meteorological monitoring station ('met station') will be installed and operated at the Premises. The siting of the weather station will be in compliance with AS/NZS 3580.1.1. The parameters to be monitored and the specifications for the weather station will be in compliance with AS/NZS 3580.14, including:

- Air temperature measurement at 2 m and 10 m AGL
- Wind speed and direction at 10 m AGL
- Sigma theta (by calculation)
- Barometric pressure
- Rainfall measurement (ground-level, 0.2 mm tipping bucket rain gauge)
- Relative humidity

The met station will also have telemetry capabilities and battery backup for remote access and any unforeseen circumstances to maintain the data (i.e. 10 day buffer).

7. MANAGEMENT, MONITORING AND REPORTING

7.1. Corrective Action

As discussed in Section 3.1, the AQMP monitoring plan has been designed to achieve the required outcomes outlined within the EPL and Environmental Guidelines. However, If the monitoring program detects a surface CH₄ emission concentration above 500 ppm, and / or the Premises receives a verified odour / dust complaint, corrective actions will to be implemented to minimise the potential for emissions to air to be generated / propagated.

7.1.1. LFG and Odour

Following an instance of non-compliance with the monitoring threshold criteria or a received complaint, the Premises staff must perform a visual inspection to identify potential components of the site that may require remediation. Specific components that may indicate that fugitive emission of LFG are being generated include but are not limited to:

- Example remedial actions for LFG / odour from landfill:
 - Surface cracks on intermediate or finally capped landfill cells;
 - Surface cracks proximate to extraction wells;
 - Structural damage at extraction wells;
 - Leachate or soil accumulation within extraction wells;
 - Depressions in the landfill surface;
 - Ponding on the landfill surface; and
 - Distressed or dying vegetation.
- Example remedial actions for odour from leachate:
 - Checking that the H₂O₂ dosing rate in Leachate Dam 1 is sufficient to deal with the leachate loading rates;
 - Checking that the aeration pumps in Leachate Dam 1 are operating effectively;
 - Checking that the leachate stored in Leachate Dam 2 has not become stagnant / anoxic; and
 - Checking that the precipitated solids in Leachate Dams 1 and 2 are not being disturbed / agitated, allowed to build up excessively, or are exposed to air to create an emission pathway.

7.1.2. Dust

In case of a validated dust complaint received, the Premises will:

- Analyse the data to try to identify the source(s) of dust. This may involve analysing the previous month's type/amount of loads, regional dust events (e.g. bushfires), predominant wind directions and the downwind complainant location.
- If required, implement additional mitigation measures as required, such as additional water sprays, surface stabilisation with polymers, access road maintenance or as otherwise appropriate.

7.2. Complaints Register

The Premises will maintain an odour and dust complaint register. The Environmental Guidelines suggests that the following details associated with odour complaints should be recorded as a minimum:

- Date and time of the received complaint;
- Contact details of the complainant;
- Nature of the complaint including: (as applicable):
 - Odour/dust characteristic(s)
 - Duration / frequency
 - Perceived source of condition causing odour/dust
- Activities being performed at the time of the complaint;
- Meteorological conditions at the time of the complaint;
- Name of staff on duty at the time of the complaint; and
- Corrective action implemented to resolve the complaint.

7.3. Record Keeping

The Premises will keep a record of the monitoring data and registered complaints as outlined above. A review of the data will be undertaken every 6 months to review the air quality performance of the Premises, which will be summarised in a report. The review will:

- Be performed by a suitably qualified and experienced person;
- Review the monitoring data for the review period;
- Analyse the performance of the Premises;
- Identify any potential deficiencies in the ability for the Premises to achieve the relevant air quality criteria; and
- If required, recommend measures to improve the air quality control at the Premises to reduce the potential for emissions of LFG, odour and dust to be generated.

Within one month of the completion of the air quality review, the Premises must submit a copy to NSW EPA with responses to recommendations (if required) included within the review report.

7.4. Reporting

Reporting to the NSW EPA is conducted in accordance with the conditions specified in EPL 21440.

MHE also maintains internal reporting systems that document monitoring results and operational responses / corrective actions. These reports are used to inform landfill management decisions, ensure the effectiveness of environmental controls, and support continual improvement across LFG, odour and dust management practices and holistically across the other aspects of management employed at the Premises.

7.5. Training

All personnel engaged in air quality management are provided with appropriate training to ensure consistent, accurate and reliable data collection, analysis and documentation. The training includes familiarisation with EPL 21440 monitoring requirements, and the requirements of this AQMP.

Ongoing competency development ensures that staff that are engaged in air quality management on-site are equipped to uphold compliance, maintain transparency and contribute meaningfully to MHE's environmental management objectives.

7.6. Emergency Response

Emergency response is provided in accordance with the Emergency Response Plan (ERP).

8. DOCUMENT REVIEW

The AQMP will be reviewed periodically to ensure that it is maintained in accordance with any updated guidance, or requirements imposed through the EPL. A document review history to date is shown in Table 7.

Table 7 Document Review History

Version	Date	Description / Changes
25.1120.FR2V2	12 September 2025	Submitted to EPA on 12 September 2025
25.1120.FR2V3	14 November 2025	Re-named from LFGMP to AQMP Additional monitoring measures for odour, H ₂ S and dust Section 5 Dust management Section 6 Meteorology

9. REFERENCES

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APPENDIX A

Odour Surveillance Form

Date	/ /	Weather prior to survey	Weather after survey
Day	M T W T F S S		
Assessor			

[illegible]



Note: Wind speed may be estimated without an anemometer using the Beaufort Scale

Force 0	Calm	smoke rises vertically.
Force 1	Light Air	direction of wind shown by smoke drift only.
Force 2	Light Breeze	wind felt on face, leaves rustle, and ordinary vane moved by wind.
Force 3	Gentle Breeze	leaves and small twigs in constant motion and Light flag extended.
Force 4	Moderate Breeze	raises dust and loose paper, small branches move, and wind extends light flag.
Force 5	Fresh Breeze	small trees in leaf begin to sway and flags ripple.
Force 6	Strong Breeze	large branches move, flags beat, wires whistle, and umbrellas are difficult to control.
Force 7	Near Gale	whole trees in motion and inconvenience felt walking against the wind.

air quality | environment | sustainability

air quality	Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness.
environment	Our team has extensive experience in environmental management, covering environmental policy and management plans, licencing, compliance reporting, auditing, data, and spatial analysis.
sustainability	We look beyond compliance to add value and identify opportunities. Our services range from sustainability strategies, ecologically sustainable development reporting and assessment, to bespoke greenhouse gas and energy estimation and reporting.

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