



Shoalhaven City Council

West Nowra Recovery Park EIS

Air Quality Assessment

November 2015

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Appendix D – Sample Ausplume output file

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1. Introduction

1.1 Purpose of this report

Shoalhaven City Council (Council) proposes to construct and operate a resource recovery park (RRP) at West Nowra (referred to in this report as 'the proposal'). This report has been prepared by GHD Pty Ltd to provide an assessment of potential air quality impacts associated with the proposal as an input to the environmental impact statement. Council is the proponent of the proposal and the environmental impact statement is being prepared by GHD in accordance with the requirements of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (the EP&A Act).

The report addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the Secretary's Environmental Assessment Requirements (SSD 15_7015)) dated 13 May 2015.

1.2 Staged project approval

The West Nowra RRP is proposed to be assessed in stages under Section 83B of the EP&A Act. The EIS provides an assessment of the concept proposal for the whole project and a detailed assessment of Stage 1 works.

The Concept Proposal for the whole West Nowra RRP project includes two stages:

- Stage 1 – clearing of land and provision of basic infrastructure on the nominated site, which would be undertaken by Council or contractors appointed by Council as part of early construction works.
- Stage 2 – construction and operation of a RRP and would be undertaken by an alternative waste technology provider/facility operator, who would be selected by a tendering process to provide the specialised resource recovery facilities.

The EIS assesses both stages at a concept proposal level and provides detailed environmental assessment of the Stage 1 works.

The remainder of the RRP Master Plan including the composting facility, materials recovery facility and C&D sorting and recovery facility technology/processes, buildings, services and internal roadways and weighbridges has been developed as a concept proposal only (so far).

The staged approach would enable construction of Stage 1 of the West Nowra RRP to commence (subject to planning approval) while a contractor is appointed and the details of Stage 2 are determined via the tendering and design process.

1.3 Concept proposal description

The West Nowra RRP would comprise a range of waste and resource processing activities aimed at maximising resource recovery and minimising the amount of waste destined for landfill disposal.

The proposal is defined as the construction and operation of a RRP with combined capacity to receive and process up to 130,000 tonnes of waste per year, comprising:

- A composting facility to process up to 65,000 tonnes of waste per year from both domestic and commercial waste sources.
- A materials recovery facility for sorting up to 40,000 tonnes of dry (non-putrescible) solid wastes per year from both domestic and commercial waste sources.

- A sorting and recovery facility for approximately 15,000 tonnes per year of construction and demolition (C&D) waste
- Other areas for processing and storing approximately 10,000 tonnes per year of other recyclable materials, such as green waste, scrap steel and concrete.

The proposal also includes ancillary infrastructure including:

- Circulation roadways and weighbridges for entering and exiting vehicles
- Offices and amenities
- Sediment / detention basins
- Car parking for up to 30 cars vehicles and 10 visitor vehicles
- Security fencing around the perimeter of the site
- Asset protection zones (APZs).

A preliminary Master Plan, including footprints of potential processing buildings, has been prepared for the purpose of concept proposal level assessment in the EIS and to indicate how the proposed facilities and infrastructure items would be integrated with related activities on the site. This is shown in Figure 1.1.

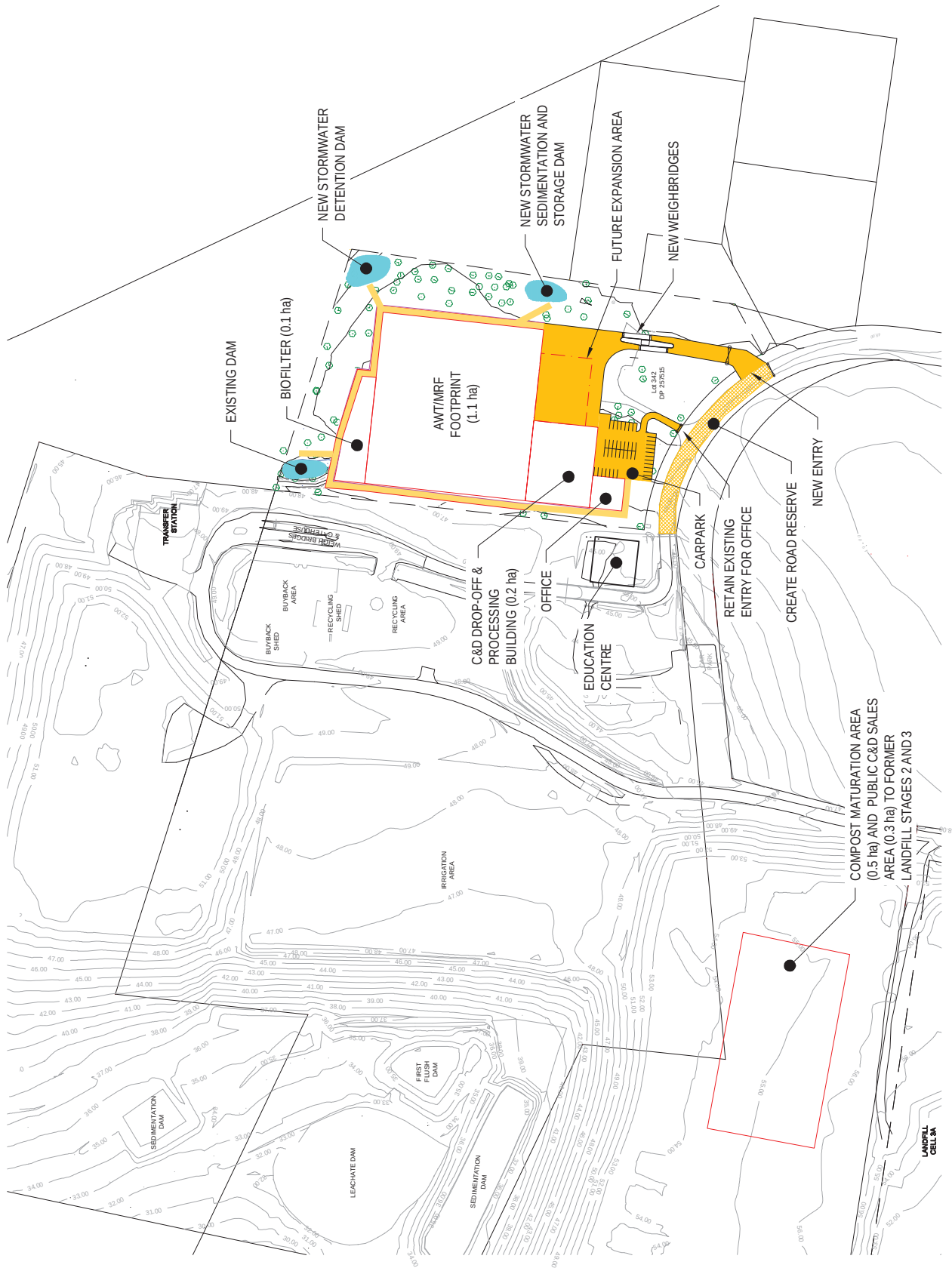
Stage 1 would include:

- Clearing of land (including demolition of existing buildings)
- Site grading and preparation
- Provision of basic infrastructure including drainage works, sediment/detention basins, roads, utilities and security fencing and gates.

A schematic of Stage 1 is shown in Figure 1.2.

1.4 Location of the proposal

The proposal would be located at 114 Flatrock Road in Mundamia (City of Shoalhaven), specifically, a 3.6 hectares (ha) site which currently operates as an animal shelter (Lot 342 DP 257515). The proposal site is approximately 5 kilometres (km) west of the Nowra Central Business District, and adjacent to the existing West Nowra Recycling and Waste Facility. Refer Figure 1.3.



NOTES:

1. AWT CONTRACTOR TO PROVIDE AMENITIES (SHOWERS, TOILETS, LUNCHROOM ETC.) TO STAFF WITHIN AWT BUILDING
2. OFFICE TO CONTAIN RECEPTION AREA, MEETING ROOM, OFFICES (MIN. OF 2) AND AMENITIES (TOILETS ETC.)
3. COMPOST MATURATION AREA TO BE LOCATED ON FORMER LANDFILL STAGES 2 AND 3
4. PUBLIC C&D SALES AREA TO BE LOCATED ON FORMER LANDFILL STAGES 2 AND 3

SHOALHAVEN CITY COUNCIL
WEST NOWRA RRP

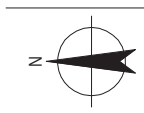
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Revision | B

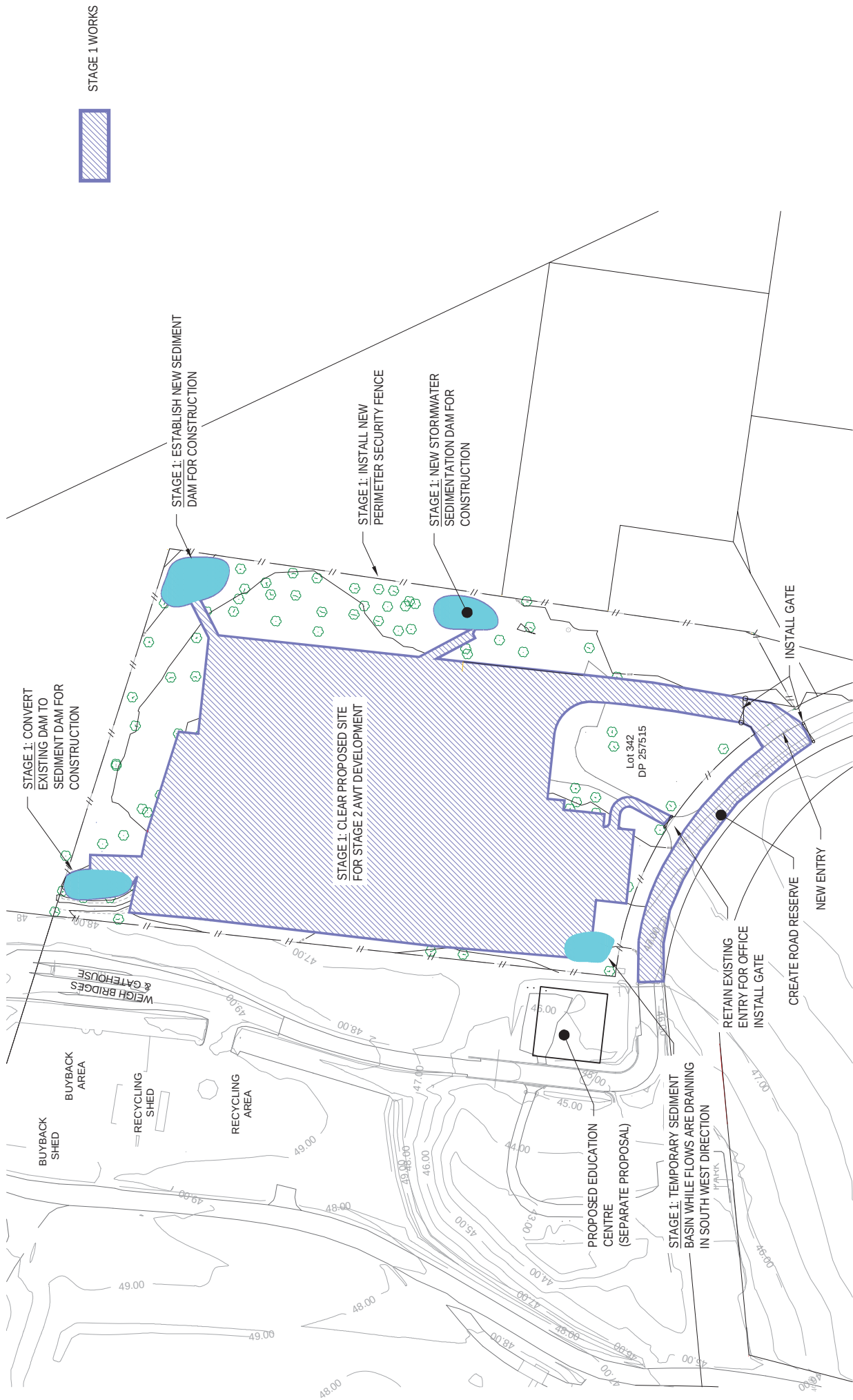
Date | SEPT 2015

Figure 1.1



PRELIMINARY MASTER PLAN





SHOALHAVEN CITY COUNCIL
WEST NOWRA RRP

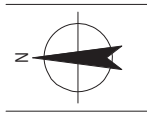
Job Number | 21-22855
Revision | A

Date | SEPT 2015

Figure 1.2

PROPOSED STAGE 1 WORKS

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7100 E sydmall@ghd.com W www.ghd.com



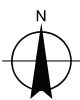
0 15 30 45m
SCALE 1:1500 AT ORIGINAL SIZE



LEGEND

- Site boundary
- Major Roads
- Highways

Paper Size A4
0 160 320 640 960 1,280
Metres
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56



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Revision 0
Date 14 Sep 2015

Proposal Site Location

Figure 1.3

1.5 Secretary's Environmental Assessment Requirements and agency requirements

The specific SEARs and agency requirements addressed in this report are summarised Table 1-1.

Table 1-1 Director-General's Requirements

Assessment requirements	Where addressed in report
Air quality – including odour, dust and greenhouse gas emissions in accordance with relevant EPA guidelines. This assessment must consider any potential impacts on nearby private receptors.	Section 8, Section 9
Potential for air pollution, including odours, organic vapours and particulate matter	Section 8, Section 9
The management of odours and mitigation measures to control potential odours generated by the proposal	Section 10
Dust management and controls	Section 10
Describe topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals.	Section 2
Provide and analyse site representative data on meteorological parameters	Section 5

1.6 Scope and structure of the report

1.6.1 Scope of report

This air quality assessment is based on the following scope of works:

- Initial review of project information provided by SCC covering the facility layout and the operational sequence, including any site layout plans and elevations. In addition any odour emission data from other SCC composting operations will be reviewed
- Undertake a site visit to ascertain the local terrain and the nearest sensitive receptors / residences
- Develop an inventory of source odour emission rates (OERs) for the facility from SCC data and from other green waste facilities. This inventory will be supported by a project memo from GHD to SCC which summarises the results of the review, recommends and justifies OERs for the site
- Synthesise meteorological data for the site using Nowra Airport AWS
- Conduct a Level 2 modelling assessment to predict odour and dust impact at the nearest residences during operation
- Determine if compliance to the OEH/EPA odour criterion is met
- Determine suitable mitigation measures if required in order to meet criterion
- Report on the analyses conducted above.

1.6.2 Structure of report

This assessment comprises the following sections:

- Introduction – including an overview of the project and the scope of the report

- Site Description
- Current and proposed project activities
- Environmental guidelines for green waste composting and landfills
- Approach to Assessment
- Existing Environment and Meteorology
- Estimated Emissions
- Dispersion modelling
- Assessment of Impacts
- Mitigation measures – details measures to be undertaken in order to avoid, minimise and mitigate the potential impacts of the project
- Conclusions – a summary of the findings of the assessment.

2. Site description

2.1 Site location and ownership

The proposal site is approximately five km to the west of the Nowra Central Business District and is accessed from Flatrock Road, off Yalwal Road in Mundamia (refer to Figure 1.3).

The proposal site is adjacent to the existing landfill and is located on an approximate 3.6 ha parcel of land (Lot 342 DP 257515), which is owned by the proponent. The land is currently used as an animal shelter with associated kennels and paddocks for impounded and surrendered animals.

2.2 Site description

The land is currently occupied by an animal shelter and associated buildings. The majority of it is cleared with some small paddocks around the kennels. There is approximately 0.5 ha of relatively intact (though degraded) vegetation in the south of the lot where the site fronts Flatrock Road.

Around the boundaries and scattered over the northern half of the land are numerous remnant and regrowth Scribbly Gums (*Eucalyptus sclerophylla*) and Red Bloodwood (*Corymbia gummifera*) with small areas of native shrubs and occasionally mown or slashed vegetation.

There are a number of small dams scattered through the north of the site. The current entrance to the site is currently off Flatrock Road. There is a small carpark in front of the animal shelter building.

Nowra Sandstone, derived from the Shoalhaven Group, underlies the site. This Early Permian geology consists of quartz sandstone with minor siltstone and conglomerate beds. Soils derived from this geology are typically poorly drained with low nutrient levels. Low hills, ridges and valleys are typically associated with these soils (Hyder 2007).

The entire site is flat, located on a broad crest landform, with the terrain sloping down outside the proposal site to waterlines further to the east and west. Some dense grass coverage and vegetation exists in the south portion of the site.

The site is approximately 1.2 km from the Shoalhaven River. The closest waterlines are represented by Cabbage Tree Creek, Sandy Creek which are located approximately 300 m and 800 m from the study area respectively. Both of these Creeks are ephemeral.

2.3 Surrounding land uses

The proposal site is in close proximity to the Office of Environment and Heritage (OEH) Nowra Area Office and Depot (refer to Figure 1.3). A small number (approximately six) of rural residential properties are located approximately 700 m south of the proposal site and the Shoalhaven Campus of the University of Wollongong is located approximately 1.3 km to the east.

The existing West Nowra landfill is immediately adjacent the proposal site – to the west.

The remaining land surrounding the proposal site is undeveloped bushland – primarily the Bamarang Nature Reserve and/or land owned by the Nowra Local Aboriginal Land Council and the proponent.

2.4 Sensitive Receptors

A sensitive receptor is defined in the DEC odour assessment guideline¹ as a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. Figure 2.1 shows the location of the existing nearby sensitive receptors in relation to the project. The nearest sensitive receptors will be those workers on site at the RRP. The nearest residential receptors are approximately 700 m to the south. The nearest sensitive receptors to the site are listed in Table 2-1.

The OEH offices to the east of the site will only be in use during standard daytime office hours. Worst case odour impacts would generally occur outside standard office hours.

Table 2-1 Nearest sensitive receivers and land uses

Receptor type	Receptor ID	Receptor Address
Residential	R1	43 Flatrock Road, Mundamia
	R2	41 Flatrock Road, Mundamia
	R3 to R6	3 Flatrock Road, Mundamia
	R7	18 Bamarang Road, Mundamia
	R8	Jim Da Silva Farm, 38A Old Bamarang Road, Mundamia
	R10	56 Stonegarth Road, Mundamia
Educational	R9	University of Wollongong Shoalhaven Campus
Office	R11	OEH buildings adjacent to the West Nowra Recycling and Waste Facility

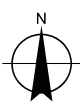
¹ DEC 2006 "Assessment and management of odour from stationary sources in NSW – technical framework", November 2006



Legend

- Site boundary
- Sensitive receivers

Paper Size A4
0 125 250 500
Metres



Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

Shoalhaven City Council
West Nowra Resource Recovery Park
Air Quality Assessment

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Nearest sensitive receptors

Figure 2.1

3. Current and proposed operations

3.1 Current operations on-site

Current activities at the West Nowra Recycling and Waste Facility include:

- Landfilling of approximately 65,000 tonnes per year of general solid waste
- Composting of approximately 2,865 tonnes per year of green waste

3.1.1 Landfilling

The current input rate for landfilling of waste at the West Nowra Recycling and Waste Facility is 62,000 tonnes per year (mixed waste - Class 1 and 2 (putrescible and non-putrescible)).

The current operating hours for the site are 8 am – 5 pm Monday to Friday and 8 am – 5 pm on Saturdays, Sundays and public holidays.

Figure 3.1 shows the current location of landfilling tipping face, the intermediate and final capped areas and the leachate pond.

3.1.2 Green waste composting

The onsite composting produces a range of products suitable for mulch and compost applications. Mulch products are extensively used in ornamental landscaping, while composting products are used as soil conditioners for agricultural, horticultural and restoration projects.

The current green waste composting operations are summarised in Table 3-1 below and is currently undertaken on un-vegetated areas of the landfilled areas shown in Figure 3.1.

Table 3-1 Current green waste composting process

Stage	Activity	Duration
1	Receival, decontamination and grinding/shredding Incoming garden organics is delivered to the receival/ decontamination area and shredding area where gross contaminants are removed, and the organics ground and/or shredded.	1 to 4 weeks
2	Static stockpile - Watering and Turning The material is then stockpiled for approximately three months – some water may be added at this stage to maintain moisture levels. During this phase the compost may be turned (every two weeks or monthly) and watered. The temperature of the piles is monitored regularly.	3 months
3	Windrows for maturation After approximately three months the material is then formed into windrows for further maturation. The windrows are turned and watered as required. Turning generally occurs weekly. The temperature of the piles is monitored regularly.	3 months
4	Matured product At the completion of the maturation phase the matured compost is stored ready to be sold or given back to the community.	-



3.2 Proposed operations

3.2.1 Landfill

There are no proposed changes to the current landfill operating conditions. The proposal will decrease the volume of waste being disposed of to landfill and therefore the current scenario for landfilling is considered worst-case.

3.2.2 Green waste composting

A proposed technology for the composting facility has not yet been selected. However it is anticipated that this will include:

- A composting facility to process up to 65,000 tonnes of waste per annum from both domestic and commercial waste sources
- A materials recovery facility for sorting through up to 40,000 tonnes of dry (non-putrescible) solid wastes per annum from both domestic and commercial waste sources
- A sorting and recovery facility for sorting of approximately 10,000 tonnes per annum of construction and demolition (C&D) waste
- Other stockpile areas for storing and processing approximately 10,000 tonnes per annum of recyclable materials, such as green waste, scrap steel and concrete.

The composting processes have not been selected but are expected to involve either tunnel (in-vessel) composting, or composting in bays in a ventilated composting hall. Whichever process is chosen, there will be a need for odorous exhaust air from the composting processes to be treated by a biofilter or other odour control process (OCP), before being discharged to the external environment.

After the initial weighing of each truckload, the next operation would be an inspection of the incoming waste materials, after unloading onto the floor/apron. If food and garden organics are processed, any contamination would be removed from the stockpiles of raw material whilst it is on the floor.

It is likely that the material would then be conveyed past a manual picking line, where people stand alongside a conveyor belt, and the material is visually inspected before being stockpiled prior to a shredder. The material would be loaded into a shredder using a front end loader or grab system. The shredder would be used to grind the material into fine (< 50 mm) material so that it can be composted.

If mixed waste is processed, rather than food and garden organics, any large items would first be removed from the waste manually, whilst the material is on the floor. A manual picking line using a conveyor belt would be used to remove any hazardous items, and other items unsuitable for composting. The material would then likely pass through one or more rotating trommels and screens, with the fine fraction of the material passing through the screens and onto a conveyor to be transported to the composting area.

Material rejected by the facility would be disposed of at the existing landfill, or otherwise managed in accordance with regulatory requirements e.g. car batteries or gas cylinders.

Staff would be trained to identify hazardous items and to implement procedures for their handling and management/disposal.

3.2.3 Concrete

Under the proposal the total amount of concrete received at the site would increase. Concrete would be stockpiled until there is sufficient amount to be crushed by a mobile crusher unit. It is

considered that worst case dust impacts from this activity would remain the same however as this activity is only undertaken on an as-needs basis.

4. Air quality criteria

This section considers the key guidelines/criteria which relate to and are relevant to the following potential impacts arising from green waste composting and landfilling, namely:

- Odour; and
- Dust.

4.1 Legislation

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes, amongst other things, the procedures for issuing licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an environmental protection licence (EPL) and comply with the conditions of that licence. Council holds an EPL for the West Nowra Recycling and Waste Facility (EPL No. 5877).

The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act).

The POEO Act also addresses the issue of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

4.2 Guidelines

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (DEC, 2005) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

The *Technical framework for the assessment and management of odour from stationary sources in NSW* (DEC, 2006) introduces a system to help protect the environment and the community from the impacts of odour emissions while promoting fair and equitable outcomes for the operators of activities that emit odour.

4.3 Odour criteria

The Approved Methods defines odour criteria and then specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are:

- The **F**requency of the exposure
- The **I**ntensity of the odour
- The **D**uration of the odour episodes
- The **O**ffensiveness of the odour
- The **L**ocation of the source.

These factors are often referred to as the FIDOL factors.

The odour criterion is defined to take account of two of these factors (**F** is set at 99th percentile; **I** is set at from 2 to 7 OU). The choice of criterion odour level has also been made to be

dependent on the population of the affected area, and to some extent it could be said that population is a surrogate for location – so that the **L** factor has also been considered. The relationship between the criterion odour level **C** to affected population **P** is given below:

$$C = [\log P - 4.5] \div -0.6 \quad \text{equation 1}$$

Table 4-1 lists the values of **C** for various values of affected populations as obtained using equation 1.

Table 4-1 Odour criteria for the assessment of odour (DEC, 2005)

Population of affected community	Odour performance criteria (nose response odour certainty units at 99th percentile)
Single Residence ($\leq \sim 2$)	7
~ 10	6
~ 30	5
~ 125	4
~ 150	3
Urban ($\sim 2,000$)	2

The criteria assumes that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be encountered. The criterion of 2 OU at the 99th percentile is considered to be acceptable for the whole population.

The criteria have also been specified at an averaging time of nominally 1 second. The choice of the short averaging time recognises that the human nose has a response time of less than 1 second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the Ausplume dispersion model (used in this assessment) cannot predict concentrations for a 1 second average, a ratio between the 1 second peak concentration and 60 minute average concentration has been applied. This is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (i.e. near or far-field), and values are tabulated in the Approved Methods.

4.4 Project odour criterion

The proposal site is surrounded primarily by vegetated land including the Bamarang Nature Reserve to the west. There are less than 10 houses within a 1 km radius of the proposal site with an expected population of less than 30 people. This population is present adjacent the existing West Nowra Recycling and Waste Facility, and with this density, equation 1 gives an odour criterion of 5 OU to apply to this project.

4.5 Dust

There is potential for dust emissions during the construction and operational phases of the project. However, the scale of construction and the comparatively small volumes of earth movement are broadly comparable to that needed to establish an industrial warehouse. While it is essential to manage and minimise dust emissions during construction, the impact of dust emissions are generally not modelled unless the project scale is large, or there are exceptional circumstances.

In this case, the site operations are to be located within enclosures with all air being ventilated through a biofilter prior to discharge into the atmosphere. Hence dust impacts from the proposal will not increase from the present levels at the site. It has not been considered necessary to model dust emissions.

Dust emissions during construction would be managed via a Construction Environmental Management plan (CEMP), and during operation via an Operational EMP. Recommendations to minimise dust emissions are provided in Section 11.3.

In the operation phase, the requirement that compost be kept moist so that the micro-organisms survive, means that dust emissions during handling of compost would be minimal.

In practice, the impact of dust emissions is minimised by conscientious implementation of a facility dust management plan (DMP) – in some cases supplemented by real-time monitoring of dust levels.

4.5.1 Dust criteria

Table 4-2 and Table 4-3 summarise the current air quality assessment criteria for in-air dust and deposited dust prescribed in the Approved Methods.

Table 4-2 NSW criteria for particulate matter

Pollutant	Criterion	Average period
Total Suspended Particulate Matter (TSP)	90 µg/m ³	Annual
Particulate Matter < 10 µm (PM10)	50 µg/m ³	24 hour maximum
	30 µg/m ³	Annual

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. Table 4-3 shows the maximum acceptable increase over existing dust levels.

Table 4-3 NSW assessment criterion for dust deposition

Pollutant	Average Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited Dust	Annual	2 g/m ² /month	4 g/m ² /month

5. Existing environment and meteorology

5.1 Regional climate and prevailing meteorology

The climate in the Nowra area is similar to that of the broader Wollongong region with warm to hot summers and cool to mild winters. The local climate at the West Nowra site is affected by broader regional patterns of synoptic pressure and wind with embedded weather systems.

Synoptic features vary in intensity and location according to the season. For instance, during summer a high-pressure belt is usually found over or just to the south of Australia, bringing warm weather while the subtropical easterlies cover most of the continent. In winter, the subtropical high-pressure belt is usually located further north over the continent, allowing westerly winds and occasional to frequent strong cold fronts to affect southern Australia.

The mean daily maximum temperatures range from 26°C in summer to 16°C in winter, and the mean daily minimum temperatures range from 16°C in summer to 6°C in winter. The West Nowra area experiences significant diurnal and seasonal variations in meteorological conditions.

According to meteorological data, the average rainfall in the region is 1,112 mm (Bureau of Meteorology). Average monthly rainfall ranges from between 57 mm and 124 mm, and the driest months are in winter and early spring, with the higher rainfalls experienced between November and March.

5.2 Wind pattern

Local wind climate largely determines the pattern of off-site odour impact. The characterisation of local wind patterns requires accurate site-representative hourly recordings of wind direction and speed over a period of at least a year. The nearest meteorological data available is from the BOM Nowra RAN Air Station AWS approximately 7 km to the south of the site.

The 12-month on site dataset for the period November 2009 – October 2010 was used for this project and created following the Approved methods for modelling and assessment of air pollutants in NSW.

The effect of wind on odour dispersion patterns can be examined using the general wind climate and atmospheric stability class distributions. The general wind climate at a site is most readily displayed by means of wind rose plots, giving the incidence of winds from different directions for various wind speed ranges.

The features of particular interest in this assessment are: (i) the prevailing wind directions and (ii) the relative incidence of more stable light wind conditions (these define peak impacts from ground-based sources).

5.2.1 Annual wind rose

The average predicted annual wind rose for the site is shown in Figure 5.1 and indicates that predominant annual average wind directions are from the west quadrant from the northwest around to the south-southeast. Typical of this region there is a westerly component, with a lesser easterly component. The annual average wind speed was 4.0 m/s. The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 6 m/s) are from the west and south, while the largest proportion of light winds (<2 m/s) are also from the west.

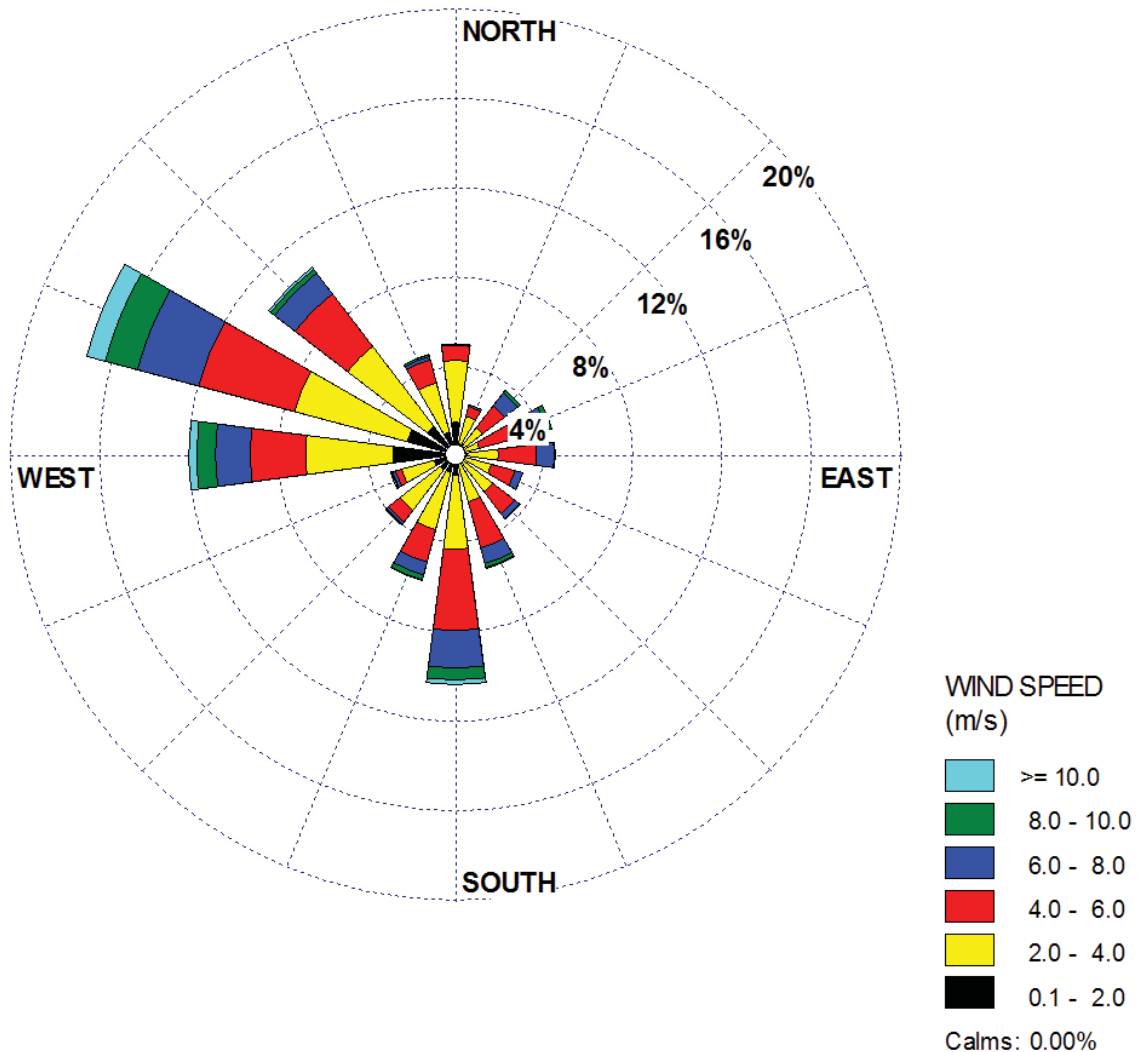


Figure 5.1 Annual wind rose

5.2.2 Seasonal wind roses

The seasonal wind roses in Figure 5.2 indicate that:

- In winter, the winds are predominantly from the west-northwest. This observation reflects cool air drainage flows from the hills and mountains from the surrounding land in the west, as well as with the synoptic winter westerlies associated with the pre-frontal (stronger) winds; while
- In summer, the majority of stronger winds are from the south/ south east reflecting the synoptic sub-tropical ridge migrating to the south of this location during the warmer months of the year and the summertime sea breeze in the afternoon and evening.

Autumn and spring are transitional seasons with a mixture of both winter and summer observations, with peak incidences from the west, west-northwest and south.

The seasonal incidence of high winds (>6 m/s) is greatest in winter, and lowest in autumn, while the incidence of light (<2 m/s) winds is greatest in autumn.

The direction and high proportion of light winds in autumn and spring are predominantly westerly and north-westerly. These air flows are likely to be associated with high stability, and can be expected to define the directions of poorest dispersion for low lying odour emission sources. As the site is located inland with prominent stable winds from the west and northwest, the potential for odour impact is somewhat increased towards the east and southeast.

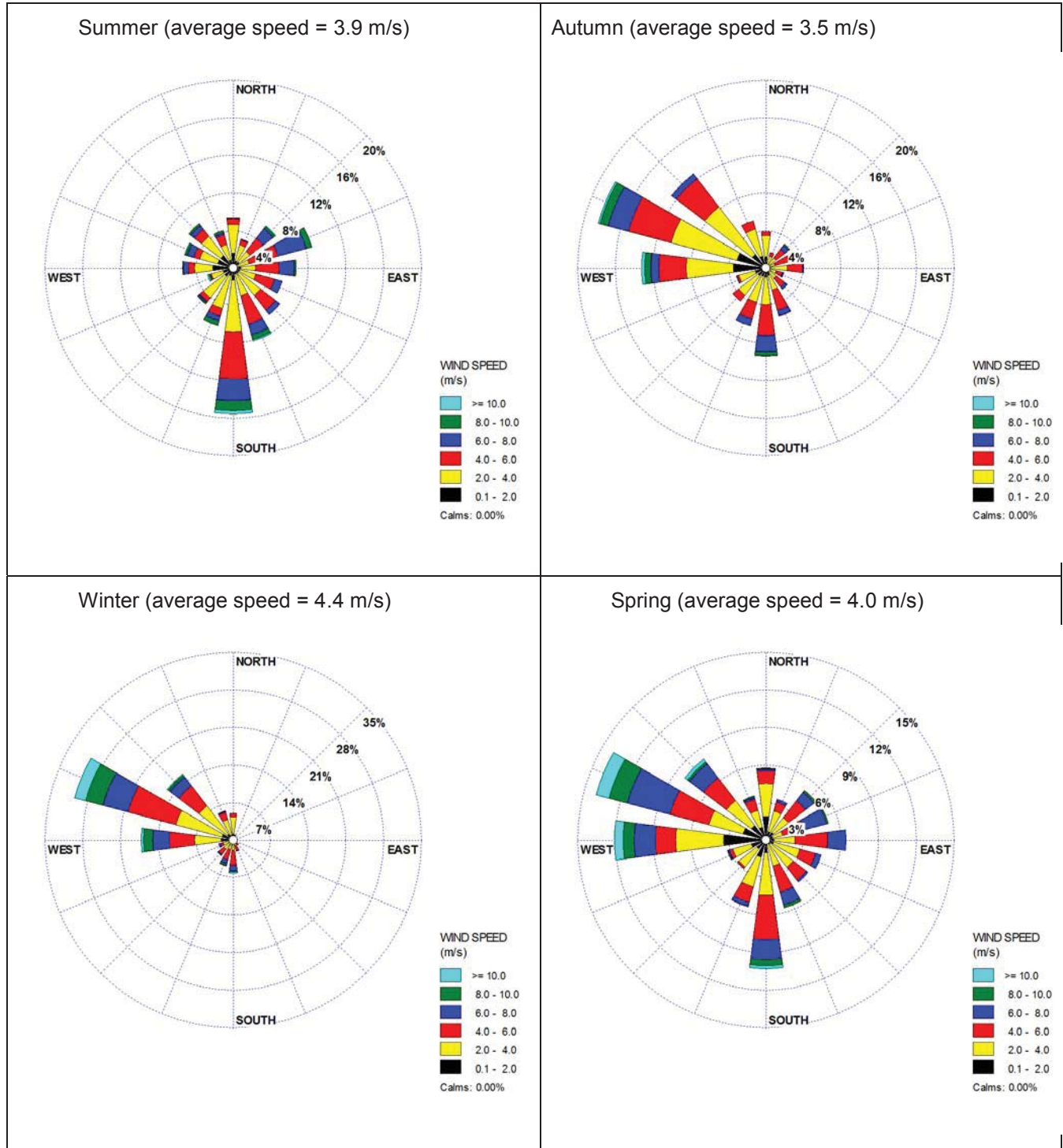


Figure 5.2 Seasonal wind roses

5.3 Annual pattern and seasonal variation in atmospheric stability

In the Pasquill/Gifford atmospheric stability scheme, stability is classified into six classes A through F. The A, B and C stability classes represent strongly, moderately and slightly unstable atmospheres respectively. Under unstable conditions dispersion of emissions from near ground sources is good due to convectively vertical turbulent mixing. The stability category D denotes neutral atmospheric conditions (strong winds in moderate temperatures or lighter winds on overcast to partly cloudy days). Categories E and F denote slightly and moderately stable atmospheres when dispersion is poorest, as vertical mixing of air is suppressed. Stable atmospheric conditions occur in the absence of strong gradient winds, and mostly on nights with clear skies. They are often associated with ground-based radiation force temperature inversions, sometimes with fog, mist or frost.

Neutral stability (D class) conditions generally occur most frequently and along with the prevailing wind direction can indicate the most common direction for potential odour impact. Under night-time E and F class conditions, odour emissions from ground based sources result in a downwind plume that is detectable to a greater distance than during the day with associated neutral or unstable atmospheric conditions. It is commonly these conditions that result in odour complaints at maximum range.

Figure 5.3 shows the stability rose for the entire data period. Neutral atmosphere (D) comprises 50.8% of incident time while the A, B and C class contribute unstable atmospheres 20.6% of the time and the stable E and F conditions contribute 28.6%. Figure 5.3 shows that the majority of stable winds are from the northwest, west-northwest and west.

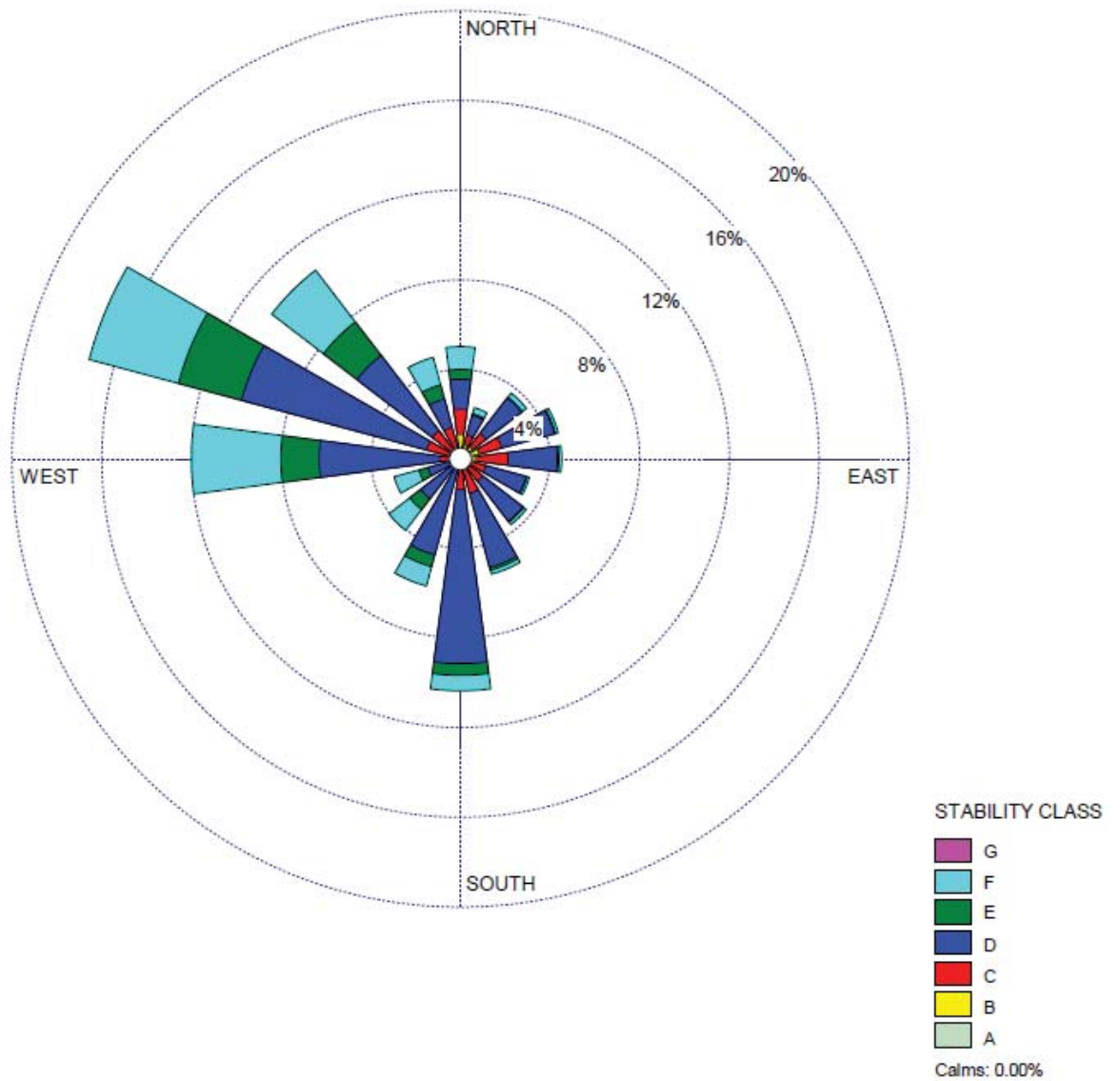


Figure 5.3 Annual stability rose

Figure 5.4 shows the following seasonal variation trends in atmospheric stability:

- In Summer, stable winds predominate from the west and south
- In Autumn, stable winds predominate from the west to northwest
- In Winter, stable winds predominate from the west to northwest
- In Spring, stable winds predominate from the western quadrants

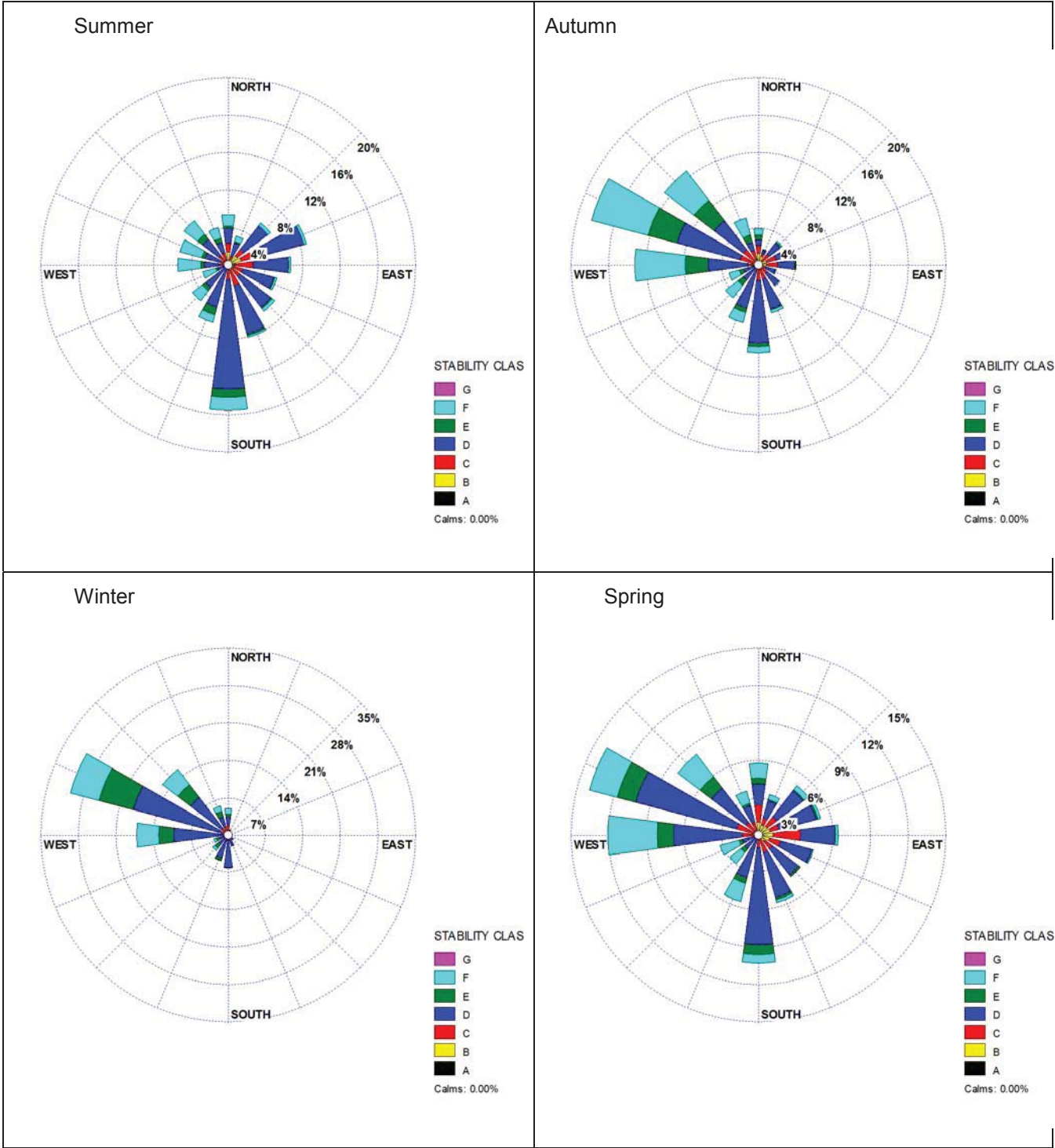


Figure 5.4 Seasonal stability roses

5.4 Background air quality

The NSW EPA used to operate an air quality station at the Nowra Sewage Treatment Plant however was decommissioned in December 2001. The nearest existing EPA air quality monitoring station is at Albion Park South in the Illawarra region approximately 40 km north of the site. Air quality data from the Albion Park site was analysed for the last five years (2009 to 2013).

Annual PM₁₀ averages for daily mean levels, daily max levels and number of days exceeding the criteria for Albion Park were calculated. The results are detailed in Table 5-1 and Table 5-2 and shown in Figure 5.5 and Figure 5.6. No other relevant air quality data is available in the area.

Table 5-1 Albion Park PM₁₀ average annual daily mean levels, µg/m³

Year	Annual mean	70 th percentile	Number of days exceeding criteria
2009	18.3	21.5	45
2010	14.0	16.2	14
2011	13.6	15.7	10
2012	13.6	15.3	9
2013	14.7	16.5	9
Five yearly mean	14.8	17.0	17

Table 5-2 Albion Park PM₁₀ average annual daily max levels, µg/m³

Year	Annual mean	70 th percentile	Number of days exceeding criteria
2009	42.8	42.7	191
2010	29.3	34.3	132
2011	28.9	33.3	129
2012	31.2	33.8	146
2013	33.3	35.6	155
Five yearly mean	33.1	35.9	151

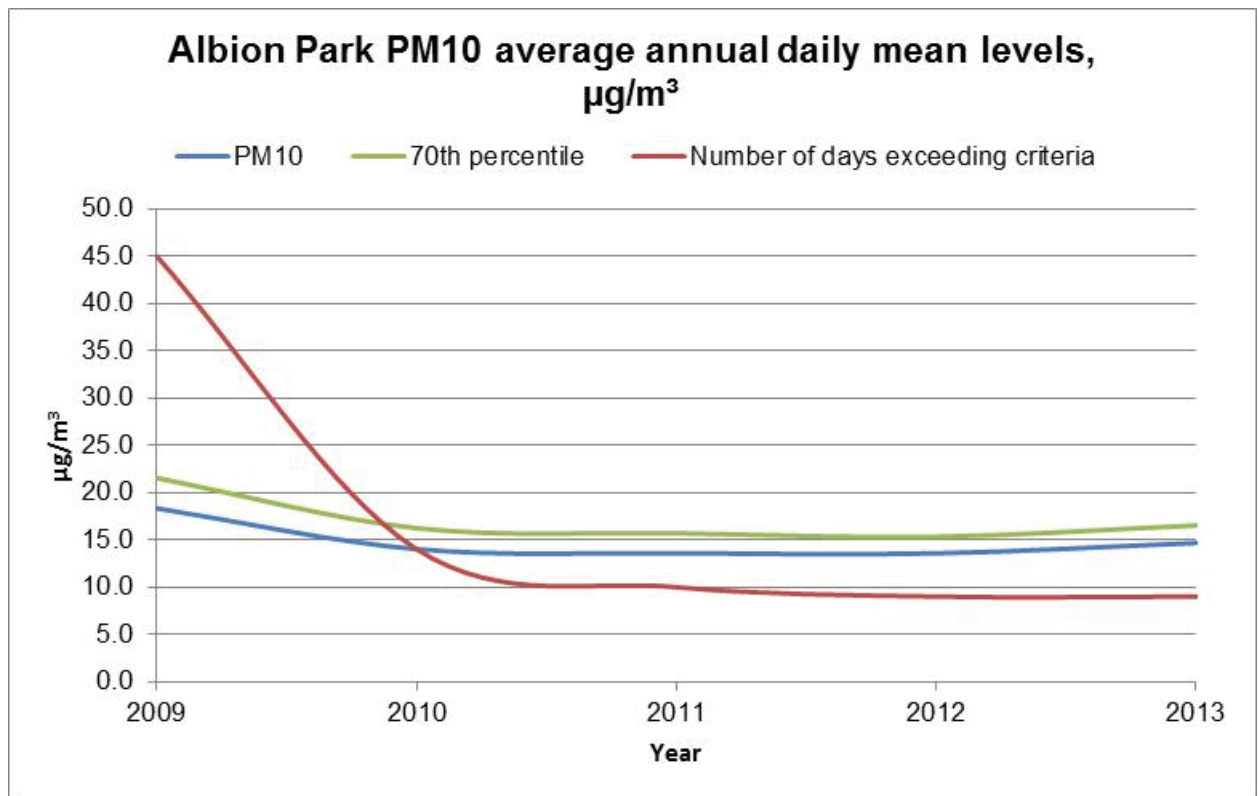


Figure 5.5 Albion Park PM10 average annual daily mean levels, $\mu\text{g}/\text{m}^3$

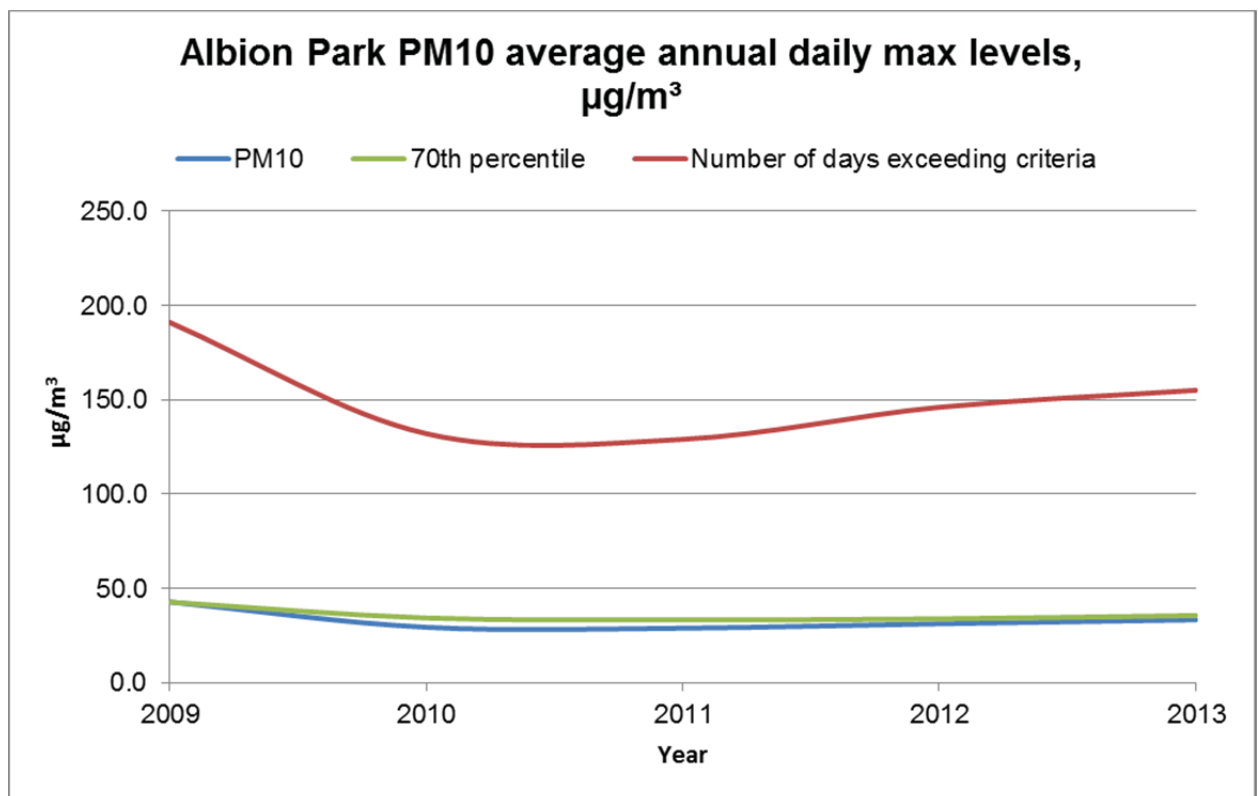


Figure 5.6 Albion Park PM10 average annual daily max levels, $\mu\text{g}/\text{m}^3$

5.5 Complaint history

No odour complaints were provided by Shoalhaven City Council.

6. Estimated emissions – landfill

6.1 Landfill tipping face

No odour sampling data was available for the site and therefore odour emissions data from other similar sites have been used in this assessment. The data used is considered representative of a typical landfilling operation

Screening level OER data for the West Nowra Recycling and Waste Facility were taken from previous measurements of the municipal tipping face at SITA's municipal landfill at Taylors Road, Lyndhurst, Victoria. A description of the odour monitoring conducted at Lyndhurst is given below.

In-field measurements of odour emissions from the active tipping face for municipal waste were conducted at the Lyndhurst site. Direct methods of OER measurement for extended sources (such as use of flow-through hoods and isolation flux chambers) could not readily be used as: (i) the operations of delivering loads to the tipping face by truck and the moving of waste to the tipping face by dozer would have to cease; (ii) the emitting surface is highly heterogeneous and is very uneven, making the placement and sealing of hoods or chambers difficult.

The indirect method of measuring the down-wind plume odour levels across a transect at short range was adopted instead. This method required concurrent sampling at each station on the transect, and required the atmospheric conditions (wind speed and atmospheric stability category) at the time of sampling to be measured/calculated. The method also required dispersion modelling to back-calculate the specific odour emission rate (SOER), (where $SOER = OER/\text{unit area}$) of the active tipping face.

Sampling programme

Sampling of the downwind plume was done at three stations along a transect at short (~20 m) range from the downwind limit of the tipping face. In addition, an upwind station was used so as to measure background ambient odour levels. All samples were done in duplicate giving 8 samples per plume sampling.

The sampling programme at Lyndhurst was conducted in winter. The municipal tipping face and the prescribed waste trench were each sampled twice, morning and at early afternoon. The placing of the transect lines and the sample positions were dependent on the wind direction at the time, and on the need to sample the plume from each source before they merged at greater distance downwind.

Each sampling was conducted synchronously at all four stations for 5 minutes. Local wind speed was measured using a 0.1 m multivane anemometer mounted on a 2 m mast. A series of ten, 30 second averaged wind speeds were recorded for each sample.

The odour levels showed that the downwind stations return values clearly above the upwind stations – i.e. the plume odour level can be distinguished against the background ambient levels. The afternoon surveys also show increased odour levels compared to that measured in the morning – reflecting the effect of increase in ambient temperature on odour emissions.

The measurements of odour level upwind and downwind of the tipping face were then used in a back-calculated procedure as described below.

Back-calculation of SOER

The back-calculation of SOER for the municipal tipping face showed morning values of 4.1 OUm/s respectively, increasing to 36 OUm/s by mid-afternoon when most of the waste stream had been delivered and placed.

The Lyndhurst landfill was open to receive waste from 6 am till 5.45 pm. Outside these hours both the trench and the active face are covered with a 300 mm layer of soil - substantially reducing emissions to air. Table 6-1 shows the time varying values of SOER adopted for the modelling of odour impact.

Note that a linear time variation in SOER was assumed between each pair of measurements. Outside the measurement times (but within tip operating times) the sources were assumed to 'plateau' at the same value as the nearest measurement.

Outside tip operating hours (i.e. 5.45 pm to 6 am) the sources are covered with soil, and a nominal SOER equal to 1% of the peak measured value was adopted.

Table 6-1 Specific odour emission rate time variation measured at Lyndhurst

Time, hr	1	2	3	4	5	6	7	8	9	10	11	12
SOER Municipal	0.36	0.36	0.36	0.36	0.36	0.36	4.1	4.1	4.1	4.1	12	20
SOER Prescribed	0.41	0.41	0.41	0.41	0.41	0.41	4.4	4.4	4.4	4.4	14	23
Time, hr	13	14	15	16	17	18	19	20	21	22	23	24
SOER Municipal	28	36	36	36	36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
SOER Prescribed	32	41	41	41	41	0.41	0.41	0.41	0.41	0.41	0.41	0.41

6.2 Application to West Nowra Recycling and Waste Facility

Table 6-2 below gives the adopted tipping face SOERs at the West Nowra Recycling and Waste Facility based on the Lyndhurst landfill measurements for current operations. The SOERs have been calculated for the current licenced tipping rate of 63,284 tonnes per annum with an average tipping face size of 625 m² (corresponding to a tipping face of size 25 m by 25 m, based on information provided by Council).

The hourly SOERs have been calculated based on the landfill operating hours of 8 am to 5 pm, consistent with current operations. Emissions from the tipping face are assumed to occur up until 5 pm, based on progressive covering with a 300 mm layer of soil from 3 pm until 5 pm.

It is noted that seasonal variation in the landfill tipping face SOER has not been accounted for in conducting the assessment, as GHD is not aware of any recorded odour measurements from a landfill tipping face during summertime. It can be expected that during summer the SOER will increase, however as this could not be quantified without actual measurements the modelling did not account for this.

It is noted, however, that the output of the maximum (99th percentile) odour impact would most likely be driven by the winter/autumn time climate as it is the time of year with the poorest dispersion conditions. Thus, although the landfill SOER may be higher on a summer afternoon, the predicted odour impact may not change significantly from what has been predicted using the winter time odour measurements.

Table 6-2 SOER Data for municipal tipping face

Time, hr	Reference landfill ¹	West Nowra Recycling and Waste Facility, current ^{2,3}
1	0.36	0.2
2	0.36	0.2
3	0.36	0.2
4	0.36	0.2
5	0.36	0.2
6	0.36	0.2
7	0.36	0.2
8	4.4	2.5
9	4.4	2.5
10	4.4	2.5
11	12	7.2
12	20	12.1
13	28	16.9
14	36	21.7
15	36	21.7
16	36	21.7
17	36	21.7
18	0.36	21.7
19	0.36	0.2
20	0.36	0.2
21	0.36	0.2
22	0.36	0.2
23	0.36	0.2
24	0.36	0.2

Note 1: Odour Levels measured to B2 Protocol

Note 2: Pro-rated from Lyndhurst landfill based on throughput ratio

Note 3: Note that these SOERs were taken when the B2 olfactometry protocol was enforced. While not acknowledged by EPA, the new Australian olfactometry standard AS4323.3 yields results that are on average twice that of the B2 method. Thus a factor of two has been applied to the SOER's.

The OER data given in Table 6-2 for the West Nowra Recycling and Waste Facility has been calculated from the Lyndhurst landfill data by assuming the tipping face OER is proportional to daily throughput, T (tonnes).

Hence:

$$\text{SOER}|_{\text{WNRWF, Current/ Future}} = \text{SOER}|_{\text{Lyndhurst}} \times \frac{A_{\text{Lynd}}}{A_{\text{WNRWF}}} \times \frac{T_{\text{WNRWF}}}{T_{\text{Lynd}}}$$

Equation 1

Where A is the area of the tipping face.

Current Operations at West Nowra Recycling and Waste Facility

Then for $A_{\text{Lynd}} = 33 \text{ m} \times 46 \text{ m} = 1,518 \text{ m}^2$

And $A_{\text{WNRWF}} = 25 \text{ m} \times 25 \text{ m} = 625 \text{ m}^2$

And with $T_{\text{Lynd}} = 600 \text{ to } 800 \text{ tpd} \approx 700 \text{ tonnes per day (tpd)}$

And $T_{WNRWF} \approx 174 \text{ tpd}$

Equation 1 becomes:

$$\begin{aligned} \text{SOER}|_{WNRWF} &= \text{SOER}|_{Lynd} \times \frac{1518}{625} \times \frac{174}{700} \\ &= 0.6 \times \text{SOER}|_{Lynd} \end{aligned}$$

6.3 Emissions from intermediate capped areas

Emission rates from area sources at a landfill are difficult to measure due to the heterogeneous nature of the source. Unlike stack emissions, area emission rates are dependent upon atmospheric conditions including atmospheric pressure, wind speed, wind direction, temperature and stability. Furthermore, the generation of landfill gas is a complex process that will change over time. GHD has used data regarding emissions from intermediate capped areas from a site odour audit² conducted by Holmes Air Sciences (HAS).

The measurements on the intermediate capped areas have been made utilising the IFC method, which is known to underestimate emissions on semi-permeable surfaces³. In addition, the IFC method suffers from the limitation of a small 'footprint' (~40 cm diameter) for a source that will have spatial variability. However, as no other data using other than IFCs was available, the HAS data was used.

The odour emission rate will vary depending on the state of capping. As each stage of the landfill is completed, an intermediate cover will be placed over each layer and will be seeded to aid in reducing wind erosion while other layers are filled.

Measurements made over an intermediate cap indicate a specific odour emission rate of the order of 0.084 OU/m/s.

There were no odour measurements conducted on the final capped areas in this odour audit. GHD considers that the odour from the final capped areas would be negligible.

The size and location of the intermediate cap modelled area is given in Table 6-3 below and shown in Figure 3.1.

Table 6-3 Intermediate and capped area sources and SOER

Cell type	Area m ²	SOER (OUm/s)
Intermediate capped	71,717	0.0841

6.4 Landfill leachate pond

A leachate pond SOER of 0.28 OU/m²/s was sourced from measurements taken at the Armidale Landfill⁴. One active leachate pond has been identified at the West Nowra Recycling and Waste Facility. The pond OER of 0.28 OU/m²/s was applied to the emitting surface area of the pond (6620 m²).

² Odour Audit: Lucas Heights Waste and Recycling Centre for WSN Environmental Solutions by Holmes Air Sciences May 2006

³ Gostellow et al "Sampling for Measurement of Odours" Scientific and Technical Report No 17, IWA publishing UK. 2003

⁴ Air Quality Impact Assessment for Armidale Landfill by Homes Air Sciences, June 2009

6.5 Comparison of component landfill odour sources

Table 6-4 summarises the area source geometries and odour emission rates estimated for the West Nowra Recycling and Waste Facility landfill, and gives the percentage contribution of each source to the total landfill odour emission rate. It can be seen that when the active tipping face is open, it is the largest single odour source, increasing from about 16% of the total in the morning up to 63% in the afternoon. By comparison the intermediate capped cells contribute about 70% during non-operating times, reducing to 63 % in the morning and about 28% in the afternoon. The leachate pond contribution is negligible compared to the emissions from the landfill cells.

On the basis of the IFC measurements of the intermediate capped cells, the landfill OER in non-operating hours, at 625 OUm³/s is low compared to the values when the active tipping face is open (~1,500 OUm³/s in the morning, and ~13,500 OUm³/s in the afternoon).

However, the significance of the odour emission rates depend on the dispersion conditions and these vary through the day.

Table 6-4 Comparison of component landfill odour sources

Source	Area m ²	SOER OUm/s	OER OUm ³ /s	Contribution % non-op	Contribution % am	Contribution % pm
Active Tipping face	625	Non-op 0.2	625	7.3		
		am 2.5	1,563		16.5	
		pm 21.7	13,563			63.2
Intermediate capped cell	71,717	0.084	6,024	70.8	63.8	28.1
Leachate Pond	6620	0.28	1,854	21.7	19.7	8.6
Total non op			8,503	100		
Total am			9,441		100	
Total pm			21,441			100

7. Estimated emissions - green waste composting

7.1 Characterisation of source odour emission rates

In order to predict the maximum potential odour impact associated with operation of the existing site and proposal, the identified odour emission sources will be characterised as follows:

- **Fugitive emissions and transfer points:** These sources have been characterised with reference to odour testing at an existing facility, or by using data from other similar composting facilities;
- **Static Piles** The static piles of green waste have been characterised with reference to odour testing at an existing facility (ANL⁵);
- **Maturation Windrows:** Odour emission rate (OER) data has been obtained from testing of trial windrows that were formed from the composted product from Veolia's in-vessel facility at Dandenong, and which were set up at Veolia's Bangholme facility. The tests were conducted at different elapsed times during the 4-week maturation process, so that the combined odour emission rate from the windrow array could be quantified. The odour emission rates for windrow activities such as the formation and break apart of windrows were also characterised.

The output windrow OER from the in-vessel has been assumed to be similar to the output from the static green waste piles.

7.2 Static windrow emission rates

Given that on-site measurements were not available to GHD, the static windrow emission rates were sourced from a report on Odour Survey and Improvement Plan for ANL at Coldstream⁵. These emission rates are considered representative of a typical green waste composting operation.

Odour monitoring was conducted on various windrows including:

- Green waste with added moisture – undisturbed;
- Green waste with added moisture – disturbed;
- One month old compost pile – undisturbed;
- One month old compost pile – disturbed;
- Three month old compost pile(s) – undisturbed;
- Three month old compost pile(s) – disturbed;
- Mature compost pile- undisturbed; and
- Mature compost pile- disturbed.

Table 7-1 gives the SOER's for the static green waste windrows at different ages. The relevant summary Table from the ANL report is included as Appendix A.

⁵ Report on Odour Survey and Improvement Plan for ANL – Sustainable Infrastructure Australia 29th March 2007.

Table 7-1 Static stockpile SOERs

Green Waste - Source Description	SOER (OUm/s)
Static Windrows - 1 month	2.1
Static Windrows - 2 months	1.4
Static Windrows - up to 4 months old	0.8

7.3 Maturation windrow OER measurements – greenhouse enclosure method

Technique of measurement of windrow OER

SOER data for the maturation windrows was obtained from trial windrows set up at Bangholme, Victoria. The material for these windrows was taken from the in-vessel composting facility operated by Veolia (Natural Resource Systems (NRS)) in Dandenong. The OER measurements taken from the trial windrows are considered by GHD to be representative of the emissions from the compost that will be generated at the proposed operations at West Nowra Recycling and Waste Facility. That is, the matured compost was a mixture of green waste and approximately 3-4% grease trap waste. Grease trap waste is not added at West Nowra meaning the emission rates are considered conservative.

Odour sampling of the trial windrows was conducted on three occasions by EML, and the results are presented in preliminary reports N86839p, N86839p2 and N86839p3 which can be found in Appendix B. The initial stage of testing involved sampling of a compost windrow by two methods:

- by using an isolation flux chamber at three points along the crest of the windrow; and
- by fully enclosing the windrow with a greenhouse frame and stretching an impermeable polyethylene sheet over the frame. The sheet extends both ends – at the exit, the sheet is drawn onto the housing of a 1.3 m axial fan with a variable speed controller, and the inlet is formed to a circular aperture at approximately 800 mm diameter. Figure 7.1 below shows the arrangement. To determine the windrow OER, samples of odour are taken at the inlet and outlet, and the air flowrate Q drawn by the fan is measured at the inlet. Windrow OER is calculated as $OER = (OU_{outlet} - OU_{inlet}) \times Q$. This temporary enclosure is referred to here as the 'greenhouse' method.



Figure 7.1 Enclosed windrow for odour sampling

Calculation of age-mean windrow SOER

Measurements of trial windrow OER were made at windrow 'ages' of 1, 10, 21 and 31 days, with fan speed settings at 10 Hz and 20 Hz (50 Hz representing a 100% fan flow rate of $\sim 10\text{m}^3/\text{s}$). The results are presented in Figure 7.2, where the OER/ m^2 of windrow surface – specific OER, or SOER is plotted against windrow age in days.

The results for the 10 Hz fan controller setting (giving an annular air speed of $\sim 0.1\text{ m/s}$) were assumed to be representative of light wind ambient conditions, and as such, an age-average SOER of 100 OUm/min for the maturation windrow array has been adopted for the odour modelling (see Figure 7.2).

For ground level sources, dispersion under light stable winds generates maximum off-site impact, and experience has shown that any increase in emission rate as wind speed increases is more than off-set by the stability category changing to less stable settings. In other words, the increased dispersion as a consequence of the lessened stability more than outweighs the increased source emission rate as a result of increased wind stripping. As such, the effect of wind stripping was not accounted for in the model.

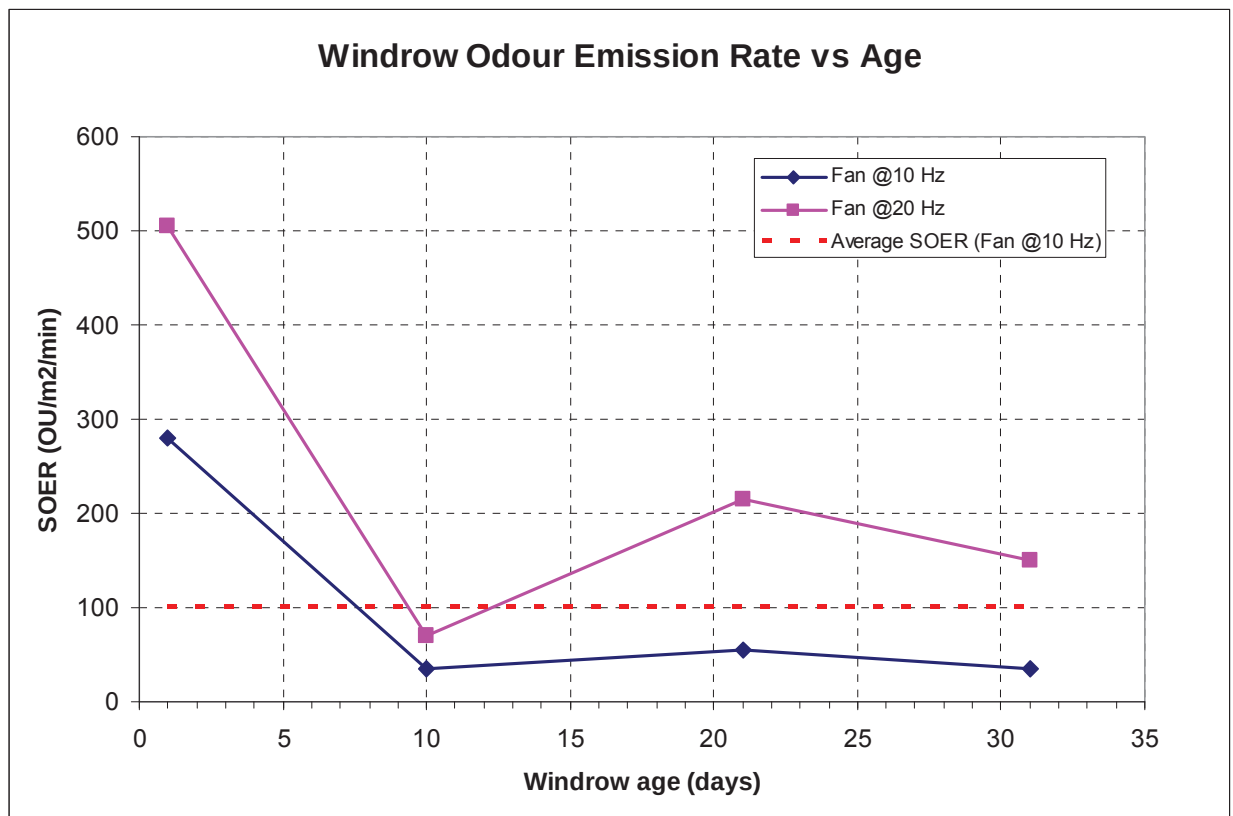


Figure 7.2 Windrow Odour Emission Rate vs Age

Calculation of windrow array SOER

Current

A trapezoidal windrow geometry was assumed, as indicated by Figure 7.3. Based upon this windrow geometry and the expected throughput for a 8 week on-site maturation, it was calculated that three windrows of approximately 20 m length would be present on site at any one time.

The total exposed surface area of the windrows was calculated as approximately 686 m². Based on windrow parameters of width of 8 m and a height of 3.5 m, which equates to a cross-sectional area 17.5 m², the volume on site at any one time was calculated to be ~ 1,000 m³. This equates to an approximate windrow length of 60 m. The 'footprint' area of the three windrow array was calculated to be 640 m².

Proposed

The proposed composting activities will all be undertaken in an enclosure and all exhaust air will be treated by a biofilter prior to discharge. Details of the proposed biofilter are discussed in more detail below in Section 7.5.

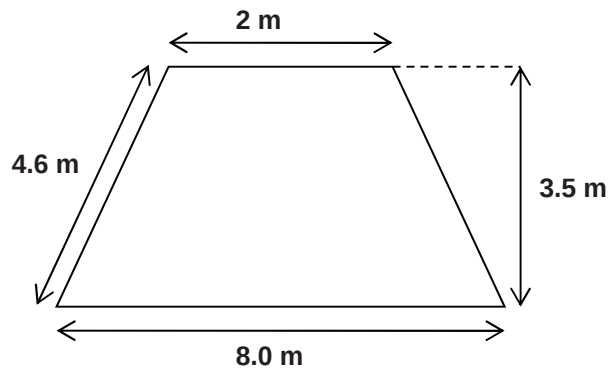


Figure 7.3 Current typical windrow geometry

7.3.1 Matured stage

Current

An SOER of **35 OU_m/min** for the matured windrow product has been adopted for the odour modelling. This value is that measured for the 31 day old windrow under light wind conditions (see Figure 7.2), and it will represent the upper limit SOER for the matured compost stockpile.

A trapezoidal windrow geometry was assumed, as indicated by Figure 7.3. Based upon this windrow geometry and the expected volume of 1,145 m³ of stored product on-site the total exposed surface area of the matured compost product was calculated as approximately 793 m².

Proposed

Matured compost from the proposal will be stored onsite in a designated area at the northern end of the landfill site. The proposed maximum amount of input waste has been assumed for this scenario and includes 2,865 t of green waste and 39,000 t of other collected organics such as food waste. After the composting process there is expected to be approximately 30,000 t of matured product to be stockpiled throughout the year.

The total length of matured windrows at any one time has been calculated to be 330 m with a surface area of 4155 m² and a total ground area of 3,000 m².

7.4 Summary of OER inventory for all windrows

7.4.1 Quiescent windrows

Table 7-2 describes the separate windrow sources and their corresponding SOERs.

Note the static windrow emission data is from Isolation Flux Chamber (IFC) measurements which is known to be an under estimate of actual OER. The basis for accepting that IFC measurements under-estimate windrow OERs is described elsewhere⁶.

The SOER data for static piles as given in Table 7-1 was based on the use of an IFC at Coldstream. To enable an estimate of the degree of under-estimation of SOER due to the use of an IFC for static piles, the mean SOER measured on the Bangholme trial windrow (obtained using a total enclosure) was taken to be the equivalent of the static piles at Coldstream. On that basis, the factor of increase to apply to the Coldstream static pile results is: (100/60) / 0.8 = 2.1. Thus a factor of increase of 2.1 to account for the under-estimate of IFC has been applied to the

⁶ Pollock T, Braun H "Odour Emission rate Measurements on Greenwaste Windrows" 19th Int. Clean Air & Env. Conf. 9-11 Sept 2009 , Perth WA.

static windrows at 1 month, 2 months old and 3 to 4 months old (see Table 7-2). In the absence of on-site measurements this may be an over-estimate.

Table 7-2 Summary windrow SOERs

Green Waste - Source Description	Corrected SOER (OUm/s) to account for under-estimate of IFC
Static Windrows - 1 month	4.4
Static Windrows - 2 months	2.9
Static Windrows - 3 to 4 months old	1.7
Maturation Windrows	1.7
Matured Stockpile	0.6

Note that GHD has used 3 OUm/s for static windrows SOER as the average was taken from the windrows 1-3 months old.

Other assumptions supplied by Shoalhaven City Council and used in the assessment were:

- 50% of the daily input of raw green waste sits at the receival area at any one time during operating hours;
- A 30% reduction in the mass of material at the maturation stage i.e. after static phases due to evolution of moisture and VOCs during the composting process; and
- The bulk density of composting material during the static phases is assumed at 0.33 t/m³, increasing to 0.6 t/m³ during maturation phase.

7.4.2 Break apart and turning of static piles & windrows

Open windrows would be 'turned' periodically, to ensure uniform composting throughout the windrow and to reset the matrix, opening pore spaces in sub-areas that might have slumped, preventing access of ambient air drawn into the warm (up to 80°C) core of the composting windrow.

The break apart of a windrow releases the VOCs within the interstitial spaces of the compost matrix in a near instantaneous manner, with typically a buoyant plume of warm gases visualised by the condensing water vapour when in contact with the cooler ambient air. The measurement of the OER during this process is difficult, and the OER is dependent on how rapidly the windrow is broken apart.

GHD has measured the release of OER from an open windrow during its 'turning' with a TopTurn X53 machine operating at a speed of 10 m per minute⁷. At that rate, the release of VOCs in the buoyant plume gave an OER ratio to the quiescent OER measured just prior to the turning event of ~ 100:1. The quiescent windrow SOER had been measured by a draped tunnel so that no under-prediction of emission applied. This ratio can be applied to slower methods of break apart (such as with a wheel loader as is proposed for this project) by assuming that the same mass of VOCs (and odour) is released at the completion of the break apart independent of the method. Then the OER can be factored from the TopTurn data by applying a ratio to the OER by the inverse of the duration time to break apart.

Calculation of maturation windrow SOER during turning

On average turning occurs for 6 hours per day, once per week, over 6 weeks for the maturation stage.

Then, for the 60 m windrows at the proposed project site:

Time to break apart a 60 m windrow is 5.25 hours

⁷ Measurements for SITA Brooklyn Facility, October 2008.

Time to turn with TopTurn @ 10 m/min is 8 min

$$\frac{\text{SOER}_{\text{break apart}}}{\text{SOER}_{\text{quiescent}}} = 100 \times \left[\frac{8}{5.25 \times 60} \right] = 2.5 : 1$$

Turning of static piles

Note that on average the turning of static piles occurs for 6 hours a day, once every 2 weeks over 4 months for current operations. Treating the large static piles as a windrow each of 75 m long, at the proposed site:

Time to break apart a 75 m windrow is 4.9 hours

Time to turn with TopTurn @ 10 m/min is 5 min

$$\frac{\text{SOER}_{\text{break apart}}}{\text{SOER}_{\text{quiescent}}} = 100 \times \left[\frac{7.5}{4.9 \times 60} \right] = 2.6 : 1$$

Reforming windrow

The $\text{SOER}_{\text{break apart}}$ was assumed to apply to the formed windrow on the new pad, effectively multiplying the windrow OER by 2.5 for the windrows for an assumed 3 hour period taken to reform the material. GHD has modelled the source as if it was fully formed for that 3 hour period. Hence the characterisation of OER during the reforming phase would be an over-estimate of that actually occurring.

7.4.3 Fugitive emissions and transfer points:

GHD holds a large database of odour emission rate measurements taken from odour sources associated with similar green waste composting operations to those proposed by SCC. This database has been collated principally by GHD (using the specialist firm Emission Testing Consultants (ETC) – refer Appendix C) and also (in the case of the ANL Coldstream facility) by URS (using the olfactometry laboratory operated by EML). The GHD database comprises some 16 reports by ETC while the URS database is contained in URS's reports of March 2008 and August 2008 (URS 2008a, 2008b).

Receivals area/ shredder/pre-sort

An SOER for non-mulched green waste of 0.3 OU m/s was referenced from available data for Alternative Waste Treatment operations within NSW (Heggies, 2011). To account for some seasonal variability in the received green waste material, a conservative SOER of 1.0 OU m/s was adopted for the purpose of the odour modelling. In general, all of the material received would be contained within the building and on any one day, would be processed before the end of that day. As such, the odour modelling has assumed a pad containing approximately 8 tonnes of received material increasing to 10 tpa, with an emitting surface area of approximately 50 m² and 62 m² respectively. Emissions from this source are assumed to occur 8 hours/day, 7 days per week.

A dedicated shredder would be located at the receivals area where oversize material from the pre-sort screening operation would be processed. Activities within would include loading of material into the building via dump trucks and shredding.

Shoalhaven City Council propose to use a mobile slow speed shredder. GHD has assumed that the OER measured from the shredder used by ANL would be representative for this unit. Emissions are from the URS Report of 7 March 2008 (Table 3-1 and Appendix A (Section A.1)).

Screening

Shoalhaven City Council propose to use a mobile screener trommel. GHD has estimated the OER based on ANL data from Coldstream. A ratio of 3:1 (SOER of raw green waste stockpile / SOER of undisturbed maturation windrows) was applied to the OER for screening of mature compost (from ANL Coldstream) to provide an estimated OER.

Transfer points

The transfer of compost material is made by a wheel loader using either a 6 m³ or 4 m³ bucket. The transfer is then effectively a mobile odour source passing between stages for a period of ~3 hours. GHD has accounted for this source by assuming that the SOER_{break apart} applies to the exposed surface of the bucket.

7.5 Proposed operations

The two main sources of odour from the proposal are the AWT building and the green waste maturation area. As discussed in Section 5.2 of the EIS, the green waste receivals area, shredding and composting will all be housed within an enclosed building maintained at negative air pressure. All air within the building will be directed through a biofilter for treatment prior to being released into the surrounding environment. GHD has been advised that the facility will operate similar to the proposed Kimbriki Resource Recovery Centre and that biofilter emissions as assessed in the PAE Holmes Report "Air Quality Impact Assessment Kimbriki Resource Recovery Centre" 2001 would be relevant for this study.

The green waste matured product storage area will not be enclosed and odour emission rate (OER) data has been obtained from testing trial windrows that were formed from the composted product from Veolia's in-vessel facility at Dandenong, and which were set up at Veolia's Bangholme facility.

GHD has been advised that the total air flow rate through the AWT biofilter would be approximately 396,000 m³ per hour. This represents three building air exchanges (approximate building volume is 132,000 m³) that flow through the biofilter. The residual odour concentration for the biofilter has been assumed to be 300 OU, as was used in the Kimbriki report.

7.6 OER inventory - current vs proposed operations

The OER's from the green waste piles and windrows plus turning contribution, fugitive and transfer point sources are summarised in Table 7-3 and Table 7-4 to enable a comparison of the component source contributions to the site OER, and to determine the increase in overall site OER due to the proposed upgrade.

Current operations

Key points from Table 7-3 in terms of emission sources, the appropriateness of technology and proposed practices are as follows:

- The shredder dominates emissions at 31% of the total emissions during operating hours;
- The contribution from the static windrows is 21%
- The receivals area contributes just 1%. There would be no need to mitigate this small source, especially given that this source cannot be eliminated. Full enclosure of the receivals area and ducting to a bio-filter may remove some odour, but the bio-filter would be expected to contribute to the project OER – even exceeding the source OER that was treated.

- During non-operating hours (when poor dispersion occurs) the site OER reduces to ~ 40% of daytime values. Hence, any reduction of OER from daytime-only sources will not decrease the extent of the 99th percentile contour.
- In summary, the peak off-site impact is defined almost solely by the static and maturation windrows and leachate pond at night.

Table 7-3 OER inventory for current operations

Source description	Emitting surface area (m ²)	SOER (OUm/s)	OER (OUm ³ /s)	Percentage of OER (%)
Operating Hours				
Green waste stockpile – Receival	53	4.0	212	1.1
Screening via a trommel		-	4,960	26.5
Loaders	5 x 4	8.0	160	0.9
Dumping	5 X 4	5.3	106	0.6
Shredder		-	5,740	30.6
Static Windrows	1,306	3	3,918	20.9
Maturation windrows (with turning)	690	1.7	1,173	6.3
Matured stockpile	790	0.6	467	2.5
Leachate pond	6,620	0.3	1,986	10.6
Total			18,729	100.0
Non-Operating Hours				
Green waste stockpile - Receival				0
Screening via a trommel				0
Loaders				0
Dumping				0
Shredder				0
Static windrows	1306	3	3,918	51.9
Maturation windrows	690	1.7	1,173	15.5
Matured stockpile	790	0.6	474	6.3
Leachate pond	6620	0.3	1,986	26.3
Total			7,551	100.0

Proposed expansion

Key points from Table 7-4 below in terms of emission sources, the appropriateness of technology and proposed practices are as follows:

- The biofilter dominates emissions at 87.2% of the total emissions during operating hours;
- The next biggest contribution is from the leachate pond at ~5 % of the total;
- The contribution of the green waste receivals area decreases to 0.7%. Note this does not include any other organic waste.
- During non-operating hours (when poor dispersion occurs) the site OER reduces to ~ 98% of daytime values. Hence, any reduction of OER from daytime-only sources will not decrease the extent of the 99th percentile contour.
- In summary, the off-site impact is defined almost solely by the biofilter at night.

Table 7-4 OER inventory for proposed operations

Source Description	Emitting Surface Area (m ²)	SOER (OUm/s)	OER (OUm ³ /s)	Percentage of OER (%)
Operating Hours				
Green waste stockpile – Receival	62	4.0	248	0.7
Loaders	5 x 4	8.0	160	0.4
Dumping	5 X 4	5.3	106	0.3
Matured stockpile	3,875	0.6	2,325	6.1
Leachate pond	6,620	0.3	1,986	5.3
Biofilter			33,000	87.2
Total			37,825	100.0
Non-Operating Hours				
Matured stockpile	3,875	0.6	2,325	6.2
Leachate pond	6,620	0.3	1,986	5.3
Biofilter			33,000	88.4
Total			37,311	100.0

8. Odour dispersion modelling

8.1 Landfill and composting odour sources

The odour characteristics of landfill sources are significantly different to that of green composting and the air emitted from a biofilter. The two odour sources in this assessment (landfill and green waste) have been combined and are considered conservative.

8.2 Choice of dispersion model

Dispersion modelling was undertaken using Ausplume version 6.0. Ausplume is a Gaussian plume dispersion model developed by the Victorian EPA to assess the impact of airborne pollutants. AUSPLUME is the approved dispersion model for use in most simple, near field applications where coastal effects and complex terrain are of no concern.

Ausplume predicts downwind concentrations for the model inputs representative of pollutant emissions at a given physical site under a range of hourly varying meteorological conditions over a period of a year or more. Features of the model include: building downwash (the effect of buildings in causing a plume to be dragged down to ground level where it can impact an area); area, line and volume sources; plume rise as a function of downwind distance; and terrain adjustment.

AUSPLUME is specifically not approved for use in 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.

GHD conducted a site visit to assess the local and surrounding terrain and found that the local region is characterised by gently undulating rises and low hills. The proposal site presents relatively low topographic relief between approximately 50 m AHD at the south eastern boundary and 30 m AHD at the north western boundary. The northern part of the proposal site slopes down to the northwest.

The site is approximately 1.2 km from the Shoalhaven River. Other watercourses in the local area include Sandy Creek (approximately 200 m to the west) and Cabbage Tree Creek (approximately 200 m to the east).

It is of GHD's opinion that no receptor height exceeds the lowest release height and that the terrain is not overly complex.

There are no buoyant line plumes, the site is not subject to coastal effects such as fumigation due to being located almost 20 km from the coast and the site is not subject to inversion break-up fumigation conditions.

The frequency of night-time (8 pm to 6 am) stable E and F class conditions indicate a incidence of ~58% compared to D (neutral conditions) occurring for ~42% of the time, while for all hours of the day the incidence of E and F classes is ~29% compared to D conditions occurring for 51% of the time. Neither case represents a high frequency of stable conditions, GHD considers these conditions to be average.

Thus GHD concludes that the AUSPLUME model will be appropriate for the proposal site.

8.3 Model configuration

AUSPLUME was configured to model the situation in accordance with the estimated emissions, relevant physical building characteristics and representative meteorological data.

Key components of the model configurations are summarised below:

- 12 month meteorological data for the period November 2009 – October 2010 from the Nowra AWS;
- A 5 km x 5 km square receptor grid, centred over the West Nowra Recycling and Waste Facility, using a grid resolution of 50 metres;
- An averaging period of one hour (with P/M60 ratios applied);
- Given that the plant odour sources are all at or near-ground, the effect of local terrain is not accounted for in AUSPLUME, and terrain was therefore not included;
- Horizontal and vertical dispersion were calculated according to equations for the Pasquill-Gifford curves; and
- A surface roughness height of 0.4 metres (rolling rural) was used.

Full details of the parameter settings are given in Appendix D.

8.3.1 Biofilter stack configuration

The following biofilter stack and building parameters have been used in the model.

Table 8-1 Biofilter stack parameters

Parameter	AWT Building
Building height	11 m
Stack height above roof line	1 m
Exit velocity	11.2 m/s
Exit temperature	35 degrees C
Stack diameter	2.5 m
Building dimensions	100 m x 120 m
Building downwash algorithm	PRIME

8.3.2 Peak to mean calculations

The *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* states that peak to mean values are applied to the emissions from the sources in order to estimate the peak concentration. Peak to mean values are required as the evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. Dispersion model predictions however are typically valid for averaging periods of 1 hour and longer. Thus in order to predict peak concentrations a ratio between extreme short term concentration and longer-term averages were used as defined in the *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* (refer Table 6.1). The far field peak to mean values were applied to the area and volume sources at the site.

8.4 Cumulative impacts

Cumulative impacts were not required to be modelled due to the fact that there are no significant odour sources in the immediate vicinity of the project site.

8.5 Scenarios

Three scenarios will be assessed as part of this assessment and are stated below:

8.5.1 Scenario 1 – Current landfill with existing green waste

This scenario involves the current green waste operations at 2,865 tpa only.

8.5.2 Scenario 2 – Current landfill

This scenario model the current landfill at 62,000 tpa and current green waste operations at 2,865 tpa.

8.5.3 Scenario 3 – Current landfill and proposed AWT

This scenario models the landfill at 62,000 tpa and the proposed AWT.

9. Assessment of impacts

The dispersion modelling was conducted to predict the pattern of maximum off-site ground level odour concentrations resulting from odour emissions from the site for three scenarios including current landfill and green waste, current landfill only and proposed AWT with current landfill operations.

9.1 Pattern of peak odour impact

9.1.1 Current landfill

Figure 9.1 shows the predicted maximum odour impact from the site for normal operations, expressed as a 1-hour average at the 99th percentile. The figure shows the predicted peak off-site odour impact for the current landfill operations only, based on the OER values described in Section 6.

The 5 OU criterion adopted for the project can be seen to extend in the south east out from the existing West Nowra Recycling and Waste Facility as far as Flatrock Road.

The maximum extent of odour impact towards the east shows the predicted pattern is consistent with the directions of the local cool air drainage (katabatic) flow outlined in Section 5 (see E and F class stability in Figure 5.3).

9.1.2 Current landfill with existing green waste

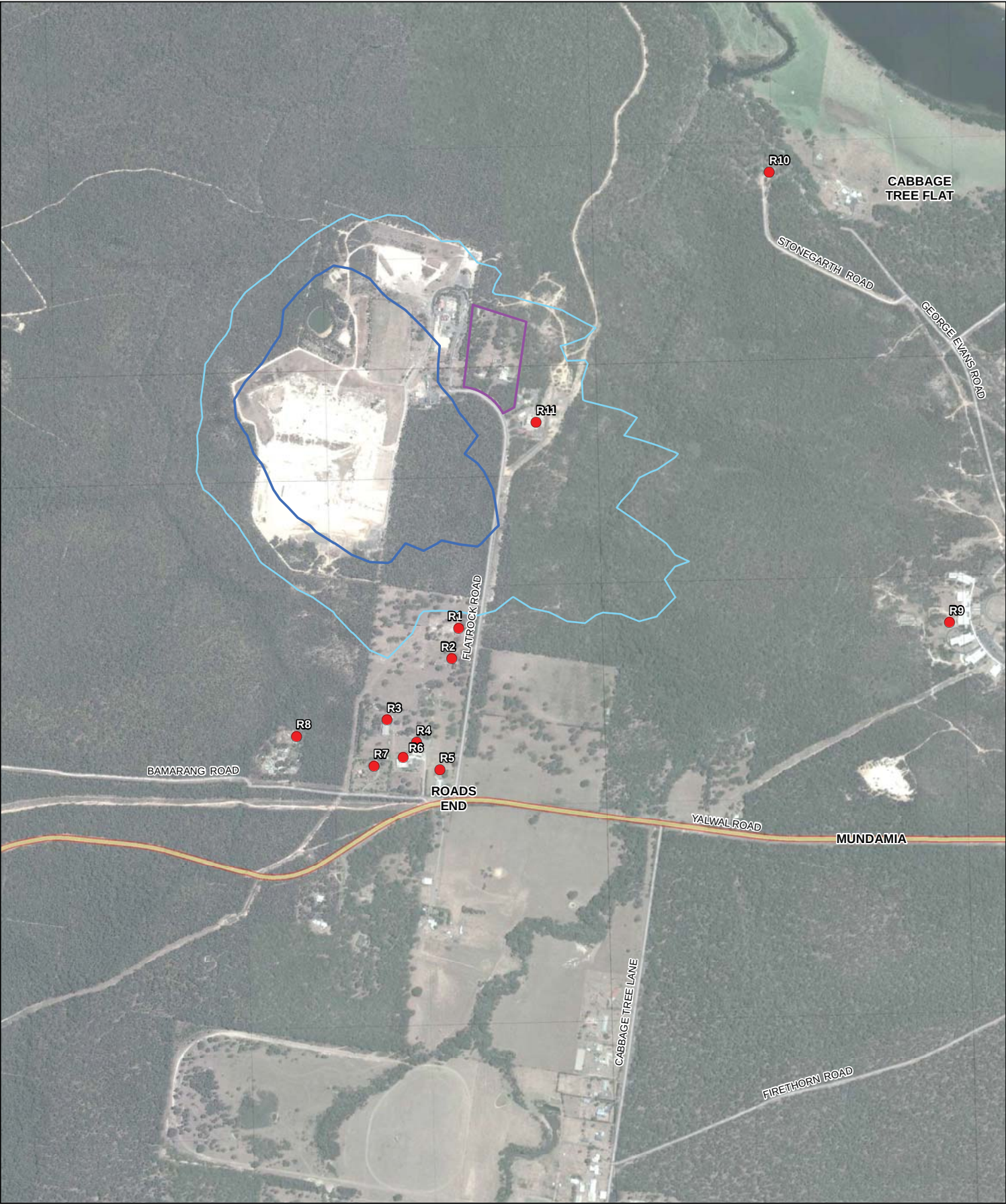
Figure 9.2 shows the predicted maximum odour impact from the site for normal operations, expressed as a 1-hour average at the 99th percentile. The figure shows the predicted peak off-site odour impact for the current landfill and green waste operations, based on the OER values described in Section 6 and Section 7.

The 5 OU criterion adopted for the project can be seen to extend to the east of the existing West Nowra Recycling and Waste Facility just over Flatrock Road. There are no sensitive receptors here however the 5 OU odour contour encroaches slightly into the Office of Environment and Heritage (OEH) Nowra Area Office and Depot (Receptor R11).

9.1.3 Current landfill and proposed AWT

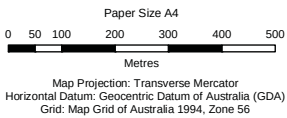
Figure 9.3 shows the predicted maximum odour impact from the site for normal operations, expressed as a 1-hour average at the 99th percentile. The figure shows the predicted peak off-site odour impact for the landfill and the proposed operations, based on the OER values described in Section 6.

The 5 OU criterion adopted for the proposal can be seen to extend to the east, just over Flatrock Road. There are no receptors in this area and predicted odour impacts are expected to comply with the 5 OU odour criterion.



Legend

- Site boundary
- Odour contour - 50u
- Sensitive receivers
- Odour contour - 20u

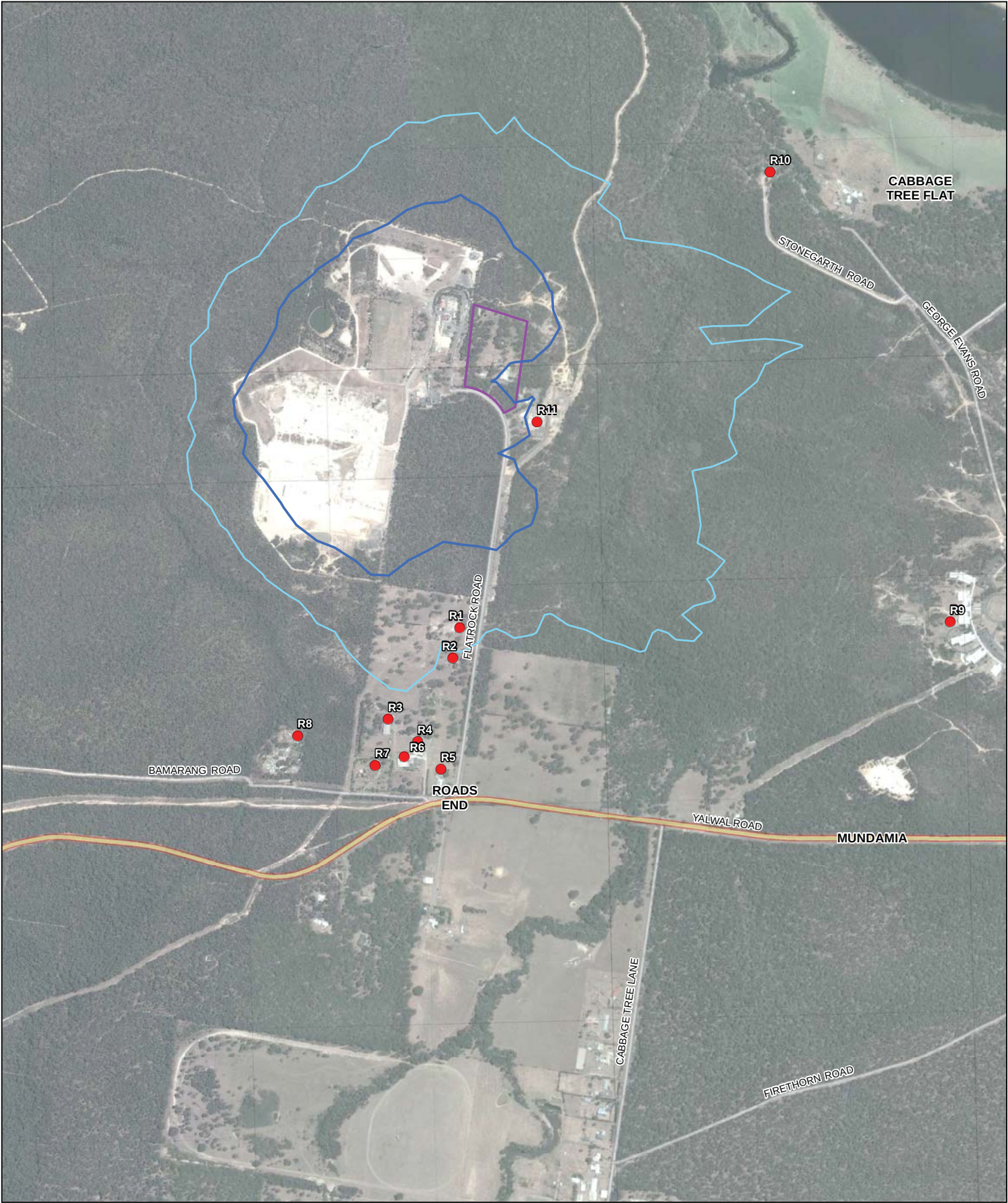


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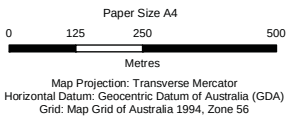
Predicted peak odour impact (99th Percentile, P/M60)
Current landfill

Job Number | 21-22855
Revision | 0
Date | 07 Oct 2015

Figure 9.1



- Legend**
- Site boundary
 - Odour contour - 50u
 - Sensitive receivers
 - Odour contour - 20u

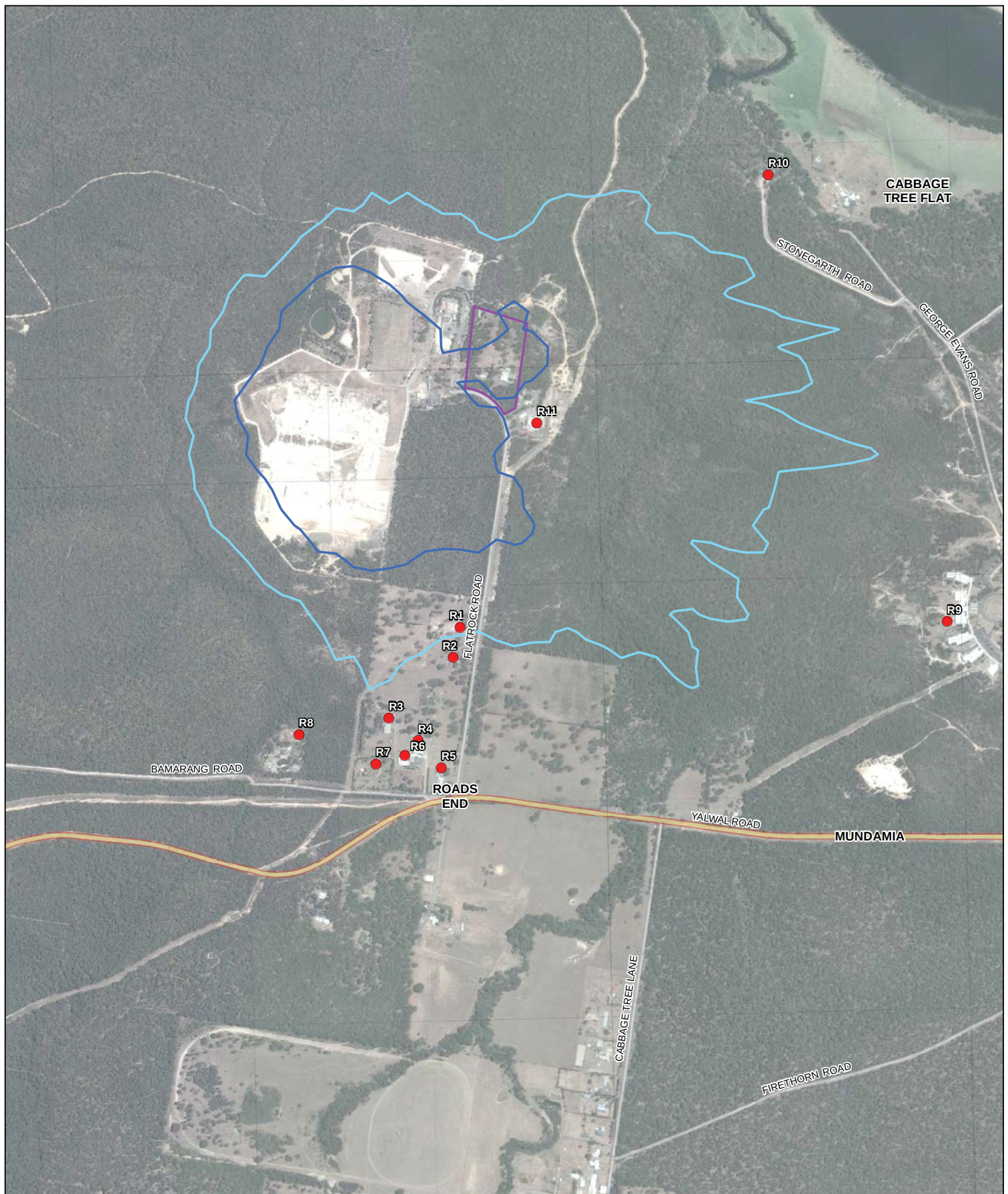


Shoalhaven City Council
West Nowra Resource Recovery Park
Air Quality Assessment

Predicted peak odour impact (99th Percentile, P/M60)
Current landfill and existing green waste operations

Job Number 21-22855
Revision A
Date 07 Oct 2015

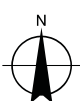
Figure 9.2



Legend

- Site boundary
- Odour contour - 50U
- Sensitive receivers
- Odour contour - 20U

Paper Size A4
0 125 250 500
Metres
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56



Shoalhaven City Council
West Nowra Resource Recovery Park
Air Quality Assessment

Predicted peak odour impact (99th Percentile, P/M60)
Current landfill and proposed RRP

Job Number	21-22855
Revision	1
Date	07 Oct 2015

Figure 9.3

9.2 Predicted peak impact at discrete receivers

The predicted peak 99th percentile (1-hour average) odour levels were assessed for some of the discrete receptors near the site, the locations of which are shown on Figure 2.1.

The highest predicted concentrations are at 43 Flatrock Road (Receptor R1) which is approximately 700 m from the proposal. The 99th percentile odour level at this receptor is predicted to be 2 OU for the combined future scenario of the proposed AWT and existing landfilling operations, which is Scenario 3 in 8.5. Slightly lower concentrations would be expected at 41 Flatrock Road (Receptor R2), based on the contours shown on Figure 2.1.

No significant odour impacts are predicted as a result of the proposal. Decreases in odour impacts are predicted at 43 Flatrock Road (Receptor R1) and the OEH office (Receptor R11) due to composting of garden organics occurring within the AWT in future rather than outdoors.

Biofilter emissions from the AWT may result in slight increases in odour levels at receptors such as 38A Bamarang Road (Receptor R8) and 56 Stonegarth Road (Receptor R10) however the levels are still well below the criteria, would be characteristic of woody odours rather than composting emissions and would be at a level which cannot generally be detected against background ambient conditions.

Table 9-1 Predicted peak odour impact at receptors (OU)

Residence (Closest resident to West Nowra Recycling and Waste Facility in Suburb)	OEH Office (R11)	43 Flatrock Rd (R1)	38A Bamarang Rd (R8)	University of Wollongong Shoalhaven Campus (R9)	56 Stonegarth Rd (R10)
Scenario 2 Current GW and Landfill	5.6	2.3	0.7	1.3	1.1
Scenario 3 Proposed AWT and Landfill	4.6	2.0	0.8	1.5	1.5
% change	-17.9	-13.0	14.3	15.4	36.4

10. Dust Impact Assessment

10.1 Overview

There is potential for dust emissions during the construction and operational phases of the project. Dust dispersion modelling has been undertaken to assess the potential worst-case dust impact of the proposal.

No background dust (PM₁₀) measurements were available for the site. It is expected background dust levels would be low. The prominent source of background dust would be areas subject to wind erosion and from urban activities. Pollen and vegetation derived dust would also be expected.

Daily dust monitoring data from the EPA Albion Park site (refer section 5.4) for the modelling period November 2009 – October 2010 has been obtained in order to undertake the assessment.

10.2 Dust criteria

Dust assessment criteria are in accordance with the Approved Methods are described in Section 4.

10.3 Maximum dust impact scenario

An indicative worst-case dust modelling scenario was undertaken for the RRP. Significant sources of dust at the site are wheel generated dust from trucks travelling on unpaved surfaces, wind erosion from unsealed surfaces such as the intermediate cover and stockpiles, unloading waste and bulldozers moving waste around. The worst-case dust scenario considers both construction of the RRP facilities and operational activities occurring at the same time.

An inventory of potential dust impacts is shown below. It can be seen that the largest potential contributor of dust is wheel generated dust from trucks. The worst case dust scenario assessed allowed for a long haul route of 1 km per truck (500 m each way) on unsealed surfaces. This was from the end of the sealed access road that goes past the resource recovery area and old landfill to the tip face at the southern end of the site. A 400 m truck access route (200 m each way) was also allowed for the proposed construction area of the RRP facilities.

The potential sources of dust would move around the site as the construction footprint and the landfilling activities move around. As such an assessment against the worst-case 24 hour PM₁₀ criteria is most relevant to determine compliance.

10.4 Dust emissions inventory

A dust emissions inventory is presented below in Table 10-1.

Table 10-1 Dust emissions inventory

Equipment	Default TSP Emission Factor	Default PM ₁₀ Emission Factor	Unit	Application	TSP Emission Rate (kg/hr)	PM ₁₀ Emission Rate (kg/hr)
Waste truck - dumping	0.48	0.24	kg/h	Assumed one truck constantly unloading all day.	0.48	0.24
Waste Truck – travelling on unpaved	4.23	1.25	kg/VKT	Assumed 7 waste trucks per day and 20 construction trucks per day. Average trip of	63.5	18.8

Equipment	Default TSP Emission Factor	Default PM ₁₀ Emission Factor	Unit	Application	TSP Emission Rate (kg/hr)	PM ₁₀ Emission Rate (kg/hr)
roads				each truck on unpaved roads is 1 km (operation) and 400 m (construction). Total of 15 km total travelled per day.		
Dump Truck – travelling on unpaved roads with mitigation (Level 2 watering)	0.975	0.2895	kg/VKT	Assumed 7 waste trucks per day and 20 construction trucks per day. Average trip of each truck on unpaved roads is 1 km (operation) and 400 m (construction). Total of 15 km total travelled per day.	15.9	4.7
Landfill waste compactor on waste and bulldozer construction	4.10	2.05	kg/h/veh	One landfill waste compactor and one construction bulldozer 9 hours per day. Assumed half the rate of a bulldozer on ground as includes watering	2.13	0.52
Wind Erosion of unsealed surfaces	0.4	0.2	kg/ha/hr	Assuming stockpiles of various sizes located around the site and intermediate cover area	-	-

10.5 Dust dispersion modelling

Potential dust impacts were modelled with the significant proposed construction and operational sources of dust. Dust modelling was undertaken with consideration to the Approved Methods to determine the concentration of dust (PM₁₀) over a 24 hour period. Modelling was conservative as dust depletion was not considered in the modelling. Dust depletion allows material to be removed from the plume as it is deposited on the ground surface, and if no depletion is modelled it would result in an overestimate of the predicted dust concentrations.

10.6 Predicted dust impacts

The highest five results from the predicted maximum (100th percentile) 24 hour dust impact modelling of the proposal are shown in Table 10-2. Predicted dust increments (levels) at the five sensitive receptors are listed in the table. It can be seen that dust emission increments from the proposal alone (not taking into account the background levels) are below the 24 hr PM₁₀ dust criteria of 50 µg/m³ criteria at all times at all surrounding receivers.

As the average background dust level at the EPA monitoring station in Albion Park for the year 2010 was less than 15 µg/m³, and a day with a high background level would need to coincide with site activities generating maximum dust emissions, it is unlikely that cumulative dust impacts exceeding the criteria (50 µg/m³) would occur. As mentioned previously, dust depletion from the plume, which would reduce the predicted dust impact, was not considered in the modelling.

The OEH office is the closest receptor to the proposal site, but is relatively remote from the operational areas of the landfill (where higher background dust levels have greater potential to occur). Roads in the resource recovery area nearest the OEH office are all sealed. There is a slight possibility that the 50 µg/m³ criteria could be exceeded at the OEH office (R11) with the existing background dust levels taken into consideration. Therefore a contemporaneous dust assessment was undertaken to determine if the proposal would result in any additional days exceeding the dust criteria, than those recorded by background ambient dust data (where the background levels exceeded 50 µg/m³).

Review of the background ambient dust monitoring data indicates two days historically where the background dust levels exceeded 50 µg/m³ (refer Appendix E). When the predicted site dust increment is added to the corresponding background levels for those days, there are no additional days that exceed the PM₁₀ criteria.

This means that the proposal complies with the dust criteria. The contemporaneous dust impact and background dust data is provided in Appendix E, with two days in total predicted to exceed the 24 hr PM₁₀ dust criteria, due to unusually high background levels, rather than the proposal.

Table 10-2 Predicted maximum dust impact at sensitive receptors 24 hour PM₁₀ µg/m³

Rank	OEH Office (R11)	43 Flatrock Rd (R1)	38 Bamarang Rd (R8)	University of Wollongong Shoalhaven Campus (R9)	56 Stonegarth Rd (R10)
1	38.9	16.5	10.1	4.7	2.6
2	19.4	15.7	7.5	3.1	1.9
3	18.6	14.9	7.1	3.1	1.8
4	17.6	13.4	6.8	2.8	1.8
5	16.5	13.0	6.6	2.4	1.8

11. Mitigation measures

11.1 Operational monitoring procedures at West Nowra Recycling and Waste Facility

Odour would be constantly monitored on site during daily inspections. Odour monitoring patrols would also be initiated subject to complaints being received.

Surface gas and accumulation monitoring would be carried out every 6 months based on a 25 m spaced grid format; and visual dust inspections would be under taken on a daily basis with consideration to the prevailing wind direction.

11.2 Odour

Most mitigation measures to reduce odour are already incorporated into the design of the facility, but there is always some potential for odours to be generated during daily operations once the facility is being operated. Management practices to prevent and manage odours from general sources may include:

- Regular monitoring of the operation and performance of the odour control system (biofilter);
- Periodically testing of air emissions from the biofilter;
- Routine inspections and maintenance of all equipment;
- Supply or storage of critical spare parts for ventilation and odour control system;
- Traffic management procedures to co-ordinate the delivery schedule and avoid a queue of the incoming or outgoing trucks outside the area for extended periods of time;
- Spill management procedures to ensure immediate clean-up of any spill from the incoming and outgoing of trucks;
- Maintaining an odour complaint logbook and in the event of a complaint immediate investigation of any odour sources, together with appropriate actions to eliminate them;
- No stockpiling of raw materials for more than a day under normal operating conditions; and
- Management of stockpiles to facilitate natural ventilation and prevent the development of anaerobic zones.

11.3 Dust

If dust is managed appropriately there would be minimal dust generation from either the construction or operation phases of the project.

11.3.1 Construction

Council would require the construction contractor(s) to develop and implement a Construction Environmental Management Plan (CEMP) for the Project. The use of SCC standard environmental protection measures and some additional project specific controls are recommended. These would be incorporated into the CEMP.

Project specific controls are proposed to reduce risks to air quality and these are outlined in Table 11-1. These controls are based on GHD experience as well as from EPA 'Best Practice Environmental Management - Environmental Guidelines for Major Construction Sites' (1996).

Table 11-1 Project specific construction dust management controls

Management type	Specific controls
Prevention	Methods for management of emissions would be incorporated into site inductions, training and pre-start talks.
	Prompt remedial strategies, such as watering, would be implemented in the event of visible dust emissions.
	Reduce dust production on site by scheduling work into stages to minimise land disturbance in the planning and design stage, including scheduling installation of control measures for dust prevention, while having regard for seasonal dryness.
	Limit vehicle movements to designated sealed entries and exits, haulage routes and parking areas. Site exits would be fitted with hardstand material or other appropriate measures to limit the amount of material transported off-site (where required).
	Use of cattle/shaker grids and wheel wash in order to reduce the tracking of mud off site.
	Regular watering of access roads to ensure material is not transported onto the roads around the site.
	Identify dust sources prior to carrying out works in a particular area.
	Keep the areas of land cleared to a minimum, and the period of time areas remain cleared to a minimum.
	Minimise working areas and define haul routes to be used wherever it is necessary for vehicles to traverse unformed roads.
	Rehabilitate cleared areas promptly.
	Locate stockpiles in areas that are protected from wind where possible and/or away from sensitive receptors.
	Ensure plant and machinery is regularly checked and maintained in a proper and efficient condition.
Monitoring	Identify all possible dust sources at the beginning of each day and throughout the day. Sources may include: haul roads, earthworks, windblown dust, general construction and stockpiles.
	Visually monitor dust and where necessary implement controls
Mitigation	The primary method for controlling dust generated by construction and maintenance activities would be the application of water and/or an approved suppression agent, via water.
	The Site Supervisor should determine the frequency of passes and number of water tankers required, based on the following: • weather conditions; • volume of traffic on exposed or dusty surfaces; • extent of stripped area; and • extent of unprotected areas.
	Plant and machinery would be turned off when not in use and would be fitted with emission control devices complying with Australian Design Standards.

11.3.2 Operation

The proposal is mostly contained within enclosed buildings, limiting the potential for dust impacts.

Dust may be generated by movement of materials by front end loaders and delivery trucks. Such operations may need to be suspended on very windy days.

Dust can occur during storage, mixing, screening and transport of feedstocks and products. Dust suppression – such as covering dusty materials or applying a light water spray and

enclosing fixed mechanical equipment used to process the raw and finished materials – may be required.

If organic material arrives at the site in an excessively dry state, a water spray truck would be used on the material. Similarly the shredder would have a water mist spray that can be activated to prevent dusting.

Dust from the turning of composting materials is unlikely due to the normally high moisture content of compost.

High levels of moisture would be maintained in the fresh compost exiting the windrows so that after screening the material can be set up in external stockpiles without being a source of dust emissions.

12. Conclusions

An operational air quality impact assessment has been undertaken with consideration given to the *Approved methods for the modelling and assessment of pollutants in NSW* (DEC, 2005). The EPA's odour impact criterion was a level of 5 OU not to be exceeded at the residences on Flatrock Road and Yalwal Road.

The results of odour modelling show that for the proposed RRP with current landfill operations (the proposal), the 5 OU criterion adopted for the project is contained mostly within the site. It extends to the east just over Flatrock Road, where there are no receptors. Therefore the predicted odour levels would comply with the project criterion.

The highest predicted odour concentration at 43 Flatrock Road (Receptor R1), which is approximately 700 m from the proposal, is 2 OU. Slightly lower concentrations would be expected at 41 Flatrock Road (Receptor R2).

No significant odour impacts are predicted as a result of the proposal. Decreases in odour impacts are predicted at 43 Flatrock Road (Receptor R1) and the OEH office (Receptor R11) due to composting of garden organics occurring within the AWT in future rather than outdoors.

Biofilter emissions from the RRP may result in slight increases in odour levels at receptors such as 38A Bamerang Road (Receptor R8) and 56 Stonegarth Road (Receptor R10) however the levels are still well below the criteria, would be characteristic of woody odours rather than composting emissions and would be at a level which cannot generally be detected against background ambient conditions.

In terms of worst-case dust impacts, it is concluded that there would be minimal dust generation from project construction or operations if dust is managed adequately via a Construction Environmental Management Plan (CEMP) and an operational EMP.

It is noted that the project has not yet been tendered, and that the final technology may vary from that which has been modelled.

Therefore it is recommended that this air quality assessment be updated if the final AWT building design and biofilter is significantly different to what was included in this assessment. This would be carried out as part of the Stage 2 assessment if required.

Appendices

Appendix A – ANL SIA Report



**SUSTAINABLE
INFRASTRUCTURE
AUSTRALIA**

Australian Native Landscapes

Report on Odour Survey And Improvement Plan

29th March 2007



**Prepared for: Australian Native Landscapes, 29th March 2007
Prepared by: Sustainable Infrastructure Australia**

TABLE 1.1: SUMMARY OF SAMPLING DATA (see notes below)

ODOUR SAMPLING RESULT FOR TESTS OF 8TH NOV 2006 TP 10TH AND 11TH JAN 2007

Windrow Number and Description	Sampling dates	Pile length (m)	Pile width (m)	Pile Height (m)	Pile volume (m3)	Pile surface area (m2)	Portion subject to condition	Flux rate (Ouv/min. m2)	Emission mass rate (OU/min)
1 Green waste pile with added moisture - undisturbed	8-Nov-06	30	26	8	6240	1676	90%	15	22,626
	10-Jan-07	35	28	5	4550	1400	90%	15 ✓	18,900
1 Green waste pile with added moisture - disturbed	8-Nov-06	30	26	8	6240	1676	10%	900	150,840
	10-Jan-07	35	28	5	4550	1400	10%	280 ✓	39,200
2 One month old compost pile - undisturbed	8-Nov-06	44	10	5	2200	672	95%	< 13	<44,705
	10-Jan-07	1 through 4 months			4900	9300	95%	17 ✓	150,195
2 One month old compost pile - disturbed	8-Nov-06	44	10	5	2200	672	5%	1600	53,780
	10-Jan-07	1 through 4 months			4900	9300	5%	1600 ✓	744,000
F Three month old compost pile(s) - undisturbed	8-Nov-06	27	11	5	1485	3651	90%	73	239,875
	10-Jan-07	see above				0	0	0	0
F Three month old compost pile(s) - disturbed	8-Nov-06	27	11	5	1485	3651	10%	1600	584,171
	10-Jan-07	see above				0	0	0	0
3 Mature compost pile - undisturbed	8-Nov-06	27	23	7	4347	1321	50%	18	11,889
	10-Jan-07	29	13	7	5104	1620	80%	18 ✓	23,328
		29	17	5					
3 Mature compost pile - disturbed	8-Nov-06	27	23	7		1321	50%	76	50,198
	10-Jan-07				5104	1620	20%	83 ✓	26,892
- Leachate pond	8-Nov-06	84	36			2375	100%	780	1,852,534
	10-Jan-07	82.5	34.5			2235	100%	290	648,277
- TOTALS FOR THE SITE	8-Nov-06				14,272	7,320	(N/I dam)	TOTAL	3,010,619
	10-Jan-07				14,554	12,320	(N/I dam)	TOTAL	1,650,792

Summary

- [a] The green waste pile has improved 67%
- [b] The combined 1 month to 3 month old compost is much the same (3% reduction), even with increased volume.
- [c] The mature compost piles have improved 20%, even though the volume has increased.
- [d] The leachate pond has improved 65%
- [e] The overall improvement is 45%
- [f] The surface area has increased by about 70% which has a significant negative effect.
- [g] Volume in process has increased slightly over the period, composting is taking longer with revised process. Volume and surface area will both be reduced by speeding the process with forced aeration.

Figures in red are estimates based on later test results.

Please refer to APPENDIX 1 for the complete ETC reports on odour sampling and analysis.

07 Jan - mature piles
06 Nov - piles weather

FIGURE 1.1: WINDROW CONFIGURATION, 8TH NOVEMBER 2006

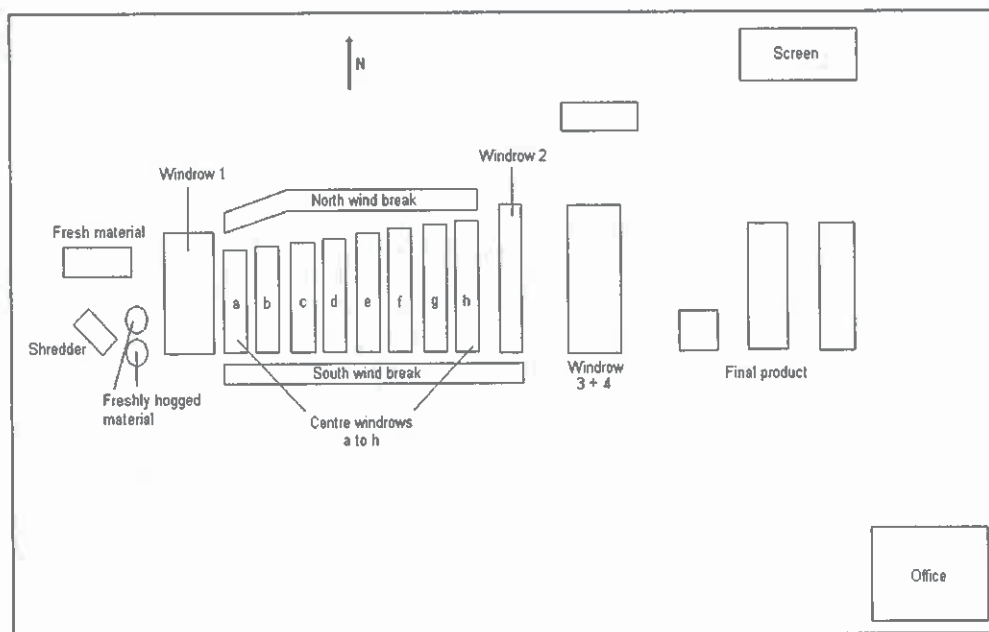
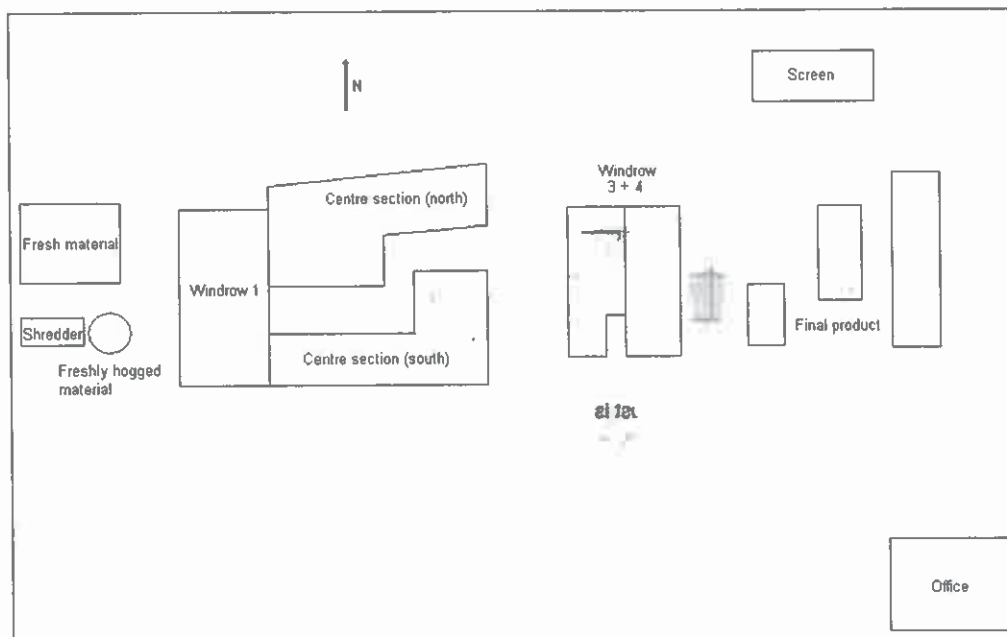


FIGURE 1.2: WINDROW CONFIGURATION, 10TH & 11TH JANUARY 2007





Appendix C

ETC Odour Test Reports



EMISSION TESTING CONSULTANTS

29 January 2007

Report No: 060295r

Page: 1 of 13

Australian Native Landscapes Pty Ltd
527 Maroondah Highway
Coldstream VIC 3770

Odour flux testing – November 2006

Dear Mr Tony Farricello,

Tests were performed on 8 November 2006 to determine odour emissions from various sources at the Coldstream plant of Australian Native Landscapes Pty Ltd.

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Yours faithfully
Emission Testing Consultants

Terry Burkitt
Director

terryburkitt@emission.com.au



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ABN 74 474 273 172

DEFINITIONS

The following symbols and abbreviations are used in this test report:

NTP	Normal 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.
Nm ³ /min	Flow rate (m ³ /min) at NTP conditions
>	Greater than
<	Less than the minimum limit of detection using the specified method.
~	Approximately
NA	Not applicable

SAMPLING LOCATION DESCRIPTIONS AND OBSERVATIONS

Windrow 1

Sampling

Two sets of duplicate samples were taken from the western face of the windrow using an isolation flux chamber, approximately two hours after turning. One sample from each set of duplicates was analysed by ETC and the other by Victorian EPA.

Observations

The material was dark brown, moist and fibrous and warm at the sampling location. A moderate (distinct) compost odour was observed at the sampling location.

Windrow 2

Sampling

A single sample was taken using an isolation flux chamber from the undisturbed windrow. Sampling was conducted at the centre of the eastern face of the windrow.

Observations

The material was dark brown to black, moist and fibrous and warm at the sampling location. A weak compost odour was observed at the sampling location.

Old Windrow 3 & 4

Sampling

A single sample was taken using an isolation flux chamber from the exposed eastern face of the windrow. The eastern face of the windrow had been disturbed approximately 30 minutes prior to sampling.

Observations

The material was dark brown to black, moist and fibrous and warm at the sampling location. A moderate (distinct) compost odour was observed at the sampling location.

Centre section - windrow f

Sampling

A single sample was taken using an isolation flux chamber from the undisturbed windrow. Sampling was conducted at the northern end of the western face of the windrow.

Observations

The material was dark brown to black, moist and fibrous and warm at the sampling location. A moderate (distinct) compost odour was observed at the sampling location.

Leachate pond

Two sets of duplicate samples were taken by means of an isolation flux chamber from the pond surface at the southern end. One sample from each set of duplicates was analysed by ETC and the other by Victorian EPA.

Observations

The pond water was dark brown and turbid. A strong offensive rotten sulphide odour was observed at the sample location.

TEST METHODS

The following methods are accredited with the National Association of Testing Authorities (NATA) and are approved for the sampling and analysis of gases. Specific details of the methods are available on request.

All sampling and analysis conducted in accordance with EPA Vic approved methods and EPA publication 440.1.

All parameters are reported adjusted to wet NTP conditions unless otherwise stated.

Odour sampling (isolation flux)*: according to ETC method 130 using an equilibrium flux chamber.

* *Given the recent development of the draft Australian Standard for area source measurement (AS4323.4), quality control protocols outlined in the draft standard were adopted if not otherwise stated in ETC method 130. Isolation flux chambers which are compliant with the draft standard and the specifications of USEPA user guide (1986 EPA/600/8) were used.*

Where static pre-dilution was conducted odour-free air was used.

Odour analysis: according to AS4323.3, by dynamic olfactometry (forced-choice technique). Panel n-butanol threshold determination by analysis against a NATA certified n-butanol gas standard.

Odour analysis was conducted with 6 member odour panels.

All samples were analysed the same afternoon as collection.

DEVIATIONS FROM TEST METHODS

Odour

The Windrow 1 samples had to be re-diluted in the laboratory to bring within the scale of the olfactometer. The resulting dilution ratio of 1 in 22 is greater than the maximum of 1 in 9 recommended by AS4323.3.

ODOUR SAMPLING AND ANALYSIS PARAMETERS

Technique:	AS4323.3 - Forced Choice	
Date and time of analysis:	8/11/2006 @ 1600 - 1750hrs	
Pre-dilution:	Windrows Leachate pond	8 L sample air + 8 L dilution air (1 in 2) 2 L sample air + 10L dilution air (1 in 6)
Pre-dilution equipment:	Dry Gas Meter 040	
Quality Requirements	Acceptance criteria	Current value
Panel n-Butanol threshold value (ppb)	20-80	75
Repeatability "r"	≤0.477	0.433
Repeatability "10r"	≤3.00	2.71
Accuracy "A"	<0.217	0.178



WEATHER OBSERVATIONS

Weather conditions were taken from the Bureau of Meteorology website for Coldstream (weather station 086383).

Date	Time	Temps	Dir	Wind	Time local	Rain mm	RH %	MSLP hPa
		°C		Spd km/h				
2/11/2006	Minimum	11.2	-	-	-	-	-	-
	Maximum	20.6	WSW	26	14:59	6.2	-	-
	0900	14.6	Calm	Calm	-	-	98	1006.0
	1500	20.4	N	11	-	-	11	1004.6
3/11/2006	Minimum	9.4	-	-	-	-	-	-
	Maximum	20.0	SW	33	13:51	19.6	-	-
	0900	13.9	WSW	15	-	-	78	1016.6
	1500	19.1	SW	24	-	-	54	1015.7
4/11/2006	Minimum	5.4	-	-	-	-	-	-
	Maximum	18.7	S	33	17:07	0	-	-
	0900	13.0	Calm	Calm	-	-	83	1021.3
	1500	17.7	SE	20	-	-	65	1019.7
5/11/2006	Minimum	8.3	-	-	-	-	-	-
	Maximum	20.6	S	39	15:45	0	-	-
	0900	13.2	S	19	-	-	67	1023.8
	1500	19.2	S	20	-	-	57	1020.3
6/11/2006	Minimum	5.0	-	-	-	-	-	-
	Maximum	21.6	SSE	43	18:23	0	-	-
	0900	14.3	NNE	6	-	-	77	1020.2
	1500	21.1	S	15	-	-	59	1016.9
7/11/2006	Minimum	10.7	-	-	-	-	-	-
	Maximum	16.2	SSE	48	10:22	0	-	-
	0900	14.3	SSE	24	-	-	64	1021.1
	1500	14.5	SSW	20	-	-	58	1021.5
8/11/2006	Minimum	8.6	-	-	-	-	-	-
	Maximum	14.7	S	35	13:36	0	-	-
	0900	10.6	S	17	-	-	66	1024.2
	1500	14.2	S	19	-	-	58	1023.3

RESULTS

Windrow 1 – after turning

8 November 2006



Location	Windrow 1 ~ 2hrs after turning	
Date tested	8/11/2006	
Equilibration time, hrs	1043 - 1109	
Sample identification	131	167
Sample dilution	1 in 2*	1 in 2*
Sampling time, hrs	1110 - 1114	1122 - 1127
Odour concentration, ou	24000	25000
Average odour concentration, ou	24000	
Average odour flux rate, ou/m²/min	900	
Source area, m ²	1700	
Odour mass rate, ou/min	1500000	
Surface temperature (°C)	50.7	
Chamber temperature (°C)	21.0	
Ambient temperature (°C)	14.0	

* A further 1 in 11 dilution was required to bring within the scale of the olfactometer. This ratio is greater than recommended by AS4323.3.

Windrow 2 – before turning
8 November 2006



Location	Windrow 2 before turning
Date tested	8/11/2006
Equilibration time, hrs	0855 - 0928
Sample ID	113
Dilution ratio	1 in 1.89
Sampling time, hrs	0928 - 0933
Odour concentration, ou	< 70
Odour flux rate, ou/m ² /min	< 3
Source area, m ²	670
Odour mass rate, ou/min	< 2000
Surface temperature (°C)	50.7
Chamber temperature (°C)	16.6
Ambient temperature (°C)	12.6

Windrows 3 & 4 – exposed face
8 November 2006



Location	Old Windrow 3 and 4 (exposed face)
Date tested	8/11/2006
Equilibration time, hrs	1345 - 1410
Sample ID	115
Dilution ratio	1 in 2
Sampling time, hrs	1411 - 1416
Odour concentration, ou	2100
Odour flux rate, ou/m ² /min	76
Source area, m ²	1300
Odour mass rate, ou/min	100000
Surface temperature (°C)	45.2
Chamber temperature (°C)	26.7
Ambient temperature (°C)	16.4

Centre section – windrow f
8 November 2006



Looking west



Looking east

Location		Centre section (windrow f)
Date tested		8/11/2006
Equilibration time, hrs		1436 - 1501
Sample ID		155
Dilution ratio		1 in 2
Sampling time, hrs		1503 - 1508
Odour concentration, ou		2000
Odour flux rate, ou/m ² /min		73
Source area, m ²		460
Odour mass rate, ou/min		33000
Surface temperature (°C)		67.3
Chamber temperature (°C)		25.9
Ambient temperature (°C)		21.6

Leachate pond

8 November 2006



Location	Leachate Pond	
Date tested	8/11/2006	
Equilibration time, hrs	1218 - 1245	
Sample identification	118	182
Sample dilution	1 in 6	1 in 6
Sampling time, hrs	1245 - 1247	1254 - 1256
Odour concentration, ou	22000	20000
Average odour concentration, ou	21000	
Average odour flux rate, ou/m²/min	780	
Source area, m ²	1900	
Odour mass rate, ou/min	1400000	
Surface temperature (°C)	18.5	
Chamber temperature (°C)	19.3	
Ambient temperature (°C)	18.3	

APPENDIX 1: Site plan

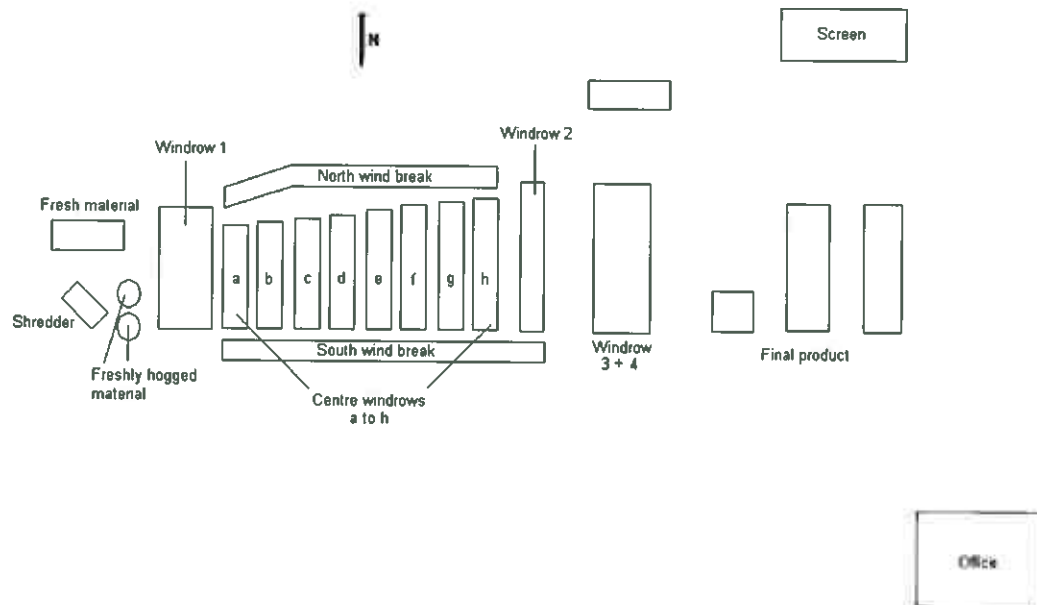
Site plan



Note: The photographs above do not reflect the operation of the plant on the test day.

APPENDIX 2: Windrow areas

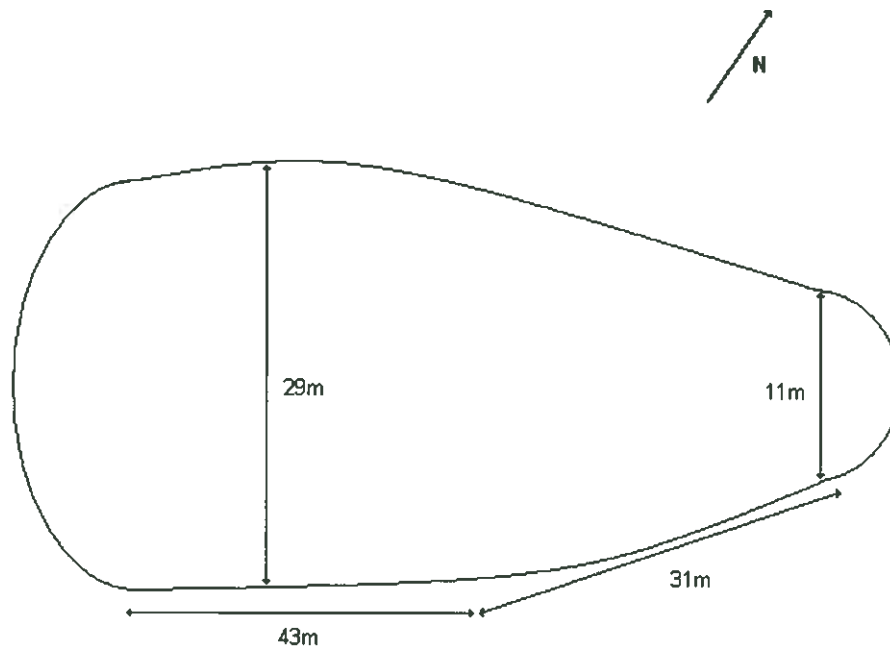
Windrow layout



Estimated windrow areas

Windrow	Assumed shape	Approximate dimensions (m)			Total surface area (m ²)
		Length	Width	height	
1	Rectangular	30	26	8	1676
a	Triangular	18	11	5	323
b	Triangular	20	11	5	352
c	Triangular	22	11	5	382
d	Triangular	24	11	5	412
e	Triangular	25	11	5	427
f	Triangular	27	11	5	456
g	Triangular	29	11	5	486
h	Triangular	31	11	5	516
2	Triangular	44	10	5	672
3+4	Rectangular	27	23	7	1321
North wind break	Triangular	95	14	7	1979
South wind break	Triangular	112	12	7	2149

APPENDIX 3: Leachate pond area



Estimated leachate pond area

For the purposes of estimating the surface area of the leachate pond, the pond was assumed to be a trapezium (turned 90°) with a semicircular section on each end (end diameters of 29m and 11m).

Estimated total surface area = 1858 m².



EMISSION TESTING CONSULTANTS

29 January 2007

Report No: 070008r

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Australian Native Landscapes Pty Ltd
527 Maroondah Highway
Coldstream VIC 3770

Odour flux testing – January 2007

Dear Mr Tony Farriciello,

Tests were performed on 10th & 11th January 2007 to determine odour emissions from various sources at the Coldstream plant of Australian Native Landscapes Pty Ltd.

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Yours faithfully
Emission Testing Consultants

Terry Burkitt
Director

terryburkitt@emission.com.au



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DEFINITIONS

The following symbols and abbreviations are used in this test report:

Odour unit	One odour unit (ou) is that concentration of odorant(s) at standard concentrations that elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
NTP	Normal 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.
Nm ³ /min	Flow rate (m ³ /min) at NTP conditions
>	Greater than
<	Less than the minimum limit of detection using the specified method.
~	Approximately
NA	Not applicable
Mass rate	Product of flux rate (disturbed or undisturbed) and the total surface area of the source

SAMPLING LOCATION DESCRIPTIONS AND OBSERVATIONS

Windrow 3 & 4 (mature) undisturbed

Sampling

A single odour sample (isolation flux) was collected from the centre of the eastern face of the windrow approximately 2m from ground level. The material was fully mature (according to ANL personnel).

Observations

The material was dark brown in colour and fibrous. The surface of the windrow was dry.

A weak compost odour was observed close to the windrow surface.

Windrow 3 & 4 (mature) disturbed

Sampling

A portion of material was removed from the northern face of windrow 3 & 4 using an excavator and dumped on the floor pan approximately 20 – 30 minutes prior to sampling. The material was fully mature (according to ANL personnel). A single odour sample (isolation flux) was collected.

Observations

The material was dark brown in colour and fibrous. The surface of the material was damp.

A weak compost odour was observed close to the windrow surface.

Centre section (1 month old) undisturbed

Sampling

A single odour sample (isolation flux) was collected from the top of the western end of the centre section. The material was approximately 1 month old (according to ANL personnel). The sample location was approximately 10m east of the marker pegs on the top and approximately 10m from the northern face of the windrow.

Observations

The material was dark brown in colour and fibrous. The surface of the material was damp.

A moderate (distinct) compost odour was observed close to the windrow surface.

Centre section (1 month old) disturbed – Test 1 (10/1/07)

Sampling

The top 1.5 m of material was removed from an area approximately 2m x 2m adjacent to the sampling location on the undisturbed material. A single (isolation flux) sample was collected from the exposed surface approximately 10 minutes after exposure.

Observations

The material was dark brown in colour and fibrous. The surface of the material was damp and hot. Some areas of mould were visible.

A strong compost odour was observed close to the windrow surface.

Centre section (1 month old) disturbed – Test 2 (11/1/07)

Sampling

The top 1.5 m of material was removed from an area approximately 2m x 2m, around 3m from the location test 1 was conducted the previous day. A single (isolation flux) sample was collected from the exposed surface 10 - 15 minutes after exposure.

Observations

The material was dark brown in colour and fibrous. The surface of the material was damp and warm.

A strong compost odour was observed close to the windrow surface.

Windrow 1 (1 week old) undisturbed

Sampling

A single odour sample (isolation flux) was collected from the top of windrow 1. The material was approximately 1 week old (according to ANL personnel). The sample location was approximately 3m from the southern edge at the approximate mid point.

Observations

The material was a straw colour and fibrous. The surface of the material was dry.

A strong compost odour was observed close to the windrow surface.

Windrow 1 (1 week old) disturbed

Sampling

The top 1.5 m of material was removed from an area approximately 2m x 2m adjacent to the sampling location on the undisturbed material. Duplicate odour samples (isolation flux) were collected from the exposed surface approximately 5 minutes after exposure.

Observations

The material was light in colour and fibrous. The surface of the material was very damp and cold.

A strong compost odour was observed close to the windrow surface.

Leachate pond

Sampling

Duplicate odour samples (isolation flux) were collected from the southern end of the pond approximately 2m from the bank.

Observations

The water was black in colour and opaque. Some floating material was observed against the air lines feeding the aerators and the southern bank. Samples were collected on an area free of floating material.

A very strong offensive odour was observed downwind of the pond.

Leachate pond downwind ambient samples

Single odour samples (grab samples) were collected downwind of the pond at intervals of approximately 5 metres (integrated sample 30m around the southern bank perimeter) and 120 metres (on the railway fence line beyond the south western boundary of the plant).

Windrow 1 downwind ambient sample

A single odour sample (ambient air) was collected downwind of the windrow on the southern fence line directly south of windrow 1 (integrated sample approximately 25m along fence line).

TEST METHODS

The following methods are accredited with the National Association of Testing Authorities (NATA) and are approved for the sampling and analysis of gases. Specific details of the methods are available on request.

All sampling and analysis conducted in accordance with EPA Vic approved methods and EPA publication 440.1.

All parameters are reported adjusted to wet NTP conditions unless otherwise stated.

Odour sampling (isolation flux)*: according to ETC method 130 using an equilibrium flux chamber.

* *Given the recent development of the draft Australian Standard for area source measurement (AS4323.4), quality control protocols outlined in the draft standard were adopted if not otherwise stated in ETC method 130. Isolation flux chambers which are compliant with the draft standard and the specifications of USEPA user guide (1986 EPA/600/8) were used.*

Odour sampling (ambient samples): sample collection according to AS4323.3, by collection into Nalophan sample bags using the 'lung' principle.

Odour analysis: according to AS4323.3, by dynamic olfactometry (forced-choice technique). Panel n-butanol threshold determination by analysis against a NATA certified n-butanol gas standard.

Odour analysis was conducted with 6 member odour panels.

All samples were analysed the same afternoon as collection.

DEVIATIONS FROM TEST METHODS

Odour sources with a very high odour concentration required a pre-dilution greater than specified in AS4323.3. Where applicable this is indicated in the results section of this report.

ODOUR SAMPLING AND ANALYSIS PARAMETERS

10 January 2007

Technique:	AS4323.3 - Forced Choice	
Date and time of analysis:	10/01/2007 @ 1700 - 1930hrs	
Pre-dilution:	Windrows 3 & 4 Centre section Windrow 1 undisturbed Windrow 1 disturbed Leachate pond Leachate pond downwind ambient samples Windrow 1 downwind ambient sample	8 L sample air + 8 L dilution air (1 in 2) 8 L sample air + 8 L dilution air (1 in 2) 2 L sample air + 10L dilution air (1 in 6) 1 L sample air + 10L dilution air (1 in 11) 1 L sample air + 10L dilution air (1 in 11) Nil Nil
Pre-dilution equipment:	Dry Gas Meter 040	
Quality Requirements	Acceptance criteria	Current value
Panel n-Butanol threshold value (ppb)	20-80	43
Repeatability "r"	≤0.477	0.350
Repeatability "10r"	≤3.00	2.237
Accuracy "A"	<0.217	0.131

11 January 2007

Technique:	AS4323.3 - Forced Choice	
Date and time of analysis:	11/01/2007 @ 1600 - 1800hrs	
Pre-dilution:	Centre Section disturbed	2 L sample air + 10 L dilution air (1 in 6)
Pre-dilution equipment:	Dry Gas Meter 040	
Quality Requirements	Acceptance criteria	Current value
Panel n-Butanol threshold value (ppb)	20-80	23
Repeatability "r"	≤0.477	0.407
Repeatability "10r"	≤3.00	2.555
Accuracy "A"	<0.217	0.099



WEATHER OBSERVATIONS

Weather conditions were taken from the Bureau of Meteorology website for Coldstream (weather station 086383).

Date	Time	Temps	Dir	Wind	Time	Rain	RH	MSLP
		°C		Spd km/h				
5/01/2007	Minimum	15.9	-	-	-	-	-	-
	Maximum	34.5	N	59	10:35	0	-	-
	0900	25.7	NNE	11	-	-	48	1014.2
	1500	33.7	N	30	-	-	24	1010.3
6/01/2007	Minimum	20.2	-	-	-	-	-	-
	Maximum	34.4	N	63	17:14	0	-	-
	0900	28.4	N	22	-	-	35	1009.2
	1500	34.3	N	39	-	-	25	1003.3
7/01/2007	Minimum	21.8	-	-	-	-	-	-
	Maximum	24.0	N	59	23:55	0	-	-
	0900	23.3	W	22	-	-	60	1001.6
	1500	19.3	SW	31	-	-	63	1005.3
8/01/2007	Minimum	12.6	-	-	-	-	-	-
	Maximum	21.2	SE	33	16:32	1.8	-	-
	0900	14.4	SSE	13	-	-	68	1014.7
	1500	20.2	SE	17	-	-	46	1013.0
9/01/2007	Minimum	3.4	-	-	-	-	-	-
	Maximum	28.9	ESE	31	16:54	0.2	-	-
	0900	12.0	NNW	2	-	-	81	1014.0
	1500	26.4	W	4	-	-	39	1008.8
10/01/2007	Minimum	6.0	-	-	-	-	-	-
	Maximum	35.3	N	41	13:22	0	-	-
	0900	20.0	ESE	11	-	-	54	1009.8
	1500	34.1	NNW	17	-	-	14	1004.3
11/01/2007	Minimum	15.6	-	-	-	-	-	-
	Maximum	37.3	N	67	9:30	0	-	-
	0900	31.1	N	30	-	-	12	1003.2
	1500	29.5	SSE	20	-	-	39	1003.7

RESULTS – A: Isolation flux measurements

Windrow 3 & 4 (mature) – undisturbed
10 January 2007



Location	Windrow 3 & 4 (mature) undisturbed
Date tested	10/01/2007
Equilibration time, hrs	0857 - 0928
Sample ID	130
Dilution ratio	8 + 8
Sampling time, hrs	0928 - 0932
Odour concentration, ou	520
Odour flux rate, ou/m ² /min	18
Source area, m ²	1600
Odour mass rate, ou/min	30000
Surface temperature (°C)	54.3
Chamber temperature (°C)	39.3
Ambient temperature (°C)	23.1

Windrow 3 & 4 (mature) – disturbed
10 January 2007



Location	Windrow 3 & 4 (mature) disturbed
Date tested	10/01/2007
Equilibration time, hrs	0909 - 0940
Sample ID	71
Dilution ratio	8 + 8
Sampling time, hrs	0940 - 0944
Odour concentration, ou	2400
Odour flux rate, ou/m ² /min	83
Source area, m ²	1600
Odour mass rate, ou/min	130000
Surface temperature (°C)	65.3
Chamber temperature (°C)	35.5
Ambient temperature (°C)	23.2

Centre section (1 month old) – undisturbed

10 January 2007



Location	Centre section (1 month old) undisturbed
Date tested	10/01/2007
Equilibration time, hrs	1018 - 1048
Sample ID	180
Dilution ratio	8 + 8
Sampling time, hrs	1048 - 1053
Odour concentration, ou	480
Odour flux rate, ou/m ² /min	17
Source area, m ²	9300
Odour mass rate, ou/min	150000
Surface temperature (°C)	58.9
Chamber temperature (°C)	41.8
Ambient temperature (°C)	28.0

Centre section (1 month old) Test 1 – disturbed
10 January 2007



Location	Centre (1 month old) disturbed - Test 1
Date tested	10/01/2007
Equilibration time, hrs	1043 - 1117
Sample ID	117
Dilution ratio	8 + 8*
Sampling time, hrs	1117 - 1121
Odour concentration, ou	89000
Odour flux rate, ou/m ² /min	3100
Source area, m ²	9300
Odour mass rate, ou/min	28000000
Surface temperature (°C)	71.0
Chamber temperature (°C)	50.2
Ambient temperature (°C)	32.2

* A further 1 in 11 dilution was required to bring within the scale of the olfactometer. This ratio is greater than recommended by AS4323.3.

Centre section (1 month old) Test 2 – disturbed

11 January 2007



Location	Centre (1 month old) disturbed - Test 2
Date tested	11/01/2007
Equilibration time, hrs	1303 - 1329
Sample ID	76
Dilution ratio	2 + 10*
Sampling time, hrs	1329 - 1330
Odour concentration, ou	46000
Odour flux rate, ou/m ² /min	1600
Source area, m ²	9300
Odour mass rate, ou/min	15000000
Surface temperature (°C)	51.6
Chamber temperature (°C)	41.7
Ambient temperature (°C)	29.2

* A further 1 in 11 dilution was required to bring within the scale of the olfactometer. This ratio is greater than recommended by AS4323.3.

Windrow 1 (1 week old) – undisturbed
10 January 2007



Location	Windrow 1 (1 week old) undisturbed
Date tested	10/01/2007
Equilibration time, hrs	1043 - 1212
Sample ID	131
Dilution ratio	2 + 10
Sampling time, hrs	1212 - 1213
Odour concentration, ou	450
Odour flux rate, ou/m ² /min	15
Source area, m ²	1400
Odour mass rate, ou/min	21000
Surface temperature (°C)	61.7
Chamber temperature (°C)	45.9
Ambient temperature (°C)	34.2

Windrow 1 (1 week old) – disturbed
10 January 2007



Location	Windrow 1 (1 week old) disturbed	
Date tested	10/01/2007	
Equilibration time, hrs	1220 - 1247	
Sample identification	87	155
Sample dilution	1 + 10*	1 + 10*
Sampling time, hrs	1247 - 1248	1250 - 1251
Odour concentration, ou	6400	10000
Average odour concentration, ou	8200	
Average odour flux rate, ou/m²/min	280	
Source area, m²	1400	
Odour mass rate, ou/min	380000	
Surface temperature (°C)	26.4	
Chamber temperature (°C)	42.1	
Ambient temperature (°C)	32.8	

*The dilution ratio of 1 in 11 is greater than recommended in AS4323.3

Leachate pond
10 January 2007



Location	Leachate pond	
Date tested	10/01/2007	
Equilibration time, hrs	1252 - 1326	
Sample identification	67	134
Sample dilution	1 + 10*	1 + 10*
Sampling time, hrs	1326 - 1327	1330 - 1331
Odour concentration, ou	9000	7600
Average odour concentration, ou	8300	
Average odour flux rate, ou/m ² /min	290	
Source area, m ²	1900	
Odour mass rate, ou/min	540000	
Surface temperature (°C)	23.2	
Chamber temperature (°C)	35.3	
Ambient temperature (°C)	33.4	

*The dilution ratio of 1 in 11 is greater than recommended in AS4323.3

RESULTS – B: Ambient measurements

Leachate pond downwind - 5m
10 January 2007

Location	Leachate pond down wind 5m
Date tested	10/01/2007
Sample ID	128
Dilution ratio	nil
Sampling time, hrs	1355 - 1405
Odour concentration, ou	79
Ambient temperature (°C)	34.6

Leachate pond downwind - 120m
10 January 2007

Location	Leachate pond downwind 120m
Date tested	10/01/2007
Sample ID	113
Dilution ratio	nil
Sampling time, hrs	1355 - 1405
Odour concentration, ou	< 30
Ambient temperature (°C)	34.6

Windrow 1 downwind
10 January 2007

Location	Windrow 1 down wind
Date tested	10/01/2007
Sample ID	147
Dilution ratio	nil
Sampling time, hrs	1415 - 1423
Odour concentration, ou	140
Ambient temperature (°C)	34.9

APPENDIX 1: Site plan & ambient sampling locations

Site plan



Note: The photographs above do not reflect the operation of the plant on the test day.

APPENDIX 2: Windrow areas

Windrow layout

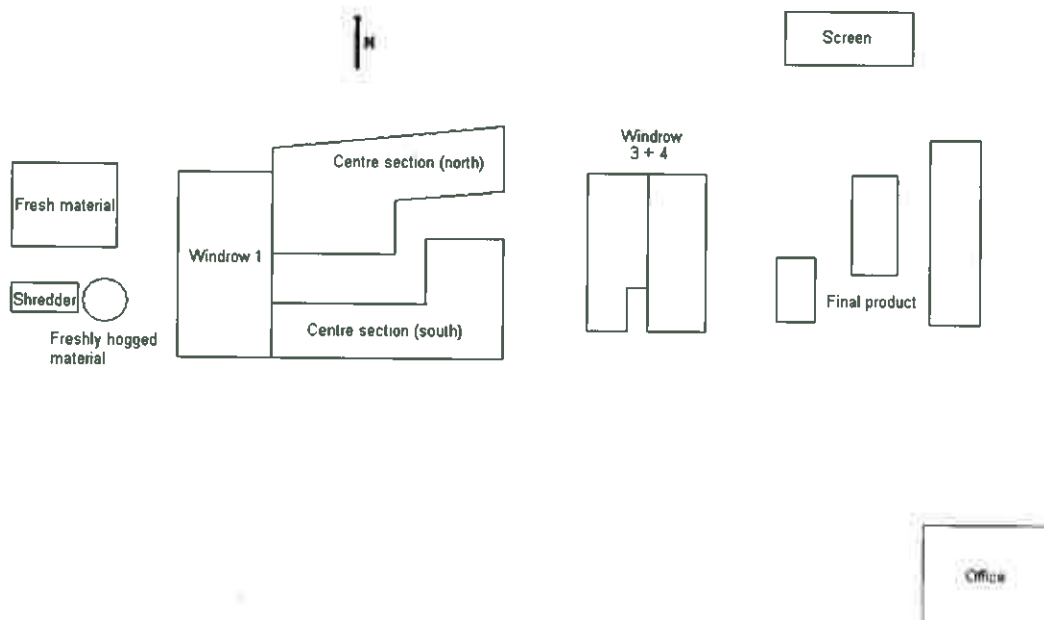


Diagram not to scale

Estimated windrow areas

Windrow 3 & 4

Windrow 3 & 4 was approximated to an eastern and a western rectangular prism side by side.

The eastern rectangular prism was 29m long x 13m wide x 7m high.

The western rectangular prism was 29m long x 17m wide x 5m high. An area of 10m x 7m was cut of the south eastern corner.

Total estimated surface area = 1620 m²

Centre section

For the purposes of estimating the surface area of the centre section; the area was divided into a northern and southern section.

The centre section (north) was approximated to an 'L'-shaped prism with a longer rectangular 'arm' to the north and a shorter rectangular 'leg' at the western end.

The rectangular 'arm' was 120m long x 15m wide x 5m high.

The rectangular 'leg' was 19m long x 57m wide x 5m high.

Total (north) estimated surface area = 4250 m²

The centre section (south) was approximated to an 'L'-shaped prism with a longer rectangular 'arm' to the south and a shorter rectangular 'leg' at the eastern end.

The rectangular 'arm' was 120m long x 22m wide x 5m high.

The rectangular 'leg' was 22m long x 40m wide x 5m high.

Total (south) estimated surface area = 5050 m²

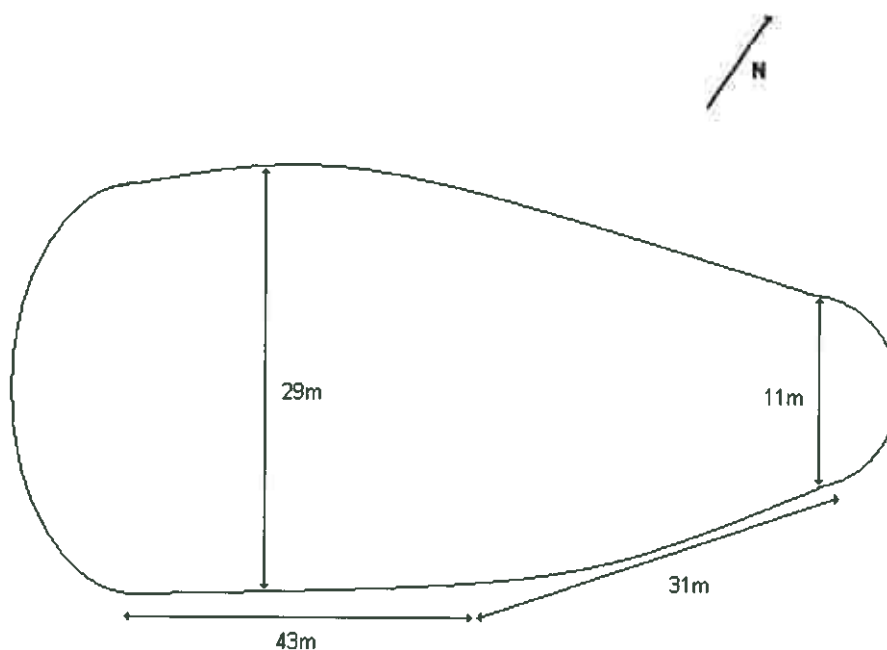
Total (north + south) estimated surface area = 9300 m²

Windrow 1

Windrow 1 was approximated to a rectangular prism 35m long x 26m wide x 5m high.

Total estimated surface area = 1350 m²

APPENDIX 3: Leachate pond area



Estimated leachate pond area

For the purposes of estimating the surface area of the leachate pond, the pond was assumed to be a trapezium (turned 90°) with a semicircular section on each end (end diameters of 29m and 11m).

Estimated total surface area = 1860 m²

Appendix B – EML odour reports



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Our reference: **N86839**

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29 April 2011

Craig Hudson and Associates
13 Barton Street
MONT ALBERT VIC 3127

Attention Mr Craig Hudson

DANDENONG PLANT

Emission Testing Report - JANUARY AND FEBRUARY 2011

Tests were performed at the request of Craig Hudson and Associates to determine emissions to air as detailed below;

Test Summary		
Location	Test Date	Test Parameters*
Greenhouse Inlet	25 January 2011	Odour
Greenhouse Outlet	25 January 2011	Odour
Stockpile Top – North End	25 January 2011	Odour flux
Stockpile Top – Middle	25 January 2011	Odour flux
Stockpile Top – South End	25 January 2011	Odour flux
GH Inlet (Compost 10 Days Old – fan @ 10 Hz)	28 January 2011	Odour
GH Outlet (Compost 10 Days Old – fan @ 10 Hz)	28 January 2011	Odour
GH Inlet (Compost 10 Days Old – fan @ 20 Hz)	28 January 2011	Odour
GH Outlet (Compost 10 Days Old – fan @ 20 Hz)	28 January 2011	Odour
GH Inlet (Compost Fresh – Fan @ 10 Hz)	28 January 2011	Odour
GH Outlet (Compost Fresh – Fan @ 10 Hz)	28 January 2011	Odour
GH Inlet (Compost Fresh – Fan @ 20 Hz)	28 January 2011	Odour
GH Outlet (Compost Fresh – Fan @ 20 Hz)	28 January 2011	Odour
Compost Stockpile 1 Inlet (34 days old – fan @ 10 Hz)	18 February 2011	Odour
Compost Stockpile 1 Outlet (34 days old – fan @ 10 Hz)	18 February 2011	Odour
Compost Stockpile 1 Inlet (34 days old – fan @ 20 Hz)	18 February 2011	Odour
Compost Stockpile 1 Outlet (34 days old – fan @ 20 Hz)	18 February 2011	Odour
Compost Stockpile 2 Inlet (21 days old – fan @ 10 Hz)	18 February 2011	Odour
Compost Stockpile 2 Outlet (21 days old – fan @ 10 Hz)	18 February 2011	Odour
Compost Stockpile 2 Inlet (21 days old – fan @ 20 Hz)	18 February 2011	Odour
Compost Stockpile 2 Outlet (21 days old – fan @ 20 Hz)	18 February 2011	Odour

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated.



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EML GROUP OF LABORATORIES
Consulting Chemists and Microbiologists MELBOURNE • SYDNEY • BRISBANE • PERTH



The results in this report supersede previously corresponded results; our references N86839p, N86839p2 & N86839p3, dated 27 January, 2 & 23 February 2011, issued to Mr Craig Hudson.

Please refer to the following pages for results, plant operating conditions, test methods, quality assurance / quality control information and definitions.

Greg Sceneay
NATA Signatory

cs doc:n86839.doc

Melissa Reddan BAppSc
NATA Signatory



**RESULTS**

Date	25/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	Greenhouse INLET
Licence No.	-	Location	Dandenong
EML Staff	NV/GS		State VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details			
Sampling plane dimensions (mm) & area	5500 x 2000	11 m ²	
Sampling port size, number & depth	Grid		
Access & height of ports	Ground level		
Duct orientation & shape	Vertical	Rectangular	
Downstream disturbance	Stockpile	1 D	
Upstream disturbance	Inlet	0 D	
No. traverses & points sampled	5	75	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	22
Velocity at sampling plane, m/s	1.1
Volumetric flow rate, discharge, m ³ /min	710
Volumetric flow rate (wet NTP), m ³ /min	650
Mass flow rate (wet basis), kg/hour	50000

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum³/min
	Predilution	Time	Date	Time			
Test 1	1	1126-1138	25/1/11	1707	20	20	13000
Test 2	1	1142-1155	25/1/11	1719	26	26	17000
n-butanol threshold (ppb)		30ppb					
Hedonic tone		1. Neutral	2. Neutral		Lower Confidence Limit	16	
Odour character		1. Earthy, dirt	2. Earthy, dirt		Upper Confidence Limit	34	





Date	25/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	Greenhouse OUTLET
Licence No.	-	Location	Dandenong
EML Staff	NV/GS		State VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details			
Sampling plane dimensions (mm) & area	1000	0.785 m ²	
Sampling port size, number & depth	Grid		
Access & height of ports	Ground level		
Duct orientation & shape	Vertical	Circular	
Downstream disturbance	Axial fan	0.5 D	
Upstream disturbance	Stockpile	2 D	
No. traverses & points sampled	5	75	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	1126-1138	25/1/11	1725	150	150
Test 2	1	1142-1155	25/1/11	1729	120	120
n-butanol threshold (ppb)		30ppb				
Hedonic tone	1. Neutral	2. Neutral			Lower Confidence Limit	91
Odour character	1. Earthy, dirt	2. Earthy, dirt			Upper Confidence Limit	200





Date	25/01/2011	Client	Craig Hudson
Report	N86839	Source	Stockpile Top - NORTH end
Licence No.	-	Location	Dandenong
EML Staff	NV/GS	State	VIC
Process Conditions	Mostly cloudy, light breeze		
Reason for testing:	Client requested testing to determine emissions to air		

Flux Parameters	
Source area, m ²	71
Hood area, m ²	0.1257
Sweep air rate, m ³ /min	0.005
Equilibration period, min	1221-1252
Barometric pressure, hPa	1009
Temperature, °C	36

Odour Flux	Sampling time	Test 1			Test 2		
		1252-1316			1318-1339		
		Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min	Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min
Odour		4900	190	14000	2700	110	7500
Lower Confidence Limit		2200			1200		
Upper Confidence Limit		11000			5800		
Sample Predilution		1			1		
Analysis Date		25/01/11			25/01/11		
Analysis Time		1612			1623		
n-Butanol Threshold (ppb)		30			30		
Hedonic tone		Very unpleasant			Mildly unpleasant		
Odour character		Earthy, rotten, compost			Earthy, compost		

Date	25/01/2011	Client	Craig Hudson
Report	N86839	Source	Stockpile Top - MIDDLE
Licence No.	-	Location	Dandenong
EML Staff	NV/GS	State	VIC
Process Conditions	Mostly cloudy, light breeze		
Reason for testing:	Client requested testing to determine emissions to air		

Flux Parameters	
Source area, m ²	71
Hood area, m ²	0.1257
Sweep air rate, m ³ /min	0.005
Equilibration period, min	1221-1252
Barometric pressure, hPa	1009
Temperature, °C	36

Odour Flux	Sampling time	Test 1			Test 2		
		1252-1316			1318-1339		
		Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min	Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min
Odour		1100	44	3200	1400	58	4100
Lower Confidence Limit		510			670		
Upper Confidence Limit		2400			3100		
Sample Predilution		1			1		
Analysis Date		25/01/11			25/01/11		
Analysis Time		1628			1636		
n-Butanol Threshold (ppb)		30			30		
Hedonic tone		Mildly unpleasant			Mildly unpleasant		
Odour character		Earthy, compost			Earthy, compost		





Date	25/01/2011	Client	Craig Hudson
Report	N86839	Source	Stockpile Top - SOUTH end
Licence No.	-	Location	Dandenong
EML Staff	NV/GS	State	VIC
Process Conditions	Mostly cloudy, light breeze		
Reason for testing:	Client requested testing to determine emissions to air		

Flux Parameters	
Source area, m ²	71
Hood area, m ²	0.1257
Sweep air rate, m ³ /min	0.005
Equilibration period, min	1345-1410
Barometric pressure, hPa	1007
Temperature, °C	29

Odour Flux	Sampling time	Test 1			Test 2		
		Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min	Concentration ou	Flux Rate ouv/m ² /min	Mass Rate ouv/min
Odour		860	34	2400	790	31	2200
Lower Confidence Limit		400			360		
Upper Confidence Limit		1900			1700		
Sample Predilution		1			1		
Analysis Date		25/01/11			25/01/11		
Analysis Time		1642			1653		
n-Butanol Threshold (ppb)		30			30		
Hedonic tone		Neutral			Mildly unpleasant		
Odour character		Earthy, compost			Earthy, rotten, compost		





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH INLET - Compost 10 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details			
Sampling plane dimensions (mm) & area	600	0.283 m ²	
Sampling port size, number & depth	Grid		
Access & height of ports	Ground level	0 m	
Duct orientation & shape	Horizontal	Circular	
Downstream disturbance	Stockpile	1 D	
Upstream disturbance	Inlet	0 D	
No. traverses & points sampled	5	30	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments	
The discharge is assumed to be composed of dry air and moisture	
All results reported on a dry basis at NTP (except odour - wet NTP)	

Stack Parameters		
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)
Gas Flow Parameters		
Temperature, °C	23	
Velocity at sampling plane, m/s	1.6	
Volumetric flow rate, discharge, m ³ /min	27	
Volumetric flow rate (wet NTP), m ³ /min	25	
Mass flow rate (wet basis), kg/hour	1900	

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum ³ /min
	Predilution	Time	Date	Time			
Test 1	1	0920-0930	28/1/11	1544	400	400	9800
Test 2	1	0933-0944	28/1/11	1551	150	150	3800
n-butanol threshold (ppb)		28ppb					
Hedonic tone		1. Mildly unpleasant	2. Neutral		Lower Confidence Limit	190	
Odour character		1. Sour	2. Earthy		Upper Confidence Limit	400	





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH OUTLET - Compost 10 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	0920-0930	28/1/11	1557	120	120
Test 2	1	0933-0944	28/1/11	1604	83	83
n-butanol threshold (ppb)		28ppb				
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	68
Odour character		Earthy, compost			Upper Confidence Limit	150





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH INLET - Compost 10 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details		
Sampling plane dimensions (mm) & area	600	0.283 m ²
Sampling port size, number & depth	Grid	
Access & height of ports	Ground level	0 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Stockpile	1 D
Upstream disturbance	Inlet	0 D
No. traverses & points sampled	5	30
Traverse method & compliance	AS4323.1	Non-compliant

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	26
Velocity at sampling plane, m/s	4.3
Volumetric flow rate, discharge, m ³ /min	72
Volumetric flow rate (wet NTP), m ³ /min	67
Mass flow rate (wet basis), kg/hour	5100

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum³/min
	Predilution	Time	Date	Time			
Test 1	1	0957-1008	28/1/11	1609	150	150	10000
Test 2	1	1010-1021	28/1/11	1615	130	130	8500
n-butanol threshold (ppb)		28ppb					
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	95	
Odour character		Sour			Upper Confidence Limit	210	





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH OUTLET - Compost 10 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	0957-1008	28/1/11	1620	76	76
Test 2	1	1010-1021	28/1/11	1625	69	69
n-butanol threshold (ppb)		28ppb				
Hedonic tone		Neutral to Mildly unpleasant			Lower Confidence Limit	49
Odour character		Earthy, compost			Upper Confidence Limit	110





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH INLET - Compost Fresh - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details			
Sampling plane dimensions (mm) & area	600	0.283 m ²	
Sampling port size, number & depth	Grid		
Access & height of ports	Ground level	0 m	
Duct orientation & shape	Vertical	Circular	
Downstream disturbance	Stockpile	1 D	
Upstream disturbance	Inlet	0 D	
No. traverses & points sampled	5	30	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments	
The discharge is assumed to be composed of dry air and moisture	
All results reported on a dry basis at NTP (except odour - wet NTP)	

Stack Parameters			
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)	
Gas density at NTP, kg/m ³	1.27 (wet)	1.29 (dry)	
Gas Flow Parameters			
Temperature, °C	29		
Velocity at sampling plane, m/s	1.7		
Volumetric flow rate, discharge, m ³ /min	29		
Volumetric flow rate (wet NTP), m ³ /min	27		
Mass flow rate (wet basis), kg/hour	2000		

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum ³ /min
	Predilution	Time	Date	Time			
Test 1	1	1138-1147	28/1/11	1642	150	150	4100
Test 2	1	1149-1200	28/1/11	1649	280	280	7400
n-butanol threshold (ppb)		28ppb					
Hedonic tone	1. Mildly unpleasant	2. Mildly unpleasant	Lower Confidence Limit		150		
Odour character	1. Sour, rotten	2. Fertilizer	Upper Confidence Limit		320		





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH OUTLET - Compost Fresh - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	1138-1147	28/1/11	1655	660	660
Test 2	1	1149-1200	28/1/11	1700	940	940
n-butanol threshold (ppb)		28ppb				
Hedonic tone		Very unpleasant			Lower Confidence Limit	540
Odour character		Earthy, fishy, rotten, sewage			Upper Confidence Limit	1200





Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH INLET - Compost Fresh - Fan @ 20 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS		State VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details			
Sampling plane dimensions (mm) & area	600	0.283 m ²	
Sampling port size, number & depth	Grid		
Access & height of ports	Ground level	0 m	
Duct orientation & shape	Vertical	Circular	
Downstream disturbance	Stockpile	1 D	
Upstream disturbance	Inlet	0 D	
No. traverses & points sampled	5	30	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.27 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	28
Velocity at sampling plane, m/s	3.6
Volumetric flow rate, discharge, m ³ /min	61
Volumetric flow rate (wet NTP), m ³ /min	55
Mass flow rate (wet basis), kg/hour	4200

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum³/min
	Predilution	Time	Date	Time			
Test 1	1	1206-1217	28/1/11	1705	90	90	5000
Test 2	1	1218-1230	28/1/11	1710	120	120	6500
n-butanol threshold (ppb)		28ppb					
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	70	
Odour character		Sour, earthy			Upper Confidence Limit	150	





Test report prepared for Craig Hudson and Associates

Date	28/01/2011	Client	Craig Hudson
Report	N86839	Stack ID	GH OUTLET - Compost Fresh - Fan @ 20 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	1206-1217	28/1/11	1715	720	720
Test 2	1	1218-1230	28/1/11	1720	510	510
n-butanol threshold (ppb)		28ppb				
Hedonic tone		Very unpleasant			Lower Confidence Limit	420
Odour character		Earthy, fishy, rotten			Upper Confidence Limit	910



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Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 1 INLET - 34 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong State VIC
EML Staff	TB/GS		
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details

Sampling plane dimensions (mm) & area	600	0.283 m ²
Sampling port size, number & depth	Grid	
Access & height of ports	Ground level	0 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Stockpile	1 D
Upstream disturbance	Inlet	0 D
No. traverses & points sampled	5	30
Traverse method & compliance	AS4323.1	Non-compliant

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	24
Velocity at sampling plane, m/s	1.7
Volumetric flow rate, discharge, m ³ /min	29
Volumetric flow rate (wet NTP), m ³ /min	27
Mass flow rate (wet basis), kg/hour	2000

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum ³ /min
	Predilution	Time	Date	Time			
Test 1	1	1004-1018	18/2/11	1448	42	42	1100
Test 2	1	1019-1034	18/2/11	1456	76	76	2000
n-butanol threshold (ppb)		35ppb					
Hedonic tone		Mildly pleasant to mildly unpleasant			Lower Confidence Limit	40	
Odour character		Combustion/burnt			Upper Confidence Limit	87	





Test report prepared for Craig Hudson and Associates

Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 1 OUTLET - 34 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	1004-1018	18/2/11	1318	150	150
Test 2	1	1019-1034	18/2/11	1441	150	150
n-butanol threshold (ppb)		35ppb				
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	100
Odour character		Rotten, earthy, sour			Upper Confidence Limit	220



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Test report prepared for Craig Hudson and Associates

Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 1 INLET - 34 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details

Sampling plane dimensions (mm) & area	600	0.283 m ²
Sampling port size, number & depth	Grid	
Access & height of ports	Ground level	0 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Stockpile	1 D
Upstream disturbance	Inlet	0 D
No. traverses & points sampled	5	30
Traverse method & compliance	AS4323.1	Non-compliant

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	24
Velocity at sampling plane, m/s	3.7
Volumetric flow rate, discharge, m ³ /min	62
Volumetric flow rate (wet NTP), m ³ /min	57
Mass flow rate (wet basis), kg/hour	4400

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum³/min
	Predilution	Time	Date	Time			
Test 1	1	1041-1055	18/2/11	1515	20	20	1100
Test 2	1	1056-1111	18/2/11	1521	20	20	1100
n-butanol threshold (ppb)		35ppb					
Hedonic tone		Neutral			Lower Confidence Limit	14	
Odour character		Combustion/burnt, sour			Upper Confidence Limit	29	





Test report prepared for Craig Hudson and Associates

Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 1 OUTLET - 34 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong State VIC
EML Staff	TB/GS		
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold	Concentration
	Predilution	Time	Date	Time	ou	ou
Test 1	1	1041-1055	18/2/11	1350	170	170
Test 2	1	1056-1111	18/2/11	1356	230	230
n-butanol threshold (ppb)		35ppb				
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	130
Odour character		Combustion/burnt, sour			Upper Confidence Limit	290



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Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 2 INLET - 21 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong
EML Staff	TB/GS	State	VIC
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details

Sampling plane dimensions (mm) & area	600	0.283 m ²
Sampling port size, number & depth	Grid	
Access & height of ports	Ground level	0 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Stockpile	1 D
Upstream disturbance	Inlet	0 D
No. traverses & points sampled	5	30
Traverse method & compliance	AS4323.1	Non-compliant

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	20
Velocity at sampling plane, m/s	1.9
Volumetric flow rate, discharge, m ³ /min	32
Volumetric flow rate (wet NTP), m ³ /min	30
Mass flow rate (wet basis), kg/hour	2300

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum ³ /min
	Predilution	Time	Date	Time			
Test 1	1	0810-0825	18/2/11	1503	35	35	1000
Test 2	1	0829-0844	18/2/11	1509	21	21	620
n-butanol threshold (ppb)		35ppb					
Hedonic tone		Neutral to mildly unpleasant			Lower Confidence Limit	19	
Odour character		Combustion/burnt, earthy			Upper Confidence Limit	41	





Test report prepared for Craig Hudson and Associates

Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 2 OUTLET - 21 Days Old - Fan @ 10 Hz
Licence No.	-	Location	Dandenong State VIC
EML Staff	TB/GS		
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture

All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	0810-0825	18/2/11	1431	110	110
Test 2	1	0829-0844	18/2/11	1441	150	150
n-butanol threshold (ppb)		35ppb				
Hedonic tone		Mildly unpleasant to very unpleasant			Lower Confidence Limit	89
Odour character		Rotten, earthy, sour			Upper Confidence Limit	190





Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 2 INLET - 21 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong State VIC
EML Staff	TB/GS		
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Sampling Plane Details

Sampling plane dimensions (mm) & area	600	0.283 m ²
Sampling port size, number & depth	Grid	
Access & height of ports	Ground level	0 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Stockpile	1 D
Upstream disturbance	Inlet	0 D
No. traverses & points sampled	5	30
Traverse method & compliance	AS4323.1	Non-compliant

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Stack Parameters

Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at NTP, kg/m ³	1.28 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	21
Velocity at sampling plane, m/s	3.8
Volumetric flow rate, discharge, m ³ /min	65
Volumetric flow rate (wet NTP), m ³ /min	60
Mass flow rate (wet basis), kg/hour	4600

Odour	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum³/min
	Predilution	Time	Date	Time			
Test 1	1	0852-0906	18/2/11	1526	30	30	1800
Test 2	1	0908-0924	18/2/11	1533	37	37	2200
n-butanol threshold (ppb)		35ppb					
Hedonic tone		Neutral			Lower Confidence Limit	23	
Odour character		Earthy			Upper Confidence Limit	49	





Test report prepared for Craig Hudson and Associates

Date	18/02/2011	Client	Craig Hudson
Report	N86839	Stack ID	Compost Stockpile 2 OUTLET - 21 Days Old - Fan @ 20 Hz
Licence No.	-	Location	Dandenong State VIC
EML Staff	TB/GS		
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Comments

The discharge is assumed to be composed of dry air and moisture
All results reported on a dry basis at NTP (except odour - wet NTP)

Odour	Sample		Analysis		Threshold ou	Concentration ou
	Predilution	Time	Date	Time		
Test 1	1	0852-0906	18/2/11	1340	360	360
Test 2	1	0908-0924	18/2/11	1345	95	95
n-butanol threshold (ppb)		35ppb				
Hedonic tone		Mildly unpleasant			Lower Confidence Limit	150
Odour character		Rotten, earthy, sour			Upper Confidence Limit	340





PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Craig Hudson and Associates's records for complete process conditions.

TEST METHODS

All sampling and analysis was performed by EML Air unless otherwise specified.

Parameter	EML Air Method	Reference Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample Plane Criteria	-	AS 4323.1	-	✓	NA
Flow rate, temperature and velocity	100	USEPA 2	not specified	✓	NA
Moisture	105	Vic EPA 3040	6%	✓	✓
Odour	-	AS 4323.3	not specified	✓	✓
Odour flux	147	USEPA/600/8-86/008	not specified	✓	✓

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

AS – Australian Standard

USEPA – United States Environmental Protection Agency

Vic EPA – Victorian Environment Protection Authority

QUALITY ASSURANCE / QUALITY CONTROL INFORMATION

EML Air Pty Ltd is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources (Accreditation number 2732). Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for EML Air at NATA's website www.nata.asn.au.

EML Air is accredited to Australian Standard 17025 – General Requirements for the Competence of Testing and Calibration Laboratories. Australian Standard 17025 requires that a laboratory have a quality system similar to ISO 9002. More importantly it also 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 Assurance Manager.

A formal Quality Control program is in place at EML Air to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.



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DEFINITIONS

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

NTP	Normal 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.
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.
BSP	British standard pipe.
NA	Not applicable
D	Duct diameter or equivalent duct diameter for rectangular ducts.
<	Less than.
>	Greater than.
≥	Greater than or equal to.
~	Approximately.

