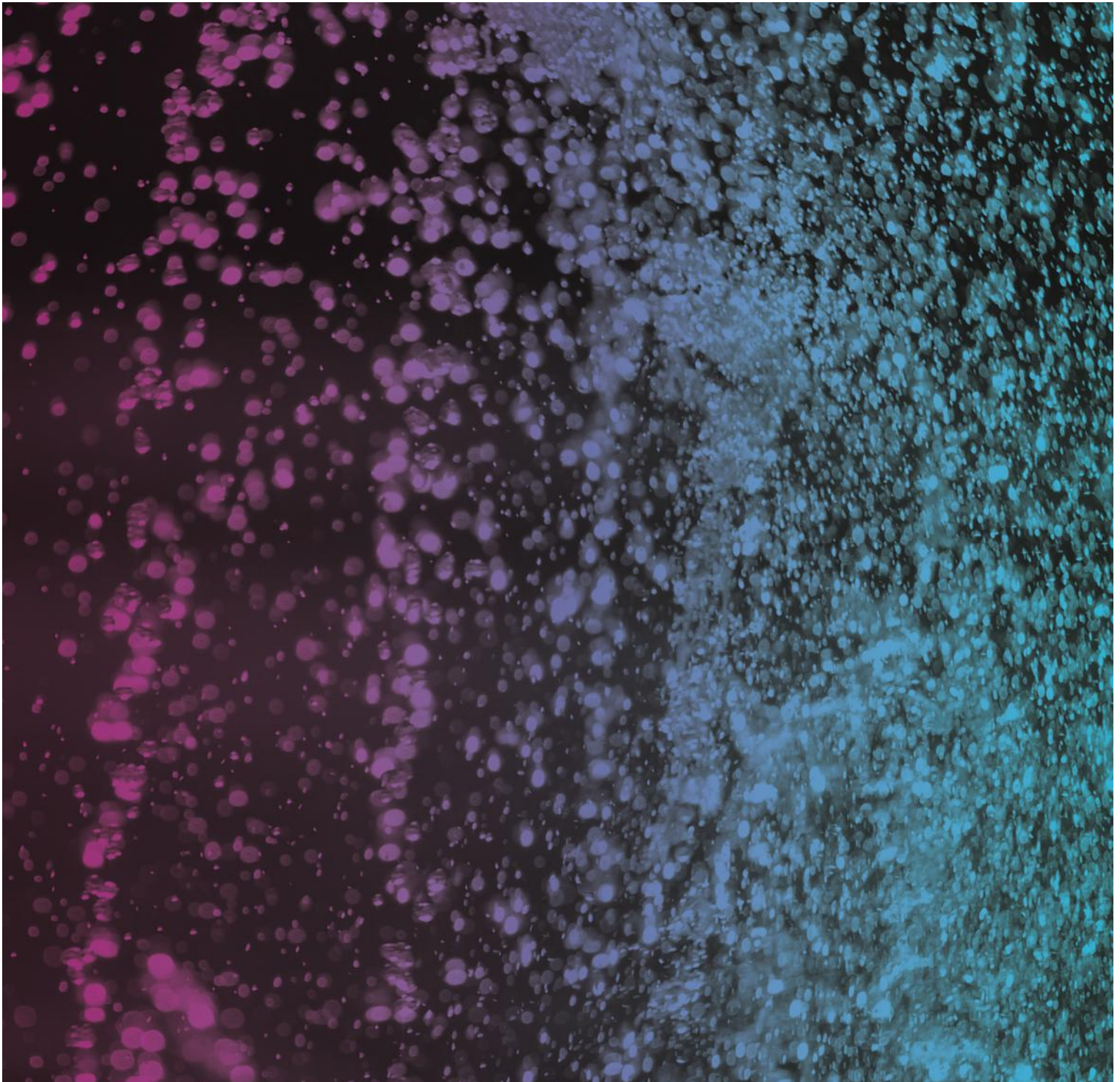


# Air Quality Management and Monitoring Plan

Armidale Regional Landfill



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Armidale Regional Landfill

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## Quality Information

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			Name/Position	Signature
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A	28-Apr-15	Council review	James Turnell Waste Manager (ADC)	
B	5-Jun-15	For Issue to EPA	Danielle Poirier Associate Director - Environment	
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## Abbreviations

AQMMP	Air Quality Management and Monitoring Plan
BoM	Bureau of Meteorology
DP&E	Department of Environment
EPA	Environment Protection Authority
LEMP	Landfill Environmental Management Plan
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
POEO	Protection of the Environment Operational Regulation 2010
TSP	Total Suspended Particulates

## 1.0 Introduction

### 1.1 Project Background

Armidale Dumaresq Council (Council) has approval for the construction and operation of a new regional landfill to service the Armidale region. The landfill is located on Waterfall Way, approximately 12 km east of Armidale. The project involves construction and operation of a landfill comprising five cells, each cell with a maximum volume of 211,000m<sup>3</sup>.

The Planning Assessment Commission, as delegate for the then NSW Minister for Planning and Infrastructure, granted approval for the project under Section 75J of the *Environmental Planning and Assessment Act 1979*, subject to conditions, on 4 July 2012. The then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Commonwealth Department of the Environment), granted approval for the project under the *Environment Protection and Biodiversity Conservation Act 1999* on 30 August 2012.

AECOM has been engaged by Council to prepare an Air Quality Management and Monitoring Plan (AQMMP) to manage air quality during the construction and operation of the new landfill.

#### 1.1.1 Consultation

A copy of this Plan was provided to the NSW Environment Protection Authority (EPA) in accordance with consultation requirements under Condition 24 of the Project Approval, on 5 June 2015. The EPA responded on 16 June 2015 (Appendix A). This Plan was subsequently updated to incorporate this feedback from EPA. No formal consultation was required with the local community under this condition.

### 1.2 Purpose and Scope

**Conditions 19, 20 and 21 / Schedule 4** of the Conditions of Approval require specific air quality controls to be implemented for the project.

**Condition 24 / Schedule 4** of the Conditions of Approval require the preparation of an Air Quality Monitoring Plan for the project in consultation with the NSW Environment Protection Authority (EPA) and to the satisfaction of the Secretary of the Department of Planning and Environment (DP&E).

**Condition 25 / Schedule 4** of the Conditions of Approval require the implementation of a meteorological station during the life of the project.

This AQMMP satisfies Condition 24. The AQMMP also fulfils the requirements of Conditions 19, 20 and 21, identifying the air quality controls to be implemented and the air quality monitoring schedules and procedures over the life of the project. This plan has also been prepared with consideration of the Benchmark Techniques in NSW Environment Protection Authority's (EPA) *Environmental Guidelines: Solid Waste Landfills* (1996) to minimise emission of pollutants to the atmosphere and to prevent the loss of amenity.

### 1.3 Structure of this Plan

This AQMMP is structured as follows:

- Section 1.0** – Introduction
- Section 2.0** – Statutory Requirements
- Section 3.0** – Air Quality
- Section 4.0** – Air Quality Criteria
- Section 5.0** – Roles and Responsibilities
- Section 6.0** – Management Measures
- Section 7.0** – Monitoring Program
- Section 8.0** – Data Management and Reporting
- Section 9.0** – Review
- Section 10.0** – References

This plan forms part of the site's Landfill Environmental Management Plan (LEMP) as shown in Figure 1

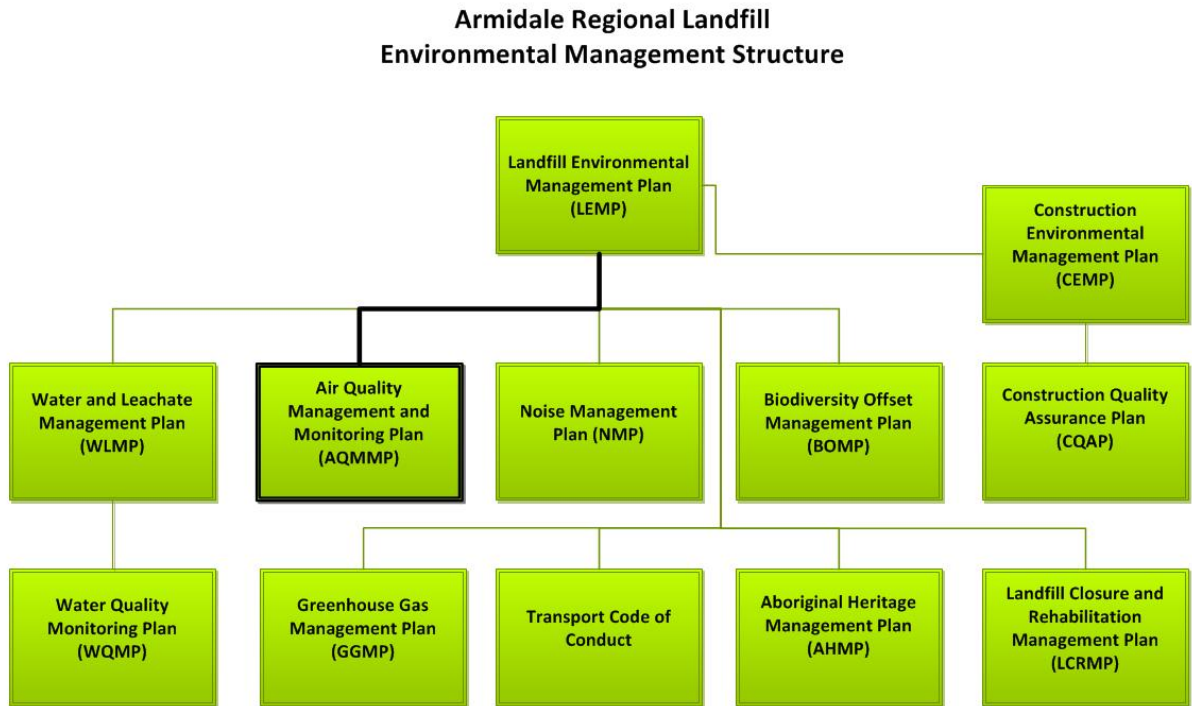


Figure 1 Environmental Management Structure

## 2.0 Statutory Requirements

### 2.1 Project Approval Requirements (PA 06\_0220)

Condition 21 / Schedule 4 of the Conditions of Approval states:

*The Proponent shall prepare and implement an Air Quality Monitoring Plan in consultation with the OEH and to the satisfaction of the Director-General prior to the commencement of operations.*

Other approval requirements relevant to this AQMMP include the following:

- Condition 19, 20 / Schedule 4 - Dust
- Condition 21 / Schedule 4 - Odour
- Condition 24 / Schedule 4 – Air Quality Monitoring Plan
- Condition 25 / Schedule 4 – Meteorological Monitoring

Table 1 sets out the approval conditions and indicates where each is addressed within this Plan.

**Table 1 Management Plan Requirements**

Project Approval Condition	Plan Section
Condition 19 / Schedule 4 <i>All operations and activities occurring at the premises or on a haulage route must be carried out in a manner that will minimise emissions of dust.</i>	6.2
Condition 20 / Schedule 4 <i>Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.</i>	6.2
Condition 21 / Schedule 4 <i>The Proponent shall not cause or permit the emission of offensive odours from the site, as defined under Section 129 of the POEO Act.</i>	6.1
Condition 24 / Schedule 4 <i>The Proponent shall prepare and implement an Air Quality Monitoring Plan in consultation with the EPA and to the satisfaction of the Secretary prior to the commencement of operations.</i>	This Plan (and 1.1.1)
Condition 25 / Schedule 4 <i>During the life of the project, the Proponent shall ensure that there is a suitable meteorological station in the vicinity of the site that complies with the requirements in the latest version of Approved Methods for Sampling of Air Pollutants in New South Wales guideline.</i>	7.1

### 2.2 Licenses and Permits

The operation of the landfill will require an Environment Protection Licence as prescribed under the *Protection of the Environment Operations Act 1997*.

### 2.3 Relevant Legislation and Guidelines

This AQMMP has been prepared in accordance with the following legislation, guidelines, standards and reports:

- *Protection of the Environment Operations Act 1997* (POEO Act) – section 129
- *Protection of the Environment Operations (Clean Air) Regulation 2010*
- NSW EPA – Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW, November 2006
- NSW EPA – Technical Notes – Assessment and Management of Odour from Stationary Sources in NSW, November 2006



- NSW EPA – Approved methods for the Modelling and Assessment of Air pollutants in New South Wales, 2005
- NSW EPA – Approved methods for the Sampling and Analysis of Air Pollutants in New South Wales, 2005
- National Environment Protection Council (NEPC) – National Environment Protection (Ambient Air Quality) Measure (NEPM), 2003
- Project Approval (06\_0220) and other relevant project information provided by Council
- Air Quality Assessment Report: Proposed Armidale Landfill – prepared by Holmes Air Sciences, 2006

## 3.0 Air Quality at the Site

### 3.1 Existing Environment

As part of the environmental assessment for the project, Holmes Air Sciences was commissioned to undertake an air quality assessment for the proposed landfill: *Air Quality Assessment Report Proposed Armidale Landfill* (Holmes Air Sciences, 2006). Modelling for the report was undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW DEC, 2005) using AUSPLUME version 6.0. The assessment quantified dust and odour impacts on nearby receivers. The following sections summarise the findings of the report in relation to air quality at the site.

#### 3.1.1 Meteorology

The rate at which pollutants are dispersed is dependent on meteorological conditions including wind speed, wind direction, atmospheric stability class and mixed-layer height. Meteorological data was sourced from the Bureau of Meteorology at Armidale Airport using an automatic weather station and cloud cover data was sourced from Glenn Innes, approximately 85 kilometres north of Armidale.

The winds in the area of the Project Site are predominantly from the east, west and east-north-east (when considered on an annual basis). Easterly winds are the most common in summer and autumn, while westerly winds dominate during winter. In spring, the winds are often strongest from the west, however easterly and east-north-easterly winds are also common.

In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. Stability is usually assigned according to six classes, A to F. Class A relates to unstable conditions, such as might be found on a sunny day with light winds. In such conditions, plumes will spread rapidly. Class F relates to stable conditions, such as those that occur when the sky is clear, the winds are light and an inversion layer is present. In such conditions plumes will spread slowly. The intermediate Classes B, C, D and E relate to intermediate dispersion conditions. The frequency of occurrence of each stability category expected in the Armidale area is shown in Table 2.

Table 2 Frequency of Occurrence of Stability Classes at Armidale

Stability Class	% frequency of occurrence
A	1.9
B	8.2
C	14.1
D	48.8
E	11.4
F	15.6
Total	100

The high frequency of D class stabilities (48.8%) indicates that emissions will disperse quickly for a significant proportion of the time. A more detailed analysis of the joint wind speed, wind direction and stability class frequency is provided in the Air Quality Assessment Report (Holmes Air Sciences, 2006).

#### 3.1.2 Local Air Quality

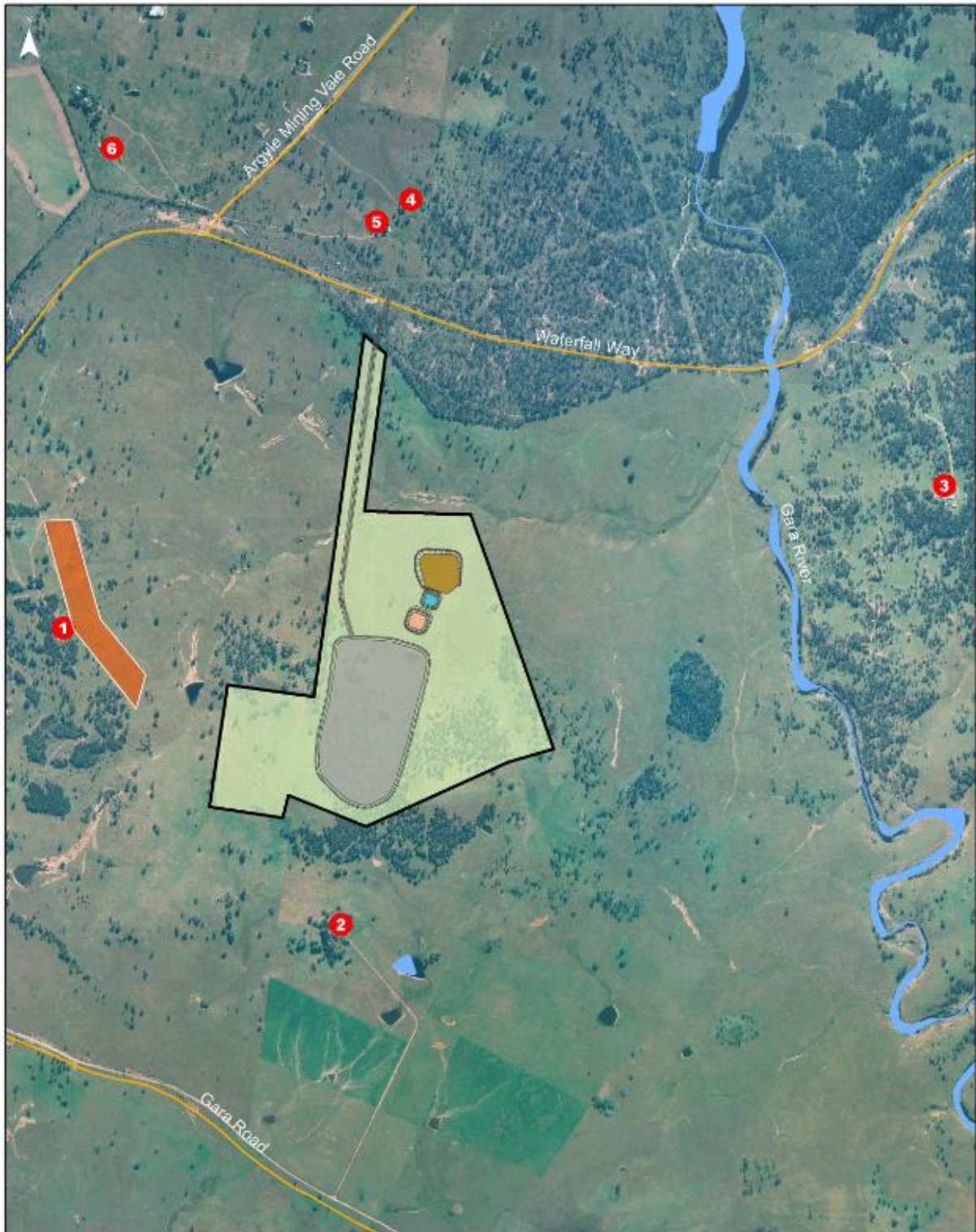
The landfill site is located in a rural agricultural area where background levels of pollution are typically low. The concentration of airborne particulate matter is highly variable, as particulates may come from a multitude of local and other sources. The main source of particulate emissions would be from domestic wood fired heaters. Bushfires and wind-blown dust also have the potential to cause 24-hour average particulate (PM<sub>10</sub>) exceedances.

### **3.2 Sensitive Receivers**

The landfill site is located within a rural setting. The nearest sensitive receivers (i.e. those within two kilometres) are residences shown on Figure 2. Only two receivers are within one kilometre of the landfill cell footprint:

- 1) Strathaven (denoted as Receiver 1) property located approximately 950 metres west of the landfill footprint.
- 2) Sherraloy (denoted as Receiver 2) property located approximately 410 metres south of the landfill footprint.

Figure 2 Location of Sensitive Receivers



### 3.3 Potential Air Quality Impacts

#### 3.3.1 Odour

The vast majority of collected green waste and other potentially recyclable materials would be separated and removed from the waste prior to landfilling at the existing Armidale Waste Management Centre on Longswamp Road. Therefore, green waste and other potentially recyclable materials would not be directed to the new Armidale regional landfill. However, the landfill may contain some level of biodegradable organic matter including a range of putrescible, organic materials, such as food waste, but may also include some paper, cardboard and/or wood/timber products, etc.

It is expected that odour from the new landfill would predominantly be emitted from the following sources and activities:

- active tipping face (during active landfilling)
- leachate storage pond
- various risers and other gas infrastructure (if required in future)

The active tipping face would be the main source of potential odour emissions. Due to the ongoing requirements for daily and intermediate cover of all waste materials, the active tipping face would be the only area of exposed waste at any one time. Also, the tipping face would only be exposed during the normal operating hours of the landfill, as the active tipping face would be appropriately covered at the end of each working day. A new tipping face would not then be established until the beginning of the next working day's tipping (i.e. landfilling) operations.

Modelling previously undertaken by Holmes Air Sciences (2006) determined that the odour levels at the 99th percentile are well within the 7 odour units (ou) goal for all stages of the landfill development, and that off-site odour impacts from the landfill would be at acceptable levels. A summary of odour predictions at sensitive receivers is provided in Table 3.

**Table 3 Predicted 99th Percentile Odour Concentrations (ou)**

Stage	Odour concentration (ou) at receivers					
	1	2	3	4	5	6
0-10 years	0.15	1.48	0.16	0.04	0.04	0.02
10-20 years	0.27	2.09	0.26	0.06	0.06	0.03
40-50 years	0.63	1.08	0.38	0.09	0.09	0.04

#### 3.3.2 Dust

Dust emissions may arise from various construction and operational activities at the landfill including:

- Site establishment works (including site clearance)
- Excavation/removal of topsoil and the movement of excavators around the site
- Stockpiling activities (including hauling and dumping of material)
- Shaping of the tipping face by dozers
- Movement of vehicles to and from site
- Dumping of waste at the tipping face
- Daily cover of material using dozers and scrapers
- Wind erosion of exposed landfill areas
- Wind erosion of stockpiles

Of these, it is anticipated the primary source of dust would be generated from excavation of material during construction, vehicles travelling on unsealed surfaces, dumping of waste, and the shaping of the tipping face.

Predictions of dust emissions were undertaken by Holmes Air Sciences (2006) for which the highest predicted concentrations at residential receivers are shown in Table 4. Overall, dust concentrations and deposition levels at

all residential receivers were very low and it was concluded that air quality impacts arising from dust emissions from the landfill would be negligible.

**Table 4 Predicted Dust Concentrations**

Stage	Dust Prediction	Receiver						Relevant Air Quality Criteria
		1	2	3	4	5	6	
0-10 years	Maximum 24-hour PM <sub>10</sub>	3.71	8.91	1.27	0.70	0.79	1.61	50
	Annual PM <sub>10</sub>	0.25	0.60	0.10	0.03	0.04	0.03	30
	Annual TSP	0.36	0.98	0.13	0.05	0.05	0.03	90
	Annual Dust Deposition	0.08	0.10	0.03	0.01	0.01	0.00	4
10-20 years	Maximum 24-hour PM <sub>10</sub>	4.28	6.21	1.37	0.79	0.90	1.66	50
	Annual PM <sub>10</sub>	0.32	0.39	0.11	0.04	0.04	0.03	30
	Annual TSP	0.47	0.62	0.15	0.05	0.06	0.04	90
	Annual Dust Deposition	0.10	0.06	0.03	0.01	0.01	0.00	4
40-50 years	Maximum 24-hour PM <sub>10</sub>	2.85	1.55	0.85	0.69	0.70	1.37	50
	Annual PM <sub>10</sub>	0.30	0.09	0.08	0.03	0.03	0.03	30
	Annual TSP	0.43	0.14	0.11	0.04	0.05	0.03	90
	Annual Dust Deposition	0.09	0.01	0.02	0.01	0.01	0.00	4

## 4.0 Air Quality Criteria

### 4.1 Odour

NSW EPA's odour assessment procedures are set out within *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) and are also reproduced in the NSW EPA document *Technical framework - Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006). The criteria have been designed to take account of population density and likely sensitivity in the area. Table 5 lists the odour certainty thresholds for different population densities. These are not to be exceeded for more than 1% of the time (DEC, 2005).

**Table 5 Odour Performance Criteria for the Assessment of Odour**

Population of Affected Community	Odour Performance Criteria (nose response odour certainty units at the 99th %ile)
Single residence ( $\leq \sim 2$ )	7
$\sim 10$	6
$\sim 30$	5
$\sim 125$	4
$\sim 500$	3
Urban ( $\sim 2000$ )	2

Source: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).

The odour performance criteria outlined above take account of the human nose response time of one-second. It should be noted that the difference between odour criteria is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For example, in a densely populated area there would be a greater risk that some individuals would find an odour unacceptable over a sparsely populated area.

Although it is possible to derive formulae for assessing odour annoyance within a community, the response of any individual to an odour is still quite unpredictable. Whether or not an individual considers an odour to be a nuisance would depend on the factors, referred to as FIDOL, which include:

- The Frequency of the exposure.
- The Intensity of the odour.
- The Duration of the odour episodes.
- The Offensiveness of the odour.
- The Location of the source.

### 4.2 Dust

NSW EPA's dust assessment procedures are set out within *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). These procedures include NSW EPA's methods for the use of models and also set out the relevant air quality criteria for particulate matter with an aerodynamic diameter of less than 10 microns (PM<sub>10</sub>), Total Suspended Particulates (TSP) and dust deposition that are to be used in modelling assessments. In addition, the Ambient Air Quality NEPM (NEPC, 2003) provides a similar 24 hour PM<sub>10</sub> goal as well as an advisory reporting standard for particulate matter with an aerodynamic diameter of less than 2.5 microns (PM<sub>2.5</sub>). It should also be noted that on 29 April 2014 a notice of intention to vary the Ambient Air Quality NEPM was issued. The varied NEPM is yet available however the provided references should be updated, where relevant, when it is published.

Table 6 sets out the air quality assessment criteria that are relevant to the landfill. The air quality criteria relate to the total dust burden in the air, not just the dust from the landfill.

**Table 6** Criteria for Particulate Matter Concentrations

Pollutant	Standard / Goal	Averaging Period	Agency
Total Suspended Particulate Matter (TSP)	90 $\mu\text{g}/\text{m}^3$	Annual mean	National Health & Medical Research Council
Particulate Matter < 10 $\mu\text{m}$ (PM <sub>10</sub> )	50 $\mu\text{g}/\text{m}^3$	24-hour maximum	NSW EPA, NEPC
	30 $\mu\text{g}/\text{m}^3$	Annual mean	NSW EPA
	50 $\mu\text{g}/\text{m}^3$	24-hour average, 5 exceedances permitted per year	NEPC
Particulate Matter < 2.5 $\mu\text{m}$ (PM <sub>2.5</sub> )	25 $\mu\text{g}/\text{m}^3$	Advisory reporting standard, one day period	NEPC
	8 $\mu\text{g}/\text{m}^3$	Advisory reporting standard, one year period	NEPC

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. Table 7 shows the maximum acceptable increase in dust deposition over the existing dust levels and the total deposited dust level provided in the Approved Methods (DEC, 2005).

**Table 7** NSW EPA Criteria for Dust Deposition

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited Dust	Annual	2 $\text{g}/\text{m}^2/\text{month}$	4 $\text{g}/\text{m}^2/\text{month}$

Source: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).

#### 4.2.1 NSW EPA Benchmark Technique 34: Dust Controls

The maximum level for dust deposition is  $4\text{g}/\text{m}^2$  per month as an annual mean for total solids. This deposition rate from the landfill shall not be exceeded outside the site boundary.



## 5.0 Roles and Responsibilities

Roles for the AQMMP are consistent with the overarching LEMP (refer to ARLF-LEMP-RP-0001). Responsibilities for the implementation of the AQMMP are summarised in Table 8.

**Table 8 Summary of Responsibilities**

Responsibility	Action
Waste Manager	<ul style="list-style-type: none"> <li>- Overall implementation of the AQMMP</li> <li>- Authorise and confirm the implementation of mitigation measures</li> <li>- Communication with EPA, as required</li> </ul>
Site Environmental Officer / Superintendent	<ul style="list-style-type: none"> <li>- Coordinate monitoring and compile reports</li> <li>- Maintain internal records of monitoring</li> <li>- Collate and maintain records of complaints, respond to complainant</li> <li>- Identify Non Conformances and notify Waste Manager</li> <li>- Review and update the AQMMP as required</li> </ul>
Council Personnel / Contractor	<ul style="list-style-type: none"> <li>- Undertake monitoring required by the AQMMP</li> <li>- Prepare monitoring reports as required by the AQMMP</li> </ul>

### 5.1 Qualifications and Training

Measurements (sampling and testing) and reporting required by this AQMMP are to be conducted by suitably qualified personnel and/or experienced air quality consultant.

It is anticipated that Council personnel will be trained in the requirements of the AQMMP by a suitably qualified air quality consultant. Training is to be completed prior to any Council personnel undertaking monitoring actions specified in this AQMMP. The training program is to include:

- Details and requirements of this AQMMP;
- Details of the monitoring equipment specifications and maintenance requirements of that equipment;
- Operation of the monitoring equipment, including a step-by-step procedure and provision of supporting training materials;
- Reporting requirements, including report format, frequency and verification;
- Data handling and storing of information; and
- Details of when air quality consultants are to be engaged under this AQMMP (i.e. for verification).

## 6.0 Management Measures

### 6.1 Odour Controls

As odour emissions from the site are anticipated to be within acceptable levels at the nearest receiver, there are no specific odour mitigation measures proposed. However, standard management controls will be employed with reference to the *Benchmark Technique Number 36 – Odour Controls*, which states:

- *The landfill occupier needs to take appropriate good housekeeping steps to prevent the production of odours. The use of daily cover and immediate attention to odorous waste loads will minimise the transmission of odours off-site.*
- *The occupier of any landfill which is identified by an odour dispersion modelling investigation (as required by DUAP 1996) as having a potential odour impact on neighbours must install and operate a meteorological station that monitors wind speed, wind direction, sigma theta (standard deviation of the horizontal fluctuation in the wind direction) and temperature.*
- *The landfill occupier will maintain a record of complaints regarding odours. This should be correlated with weather conditions and deliveries of particularly odorous wastes.*

The following odour controls are to be implemented at the landfill:

- Waste will be covered at the end of each day's landfilling activities with cover material approved by the NSW EPA.
- Immediate attention will be given to odour waste loads received at the landfill (for example, application of cover of thickness greater than 150mm may be applied to particularly odorous waste loads as soon as the load has been applied, rather than at the end of the day).
- Leachate in the leachate pond will be managed to ensure that the leachate pond does not become a source of excessive odour (for example, ponded leachate will be maintained at low levels through application/injection into the landfilled area).
- A meteorological monitoring station will be installed and odour monitoring will be undertaken, as specified in Section 7.1.
- Records will be maintained and complaints will be handled as specified in Section 8.0.

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) and the *Technical framework - Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006) includes odour criteria that takes into account the population density of the area (and which has been identified in Section 4.1 of this AQMMP). Odour will be assessed and managed at the site in accordance with the EPA Approved Method, Technical framework, and any other NSW EPA requirements as outlined in the site's EPL (once issued).

### 6.2 Dust Controls

#### 6.2.1 General Management Strategies

*Benchmark Technique Number 34 – Dust Controls* will be followed where applicable at the site. The following measures are necessary to minimise generation of dust:

- Sealed or gravel roads will be constructed from the public roadway to the gatehouse/waste reception section of the landfill.
- Water spraying is an approved method of dust suppression for unsealed roads and will be employed at the site where required in areas of fine soils and during windy conditions.
- Four dust monitoring gauges will be installed, in accordance with AS/NZS 3580.1.1:2007, AS/NZS 3580.10.1:2003 (and as described in Section 7.3).
- Sampling and testing shall be carried out by a suitably qualified person and a NATA registered laboratory.

Dust management strategies for the operational phase of the landfill are detailed below, while construction measures can be found in the CEMP (ARLF-LEMP-RP-002).

## 6.2.2 Operational Controls

The following standard dust reduction strategies are to be implemented:

- Watering of haul roads will be employed to ensure that dust related impacts are minimised.
- Daily cover material will be prevented from becoming a source of dust emissions through the frequent wetting of the area during dry periods.
- Trucks entering and leaving the premises that are carrying loads will be covered at all times, except during loading and unloading.
- All roads being used by the haul trucks travelling to the landfill site are sealed (e.g. Waterfall Way). The entire length of the proposed access road connecting the landfill from the wheel wash location to Waterfall Way will be sealed. Maintenance of the access road will continue for the life of the landfill operation.
- Waste containers will be washed down or re-covered as required at the vehicle wheel wash prior to leaving the facility. This will ensure that trucks leaving the landfill site do not transport particulate matter with the potential to be subsequently dislodged and dispersed into the surrounds.
- Truck movements on-site will be minimised and truck speed will be kept as low as practicable, further minimising the generation of dust.

Dust mitigation strategies to be implemented relating to the tipping face include:

- After waste is tipped, the waste will be spread and compacted by a dozer and/or other appropriate equipment. A water cart may also be used as required to minimise dust generated. Waste compaction is to be undertaken as soon as practical to minimise the potential for dust generation.
- Operator training will be undertaken to raise the awareness of dozer and grader drivers for the potential for fugitive emission generation.
- The exposed area of waste within the landfill will be covered at the conclusion of each day's waste transfer using soil, plastic covers or shredded wood waste, or other approved alternative daily cover material.

Dust monitoring is to be undertaken in accordance with Section 7.2.

Records are to be maintained and complaints are to be handled as specified in Section 8.0.

## 7.0 Monitoring Program

### 7.1 Meteorological Monitoring Station

A meteorological monitoring station will be installed in the vicinity of the site as per Condition 25 / Schedule 4 of the project approval dated 4 July 2012. The monitoring station will adhere to the following standards:

- AS/NZS 3580.14:2011, Methods for sampling and analysis of ambient air – Part 14: Meteorological monitoring for ambient air quality monitoring applications.
- AS/NZS 3580.1.1:2007, Methods for sampling and analysis of ambient air – Part 1.1: Guide to siting air monitoring equipment.

The Bureau of Meteorology (BoM) operates a long term meteorological station at the Armidale Airport, located approximately 17 km to the west of the site. The wind roses for the time period 1996 to 2010 are provided in Figure 3 and show a clear east-west wind axis, with winds more dominant from the east in the morning and west in the afternoon. The east-west trend was also present in the meteorological review for the year 2000 presented in *Air Quality Assessment Report Proposed Armidale Landfill* (Holmes Air Sciences, 2006). The report showed that easterly winds are the most common in summer and autumn, while westerly winds dominate during winter. In spring, the winds are often strongest from the west, however easterly and east-north- easterly winds are also common.

The topography of the site is generally flat, with a small undulation at the approximate location of the landfill. The site has sparse tree covering (of which some would be removed for the landfill footprint). The nearest receptor is approximately 410m south of the landfill footprint, with other local receptors approximately 950m to the west north-west and 1,400m to the north of the landfill footprint.

Based on the meteorology and terrain, there are no specific aspects that require the meteorological station to be located in any specific area of the site. The station will therefore be located in an area that meets the requirement of the siting standard (in relation to distance from trees, 10m in height and buildings etc) and will also take into consideration the location of mains power, readily and safe access is available, and will not interfere with the progressive movement and operation of the landfill. The station will also be located at the same geographical point as one of the four dust gauge locations (refer to Section 7.3).

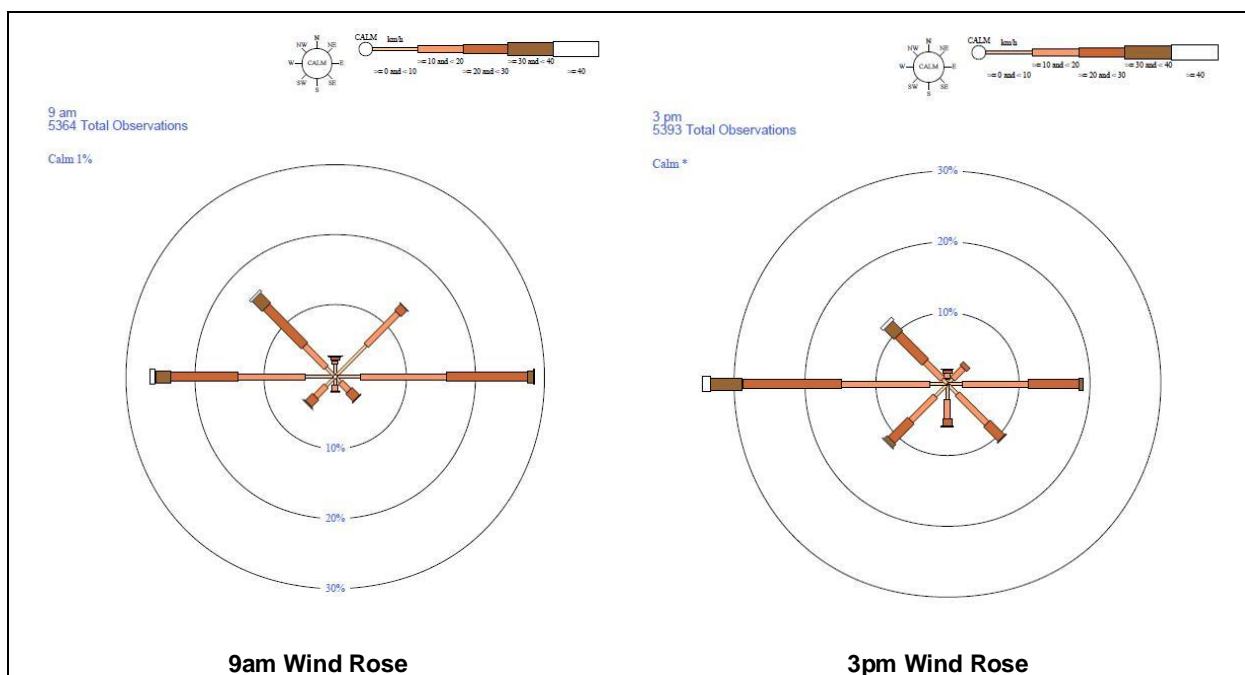
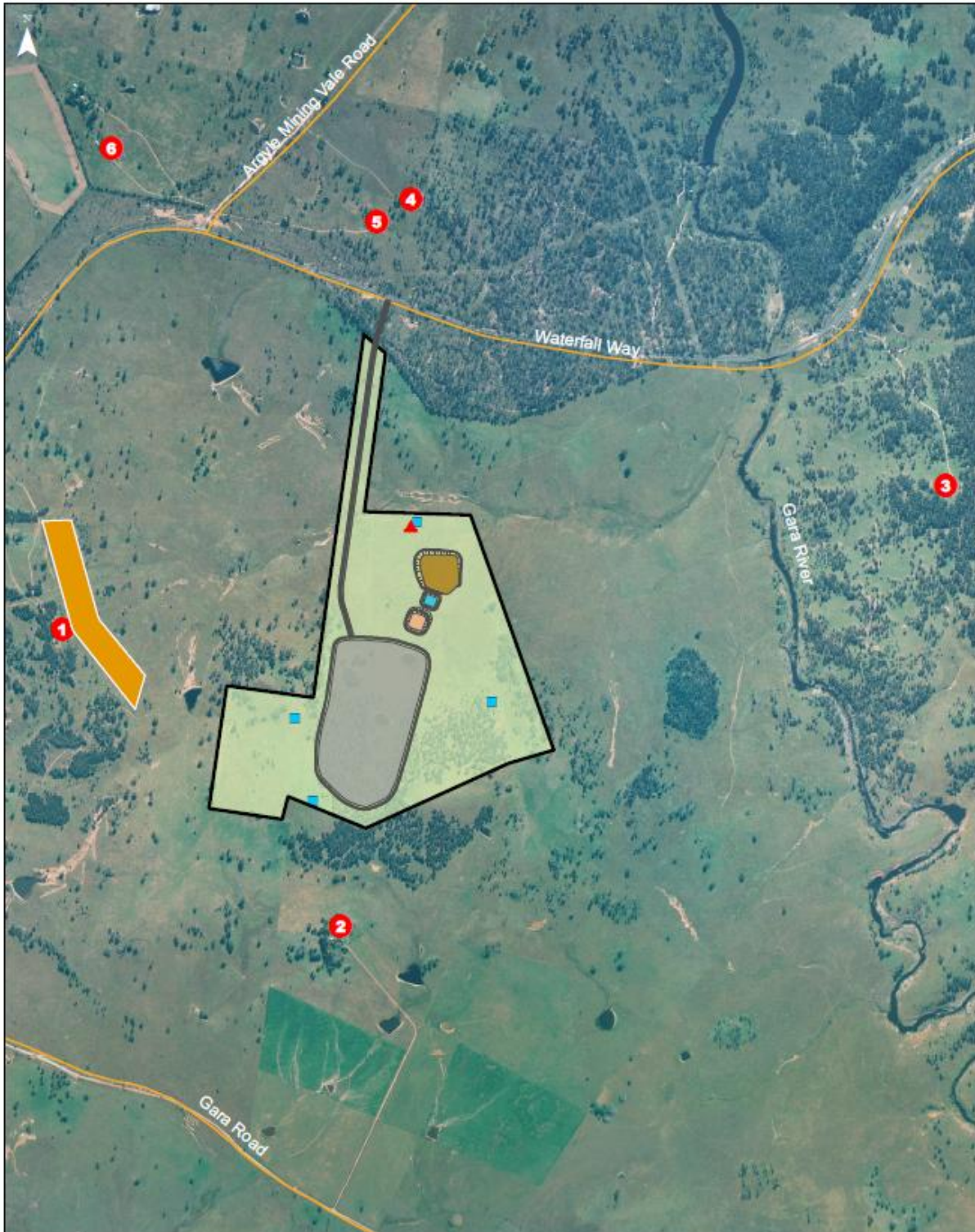
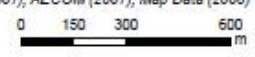


Figure 3 BoM Armidale Airport 1996 to 2010

Figure 4 Monitoring locations



<ul style="list-style-type: none"> <li><span style="color: red;">❶</span> Sensitive receivers</li> <li><span style="background-color: #d4edda; border: 1px solid #c3e6cb; display: inline-block; width: 15px; height: 10px;"></span> Biodiversity offset area</li> <li><span style="border: 2px solid black; display: inline-block; width: 15px; height: 10px;"></span> Landfill footprint</li> <li><span style="background-color: #ffc107; border: 1px solid #ffc107; display: inline-block; width: 15px; height: 10px;"></span> Leachate pond</li> <li><span style="background-color: #17a2b8; border: 1px solid #17a2b8; display: inline-block; width: 15px; height: 10px;"></span> Sedimentation basin</li> <li><span style="background-color: #6c757d; border: 1px solid #6c757d; display: inline-block; width: 15px; height: 10px;"></span> Dry basin</li> </ul>	<p style="text-align: center;"><b>ARMIDALE DUMARESQ COUNCIL - ARMIDALE REGIONAL LANDFILL FACILITY</b></p> <p style="text-align: center;"><b>LOCATION OF SENSITIVE RECEIVERS</b></p> <p style="text-align: center;"><small>Source: EA Systems (2007), AECOM (2007), Map Data (2008)</small></p> <ul style="list-style-type: none"> <li><span style="color: red;">▲</span> Proposed meteorological station</li> <li><span style="color: blue;">■</span> Proposed dust gauge</li> <li><span style="background-color: #ffc107; border: 1px solid #ffc107; display: inline-block; width: 15px; height: 10px;"></span> Olive grove (approximate location)</li> <li><span style="color: blue;">—</span> Permanent watercourse</li> </ul>	<p style="text-align: right;"><b>MAR 2015</b> 80011672</p> <p style="text-align: right;"><small>Fig.</small></p>
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## 7.2 Odour Monitoring

The purpose of the odour monitoring program will be to determine if any odours are detectable at the site boundaries following deposition of putrescible waste. The odour monitoring plan will be implemented as described in Table 9.

**Table 9 Odour Monitoring Requirements**

Monitoring requirement	Procedure / Details
Methodology	<p>Sampling will be conducted by the Site Environmental Officer using a hand held Nasal Ranger® Field Olfactometer.</p> <p>The field olfactometer, as a nasal organoleptic instrument, provides field olfactometry with a scientific method for ambient odour quantification. The field olfactometer creates a calibrated series of discrete dilutions by mixing the odourous ambient air with odour-free (carbon) filtered air. Field olfactometry defines each discrete dilution level as a “Dilution-to-Threshold,” D/T, ratio. The “Dilution-to-Threshold” ratio is a measure of the number of dilutions needed to make the odourous ambient air “non-detectable”.</p>
Locations	<p>Sampling will be undertaken at the site boundary downwind of site tip face operations. Specific locations will be selected on a daily basis with regard to specific wind direction. On days of still conditions or slight and / or variable winds sampling is to occur in all four cardinal directions (i.e. north, south, east and west).</p>
Frequency	<p>Sampling will occur on days when putrescible waste is being deposited at the landfill during adverse conditions (e.g. windy conditions) and only after a significant volume of putrescible waste has been deposited.</p>
Performance indicators	<p>The trigger level for further investigation has been selected as <math>\geq 7</math> D/T (Dilution-to-Threshold value). Should this level be reached an investigation of site activities is required and the selection of appropriate mitigation undertaken where required.</p> <p>The instances of odour complaints will indicate if the controls implemented are performing in accordance with the odour control objectives.</p>
Reporting	<p>All odour survey and results will be documented as described in Section 8.0.</p>

### 7.2.1 Remedial Actions

In the event that the objectives of the odour controls are not being met, which will be indicated by the number of odour complaints and odour levels on site, remedial actions will be investigated and implemented. These remedial actions may include:

- Review and amendment of the odour controls.
- External review and recommendations by an odour specialist for amendment of the odour controls .
- Cover material used to be altered (i.e. more or different cover material applied), with monitoring of the amendment on the instances of odour complaints.
- Non-acceptance of particularly odorous waste on windy days.
- Treatment of leachate in the leachate pond to reduce odour produced.

## 7.3 Dust

Monitoring of fugitive emissions is designed to provide quick identification of poor air quality episodes and to enable remedial action to be undertaken effectively.

Dust deposition monitoring is a long-term monitoring strategy used to identify trends in local dust levels, and primarily provide an indication of the potential nuisance effects of dust deposition. The NSW EPA has a dust deposition guideline which applies to annual average insoluble solids; as such, data must be collected for at least 12 months in order to determine regulatory compliance.

Emphasis will be placed on monitoring fugitive emissions from the landfill operation through the continuation of dust deposition monitoring. Should dust deposition results show elevated levels, a limited DustTrak monitoring program for a period of up to two months will be conducted. The program will be of a nature such that air quality impacts are well understood by Council and any review authorities (such as the NSW EPA).

The *Air Quality Assessment Report Proposed Armidale Landfill* (Holmes Air Sciences, 2006) predicted that the dust impacts from the site are minor for all dust sizes measured (PM<sub>10</sub>, TSP and deposited dust). The dust monitoring plan has been prepared with this in mind.

Dust monitoring will be undertaken as described in Table 10.

**Table 10 Dust Monitoring Requirements**

Monitoring requirement	Procedure / Details
Methodology	<p>Dust deposition monitoring will be undertaken using dust depositional gauges.</p> <p>Dust deposition will be monitored in accordance with the following standard:</p> <ul style="list-style-type: none"> <li>- AS/NZS 3580.10.1:2003 (Reconfirmed 2014), Methods for sampling and analysis of ambient air: Determination of particulate matter – Deposited matter – Gravimetric method.</li> </ul> <p>Samples from dust gauges will be collected every 30 ± 2 days and analysed in accordance with the requirements of AS/NZS 3580.10.1:2003 and the NSW EPA <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> (DEC 2005). Samples will be analysed for the following parameters:</p> <ul style="list-style-type: none"> <li>- Insoluble solids (required for regulatory compliance);</li> <li>- Ash content; and</li> <li>- Combustible material.</li> </ul> <p>Should the dust deposition results show elevated levels, airborne dust is seen to leave the sites boundary or dust complaints are received, then dust monitoring using a DustTrak will be undertaken. The DustTrak is a portable, battery-operated laser photometer which gives you a real-time digital readout and built-in data logger. The DustTrak provides a real-time measurement based on 90° light scattering. A pump draws the sample aerosol through an optics chamber where it is measured. A sheath air system isolates the aerosol in the chamber to keep the optics clean for improved reliability and low maintenance.</p> <p>The DustTrak's continuous analog output and adjustable alarm output allow remote access to real-time particle concentration data. The alarm output with user-defined setpoint alerts when upset or changing conditions occur. This feature allows site operators to program a switch closure at a set concentration value.</p>
Locations	<p>A total of four dust gauges have been proposed for the site's monitoring network using AS/NZS 3580.1.1:2007 <i>Methods for sampling and analysis of ambient air: Guide to siting air monitoring equipment</i>. These sites will be located near the site boundary at the locations shown on Figure 4.</p> <p>These sites align with seasonal wind directions and the closest residential receptors.</p> <p>The configuration of ambient monitoring locations could be changed on a seasonal basis to take into account prevailing wind directions.</p>
Frequency	<p>Dust deposition samples will be collected on a monthly basis (30 ± 2 days) in accordance with AS/NZS 3580.10.1:2003 (Reconfirmed 2014) for the life of the landfill, or as required by the site's EPL.</p> <p>DustTrak monitoring will only occur should deposition results show elevated levels, airborne dust is seen to leave the sites boundary or dust complaints are received. The sampling will be on an as-needs basis.</p>

Monitoring requirement	Procedure / Details
Performance Indicators	To determine the performance of the dust management strategy implemented, dust monitoring will be undertaken in accordance with the dust monitoring requirements and sampling and analysis procedures outlined in the <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (DEC, 2005) and the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in NSW</i> (DEC, 2005).
Reporting	Field parameters are recorded on field sheets compliant with Australian Standards and NATA certification, and included gauge identification, date of sample installation and date of sample collection as well as comments on samples collected by field staff.  All dust monitoring results are to be documented as described in Section 8.0.

### 7.3.1 Remedial Actions

In the event that the objectives of the dust control system are not being met, which will be indicated by the air and dust monitoring results, remedial actions will be investigated and implemented (in accordance with the Benchmark Technique Number 34 – Dust Control) to minimise the future occurrence of dust emissions. These remedial actions may include:

- Review and amendment of the dust controls.
- External review and recommendations by a dust specialist for amendment of the dust controls.
- Increase in the water spraying conducted at the site.

## 7.4 Data Management and Reporting

The Site Environmental Officer will establish and maintain a system of records which provides full documentation of all air quality surveys and results, including a description of site operations and commentary regarding odour and dust.

The Site Environmental Officer will establish and maintain procedures for the collection, indexing, filing, storage and maintenance of the records. Archived records will be kept in accordance with standard document control procedures.

Monitoring reports will include the following details:

- The locations and results of the monitoring.
- Notes identifying the principal sources of dust or odour.
- A summary of any measurements exceeding the criteria levels, and descriptions of the circumstances causing these exceedances.
- Details of corrective action applicable to criteria exceedances, and confirmation of its successful implementation. Where corrective action has not yet been implemented, it may be shown as pending, and the status of its implementation shall be carried forward to following reports.

The results of the monitoring will be reported in the *Annual Report*. This report will be submitted to the NSW EPA.

All complaints will be managed as per Section 8.0.



## 8.0 Reporting and Recording of Complaints

The procedure for the handling of complaints for the landfill are detailed in the site's LEMP which is to be followed for all complaints made regarding offsite impacts arising from the construction and operation of the landfill (refer ARLF-LEMP-RP-0001).

In terms of complaints relating to air quality, the Site Environmental Officer will record the following information:

- Details of any complaints regarding dust and/or odour, including the complainant's name, address and contact number.
- A summary of the complaint: complainant location, time of day, notes regarding the event, notes regarding the duration (seconds, minutes, etc.) of the period when the dust and/or odour was perceived.
- Details of the response to complaints (including supplementary monitoring, corrective action, etc.).
- A log of all factors related to the event, i.e. time of the complaint, duration of the event in question, frequency of the event if occurring on multiple occasions, landfilling operation details, weather conditions, etc.

The Site Environmental Officer will record details of all complaints received and will maintain an up-to-date log-book. The Site Environmental Officer or delegate will provide a response to the complainant within 24 hours. The corrective action may involve supplementary monitoring to identify the source of the non-conformance, and/or may involve modification of construction or operational techniques to avoid any recurrence or minimise its adverse effects. Complaints received in relation to Air Quality will be updated onto the landfill complaints register on a monthly basis.

The Site Environmental Officer will make available a report on complaints received to the community, Council and relevant government agencies upon request. A summary will be included in the *Annual Report*.

## 9.0 Review and Continual Improvement

Within three months of a report submission to the Secretary, including the annual report, incident report and independent environmental audit, this management plan shall be reviewed, and if necessary revised to the satisfaction of the Secretary.

The review should assess all relevant information to the AQMMP including but not limited to:

- Historical analytical data
- Changes in land use
- Incidents relating to Air Quality exceedances.

The AQMMP will need to be modified to reflect any variation in sampling frequency, addition of new sampling locations or variation in the analytical regime for example, from a new air quality issue being identified on site.

The AQMMP will be viewed as a live document and updated as necessary, noting that revision of the AQMMP may result in the monitoring regime increasing or decreasing.

## 10.0 References

Holmes Air Sciences (2006) Air Quality Assessment Report Proposed Armidale Landfill

National Environment Protection Council (NEPC) (2003)– National Environment Protection (Ambient Air Quality) Measure (NEPM)

NSW EPA(2005)“Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales”, Department of Environment and Conservation

NSW EPA (1996) Environmental Guidelines:: Solid Waste Landfills

NSW EPA (2006) Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW

NSW EPA (2006) Technical Notes – Assessment and Management of Odour from Stationary Sources in NSW

## Appendix A

# Consultation with EPA on AQMMP

## Appendix A Consultation with EPA on AQMMP

Frolich, Alexandra

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From: Lindsay Fulloon <Lindsay.Fulloon@epa.nsw.gov.au>  
Sent: Tuesday, 16 June 2015 3:40 PM  
To: Frolich, Alexandra  
Cc: Michael Lewis  
Subject: RE: Armidale Regional Landfill - Air Quality Monitoring Plan - for EPA

Hi Alex

As per our response to the Noise Management Plan, I would like to reiterate that it is EPA policy that it will not endorse site management plans required by project approval conditions. However I can confirm that EPA have reviewed the AQMP, and the only comment that I will offer is that the last paragraph of section 6.1 should also refer to the *Technical Framework: Assessment and Management of Odour from Stationary Source in NSW* (DEC, 2006).

Cheers

**Lindsay**

Lindsay Fulloon | Acting Head Regional Operations - Armidale | Environment Protection Authority  
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[lindsay.fulloon@epa.nsw.gov.au](mailto:lindsay.fulloon@epa.nsw.gov.au)

---

From: Frolich, Alexandra [<mailto:Alexandra.Frolich@aecom.com>]  
Sent: Friday, 5 June 2015 1:44 PM  
To: EPA RSD Armidale Mailbox  
Cc: Price, Duncan  
Subject: Armidale Regional Landfill - Air Quality Monitoring Plan - for EPA

Good afternoon,

AECOM, on behalf of Armidale Dumaresq Council, wish to consult with the EPA on the attached Air Quality Management and Monitoring Plan (AQMMP) for the Armidale Regional Landfill. The AQMMP satisfies Condition 24 of Schedule 4 of the landfills project approval (PA 06\_0220). We would appreciate any feedback or comment by 19<sup>th</sup> June 2015.

We would be pleased to discuss any queries in relation to this AQMMP, if requested.

Kind regards,

**Alex Frolich**  
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