



# Griffith City Council

## Tharbogang Quarry Air Monitoring Plan

February 2013



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# 1. Introduction

## 1.1 Overview

Griffith City Council (Council) currently operates a Landfill and Quarry in Tharbogang, NSW. The Department of Planning (DoP) have issued Conditions of Approval<sup>1</sup> (CoA) for the site that requires an air quality monitoring program to be prepared and implemented.

This report outlines the applicable air quality criteria for the site and details the monitoring requirements and methodology.

## 1.2 Scope of work

The scope of work involved in preparing the air quality monitoring program consisted of:

- An analysis of Landfill and Quarry activities on site to form an understanding of site operations and the primary activities that generate emissions to air.
- A review of surrounding sensitive receptor locations.
- Identification of the air quality criteria.
- A review of local meteorology to identify directions of prevailing winds and poor dispersion.
- A review of any previous complaints relating to air quality issues from the Landfill.
- Identification of the appropriate dust monitoring equipment and monitoring methodology, including:
  - Type of monitoring equipment required
  - Monitoring equipment setup
  - Monitoring locations and number of monitors to be used
  - Measurement intervals required
  - Measurement frequency
- Preparation of a process in which compliance with the air quality criteria can be assessed as well as ways to identify areas of improvement and evaluate the monitoring program.

## 1.3 Limitations

*This report: has been prepared by GHD for Griffith City Council and may only be used and relied on by Griffith City Council for the purpose agreed between GHD and the Griffith City Council as set out in section 1.2 of this report. GHD otherwise disclaims responsibility to any person other than Griffith City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

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<sup>1</sup> Project Approval, Tharbogang Quarry and Landfill. Application No: 06\_0334, dated 8 July 2010.

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared this report on the basis of information provided by Griffith City Council, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

## 2. Existing Environment

### 2.1 Existing Site and Sensitive Receptors

The Landfill and Quarry site is located at Tharbogang, NSW, approximately 9.5 km northwest of Griffith. The existing operations are positioned in the central part of the site, while the remainder of the site remains undeveloped and is vegetated with sparse cover of trees and grasses.

It is understood that there are plans to expand the Landfill and Quarry operations, which would be to the south and east of current operations, within the site boundary.

The nearest residential receptors to the site have been identified below in Table 2-1 and Figure 1.

Table 2-1 Residential Receptor Details

Property Identification Number	Property Address	Approximate distance from site operations <sup>1</sup> (m)
1	Farm 1765 Slopes Rd	1020
2	Farm 1743 Slopes Rd	1300
3	Farm 1760 Slopes Rd	1150
4	Farm 1757 Slopes Rd	850
5	250 Slopes Rd	830

1. Separation distances from sensitive receptors to site operations will increase as Quarry and Landfill stages progress to the south and east of current operations.





Figure 1 Site Boundary and Sensitive Receptor Locations (Source: Griffith City Council Blast Management Plan)



## 2.2 Local Weather Conditions

The transport and dispersion of the air emissions (dust and odour) from the site will be influenced by prevailing synoptic flows and vertical temperature profiles that will alter both diurnally and with wind direction.

An Automatic Weather Station (AWS) has recently been installed at a nearby Water Reclamation Plant (WRP) and has been in operation since June 2012. The Landfill and Quarry site will utilise data from this weather station to track prevailing wind patterns at the site.

Weather data from this site was obtained and analysed for the period 18 June to 9 November 2012. As data from this site was not yet available for a complete calendar year, meteorological data was also obtained from the Bureau of Meteorology's Griffith Airport Automatic Weather Station (AWS) for the year 2011. This AWS, fully conforming to World Meteorological Organization (WMO) standards, is situated approximately 8 km east-southeast of the site. Given the relatively flat land features in the area, weather data collected at this location is considered to be representative of weather conditions at the site and has been utilised in preparing the dust monitoring plan.

Figure 2 and Figure 3 show the daytime (7 am to 5 pm) and annual (all hours) wind climate in the area. Generally, prevailing winds are from the north, east and west. Stronger winds are generally from the west, northwest and north. Winds from the southeast and northeast have the lowest frequency of occurrence. These infrequent easterly component winds are the worst case for dispersion of dust toward the sensitive receptor locations.

It is the incidence of daytime winds that are of greatest concern in regards to the transport and dispersion of dust emissions from the site. Due to the nature of operations, the majority of dust generated at the site is during operational hours when material handling and vehicle movements are occurring. The daytime distribution of wind directions is not significantly different than for the entire diurnal cycle, however the average wind speed is higher during the day (4.85 m/s). Wind erosion or dust lift-off can become significant under strong winds (greater than 5 m/s).

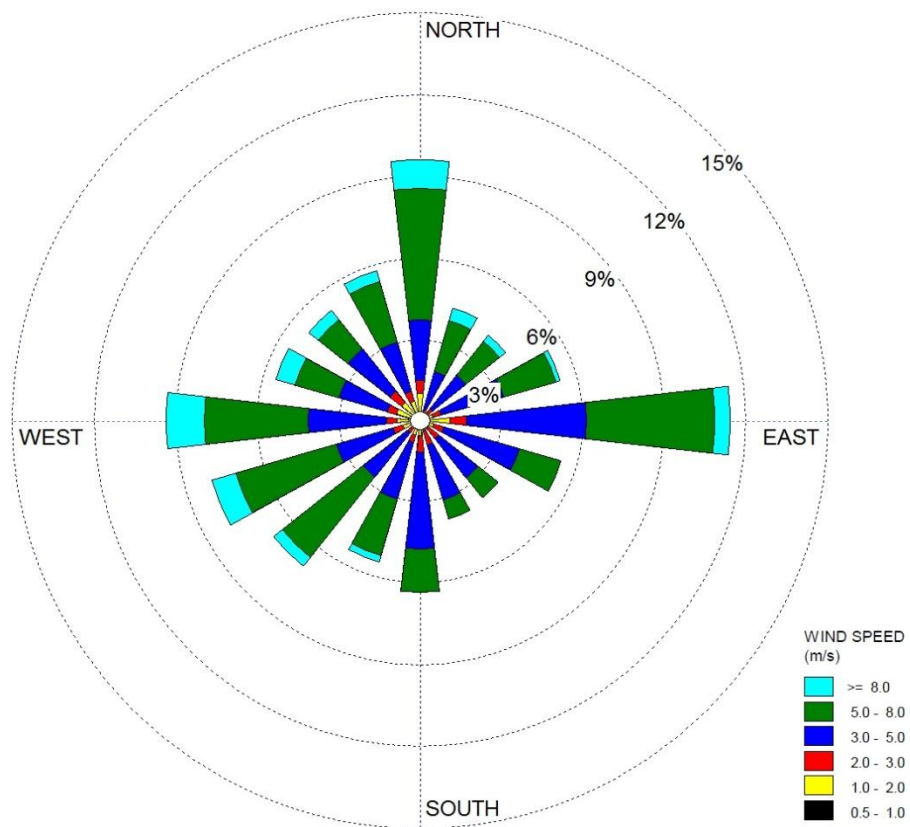


Figure 2 Griffith Airport Daytime Wind Rose - 2011

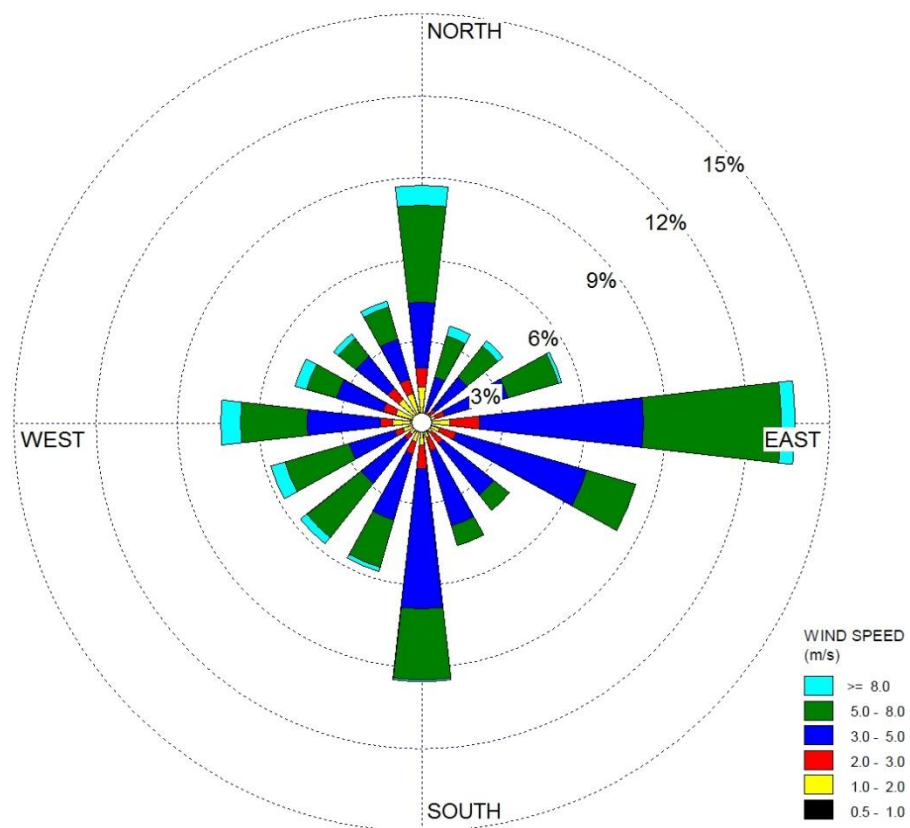


Figure 3 Griffith Airport Annual Wind Rose - 2011

### 3. Approval Requirements

The DoP CoA specifies the following air quality criteria for the site:

*“The Proponent shall ensure that dust emissions generated by the project do not cause additional exceedances of the criteria listed in Table 5 to 7 at any residence on privately owned land, or on more than 25 percent of any privately-owned land.”*

*“Table 5: Long term impact assessment criteria for particulate matter*

<i>Pollutant</i>	<i>Averaging period</i>	<i>Criterion</i>
<i>Total suspended particulate (TSP) matter</i>	<i>Annual</i>	<i>90 µg/m<sup>3</sup></i>
<i>Particulate matter &lt; 10 µm (PM<sub>10</sub>)</i>	<i>Annual</i>	<i>30 µg/m<sup>3</sup></i>

*Table 6: Short term impact assessment criteria for particulate matter*

<i>Pollutant</i>	<i>Averaging period</i>	<i>Criterion</i>
<i>Particulate matter &lt; 10 µm (PM<sub>10</sub>)</i>	<i>24 hour</i>	<i>50 µg/m<sup>3</sup></i>

*Table 7: Long term impact assessment criteria for deposited dust”*

<i>Pollutant</i>	<i>Averaging period</i>	<i>Maximum increase in deposited dust level</i>	<i>Maximum total deposited dust level</i>
<i>Deposited dust</i>	<i>Annual</i>	<i>2 g/m<sup>2</sup>/month</i>	<i>4 g/m<sup>2</sup>/month</i>

*“Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS/NZS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited Matter – Gravimetric Method.”*

It is worth noting that all of the values above are extracted from the NSW *Approved Methods*. These assessment criteria are designed for modelling impact assessments rather than monitoring goals or standards (with the exception of the short-term daily PM<sub>10</sub> criterion which matches the NEPM Air Quality standards – although this goal allows for five exceedance days per year). Moreover, all the indicators are for either human health or dis-amenity at sensitive receptor locations (residential housing in this instance). GHD therefore contend that the 25% of privately owned land condition in the CoA is not relevant to the criteria provided (as they are intended for people rather than land). In addition, it would be impracticable to measure dust impacts across a substantial land area.

The monitoring program outlined in the following sections is considered suitable for assessing dust impacts from the site and provides response mechanisms should impacts be identified.

## 4. Management Measures and Monitoring Protocol

Dust is a generic term used to describe fine particles that are suspended in the atmosphere. Deposited dust refers to any dust that falls out of suspension in the atmosphere. Activities that have been identified as possible sources of dust emissions are:

- Material handling e.g. excavation
- Vehicle induced dust emissions on unsealed roads
- Loading and dumping of material
- Wind erosion of all unstable/uncovered stockpiles and other unconsolidated surfaces.

The site currently uses a water cart to spray haul routes and unsealed surfaces as well as a sprinkler system on the quarry crushing plant and stockpiles.

Other general measures that will be implemented as part of the existing dust control management plan include:

- Rehabilitated areas will be revegetated as early as possible after completion.
- Newly stripped topsoil stockpiles will be immediately watered and revegetated with a grass (or similar) cover.
- Access routes to and from stockpiles will be watered as required, particularly during peak periods of vehicle movements or excessively dry and windy conditions.

Table E1 of the Project Approval<sup>2</sup> also requires that:

- When the 10 minute average wind speed measured at the quarry exceeds 30 km/hr from the northeast quadrant (between 0° and 90°) operation of the quarry will cease or additional mitigation measures will be implemented to ensure off-site dust impacts do not occur.
- When the 10 minute average wind speed measured at the quarry exceeds 35 km/hr in any direction, operation of the quarry will cease or additional mitigation measures will be implemented to ensure off-site dust impacts do not occur.

Additional dust management measures are provided below in Table 4-1 as options to be considered to further control dust emissions.

**Table 4-1 General Management of Air Emissions**

Emission Source	Proposed Management
Dust generated from transport activities on-site and off-site	Use of water sprays/trucks and sprays to wet down access roads. Clean sealed roads at access and egress points regularly to minimise the re-suspension of dust on sealed roads
Dust generated from loading, unloading and storage/stockpiling of material on-site	Use water sprays to minimise truck dust emissions. Ensure materials are appropriately stored and contained to prevent releases to the atmosphere (e.g. wind fences, water sprays)
Dust from movement of fill during operation	Where material is removed from the site or fill brought to the site, trucks will be covered whenever conditions are such that dust

<sup>2</sup> NSW Government Department of Planning, Application No. 06\_0334, July 2010.

	nuisance is occurring. This might include windy conditions or when materials being transported have a high level of fine particles.
Dust from Crushing and screening operations	Continue spray systems on equipment and the stabilisation of the surface silt content of working surfaces around the processing site through (i) application of water via general wheeled carting and (ii) localised, manually controlled, canon water spraying.
Unconsolidated surfaces	Regular compaction of the Landfill active tipping face in order to minimise lift-off during higher winds. Water sprays will also be used on vehicle haul routes within the site boundary if excessive dust lift-off is observed.

Deposited dust is an indicator of the effectiveness of site dust management practices and the potential for off-site dust nuisance. Deposited dust is typically monitored in a number of locations around the site boundary. Monitoring is conducted with dust deposition gauges that should be located both upwind and downwind of the activity area to reflect the impact of the Landfill or Quarry operations during the most predominant wind directions.

Results of monitoring should not exceed 4 g/m<sup>2</sup>/month (no more than 2 g/m<sup>2</sup>/month above background) as a monthly average. If dust levels exceed this value then site management practices should be reviewed and dust controls implemented to reduce dust levels to within these limits.

The criteria for deposited dust have been successfully used at numerous sites in New South Wales to protect the amenity of populations near landfills and quarries. Although the assessment criterion is a rolling 12-month average the shorter-term averaging interval is set at a monthly average to enable an assessment of nuisance dust in a timely manner to ensure that people's amenity is not adversely impacted. If the criteria are exceeded, management actions can be identified and implemented to reduce dust levels to avoid further nuisance being created.

Based on the separation distance between the nearest sensitive receptors and the site operations, it is considered that monitoring of deposited dust will provide the best indicator for site impacts on local amenity. Adverse health impacts due to fine particulate matter from an operation of this size usually have an impact zone measured in tens of metres rather than hundreds of metres. In addition, there have been no known complaints made regarding dust emissions from the site, suggesting the dust is not a particular concern at the site. Monitoring of other particulates such as PM<sub>10</sub> or TSP would not typically be required, unless the results of the dust deposition monitoring indicate high levels of dust generation and subsequent downwind dispersion from the site.

Only a procedure for dust deposition monitoring has been provided at this stage. A review of the monitoring methodology will be undertaken following review of monthly monitoring results. Additional or fewer monitoring locations may be recommended at this stage, based on the results of the monitoring.



## 5. Dust Monitoring Program

Based on the air quality criteria outlined in the DoP CoA, should be targeted at dust. In particular, monitoring of deposited dust has been identified as the most effective way of quantifying and managing dust emissions from the site.

### 5.1 Monitoring and Reporting Process

The process detailed below will be followed to enable assessment of compliance with the dust deposition criteria. As discussed in Section 4, monitoring of other particulates such as PM<sub>10</sub> or TSP would not typically be required, unless the results of the dust deposition monitoring indicate high levels of dust generation.

- Install dust deposition monitoring devices around the Landfill and Quarry site.
- Collect dust samples on a monthly basis for laboratory analysis.
- Review laboratory results on a monthly basis for preliminary comparison against the dust deposition criteria.
- Compile laboratory results over a sampling period of 12 months and calculate the average dust deposition rate for each sampling location.
- Compare the 12 month average results against the dust deposition criteria.
- Provide a dust monitoring report detailing the findings of the monitoring.
- If results indicate an exceedance of the dust deposition criteria, identify and implement dust mitigation measures on site.

The following sections detail the procedures for dust deposition monitoring, data collection and reporting.

A review of the monitoring results will be undertaken following completion of the first annual monitoring report. The requirement for further dust monitoring will be determined based on findings of the first 12 months of monitoring. If monitoring results clearly indicate that no dust impacts have been recorded, annual dust monitoring will cease. Dust monitoring will then only occur following receipt of a complaint relating to dust generation from the site.

### 5.2 Monitoring Locations

Four dust monitoring locations have been identified on the boundary of the existing site. The proposed locations are indicated in Appendix A with the following justification:

- DM01 (north): Located on the site boundary closest to Receptor 1, to the northwest of the site. This site is the most upwind relative to dust potential, and so is likely to provide the best indication of 'background' dust conditions. This also has the advantage of being located downwind of the dust source at the sensitive place (see Figure 1 with cross-referencing to Figure 2) most likely to be affected.

- DM02 (west): Along the western side of the site but as far west of operations as possible (near the western boundary fence), on the line between the active quarry and sensitive receivers, as far as practicable. This location is likely to be downwind of the site more frequently than others and is representative of the receptors to the west of the site. This site will be critical to the assessment of dust impacts on sensitive receptors.
- DM03 (south): Located on the southern edge of the site.
- DM04 (east): Located near the eastern boundary of the site.

These four sites will optimise the chance to calculate upwind, downwind and 'background' monthly dust impact, as they are strategically located so as to account for predominant wind directions and receptor locations. Whenever DM02 is within the 2.0 g/m<sup>2</sup>/month incremental criterion, all of the downwind properties will be compliant to the DoP CoA requirements (Section 3).

### 5.3 Dust Monitoring Devices

Dust deposition is measured using gauges. This method measures dust deposition rate and involves the passive deposition and capture of dust within a funnel and bottle arrangement. Data is usually collected over monthly periods and results are expressed in g/m<sup>2</sup>/month (i.e. the mass of dust deposited per square metre per month).

The Australian Standard *AS/NZ 3580.10.1:2003 Methods for sampling and analysis of ambient air Method 10.1: Determination of particulate matter – Deposited matter – Gravimetric method* defines the measurement of deposited matter by collection in a vessel and retained (together with any rainwater over the monthly exposure period).

Dust deposition gauges are sited in accordance with *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting equipment*.

The 'vessel' in this instance is a wide mouth glass bottle of at least 4 litre volume (a larger capacity bottle should be used if monthly rainfall is likely to exceed 225 mm; the only month to record above this value at the airport has been a January; this was an exceptional month in 1984 and the 225 mm capacity has a low risk of being exceeded). The collection funnel has a 150 mm diameter 'mouth' (with a tolerance of +/- 10 mm but measured to within the nearest mm for calculation purposes). The nominal angle of the cone sides is 60 degrees. A stopper is used to seal the funnel to the collection bottle but has a groove to allow for water overflow during excessively wet months. A sturdy stand is required to support the deposition gauge so that the funnel mouth is in a horizontal plane, with minimal 'sway' and is 2.0 +/- 0.2 m above ground level. An optional bird ring may be used if this is an issue at the site.

The sites selected will meet the requirements of AS/NZ 3580.1.1:2007 and ensure the key elements of:

- A clear sky cone of a minimum of 120 degrees (no tree branches for example above the gauge)
- Unrestricted airflow coming from the general area of the sources wishing to be measured (free of obstacles such as buildings, for example).

The principle of the technique is that, over a given sampling period, particles that settle from the ambient air are collected in a vessel together with any rainwater. The sampled mass deposition rate of deposited matter is calculated from the mass of solids obtained, the funnel cross-sectional area and the exposure period (i.e. one month).

A deposited dust gauge and stand will be placed at each of the selected monitoring locations. In siting, it is important to maintain a minimum of 5 m from any trees or obstacles, unrestricted air

flow around the sampling inlet and clear sky angle of 120° above the inlet. An example of a dust deposition gauge is shown in Figure 4.

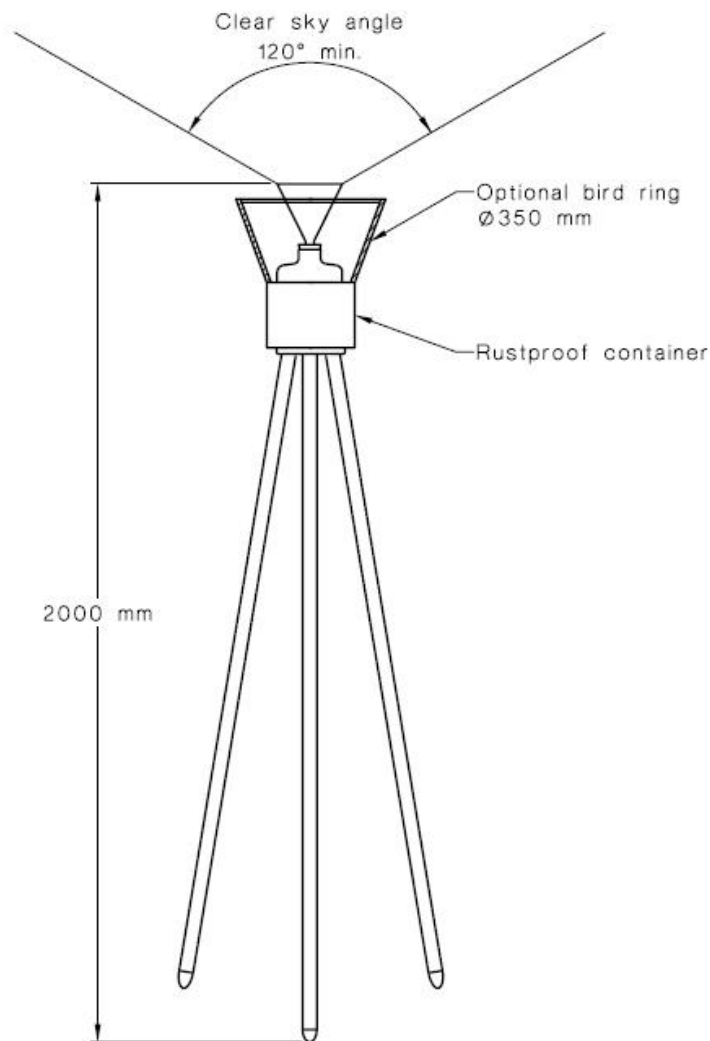


Figure 4 Typical Dust Deposition Stand with Gauge

#### 5.4 Monitoring Procedure

Each monitoring period requires the concurrent exposure of all four gauges for 30 +/- 2 days. The following outlines the steps involved in collection of samples:

- The bottles are typically exchanged on the first day of each month.
- At the end of the exposure period, remove the sample bottle and funnel from the holder.
- Wash any deposited matter adhering to the inside of the funnel into the deposit gauge bottle using a minimum volume of distilled water.
- Remove the funnel and seal the bottle with a lid. Identify the bottle with a label or ID (linked to the monitoring site, period of exposure and funnel diameter)
- With a chain of custody, deliver the bottle to a NATA registered laboratory for analysis. The analysis to include both soluble and insoluble matter.
- Insert the clean funnel into a fresh bottle and leave exposed for the next sample period.

Over time, a rolling 12-month average will be able to be calculated. These values for each gauge are required by the CoA to be below 4.0 g/m<sup>2</sup>/month for insoluble dust. To satisfy the incremental impact requirement of the CoA, the gauge with the lowest recorded value will be used as the indicator of 'background'. The calculation of the increase in deposited dust can then be made at the remaining three gauges, so that any level exceeding 2.0 g/m<sup>2</sup>/month is identified and that event is used as a trigger to audit the dust management practices for the site.

## 5.5 Data Recording and Reporting

Following receipt of the monitoring report from the NATA accredited laboratory, the data should be reviewed by the site environmental representative and entered into an internal database for the rolling 12 month average of deposited dust levels to be calculated. Unless otherwise required, an annual monitoring report should be prepared detailing the methodology and results of the dust deposition monitoring and comparison against the dust deposition criteria. Annual meteorological conditions recorded at the nearby WRP should also be reported. The air quality monitoring report would be incorporated into the Annual Environmental Monitoring Report for the site.

## 5.6 Quality Control and Assurance

Quality assurance and control will be in accordance with the Australian Standard AS/NZ 3580.10.1:2003 *Methods for sampling and analysis of ambient air Method 10.1: Determination of particulate matter – Deposited matter – Gravimetric method*.

## 5.7 Response to Exceedance of Dust Compliance Criteria

In the event that the rolling 12-month average exceeds the dust deposition criteria listed in Section 3, or an occurrence of a dust related incident that causes a complaint, GCC will notify the NSW OEH and DoP of the exceedance/incident within 24 hours of detection. The affected land owner(s) will also be notified within 6 days of the exceedance. GCC will then implement additional mitigation measures to minimise dust emissions from the site.

Following a complaint, dust monitoring will continue and a quarterly dust monitoring report will be issued demonstrating that the additional mitigation measures have resulted in a reduction of dust impacts off site and that no further exceedances have occurred.

If further monitoring indicates that the dust levels continue to exceed the relevant criteria, a review of the dust monitoring locations will be undertaken, given that there is a large buffer zone between the monitoring locations and sensitive receptor locations.

## 5.8 Responsibilities and Accountabilities

All personnel are responsible for implementing the appropriate mitigation measures to minimise and/or control the generation of dust on site according to the standards described in this monitoring plan. The staff responsible for the dust monitoring program are outlined in Table 5-1.

Table 5-1 Air Monitoring Responsibilities

Role	Areas of responsibility in relation to dust monitoring
<b>General Manager</b>	<ul style="list-style-type: none"> <li>Ensuring all legal requirements and reporting are met.</li> </ul>
<b>Waste Operations Manager</b>	<ul style="list-style-type: none"> <li>Reporting on all matters of Environmental monitoring.</li> <li>Overseeing monitoring program training.</li> <li>Overseeing monitoring program.</li> </ul>
<b>Landfill / Quarry Operators</b>	<ul style="list-style-type: none"> <li>Comply with all reasonable instructions given by the Operations Manager and any other senior manager of the GCC.</li> <li>Advise Operations Manager of any visible dust plumes moving off-site and ensuring immediate actions taken to reduce emissions.</li> </ul>
<b>Monitoring Network Technician (suitably qualified person)</b>	<ul style="list-style-type: none"> <li>Routine cleaning of equipment.</li> <li>Placement and retrieval of dust deposition gauges for laboratory on a monthly basis.</li> <li>Collating and sending samples to the laboratory on a monthly basis.</li> <li>Filling out of and maintaining Chain of Custody (COC) forms, field notes etc.</li> <li>All other monitoring items as required.</li> </ul>



## 6. Conclusion

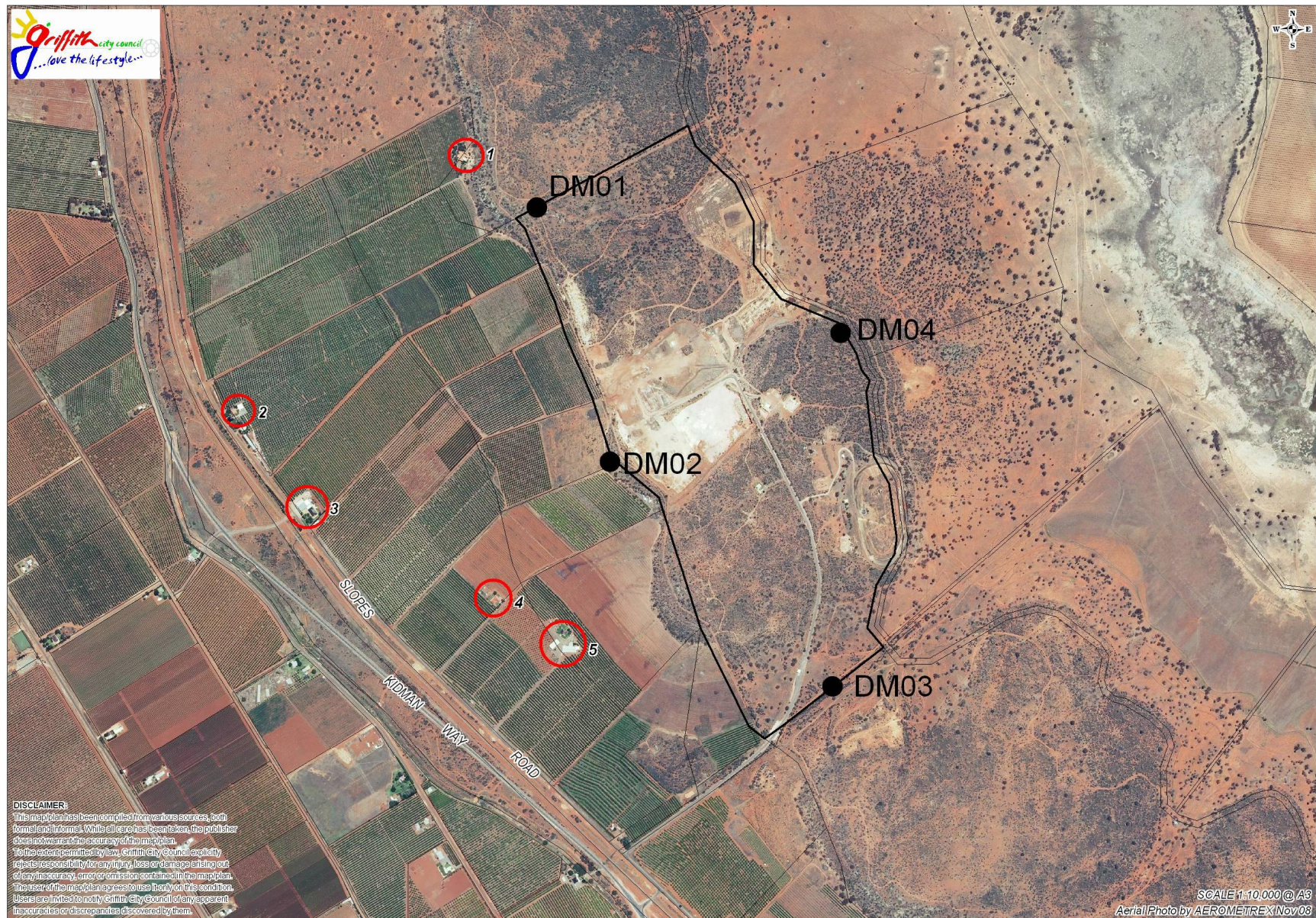
GHD recommends the Tharbogang Landfill and Quarry Air Quality Monitoring Program be carried out for an initial 12 month period. The requirement for further dust monitoring will be determined following review of the results of the initial 12-month monitoring period. If monitoring results clearly indicate that no dust impacts have been recorded after the initial 12-month period, annual dust monitoring will cease. Dust monitoring will then only occur following receipt of a complaint relating to dust generation from the site.

During the monitoring period should any exceedances of the air quality criteria outlined in Section 3 occur then these are to be reported to OEH and DoP.

Following analysis of results, dust mitigation measures will be established and implemented as required under the Conditions of Approval.

## Appendix A - Dust Monitoring Locations







GHD

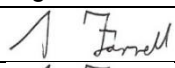
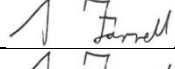
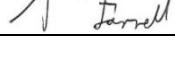
Suite 3, Level 1, 161-169 Baylis Street  
Wagga Wagga NSW 2650  
T: 61 2 6923 7400 F: 61 2 6971 9565 E: wgamail@ghd.com.au

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