12. Atmospheric Emissions

This Section details the atmospheric emissions which may arise from the surface facilities and underground operation of the W2CP. These include dust (referred to as particulate matter), odour and greenhouse gas emissions.

The assessment and proposed mitigation of dust related impacts proposed are in accordance with the "Leading Practice in Sustainable Development Handbook Series – Air Contaminants, Noise and Vibration", Australian Government Department of Resources, Energy and Tourism (2009).

12.1 Introduction

The implications of the Project on air quality were identified in the risk assessment process as being of key concern to local residents, particularly those to the east of the Tooheys Road site at Blue Haven. To address this issue, Holmes Air Sciences was commissioned by the WACJV to undertake air quality and greenhouse gas assessment for the proposed W2CP. The impacts of the smaller dust particles ($PM_{2.5}$) and silica on human health are assessed in detail in Section 10.8 and Appendix M.

The assessment is based on the use of a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the surface facilities. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality goals. Dispersion modelling has been carried out in accordance with the "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*" (DECC, 2005) administered by the New South Wales Department of Environment, Climate Change and Water (DECCW guidelines).

The specialist report is contained in Appendix L and summarised in the following sections.

12.2 Air Quality Criteria

12.2.1 Particulate Matter

Table 12.1 summarises the relevant air quality goals for particulate matter. The air quality goals relate to the total dust burden in the air and not just the dust from the Project. This requires the consideration of background levels when using these goals to assess impacts. The assessment criteria are designed to protect human health as well as to protect against nuisance effects.

12.2.2 Dust Deposition

In addition to potential health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces and possibly vegetation/crops. Table 12.2 shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. The criteria for dust fallout levels are set to protect against nuisance impacts (DEC, 2005).

Table 12.1 Air Quality Criteria for Particulate Matter Concentrations

Pollutant	Standard/Goal	Averaging Period	Agency
Total Suspended Particulate Matter (TSP)	90 µg/m^3	Annual mean	National Health and Medical Research Council (NSW DEC 2005)
Particulate Matter <10 µm (PM_{10})	50 µg/m^3	24-hour maximum	NSW DEC (2005) (assessment criteria)
	30 µg/m^3	Annual mean	NSW DEC (2005) (long-term reporting goal)

Table 12.2 DECCW Criteria for Dust (Insoluble Solids) Fallout

Pollutant	Averaging Period	Max Increase in Deposited Dust	Max Total Deposited Dust
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

The term “insoluble solids” refers to a component of the dust deposition. Dust deposition is initially collected as a total amount but is then analysed for its various constituents in order to determine the component which may have been derived from the mining operation. The individual components include soluble solids (such as cobwebs, pollen, bird droppings), insoluble solids (which can also include some organic material), combustible material (usually all remaining carbon and organic material) and ash content. This can then be correlated to wind speed and direction data from the onsite weather station to confirm the source. For the purposes of modelling and impact assessment, the “insoluble solids” component is used.

12.2.3 Odour

The determination of air quality criteria for odour and their use in the assessment of odour impact is recognised as a difficult topic in air pollution science. The topic has received considerable attention in the past five years and the procedures for assessing odour impacts using dispersion models have been refined considerably.

There are two factors that need to be considered:

- What "level of exposure" to odour is considered acceptable to meet current community standards in NSW; and
- How can dispersion models be used to determine if a source of odour meets the criteria which are based on this acceptable level of exposure.

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors. The most important factors (the so-called FIDOL factors) 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; and
- the **L**ocation of the source.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response by any individual to an odour is still unpredictable. Odour criteria need to take account of these factors.

The DECCW framework documents include some recommendations for odour criteria. The criteria have been refined by DECCW to take account of population density in the area. Table 12.3 lists the odour certainty thresholds, to be exceeded not more than 1% of the time, for different population densities.

Table 12.3 Impact Assessment Criteria for Complex Mixtures of Odours

Population of Affected Community	Odour Performance Criteria (Nose Response Odour Certainty Units at the 99th Percentile)
Single Residence (≤~2)	7
~10	6
~30	5
~125	4
~500	3
Urban (>2000), schools, hospitals	2

The criteria assume that seven odour units 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 exposed. The criterion of two odour units at the 99th percentile is considered to be acceptable for the whole population. This criterion has been considered for the W2CP as a conservative approach. In practice the population density would be less than 2000 in the potentially affected area and an odour criterion of three would be appropriate.

12.3 Existing Air Quality

Air quality standards and goals refer to pollutant levels which include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the project may contribute to these levels. This section discusses the existing air quality environment.

An Environmental Monitoring Program for the project commenced in 1996 providing monthly averages of dust fallout levels. Dust concentrations were also measured by high volume air samplers (HVAS). Air monitoring was discontinued in early 2004 but recommenced in late 2006.

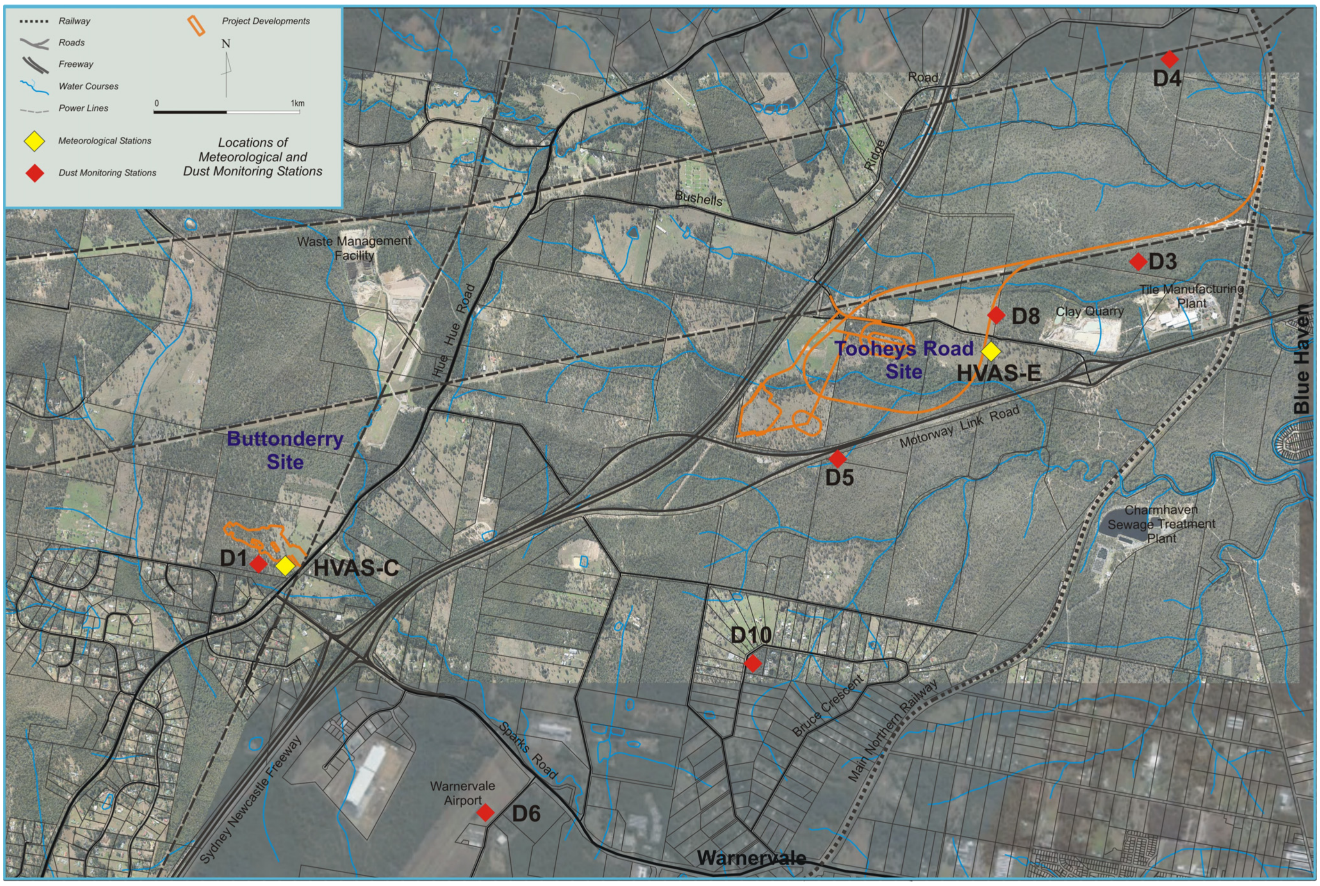

Figure 12.1 Location of Meteorological and Dust Monitoring Locations

Figure 12.1 shows the locations of the relevant monitoring sites in the area surrounding the project sites. Available data commencing in 1999 from the two relevant high volume air samplers and eight dust deposition gauges were assessed and summarised below.

The measured dust deposition and suspended particulate levels in the Project area are considered typical of a rural area remote from industrial emission sources. Air quality in the area is largely determined by emissions from natural sources, road traffic and community and agricultural activities. From time to time particulate matter levels would be expected to be affected by smoke from bushfires and dust from regional dust storms.

Analysis of the monitoring data obtained has led to the following conclusions about the existing air quality environment:

- Annual average insoluble solid deposition rates are below the air quality goal;
- Annual average TSP concentrations at the monitoring locations are below air quality goals;
- Annual average PM_{10} concentrations at the monitoring locations are below air quality goals; and

- There are several occasions on which PM_{10} concentrations have exceeded the 24-hour maximum air quality goal. This is largely due to widespread events such as bushfires.

For assessment of the air quality impacts due to a project, the general approach recommended by the DECCW is to add dispersion model predictions to existing background levels. The result is then compared with the relevant air quality goal. As discussed above, the monitoring data will represent the cumulative effect of all the dust sources relevant to the monitoring locations, including agricultural activities and other local sources.

From the monitoring data available, the following conservative background concentrations are applicable at the nearest receptors:

- Annual average TSP of 42 $\mu g/m^3$ (maximum measured in years not affected by bushfires);

- Annual average PM_{10} of 21 $\mu g/m^3$ (maximum measured in years not affected by bushfires); and

- Annual average dust deposition of 2 g/m^2/month.

In addition, the DECCW guidelines require an assessment against 24-hour PM_{10} concentrations. This assessment adopts the approach that the predicted 24-hour average PM_{10} concentration from the development should be less than 50 $\mu g/m^3$ at the nearest receptors. This approach assumes that best practice will be used to control dust from the mining activities.

In addition, this assessment has accessed continuous PM_{10} data collected by the DECCW at Beresfield near Newcastle to provide a contemporaneous background dataset for dust modelling purposes. In the year June 1998 to May 1999, the maximum 24-hour average and annual average PM_{10} concentrations were 38.9 and 16.5 $\mu g/m^3$ respectively. These data were used to assess the potential short-term impacts of dust emissions from the ventilation shaft.

12.4 Dust Generation

The project will result in the liberation of a number of classes of particulate matter (PM) described as total suspended particulate matter (TSP)[1], particulate matter with equivalent aerodynamic diameters 10 μm or less (PM_{10})[2] and particles with equivalent aerodynamic diameters of 2.5 μm and less, categorised as fine particles ($PM_{2.5}$).

Dust emissions will arise from both the construction of the mine (see Table 12.4) and during the operation of the mine (see Table 12.5). In terms of dust emissions, the more significant potential dust generating activities would be dozers working on stockpiles, loading of material and wind erosion from stockpiles.

[1] TSP is particulate matter suspended in the air and measured using a high volume sampler operated according to AS2724.3-1984. The size range of particles is indeterminate and depends on the measurement conditions. TSP is usually taken to comprise particles in the size range up to 0 to 50 μm. Particles larger than 50 μm are generally too large to remain suspended in the air for long enough to be considered as air pollutants.

[2] A particle is said to have an equivalent aerodynamic diameter of x μm if its dynamical behavior in the atmosphere is the same as a sphere of diameter x and with density 1 g/cm^3.

Table 12.4 Estimated Dust Emissions During Construction

Activity	TSP Emission Rate (kg/yr)
Tooheys Road Site	
Dozer clearing vegetation	11,274
Haulage	4,870
Loading of cut material from surface	2,255
Dumping of all material	2,541
Wind erosion	24,528
TOTAL	*45,468*
Buttonderry Site	
Dozer clearing vegetation	3,382
Haulage	490
Loading of cut material from surface	227
Dumping of all material	227
Wind erosion	14,016
TOTAL	*18,341*

Table 12.5 Estimated Dust Emissions During Mine Operation

Mining Activity	TSP Emission Rate (kg/yr)
Annual Rate of Mining	
Dozer on ROM stockpiles	16,911
Dozers on product stockpiles	16,911
Unloading ROM coal at pile	1,412
Additional ROM rehandle pile to conveyor	1,412
Loadout product coal to train	1,412
Reclaim coal to transfer house	1,412
Loadout coal to product stockpile	1,412
Coal processing	2,541
Wind erosion ROM stockpile	3,504
Wind erosion Product stockpile	11,213
TOTAL	*58,137*
Peak Rate of Mining and Processing *(used for peak 24-hour PM_{10} predictions only)*	
Dozer on ROM stockpiles	51,437
Dozers on product stockpiles	51,437
Unloading ROM coal at pile	6,698
Additional ROM rehandle pile to conveyor	6,698
Loadout product coal to train	4,122
Reclaim coal to transfer house	4,122
Loadout coal to product stockpile	4,122
Coal processing	12,056
Wind erosion ROM stockpile	3,504
Wind erosion Product stockpile	11,213
TOTAL	*155,408*

These estimates assume some control of dust emissions is achievable through the use of watering sprays on stockpiles, enclosure of conveyors on three sides and partial enclosure of the coal processing plant.

There will also be emissions from vehicles and underground equipment. These emissions will include carbon monoxide (CO) and minor quantities of sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and particulate matter. In practice, these emissions will be minor and at levels that will not give rise to any substantive environmental impacts. For this reason, these pollutants (apart from particulate matter) are not considered further in this report. The focus of the report is on the potential impacts due to dust and odour.

Dust and odour will also be emitted from the upcast ventilation shaft. Two fans each at approximately 185 m^3/s capacity are proposed to ventilate the mine. The shaft would be a source of particulate matter and odour. The estimated concentration of particulate matter in the ventilation air is based on actual experience at other comparable operations which indicates that such emission sources provide a low environmental risk. The actual conditions will depend on a number of factors, in particular the effectiveness of dust controls within the mine.

Based on dust emissions from other existing mines in the region, it is estimated that dust emissions from the W2CP ventilation system, working at 370 m^3/s, would be 0.53 g/s [370 m^3/s x 1.44 x 10^{-3} g/m^3]. This emission rate has been used to assess the effects of particulate matter emissions from the vent based on a likely maximum case derived from comparisons with an older operation.

Again, since the ventilation shaft is not yet operating, it is not possible to use site specific odour measurements. To assess odour emissions it has been assumed that the odour level in the ventilation air is 62 ou, based on other existing mining operations. At 370 m^3/s the total odour emission rate from the W2CP is estimated at 22,940 ou.m^3/s [370 m^3/s x 62 ou].

When odour is assessed using the DECCW's assessment procedures, the odour emission rate needs to be adjusted by certain factors that take account of the difference between the time interval over which a human being detects an odour and the averaging time that the dispersion model prediction relates to. For the W2CP assessment, the ventilation shaft is referred to as a surface point source with peak-to-mean factors in the range four to seven in the far-field.

12.5 Impact Assessment

12.5.1 Construction

Figure 12.2 to Figure 12.9 show the predicted maximum 24-hour PM_{10} concentrations, the predicted annual average TSP and PM_{10} concentrations, and the predicted annual average dust (insoluble solids) deposition rates during construction activities at both the Buttonderry and Tooheys Road sites.

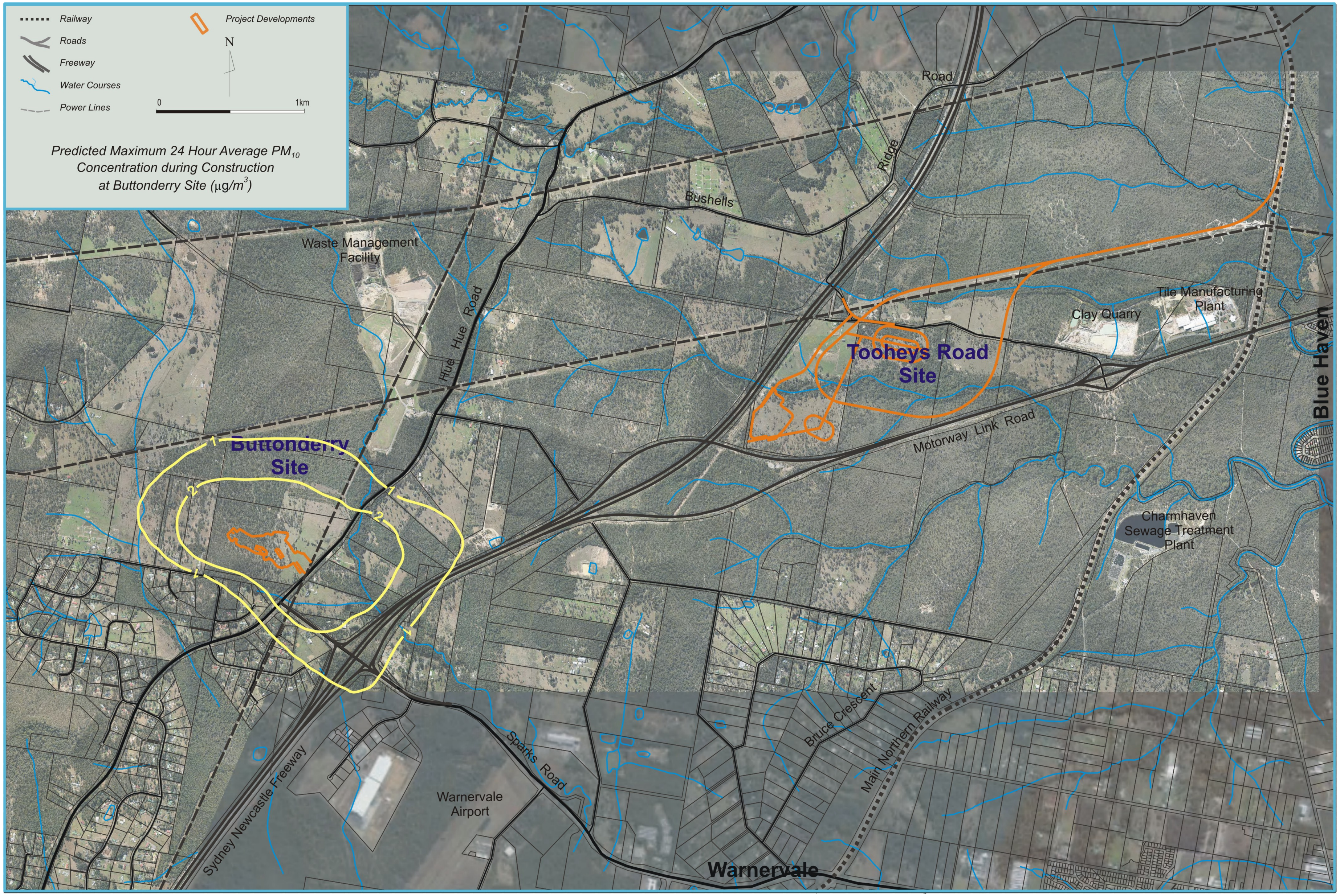

Figure 12.2 Predicted Maximum 24 Hour Average PM_{10} Concentration During Construction at Buttonderry Site

Figure 12.3 Predicted Annual Average TSP Concentration During Construction at Buttonderry Site

Figure 12.4 Predicted Annual Average PM_{10} Concentration During Construction at Buttonderry Site