APPENDIX 12

Air and Noise Quality Assessment

Air and Noise Assessment - Proposed Liquid Waste Facility, Glendenning - FINAL

Duggan & Hede Pty Ltd

February 2016

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Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s).

The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd for the purposes of this project is both complete and accurate.

Executive Summary

An existing JJ Richards and Sons workshop and truck park depot at 14 Rayben Street Glendenning is proposed to be upgraded. The upgrade is to include a new liquid waste facility, which will replace existing operations at Seven Hills. The expansion will cater for the anticipated increase in liquid waste throughput, including grease trap, liquid food waste and used oil. Grease trap and liquid food waste will be processed in an enclosed Organics Building in the western portion of the site. Used oil will be processed in the eastern portion of the site in a roofed area. As a result of the proposed development, there is a potential for air and noise impacts on the nearest sensitive receptors, which include residential zones to the north and east.

To address these potential impacts, Air Noise Environment has been commissioned to undertake an air and noise assessment of the proposed facility. The assessment has been completed using computational modelling in accordance with New South Wales Environmental Protection Authority requirements. This report presents the methodology, results and conclusions of the assessment.

Potential air quality impacts are associated with odour and VOC emissions from the new liquid waste tanks. Emissions are related to tank breathing, particularly during filling of the tanks when odour in the tank head space is forced out. All emissions from tanks in the Organics Building will pass through a single activated carbon system prior to being released external to the treatment building. The DAF unit represents a second odour source in the Organics Building – emissions from the DAF unit will also pass through an activated carbon system (however, the outlet will be located inside the treatment building). Potential emissions from the Used Oil Storage Area will be released direct from storage tanks during breathing and through a second DAF unit.

To assess air quality impacts from these sources, air dispersion modelling was undertaken using Calpuff. A prognostic meteorological dataset developed using TAPM was utilised for predicting local meteorological conditions at the subject site using Calmet. Emission rates for odour and VOCs were obtained through site sampling at the existing Seven Hills facility and another comparable site in Wacol (Brisbane). The derived Calmet meteorology and estimated emission rates were then used as an input for Calpuff to predict ground level concentrations of pollutants in the surrounding area. The results of the air modelling indicates compliance with the air quality criteria for all modelled pollutants by a significant margin.

Potential noise sources at the site include truck movements, and pumps and motors inside the treatment building. Noise modelling was completed using the Cadna noise model which utilises the ISO 9613 calculation procedure. Noise source data was obtained from measurements undertaken at the existing Seven Hills facility. The results of the noise modelling indicates compliance with the NSW Industrial Noise Policy L_{Aeq} *and sleep disturbance criteria.*

Overall, based on the results of the air and noise modelling, the site represents a suitable location for the proposed liquid waste facility.

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1 Introduction

1.1 Scope of Study

Duggan and Hede Pty Ltd commissioned Air Noise Environment Pty Ltd to undertake an air and noise assessment for a proposed JJ Richards & Sons Pty Ltd liquid waste facility at 14 Rayben Street, Glendenning.

The study has been undertaken to assess the potential impacts of the proposed facility on nearby sensitive receptors in accordance with the requirements of the New South Wales Environmental Protection Authority, Blacktown City Council and the Secretary's Environmental Assessment Requirements (SEAR) Application Number SSD 6767. Specifically, the following documents have been referenced:

- SEAR (Application Number SSD 6767);
- NSW EPA Notice No. 152611;
- Blacktown City Council information request
- NSW Industrial Noise Policy (2001) (INP);
- NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005);
- Assessment and Management of Odour from Stationary Sources in NSW (November 2006); and
- Generic Guidance and Optimum Model Settings for the Calpuff Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'.

Computational modelling has been undertaken for assessing potential air and noise impacts.

1.2 Information Requests

A list of the SEAR, NSW EPA and Blacktown City Council requirements for the air and noise assessment are provided in Tables 1.1 to 1.3. Column 2 of the tables identify the report section where the requirement is dealt with.

Table 1.1 - SEAR Number 974 – Air and Noise Requirements

SEAR Requirements	Report Section
Air Quality and Odour	
A description of all potential sources of air emissions and odour	Section 2.3 Potential Air Quality Impacts
A quantitative odour and air quality impact assessment in accordance with relevant Environment Protection Authority	Section 6 Air Quality Assessment

SEAR Requirements	Report Section
Guidelines	
A description and appraisal of air quality impact mitigation and monitoring measures	Section 2.3 Potential Air Quality Impacts
Noise and Vibration	
A description of all potential noise and vibration sources during construction and operation, including road traffic noise	Section 2.4 Potential Noise Impacts and Section 2.6 Construction Impacts
A noise and vibration assessment in accordance with the relevant Environment Protection Authority Guidelines	Section 5 Noise Assessment
A description of noise and vibration mitigation and monitoring measures.	Section 2.4 Potential Noise Impacts.

Table 1.2 - NSW EPA – Air and Noise Requirements

NSW EPA Requirements	Report Section
The Proposal	
Outline cleaner production actions including air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points.	Section 2.3 Potential Air Quality Impacts and Section 2.3 Potential Air Quality Impacts
Outline construction works including environment protection measures, including noise mitigation measures, dust control...	Section 2.6 Construction Impacts
Identify all sources of air emissions from the development. *Note: emissions can be classed as either:* *Point (e.g. emissions from stack or vent) or;* *Fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works);*	Section 2.3 Potential Air Quality Impacts Section 2.6 Construction Impacts
Air	
Identify all sources of air emissions from the development. Note: emissions can be classed as either: Point (eg emissions from stack or vent) or; Fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and	Section 2.3 Potential Air Quality Impacts

NSW EPA Requirements	Report Section
construction works);	
Provide details of the project that are essential for predicting and assessing air impacts including: The quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc.) of materials to be used, transported, produced or stored; An outline of procedures for handling, transport, production and storage; The management of solid, liquid and gaseous waste streams with potential for significant air impacts;	Section 2.3 Potential Air Quality Impacts
Noise and Vibration	
Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials;	Section 2.4 Potential Noise Impacts and Section 2.6 Construction Impacts
Specify the times of operation for all phases of the development and for all noise producing activities.	The site will typically operate 4 am to 9 pm Monday to Saturday. There is potential for operations outside of these hours.
For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc.), and land use along the proposed road and measurement locations - diagrams should be to a scale sufficient to delineate individual residential blocks.	An additional 1-2 trucks per hour and up to 1 additional passenger cars per hour are anticipated. Based on this, traffic noise impacts are expected to be minimal.
The Location	

Air
● Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
● Describe surrounding buildings that may effect plume dispersion.
● Provide and analyse site representative data on following meteorological parameters:
    ● Temperature and humidity;
    ● Rainfall, evaporation and cloud cover;
    ● Wind speed and direction;
    ● Atmospheric stability class;
    ● Mixing height (the height that emissions will be ultimately
	Section 2.6 Surrounding Topography
	
	Section 2.6 Surrounding Topography
	Section 3.1 Local Meteorology

NSW EPA Requirements	Report Section
mixed in the atmosphere); • Katabatic air drainage; • Air re-circulation.	
Noise and Vibration Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.	Section 2.1 Site Description
Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.	Section 2.1 Site Description
The Environmental Issues	
Air	
Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.	Section 3.1 Local Meteorology
Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.	Section 6.3 Air Emission Data
Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the DECCW.	Section 6 Air Quality Assessment
Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.	Section 6.6 Modelling Results
Describe the contribution that the development will make to regional and global pollution, particularly insensitive locations.	Section 6.6 Modelling Results
For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA I DECCW procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate. Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates. Reference should be made to *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2001); Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC, 2007); Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006); Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW*	Section 6.3 Air Emission Data

NSW EPA Requirements	Report Section
(DEC, 2006); Load Calculation Protocol for use by holders of NSW Environment Protection Licences when calculating Assessable Pollutant Loads (DECC, 2009).	
Describe management and mitigation measures Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes;	The proponent proposes a number of odour management measures (Section 2.3 Potential Air Quality Impacts). The odour modelling (see Section 6 Air Quality Assessment) indicates that no additional measures are required.
Noise and vibration	
Describe baseline conditions: Determine the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels in accordance with the NSW Industrial Noise Policy.	Section 3.3 Existing Acoustic Environment
Determine the existing road traffic noise levels in accordance with the NSW Environmental Criteria for Road Traffic Noise, where road traffic noise impacts may occur.	An additional 1-2 trucks per hour and up to 1 additional passenger cars per hour are anticipated. Based on this, traffic noise impacts are expected to be minimal.
The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including: ● Details of equipment used for the measurements; ● A brief description of where the equipment was positioned; ● A statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' Described in Section 3.1 .2 of the *NSW Industrial Noise Policy;* ● Details of the exact location of the monitoring site and a description of land uses in surrounding areas; ● A description of the dominant and background noise sources at the site; ● Day, evening and night assessment background levels for each day of the monitoring period; ● The final Rating Background Level (RBL) value; ● Graphs of the measured noise levels for each day should be provided; ● A record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section 81.3 of the *NSW Industrial Noise Policy;* ● Determination of L_{Aeq} noise levels from existing industry;	See Section 3.3 Existing Acoustic Environment for all noise monitoring details and results. Graphs are provided in Appendix C.
Assess impacts:	Section 4.2 Noise Criteria

NSW EPA Requirements	Report Section
• Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include: • Determination of the intrusive criterion for each identified potentially affected receiver; • Selection and justification of the appropriate amenity category for each identified potentially affected receiver; • Determination of the amenity criterion for each receiver; • Determination of the appropriate sleep disturbance limit; • Maximum noise levels during night-time period (10 pm-7 am) should be assessed to analyse possible affects on sleep. Where $L_{A1(1\ min)}$ noise levels from the site are less than 15 dB above the background L_{A90} noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*;	
Determine expected noise level and noise character (e.g. tonality, impulsiveness, vibration, etc.) likely to be generated from noise sources during: • Site establishment; • Construction; • Operational phases; • Transport including traffic noise generated by the proposal; • Other services; • Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).	For predicted noise levels during the operational phase, see Section 5 Noise Assessment. Construction noise impacts are discussed in Section 2.6 Construction Impacts
Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition;	Section 5.6 Predicted Results.
The noise impact assessment report should include: • A plan showing the assumed location of each noise source for each prediction scenario; • A list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site; • Any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc.;	Section 5 Noise Assessment

NSW EPA Requirements	Report Section
• Methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated; • An assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions; • The predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate; • For developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived; • An assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy;*	
Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures;	Section 5.6 Predicted Results. No additional mitigation is predicted to be required.
The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation;	See Section 2.4 Potential Noise Impacts. No additional mitigation is predicted to be required.
Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying: • Locations where the noise level exceeds the criteria and extent of exceedence; • Numbers of people (or areas) affected; • Times when criteria will be exceeded; • Likely impact on activities (speech, sleep, relaxation, listening, etc.); • Change on ambient conditions; • The result of any community consultation or negotiated agreement;	No additional mitigation is predicted to be required.
For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS;	An additional 1-2 trucks per hour and up to 1 additional passenger cars per hour are anticipated. Based on this, traffic noise impacts are expected to be minimal.
Where blasting is intended an assessment in accordance with the Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990) should be undertaken. The following details of the blast	Not applicable.

NSW EPA Requirements	Report Section
design should be included in the noise assessment: a) bench height, burden spacing, spacing burden ratio b) blast hole diameter, inclination and spacing c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.	
Describe management and mitigation measures Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.;	No additional mitigation is predicted to be required for the operational phase. Construction noise impacts are discussed in Section 2.6 Construction Impacts.
For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include: • Use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage; • Control of traffic (e.g.: limiting times of access or speed limitations); • Resurfacing of the road using a quiet surface; • Use of (additional) noise barriers or bunds; • Treatment of the fa9ade to reduce internal noise levels buildings where the night-time criteria is a major concern; • More stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension; • Driver education; • Appropriate truck routes; • Limit usage of exhaust breaks; • Use of premium muffles on trucks • Reducing speed limits for trucks; • Ongoing community liaison and monitoring of complaints; • Phasing in the increased road use;	An additional 1-2 trucks per hour and up to 1 additional passenger cars per hour are anticipated. Based on this, traffic noise impacts are expected to be minimal.
Cumulative Impacts: Assess the impact of the proposal against long term air, noise and water quality objectives for the area or region.	Section 2.5 Potential Cumulative Impacts

Table 1.3 - Blacktown City Council – Air and Noise Requirements

SEAR Requirements	Report Section
Planning	
Details of any noise barrier walls on the residential side of the property.	Not applicable.
Environmental Health	
Noise – An acoustic assessment is required due to the nature of the business, and proximity to residential receivers. The assessment should take into consideration the Environment Protection Authority's document NSW Industrial Noise Policy and provide recommendations to mitigate the emission of offensive noise from the proposed development. The report shall be prepared by an appropriately qualified acoustic consultant that is a member of the Association of Australian Acoustic Consultants. The report shall address any required noise attenuation measures to be imposed to ensure noise complies with the NSW Industrial Noise Policy between 10pm and 7am.	Section 5 Noise Assessment
Odour – An odour assessment is required and must be completed in accordance with the requirements of the Office of Environment and Heritage document Assessment and Management of Odour from Stationary Sources in NSW and Technical Framework November 2006.	Section 6 Air Quality Assessment

1.3 This Report

This report summarises the methodology, results and conclusions of the air quality and noise assessments. Glossaries of terms are presented in Appendix A and B to assist the reader.

2 Proposed Development

2.1 Site Description

The proposed development is situated at 14 Rayben Street, Glendenning. The site is located in an established industrial area. The nearest residential receptors are located 420 metres to the north along Lamb Street and 880 metres to the east along Knox Road. Existing industrial buildings are located between the proposed site and nearest receptors, obstructing any direct line of sight.

Figures 2.1 presents the development site location and surrounding land uses.

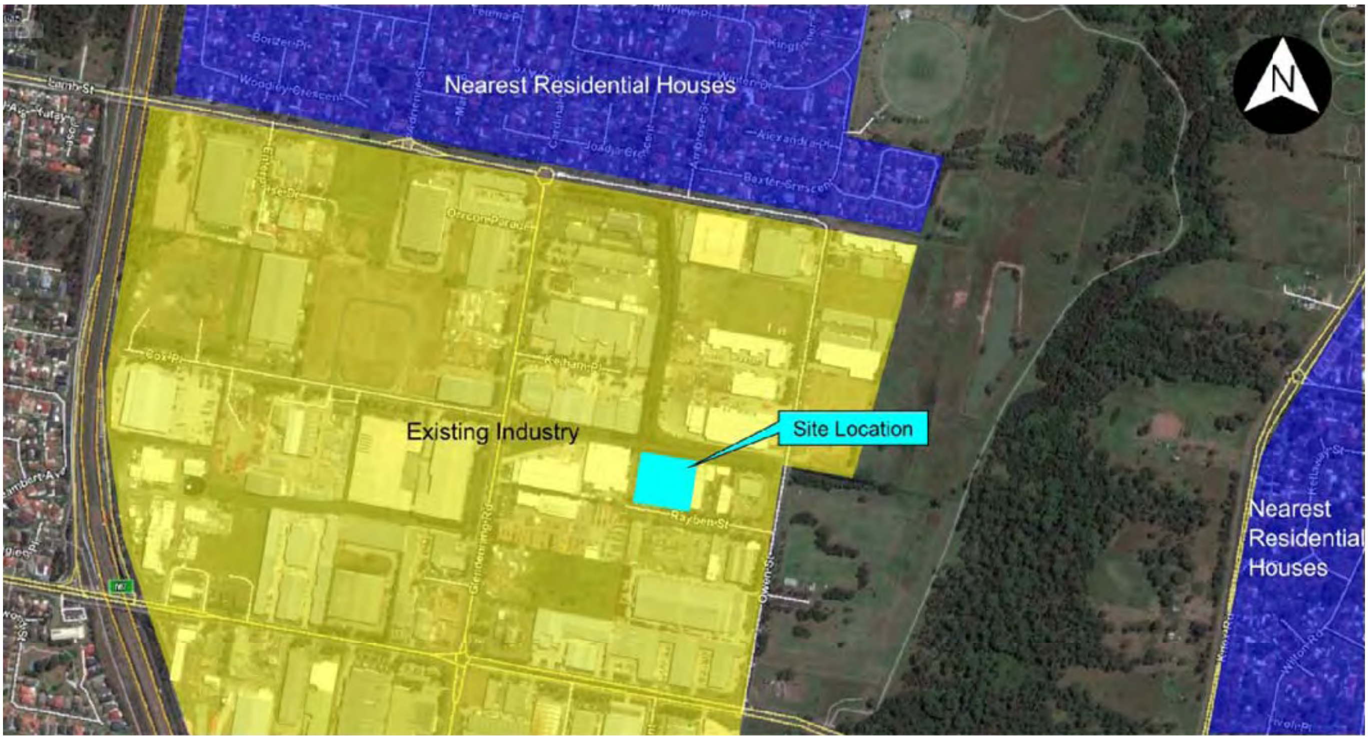

Figure 2.1: Site Location

2.2 Description of Operations

The site is currently occupied by JJ Richards and Sons, and comprises of a workshop area and washbay for trucks. An administration office and car parking bays are also provided on site.

Normal hours of operation for the site are proposed to be 4 am to 9 pm Monday to Saturday. The nature of the waste management industry however requires works outside of these hours, including vehicles leaving and returning to the site.

It is proposed to upgrade the site to include a grease trap and food waste tank farm and used oil tank farm. The existing office and car parking bays along the southern boundary of the site will be retained as part of the development. Figures 2.2 and 2.3 present the existing and proposed layout for the site.

Figure 2.2: Existing Site Layout

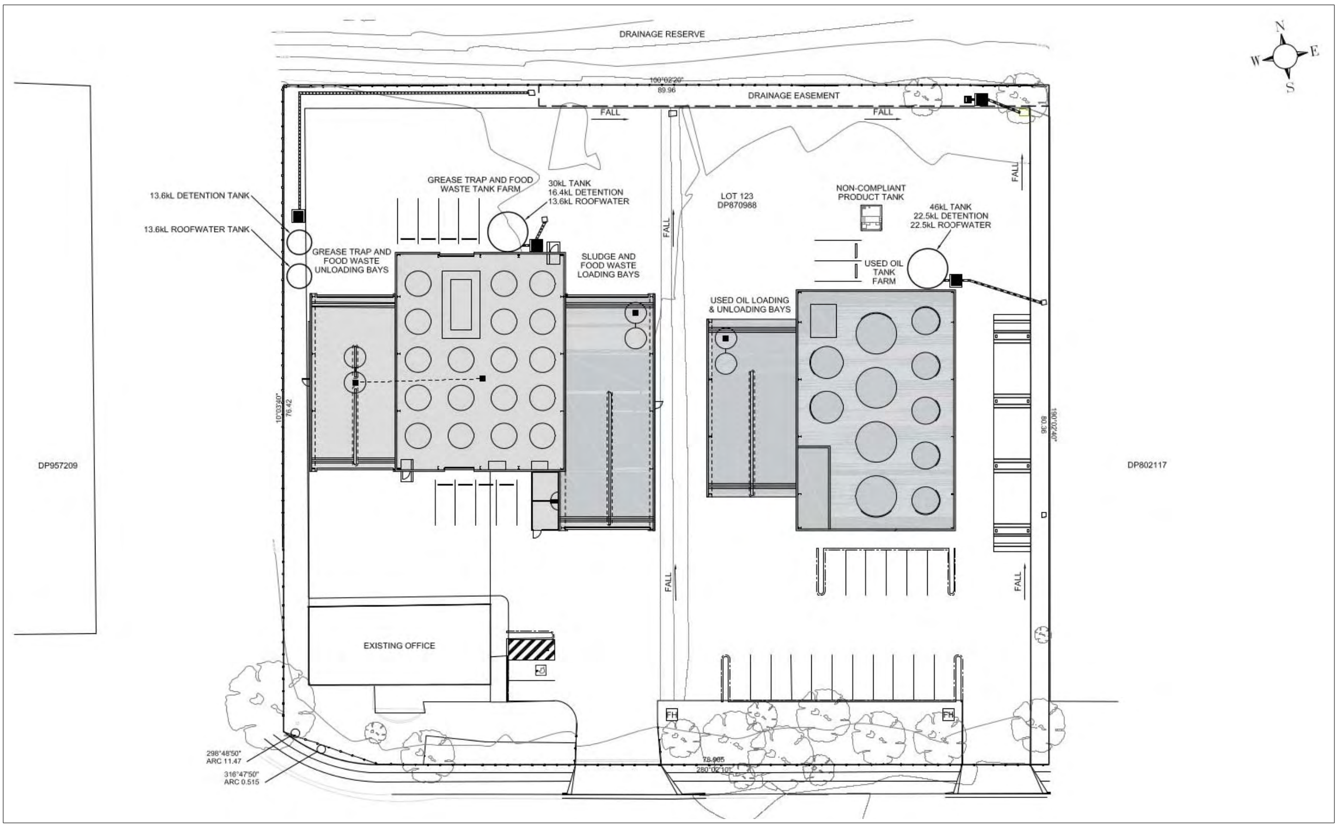

Figure 2.3: Proposed Site Layout

The grease trap and food waste tank farm (Organics Building) will be located in the western half of the site. The Organics Building will comprise of 3 sections:

- grease trap and food waste unloading bay – waste tankers are connected to transfer lines and material is pumped into receival tanks;
- treatment area – treatment tanks;
- sludge loading bay – waste tankers are connected to transfer line and sludge waste is pumped into tanker.

Grease trap waste will be delivered in tankers with up to a 24 kL capacity. Waste will be pumped from the tankers by vacuum pressure via an inlet strainer into one of two Receival Tanks. After settling of material for approximately 10 minutes, the liquid waste is transferred into Process Tanks, where the separation of liquids occurs using lime and coagulant. The sludge from the separation process is transferred to Sludge Tanks. The liquid is decanted into Water Tanks where polymers are used to assist in the formation of floc. The formed floc is transferred to the Sludge Tanks and the treated water component is pumped into the Dissolved Air Flotation (DAF) System. The DAF system provides conditions for the adjustment of pH, and removal of further solids and sludges. The solids are transferred to the sludge tanks and treated water is tested prior to discharge to sewer.

Liquid food waste will be delivered in tankers with up to a 24 kL capacity. Initially, waste will be transferred using a vacuum directly in to one of the 5 food waste storage tanks.

The tank vents will be interconnected and vented via an activated carbon filter. The DAF unit will be fully enclosed and vented via a separate carbon filter. The liquid waste treatment facility will be located inside a building constructed of Colorbond walls and a roof. A total of 6 roller doors will be included in the design (2 larger roller doors for each loading bay and 2 smaller roller doors in the treatment tank area).

Figure 2.4 presents the proposed layout of the Organics Building.

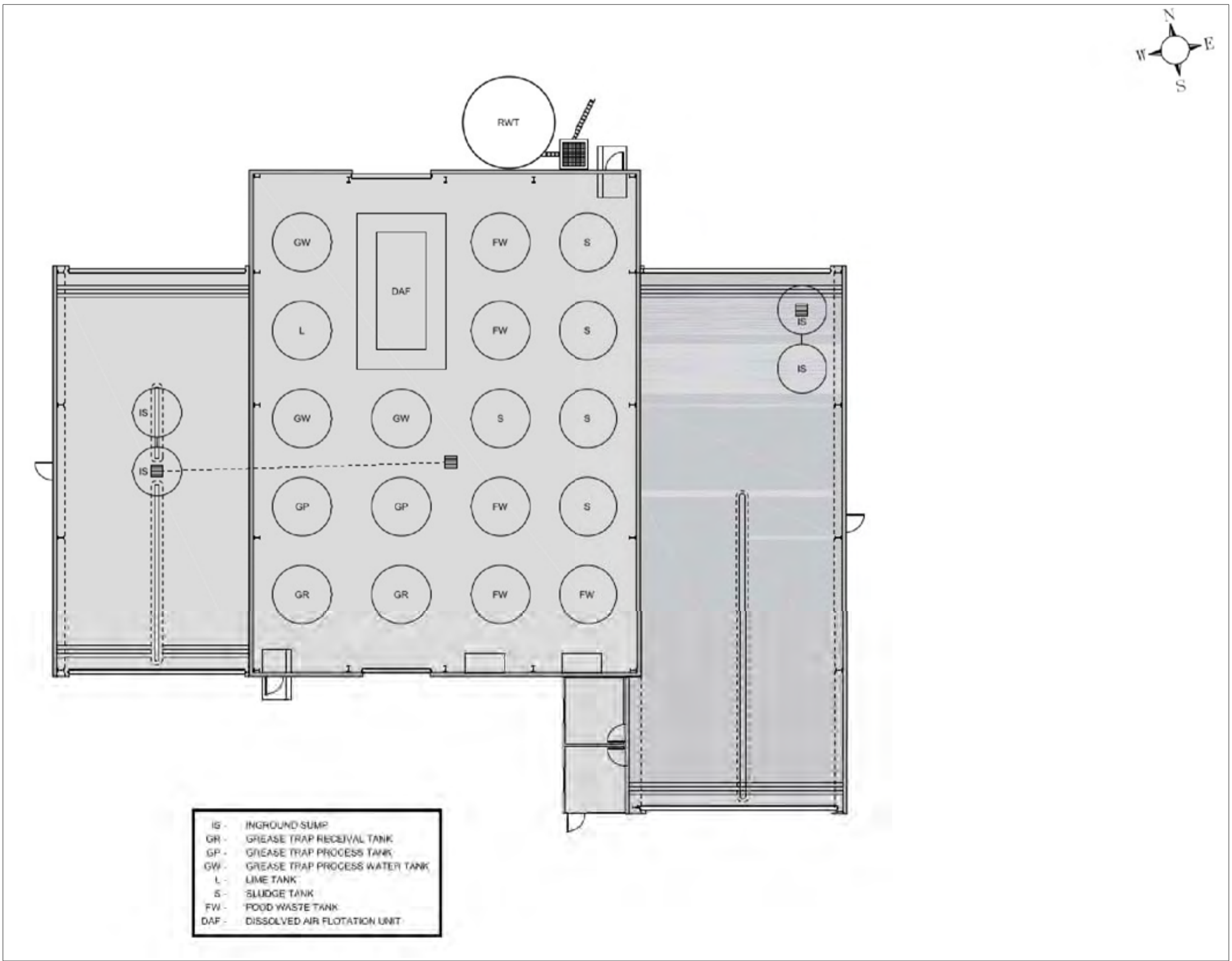

Figure 2.4: Organics Building

In addition to the Organics Building, a Used Oil Storage are will be constructed in the eastern half of the site. The following features will be included:

- sheet steel roof and partial sheet steel wall along western side of storage area;
- loading bay for trucks to unload used oil;
- 4 x used oil receival tanks;
- 5 x used oil storage tanks;
- 1 x oily water tank;
- 1 x industrial oily water tank; and
- Dissolved Air Flotation (DAF) Unit.

Used oil and industrial oily water will be delivered in tankers with a capacity up to 15 kL. Used oil will be pumped into one of the receival tanks while industrial oily water will be pumped into a designated industrial oily water tank. While in these tanks, the water and oil components will separate by gravity. Separated oil will be transferred into one of the storage tanks. The water from the used oil receival tanks will then be transferred to an Oily Water Tank. The water from the industrial oily water tank will be transferred to the DAF unit for further removal of solids and oils.

Figure 2.5 presents the proposed layout of the Used Oil Storage Area.

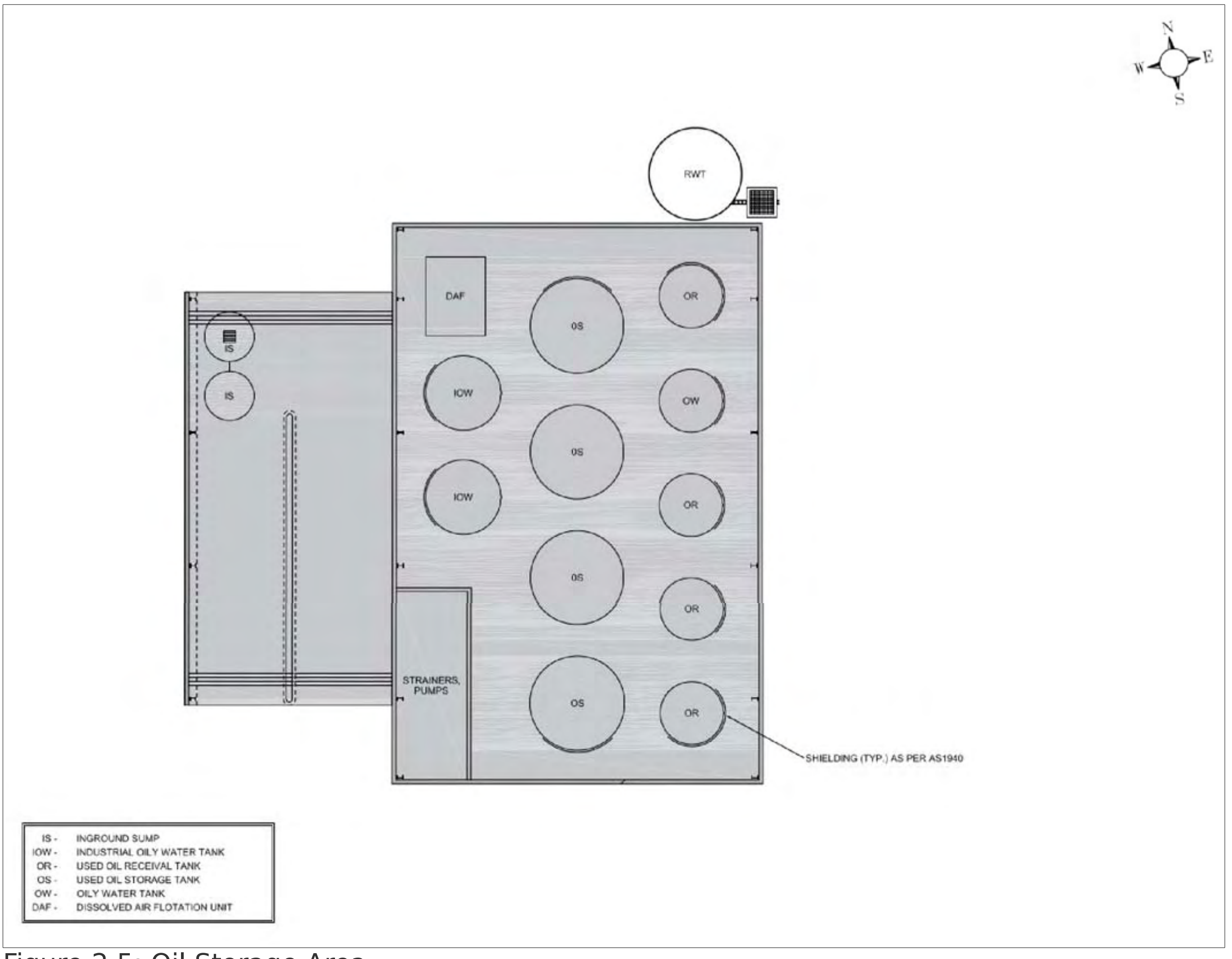

Figure 2.5: Oil Storage Area

2.3 Potential Air Quality Impacts

Odour from liquid waste is considered to be the main indicator for assessing potential air quality impacts for the site. The main sources of odour are identified as follows:

- Organics Building:
    - tank venting via an activated carbon system (connected to liquid waste tanks); and
    - venting from the DAF unit via an activated carbon filter system.
- Used Oil Storage Area:
    - tank venting direct to atmosphere (during tanker unloading and natural tank breathing);

- DAF unit.

Odour emissions from the Organics Building treatment tanks will be vented via a single outlet through an activated carbon system. The odour emissions are expected to vary throughout the day depending on the activities taking place. For example, while the receival tanks are being filled, odour in the head space would be forced out, increasing the potential for odour emissions. While natural venting is occurring, the flow rate of air from the tanks would be relatively low and the associated odour emission rate is expected to be lower.

In addition to the enclosed Organics Buildings and carbon filters, the following odour management measures will be implemented if an odorous load is received:

- Shutting any open doors;
- Dousing the load with an odour neutraliser; and
- Identifying the waste source and investigating.

If required, all future loads from this source would be either pre treated (at the source) or diverted to another waste facility.

2.4 Potential Noise Impacts

The following potential noise sources have been identified for the site:

- waste tanker movements;
- vacuum pump;
- motors and pumps associated with the DAF systems.

Based on the proposed design, it will not be necessary for trucks to reverse into or out of loading bays. The designated on-site truck route allows for trucks to move in the forward direction only. Nevertheless, there may be occasions when reversing is required. It is noted that JJ Richards and Sons utilises broadband reversing alarms to minimise noise impacts.

The nature of the waste industry necessitates the need to operate on a 24-hour a day basis from time to time. Therefore, there is a potential for sleep disturbance from short-term events such as reversing beepers (infrequent based as discussed above) and truck movements. The vacuum pump will only operate when liquid waste is transferred from tankers to the receival tanks or between different tanks. Motors and pumps for the DAF system are expected to operate throughout the day.

Tanker unloading and loading in the Organics Building between 6 pm and 6 am will only occur with the roller doors fully closed.

2.5 Potential Cumulative Impacts

Where existing industrial uses are present, there is a potential for cumulative air and noise impacts. The majority of uses in the area are office, warehouse or workshop buildings. The main air emission sources in the surrounding industrial area are identified in Table 2.1. The table also identifies the distance to the nearest residential area potentially affected by the proposed liquid waste facility (residential houses along Owen Street to the north).

Table 2.1 - Nearby Air Emission Sources

Name	Address	Air Emission Sources	Distance to Receptors along Owen Street
East Coast Scaffolding	74 Owen Street	Rooftop emission stack likely to be used for spray painting of products.	80 m
PERI Scaffolding	116 Glendenning Road	Two rooftop emission stacks likely to be used for spray painting of products;	530 m
Vella's Stock Feed	96 Glendenning Road	Two rooftop stacks, dust and odour likely to be the main air emission pollutants	730 m
Sumitomo Drive Technologies	181 Power Street	Manufacturing gear parts. One rooftop stack identified, possibly for painting or welding/grinding	730 m
Bonfiglioli	2 Cox Place	Manufacturing gear parts. One rooftop stack identified, possibly for painting or welding/grinding	411 m
Transpacific	6-8 Rayben St	Waste management (odour from waste)	420 m

Overall, other air emission sources are at relatively large distances from the nearest affected sensitive receptors and unlikely to contribute to cumulative impacts. The majority of air emission sources are between 400 m to 500 m from the sensitive receptors and at such a distance, impacts of odour or VOCs which are released via rooftop stack are expected to be minimal.

East Coast Scaffolding is closest to the nearest receptors potentially affected by the proposed liquid waste facility. The site operates an air emission stack, which is likely to vent a spray booth (potential odour and VOCs) and is located 80 metres south of residential receptors. The potential odour and VOC emissions are likely to be minor compared to other spray booth operations, such as a vehicle smash repairs facility.

In relation to noise, consideration of cumulative noise impacts is inherent in derivation of the amenity noise criteria in accordance with NSW Industrial Noise Policy. The approach adopted in the INP for deriving the amenity criteria is to measure existing levels of industrial noise and adjust the measured levels based on a comparison to recommended noise levels for the area under investigation. This methodology is described in detail in Section 4.2.3.

2.6 Construction Impacts

Potential impacts associated with construction of the proposed facility are expected to be minimal, given the large separation distance to the nearest sensitive receptors and the standard construction methods to be adopted. Construction will include demolition of concrete pavement, minor earthworks, concrete slab installation, erection of a Colorbond shed construction and installation of services and ancillary components (i.e. Drainage). Construction will take place over a 6 month period and be limited to normal daytime construction hours.

The main pollutants associated with construction are particulates from earthwork activity and diesel emissions from the operation of any heavy machinery. Potential noise impacts will primarily be associated with operation of heavy machinery, concrete trucks and pumps, and use of hand tools.

Overall, these activities have a minimal sphere of influence in terms of air and noise impacts, and are not expected to affect the nearest receptor 420 metres to the north. A Construction Environmental Management Plan will be implemented for the proposed works to assist in managing and minimising potential impacts.

3 Existing Environment

3.1 Local Meteorology

Figure 3.1 presents 2010 to 2014 wind rose data for the NSW Bureau of Meteorology Horsley Park station (11 km to the south of the development site). The wind roses indicate a relatively even spread of wind directions during the day period. However, during the early morning, wind conditions are dominated by a south-westerly component. Source-to-receptor winds (southerly) occur for approximately 11% of the time. Calm conditions occur for 16% of the time throughout the year and are highest during the early morning period (28% of the time).

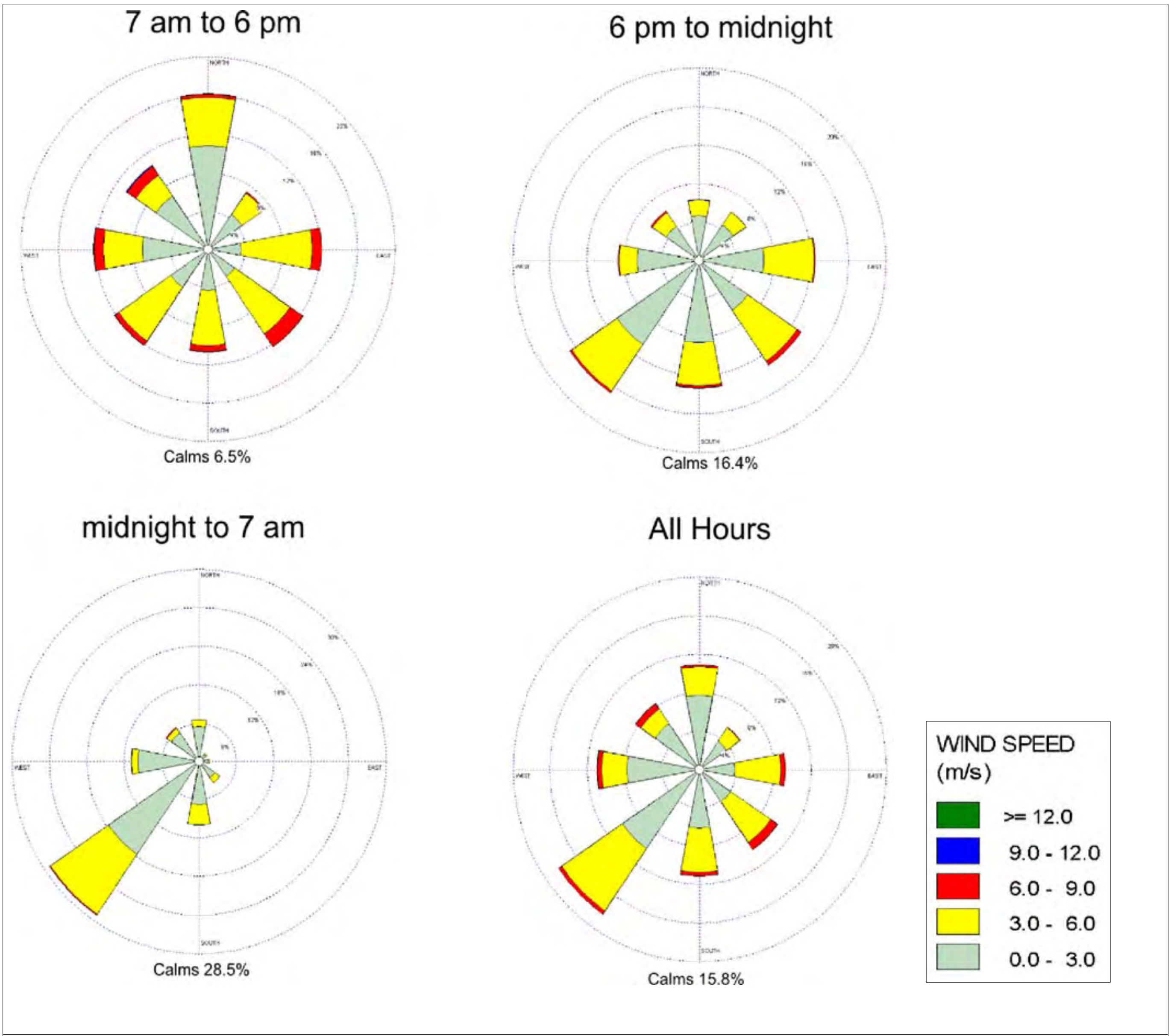

Figure 3.1: 2010-2014 Horsley Park NSW BOM Station

3.2 Surrounding Topography

The site is located approximately 32 m above sea level. There is minimal variation in topography between the site and the nearest sensitive receptors. Elevated regions exist beyond 20 km from the site. These ranges include the Blue Mountain range to the west and Ku-Rang-Gai Chase National Park to the north-east. The site in a slightly depressed valley and adjacent to a local water way extending north to south, passing through the Nurragingly Reserve. Figure 3.1 presents a diagram of the surrounding topography.

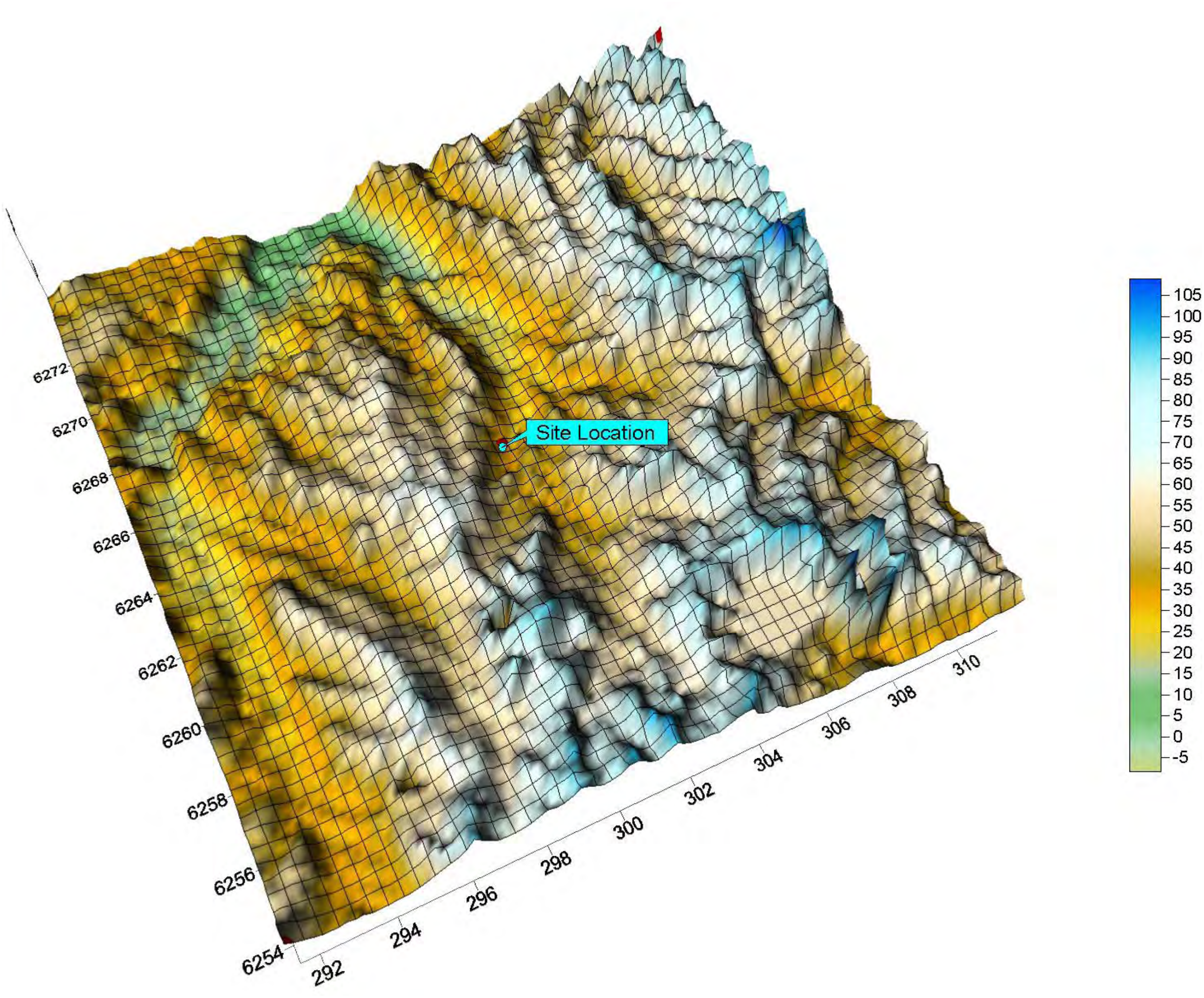

Figure 3.2: Surrounding Topography (20 km x 20 km)

3.3 Existing Acoustic Environment

3.3.1 Overview

Background noise monitoring was undertaken from 12 to 15 May 2015 at a location representative of the nearest sensitive receptors. During a site visit to the area, the main existing noise source at the monitoring location was road traffic along Lamb Street.

The following sections outline the noise monitoring methodology and results.

3.3.2 Noise Monitoring Methodology

Noise monitoring was undertaken at 24 Baxter Street (identified as one of the nearest sensitive receptors to the site). Noise from existing site activity was not audible due to the existing background, separation distance and shielding from existing buildings. Therefore, measured noise levels are considered to be 'true' background levels for the purpose of deriving noise criteria. Figure 3.3 presents the noise monitoring location.

Figure 3.3 : Noise Monitoring Position

Noise measurements were undertaken in accordance with the requirements of Australian Standard AS 1055-1997 'Acoustics – Description and measurement of environmental noise' and the NSW INP. An ARL Ngara Environmental Logger was used for the monitoring. The serial numbers and calibration information for the instruments are presented in Table 3.1. An averaging time of 15 minutes was adopted and measurements were made over a 4-day period. The microphones were positioned at a height of 1.2 metres above ground level and fitted with a windshield throughout the measurements. The instrument was also situated in a free-field position.

Table 3.1 - Noise Instrument Calibration Information

Instrument/ Serial No.	Monitoring Dates	NATA Calibration Current to:	Pre-Calibration	Post-Calibration
ARL Ngara (87809C)	12/5/15 - 15/5/15	20/3/2016	94.0	94.0

Instrument/ Serial No.	Monitoring Dates	NATA Calibration Current to:	Pre-Calibration	Post-Calibration
Pulsar 105 (48332)	-	5/11/2015	-	-

A review of meteorological data for the Bureau of Meteorology Horsley Park station indicates no periods of rain during the monitoring period. One 15-minute period was potentially affected by wind speeds above 5 m/s and data for this period has been removed for the purpose of the assessment.

3.3.3 Noise Monitoring Results

Table 3.2 presents a summary of the averages of each monitoring period (day, evening and night). The Assessment Background Level (ABL) value presented in Table 4.5 is the 10th percentile $L_{A90,15\text{-}minute}$ for a the time period of interest (day, evening or night).

Table 3.2 - Summary of Noise Levels dB(A)

Date	Period	L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	ABL
12/05/15	Day	82.3	71.9	67.8	47.8	82.7	46.8
	Evening	67.1	58.2	51.1	42.4	49.6	40.0
	Night	60.3	53.6	46.7	38.0	46.9	32.7
13/05/15	Day	69.4	60.8	55.5	47.7	53.7	45.1
	Evening	67.6	59.0	51.4	43.5	50.5	40.8
	Night	61.6	55.1	48.7	42.4	49.4	37.5
14/05/15	Day	70.5	61.1	54.2	46.1	53.2	44.1
	Evening	67.3	58.3	51.8	44.3	50.0	43.3
	Night	62.8	55.1	48.3	42.7	48.5	39.4
15/05/15	Day	72.1	62.5	54.3	46.7	55.0	45.2
	Evening	71.4	62.2	54.1	45.0	54.1	44.6

For the purpose of establishing the noise criteria in accordance with the INP (where monitoring for less than 1 week has been undertaken), it is necessary to use the lowest $L_{A90,15\text{-}minute}$ value. Based on the monitoring data, the following L_{A90} and L_{Aeq} values are applicable:

- minimum L_{A90} – day 43 dB(A), evening 38 dB(A) and night 31 dB(A); and

- L_{Aeq} – day 54 dB(A), evening 51 dB(A) and night 48 dB(A).

The above values have been used for deriving noise criteria for the site.

4 Assessment Criteria

4.1 Air Quality Criteria

The odour assessment has been completed in accordance with the odour criteria presented in the document "Assessment and management of odour from stationary sources in NSW", published by the NSW OEH in November 2006.

The document comprises two parts - a technical framework (which defines the criteria) and technical notes (that discuss assessment methodologies). In the policy document, the OEH note that odour assessment criteria need to be designed to take into account the range of sensitivities to odours within the community, and to provide additional protection for individuals with a heightened response to odours. Therefore, the odour assessment criteria allows for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. Table 4.1 presents odour criteria for various population sizes, as specified by the OEH.

Table 4.1: NSW EPA Odour Criteria

Population of Affected Community	Odour Assessment Criteria (OU)
Rural single residence (≤)	7.0
~ 10	6.0
~ 30	5.0
~ 125	4.0
~ 500	3.0
Urban area (≥ a 2000) and/or schools and hospitals	2.0

Alternatively, the NSW EPA identifies that the following equation may be applied:

$$\text{Odour assessment criterion (OU)} = (\log_{10}(\text{population}) - 4.5)/-0.6$$

The nearest sensitive receptors are residential zones in urban areas, therefore, the 2.0 ou applies for this receptor group.

For comparison to the assessment criteria, impacts in odour units are reported as peak concentrations (i.e. approximately one second average) and as the 99th percentile of predicted concentrations based on a Level 3 odour assessment methodology.

In addition to odour, an assessment of volatile organic compounds has also been undertaken. Based on the results of air emissions sampling, there is a potential for various volatile organic compounds to be emitted from the proposed operations. Section 6.3 of the report discusses the air emissions sampling. Table 4.2 presents ambient air quality criteria relevant to these compounds. In accordance with the NSW EPA requirements, the relevant statistical parameter for comparison against the criteria is the 99.9th percentile value.

Table 4.2: NSW VOC Ambient Air Quality Criteria

Compound	Criteria	Averaging Time
Toluene	360	1-hour
Tetrachloroethene	3,500	1-hour
Chloroform	900	1-hour
Benzene	29	1-hour
Ethylbenzene	8,000	1-hour
Xylene	190	1-hour
Cumene	21	1-hour
Trimethylbenzene	2,200	1-hour

4.2 Noise Criteria

4.2.1 Overview

The acoustic assessment has been completed in accordance with the procedure identified in the INP. The policy sets two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. The derivation of the two sets of criteria in accordance with the NSW OEH are presented below.

4.2.2 Intrusiveness Noise Criteria

According to the INP, intrusive noise refers to noise that exceeds background noise levels (as defined by the Rating Background Level) by more than 5 dB. The intrusiveness criteria for the assessment has been summarised in Table 4.3.

Table 4.3: Derived Intrusive $L_{Aeq,15\text{-}minute}$ Noise Criteria for Assessment

Period	Rating Background Level dB(A)	Intrusiveness Noise Criteria $L_{Aeq,15\text{-}minute}$
Day	43	48
Evening	38	43

Period	Rating Background Level dB(A)	Intrusiveness Noise Criteria $L_{Aeq,15\text{-}minute}$
Night	31	36

4.2.3 Amenity Criteria

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels (ANL) specified in Section 2.2 of the INP. The ANL is dependent on the type of area being considered. Table 4.4 presents ANL values for residential receivers in Rural, Suburban and Urban amenity areas. It is noted that where the existing acoustic environment is defined by traffic noise such that the existing industrial noise is inaudible at the monitoring location, the INP requires that the $L_{Aeq,period(traffic)}$ is considered as representative of the existing industrial noise level at the monitoring location.

Table 4.4: INP Acceptable Noise Levels for Residential Receivers

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50

When the difference between the existing industrial noise levels and ANL is minus 6 dB or higher (i.e. Existing – ANL ≥ minus 6 dB), then the noise level from a new source must be controlled to preserve the amenity of the area. The control of the new source is achieved by applying an amenity criteria derived in accordance with Table 2.2 of the INP. Table 2.2 of the INP specifies adjustments to the existing noise level or ANL to derive an amenity criteria. For example, if existing noise levels are 2 dB or more higher than the ANL, then the maximum L_{Aeq} noise level from a new source must be 10 dB below the existing noise level.

Table 4.5 presents the required adjustments for deriving the amenity criteria.

Table 4.5: Modifications to the ANL for deriving the Amenity Criteria (NSW INP Table 2.2)

Total existing L_{Aeq} noise level from industrial sources dB(A)	Maximum L_{Aeq} noise level for noise from new sources alone dB(A)
≥ Acceptable noise level plus 2	If existing noise level is likely to decrease in future: ANL minus 10 If existing noise level is unlikely to decrease in future: Existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level minus 8

For the purpose of deriving the amenity criteria, the nearest receptors have been identified as Urban Residential. Table 4.6 summarises the INP recommended noise levels these land uses.

Table 4.6: Derived Amenity Criteria for Assessment

Period	Existing Industrial L_{Aeq} Noise Level[a] dB(A)	Acceptable Noise Level dB(A)	Modification to ANL dB(A)	Amenity Noise Criteria $L_{Aeq,period}$
Day	54	60	-1	59
Evening	51	50	-8	42
Night	48	45	-10	38

4.3 Summary of Noise Criteria

As required by the NSW INP, the lower of the intrusive and amenity criteria is to be adopted for an assessment. The relevant criteria for the assessment are summarised in Table 4.7.

Table 4.7: Assessment Noise Criteria

Period	Limiting Criteria Type	Noise Criteria
Day	Intrusiveness	48 $L_{Aeq,15\text{-}minute}$
Evening	Amenity	42 $L_{Aeq,period}$
Night	Intrusiveness	36 $L_{Aeq,15\text{-}minute}$

The noise criteria applies at the most-affected point (i.e. highest noise level) on or within the residential property boundary. If the actual property boundary is more than 30 metres from the house, then the criteria applies at the most-affected point within 30 m of the house.

In addition, reference has been made to the following criteria for sleep disturbance:

Sleep Disturbance Criteria ($L_{A1,1\text{-}minute}$ or L_{AMax}) = $L_{A90,15\text{-}minute}$ + 15 dB

The above criteria is referred to in the INP Application Notes[1]. The NSW EPA recognises that this criteria is not ideal however, in the absence of additional research and evidence to replace it, the EPA will to continue to use it as a guide for the likelihood of sleep disturbance. Where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis can be undertaken.

Based on an RBL of 31 dB(A), an L_{AMax} 46 dB(A) criteria is applicable.

1 Application notes – NSW industrial noise policy, http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm, Accessed 2 July 2013.

5 Noise Assessment

5.1 Modelling Methodology

For the purposes of predicting impacts associated with noise emissions from proposed development on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software Cadna (Computer Aided Noise Abatement Model) developed by DataKustik. Cadna incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations.

The model is utilised to assess the potential noise emissions from the site under a range of operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted. The following sections discuss the inputs, assumptions and results of the noise modelling.

5.2 Meteorology

As a conservative approach, worst-case meteorology for non-arid areas (more than 500 mm annual rainfall) as defined in the NSW INP has been considered in the modelling (downwind conditions, 3 m/s wind speed and F Class Stability).

5.3 Sensitive Receptors

Discrete receptors have been modelled at the nearest sensitive receptors to the north and east (Receptor Group 1 and 2, respectively). Figure 5.1 presents the modelled discrete receptors.

Figure 5.1: Modelled Discrete Receptors

5.4 Noise Source Data

Table 5.1 presents the modelled noise source data for the expected sources as discussed in Section 2.4. Noise data for the liquid waste facility has been obtained from measurements completed at the existing site at Seven Hills which is to be replaced by the proposed development.

The modelling has considered an L_{AMax} scenario for reversing alarms and truck movement. As discussed earlier, the designated on-site truck route allows for trucks to move in the forward direction only. Reversing alarms have been considered as a conservative approach.

The data presented in Table 5.1 represent L_{Aeq} noise levels.

Table 5.1: Modelled Noise Source Data

Noise Source	Frequency Spectra (SWL, A-weighted)									Total	
	31.5	63	125	250	500	1k	2k	4k	8k	A	Lin
Proposed Organics Building											
DAF Unit Motor 1	40	53	58	63	71	78	77	77	73	83	86
DAF Unit Motor 2	44	54	61	67	75	80	78	77	73	84	88
DAF Unit Motor 3	46	57	64	68	75	77	76	74	74	83	90
DAF Unit Motor 4	46	59	68	69	77	87	81	75	64	89	92
Chemical Tank Motor	37	47	59	63	71	72	70	69	65	77	82
Air Compressor	43	56	70	80	88	91	88	85	82	95	97
Vacuum Pump	49	58	66	76	85	90	91	88	82	95	97
Truck Pump	53	82	90	99	103	106	106	102	93	111	115
Truck Movement (L_{Amax} Passby, 2 per hour)	63	78	82	91	86	90	97	99	97	103	109
Used Oil Storage Area											
DAF Unit Motor 1	40	53	58	63	71	78	77	77	73	83	86
DAF Unit Motor 2	44	54	61	67	75	80	78	77	73	84	88
DAF Unit Motor 3	46	57	64	68	75	77	76	74	74	83	90
DAF Unit Motor 4	46	59	68	69	77	87	81	75	64	89	92
Vacuum Pump	49	58	66	76	85	90	91	88	82	95	97
Truck Movement (L_{Amax} Passby, 1 per hour)	63	78	82	91	86	90	97	99	97	103	109
L_{AMax} Scenario											
Reversing Beeper (L_{AMax})	46	65	64	69	81	93	95	99	97	103	103
Truck Movement (L_{Amax} Passby)	63	78	82	91	86	90	97	99	97	103	109
[a] A plus 3 dB correction for tonality or impulsiveness has been included											

5.5 Noise Source Locations

Figure 5.2 presents modelled noise source locations for the proposed activity. All sources have been modelled between 1 to 2 metres above ground.

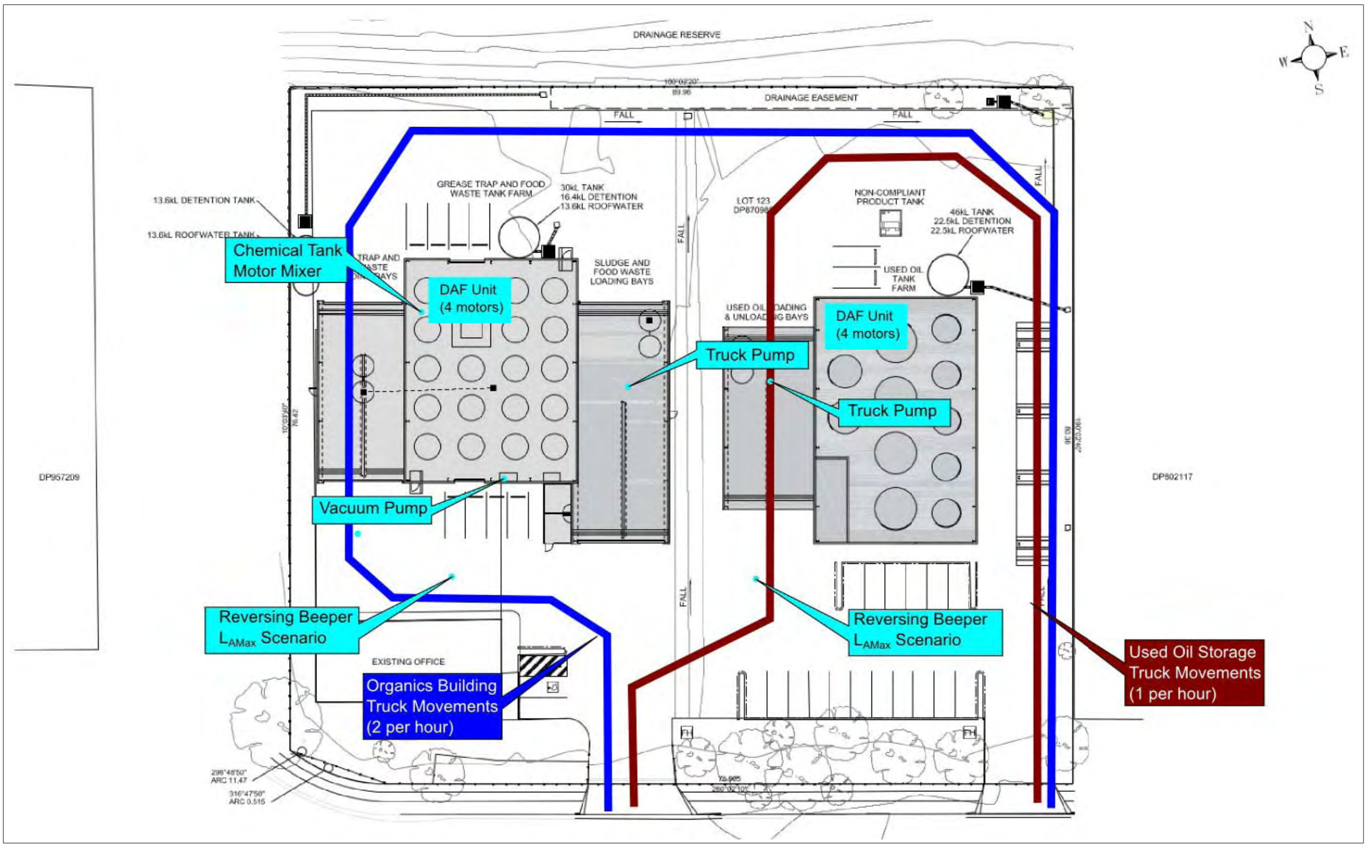

Figure 5.2: Modelled Noise Source Locations

5.6 Predicted Results

Table 5.2 presents predicted L_{Aeq} noise levels for the operation of the proposed development.

Table 5.2 - Predicted L_{Aeq} Noise Levels

Receptor Group	Predicted L_{Aeq} Noise Levels dB(A)	Predicted L_{AMax} Noise Levels dB(A)
1	36	37
2	28	24
RG1 Criteria	***Day/Evening/Night (48/42/36)***	***46 dB(A)***

The results of the noise monitoring indicate compliance with the L_{Aeq} criteria with the proposed liquid waste facility. Modelling of L_{AMax} noise levels from reversing alarms and truck movement (modelled) simultaneously) identifies a maximum noise level of 37 dB(A) at the nearest sensitive receptors, which is compliant with the 46 dB(A) criteria.

The noise criteria is based on monitoring derived from measurements at Receptor Group 1. Receptor Group 2 is located outside the industrial area to the east. Assuming a worst-case L_{Aeq} and L_{AMax} criteria of 35 dB(A) (which is based on a minimum background level of 30 dB(A) as defined by the INP), predicted noise levels at Receptor Group 2 are compliant.

It is noted that the model is conservative by assuming worst-case meteorological conditions and all sources operating simultaneously. Based on the results of the modelling, noise impacts associated with the proposed changes to the site are considered to be minimal.

6 Air Quality Assessment

6.1 Modelling Methodology

6.1.1 Overview

Atmospheric dispersion modelling involves the mathematical simulation of the dispersion of air contaminants in the environment. The modelling utilises a range of information to estimate the dispersion of pollutants released from a source including:

- meteorological data for surface and upper air winds, temperature and pressure profiles, as well as humidity, rainfall, cloud cover and ceiling height information;
- emissions parameters including source location and height, source dimensions and physical parameters (eg exit velocity and temperature) along with pollutant mass emission rates;
- terrain elevations and land use both at the source and throughout the surrounding region; and
- the location, height and width of any obstructions (such as buildings or other structures) that could significantly impact on the dispersion of the plume.

For the purpose of the assessment, meteorological modelling has been undertaken using TAPM (The Air Pollution Model) and CALMET to predict localised meteorological conditions. The meteorological data derived from these models have been used as an input for the CALPUFF dispersion modelling.

6.1.2 TAPM Predictions

A site specific meteorological dataset has been determined using the prognostic model TAPM (The Air Pollution Model). Prognostic models, such as TAPM, permit the development of localised meteorological datasets, based on synoptic weather conditions. The model predicts the regional flows important to dispersion, such as sea breezes and terrain induced flows, against a background of larger-scale meteorology provided by synoptic analyses. The output of this model, when used with a diagnostic meteorological model, such as Calmet, provides a meteorological dataset suitable for introduction into the diagnostic wind field results. This methodology is the recommended approach for the modelling of contaminant concentrations using Calmet[2].

Predictions of meteorological parameters for the year 2012 for the region in the surroundings of the development site were undertaken using TAPM (Version 4). The model was configured with a series of nested grids chosen to provide an appropriate communication and transfer of information from the broad synoptic to the local scale.

The model was configured to use a domain consisting of 25 x 25 x 25 grid points with nesting spacings of 30 km, 10 km, 3 km and 1 km.

2 TRC Environmental Corporation (March 2011) 'Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the ‘Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia’ prepared on behalf of the NSW Office of Environment and Heritage.

6.1.3 Calmet Predictions

6.1.3.1 Overview

A three dimensional prognostic dataset derived from the TAPM model was input to CALMET to predict meteorological conditions near the development site. TAPM 2012 data has been used to allow for validation against 5 years of meteorological data for the nearest Bureau of Meteorology station at Horsley Park. The following sections provide an overview of the data utilised in the CALMET modelling, along with details of some of the key parameters selected to establish calculation limits within CALMET.

6.1.3.2 Vertical Stations

For the purposes of the modelling, CALMET was initialised with a total of 12 vertical layers with layer boundaries at 20 m, 50 m, 75 m, 150 m, 200 m, 500 m, 750 m, 1,000 m, 1,500 m, 2,000 m, 3,000 m and 4,000 m respectively. The vertical levels used in the modelling were selected to provide the model with the ability to predict a generic range of atmospheric conditions near to the site.

6.1.3.3 Terrain And Land Use Data

Terrain height data was based on data from the Shuttle Radar Imaging Mission (SRTM), and obtained from the United States Geological Survey (USGS) web site. This produced terrain height data on a 3 arc-second longitude/latitude grid (approximately 0.09 km) for a grid domain of 30 km x 30 km encompassing the site region.

Land use and coastline data was also obtained from the USGS and incorporated into the CALMET model.

6.1.4 CALPUFF Dispersion Modelling

The CALPUFF modelling system treats emissions as a series of puffs. These puffs are then dispersed throughout the modelling area and allowed to grow and bend with spatial variations in meteorology. In doing so, the model is able to retain a memory of the plume's movement throughout a single hour and from one hour to the next while continuing to better approximate the effects of complex air flows.

CALPUFF utilises the meteorological processing and prediction model CALMET to provide three dimensional wind field predictions for the area of interest. The final wind field developed by the model (for consideration by CALPUFF) includes an approximation of the effects of local topography, the effects of varying surface temperatures (as is observed in land and sea bodies) and surface roughness (resulting from varied land uses and vegetation cover in an area). The CALPUFF model is able to resolve complex terrain influences on local wind fields including consideration of katabatic flows and terrain blocking.

6.1.5 CALPOST

Post processing of modelled emissions is undertaken using the CALPOST package. This allows the rigorous analysis of pollutant predictions generated by the CALPUFF system. In particular CALPOST is able to provide an analysis of predicted pollutant concentrations for a range of averaging periods from 1 hour to 1 year.

6.2 Meteorology

6.2.1 Wind Predictions

Figure 6.1 presents a predicted wind rose for the development site and a measured wind rose for the nearest meteorological station at Horsley Park. Both predicted and measured wind roses are comparable in terms of wind direction. The predicted wind roses are noted to have a slightly higher proportion of south-westerly and southerly (source-to-receptor) winds. The predicted data also has a lower proportion of calms however, it is noted that there is a higher proportion of low wind speeds (below 3 m/s).

Overall, the predicted dataset is considered suitable for use in the assessment of air quality impacts.

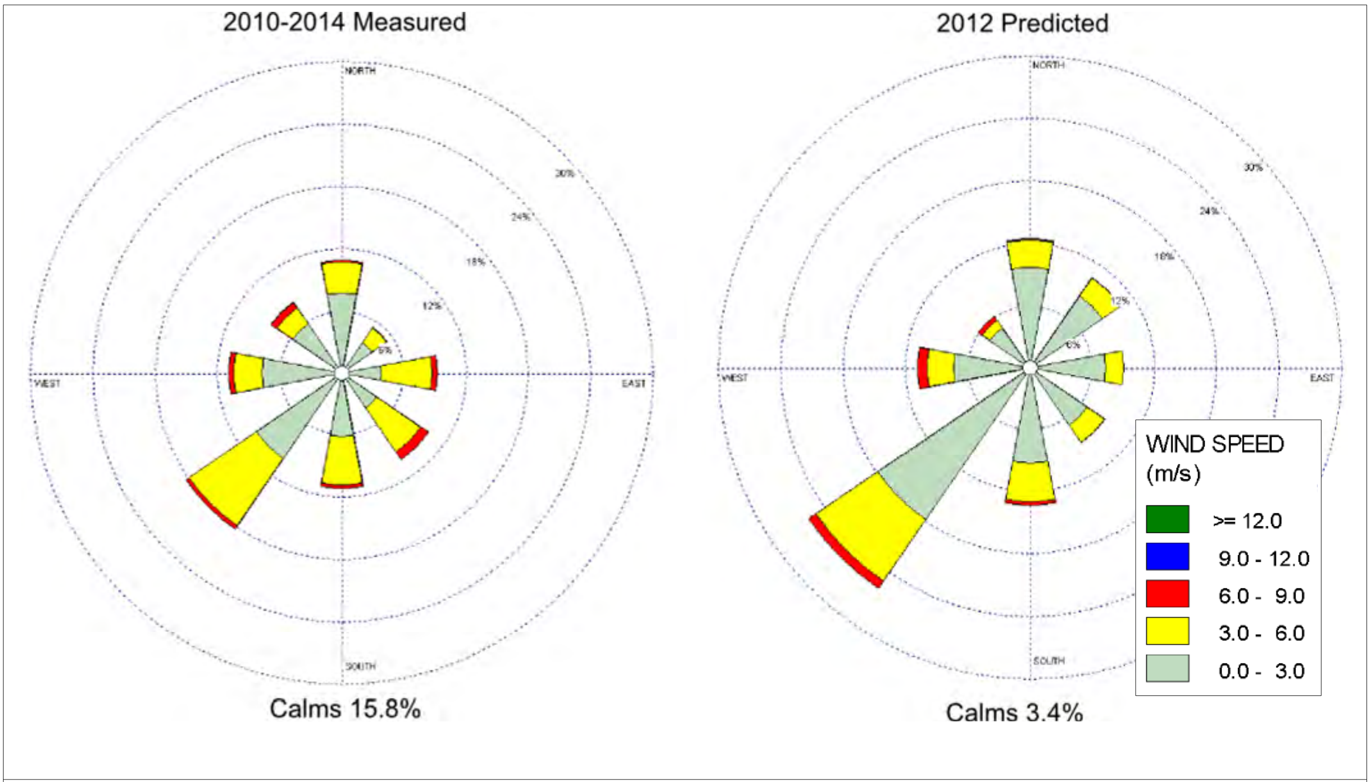

Figure 6.1: 2010-2014 Measured Wind Rose (Horsley Park) vs 2012 Predicted Wind Roses (Development Site)

6.2.2 Predicted Atmospheric Stability

The amount of turbulence in the ambient air has a major effect upon the rise and dispersion of emissions. The amount of turbulence in the atmosphere is often described using series of six Pasquill stability classes A, B, C, D, E and F (Turner, 1970). Of these, Class A denotes the most unstable or most turbulent conditions and Class F denotes the most stable or least turbulent conditions. Table 6.1 provides a summary of the predicted atmospheric stability conditions (derived by CALMET) for the area.

Table 6.1 - Summary of Predicted Stability Classes by Hour

Hour	Predicted Pasquill Stability Class					
	A	B	C	D	E	F
0	0	0	0	70	32	263
1	0	0	0	78	29	258
2	0	0	0	85	29	251
3	0	0	0	88	26	251
4	0	0	0	90	26	249
5	0	0	62	110	16	177
6	0	23	115	124	11	92
7	0	45	151	169	0	0
8	6	95	122	142	0	0
9	14	92	111	148	0	0
10	36	92	89	148	0	0
11	38	98	87	142	0	0
12	29	91	87	158	0	0
13	13	81	83	188	0	0
14	3	54	87	221	0	0
15	1	30	93	241	0	0
16	0	6	98	261	0	0
17	0	1	38	209	16	101
18	0	0	17	116	54	178
19	0	0	0	40	60	265
20	0	0	0	44	38	283
21	0	0	0	45	30	290

Hour	Predicted Pasquill Stability Class					
	A	B	C	D	E	F
22	0	0	0	52	32	281
23	0	0	0	62	30	273
%	1.6%	8.1%	14.1%	34.5%	4.9%	36.6%

6.3 Air Emission Data

6.3.1 Organics Building

In order to gain an understanding of the potential emissions from the proposed activities at the Organics Building, odour and VOC sampling was undertaken at the existing JJ Richards and Sons liquid waste management facility at Tucks Road, Seven Hills. The proposed development site is to accommodate the relocation of the existing Seven Hills facility. Following relocation of the facility, the waste stream currently processed at the existing facility is to be treated at the new Glendenning site. Hence, the emissions from the existing site are expected to be the same as those for the new facility.

Sampling was undertaken on Tuesday 12 May and Wednesday 13 May 2015. A total of 10 samples across 6 odour sources were collected as summarised in Table 6.2. Duplicate samples were collected for 4 of the sources to allow for variation in waste composition which can affect odour concentration.

Table 6.2 - Odour Sample Details

Odour Sources	Sample Location	12/5/15	13/5/15
Filling of Receivals Tank	Sample port, post filter system	✓	✓
Filling of Process Water Tanks	Sample port, post filter system	✓	✓
Filling of Mixer Tank	Sample port, post filter system	-	✓
Natural Venting of All Tanks	Sample port, post filter system	✓	✓
DAF Unit Activated Carbon System Outlet	Outlet of carbon filter	✓	✓
Middle of Building between Tanks	Between Receival and Water Tanks	✓	-

Point source sampling from the tank vents was undertaken using an evacuated drum allow collection of the odour sample directly into a sample bag. To determine the flow rate and derive a total emission rate, the exit velocity at the vent opening was measured using a VelociCalc 9555-P Air Velocity Meter.

Following completion of sampling, samples were transported to a specialist laboratory and analysed within 24 hours of sampling. The analysis was undertaken by a NATA accredited laboratory (The Odour Unit Sydney) in accordance with AS 4323.3:2001 Station source emissions – Determination of odour concentration by dynamic olfactometry.

Sampling of VOCs was also undertaken from each odour sample bag. NIOSH Method 1500 was adopted which involves drawing sample air across a charcoal sample tube at a known flow period over a known time period. The flow rate and time period adopted for the sampling was 200 mL/min and 15-minutes, respectively. The sample tubes were transported to the National Measurement Institute for analysis of a suite of volatile organic compounds.

Tables 6.3 and 6.4 present a summary of the odour and VOC sampling results.

Table 6.3 - Odour Sample Results

Odour Sources	Measured Odour Concentration (OU)	
	12/5/15	13/5/15
Filling of Receivals Tank	5,313	7,640
Filling of Process Water Tanks	9,740	8,190
Filling of Mixer Tank	-	12,400
Natural Venting of All Tanks	558	79
DAF Unit Activated Carbon System Outlet	197	108
Middle of Building between Tanks	181	-

Table 6.4 - VOC Sample Results

Odour Sources	12/5/15	13/5/15
Filling of Receivals Tank	• Toluene – 5 ug • Tetrachloroethene – 12 ug • Chloroform – 13 ug • All other target compounds below detection limit	• Toluene – 4.3 ug • Tetrachloroethene – 1.7 ug • Chloroform – 22 ug • All other target compounds below detection limit

Odour Sources	12/5/15	13/5/15
Filling of Process Water Tanks	• Toluene – 5.2 ug • Tetrachloroethene – 4.6 ug • Chloroform – 19 ug • All other target compounds below detection limit	• Toluene – 3 ug • Chloroform – 7.2 ug • All other target compounds below detection limit
Filling of Mixer Tank		• Toluene – 3.2 ug • Chloroform – 17 ug
Natural Venting of All Tanks	• All compounds below detection limit	• All compounds below detection limit
DAF Unit Activated Carbon System Outlet	• All compounds below detection limit	• All compounds below detection limit
Middle of Building between Tanks	• All compounds below detection limit	

The highest odour concentrations were measured during filling of the treatment tanks (receivals, process water and mixer tank). Measured odour concentrations ranged from 5,313 ou to the highest of 12,400 ou (mixer tank). Odour concentrations during natural venting of all tanks (558 ou and 79 ou) was significantly lower than during filling. Samples collected at the DAF carbon filter system outlet and middle of the process building were all below 200 ou.

The results of the VOC sampling indicate that toluene, chloroform and tetrachloroethene were present in the liquid waste. All other compounds were below the detection limit. The 3 compounds listed above were detected in the receivals tank, process water tanks and mixer tank. It is noted that all compounds were below the detection limit for the following samples:

- during natural venting of all tanks;
- DAF activated carbon system outlet; and
- middle of building between tanks.

6.3.2 Used Oil Storage

In order to predict odour emission rates for the Used Oil Storage Area, odour sampling previous completed by Air Noise Environment at a similar JR Richards & Sons and JJ Richardson & Sons facilities has been adopted in the assessment. Sample data adopted for the assessment includes:

- Oily water tank sample - JR Richards & Sons Port Macquarie liquid tank farm;
- Filling of receivals tank with used oil and tank breathing – JJ Richards & Sons Wacol liquid tank

farm.

The sampling and analysis was completed in accordance with *AS 4323.3:2001 Station source emissions – Determination of odour concentration by dynamic olfactometry*.

6.3.3 Modelled Emission Data

Table 6.5 presents the modelled odour emission data based on the results of the sampling. As a worst-case scenario, the emissions (released via the tank network vent) from the filling of the mixer tank have been modelled. Mixer tank odour concentrations were higher than other venting scenarios.

Table 6.5 - Modelled Odour Emission Data

Odour Source	Measured Odour Concentration (OU)	Air Flow Rate (m^3/s)	Odour Emission Rate (OUV/s)
Organics Building			
Filling of Mixer Tank	12,400	0.039[a]	486.9
DAF Unit Activated Carbon System Outlet	197	0.63[b]	123.8
Used Oil Storage Area			
Filling of Receivals Tank	2445	0.013	31.8
Natural Venting from Other Receivals Tank	1515	0.001	1.5
Breathing Emissions from Used Oil Storage Tanks	1515	0.001	1.5
Breathing emissions from Oily Water Tank	512	0.001	0.5
Breathing emissions from industrial oily water tank	512	0.001	0.5
DAF Unit	512	0.63[b]	322.6
[a] Based on 100 mm pipe diameter and 5 m/s measured exit velocity [b] Based on 8 x 100 mm pipes each with a 10 m/s measured velocity			

Table 6.6 presents the VOC emission rates considered in the assessment. Only compounds which were present in amounts above the detection limit have been modelled.

Table 6.6 - Modelled VOC Emission Data During Tank Filling

Odour Source	Measured VOC Concentration (g/m³)	Measured Air Flow Rate (m³/s)	Odour Emission Rate (g/s)
Organics Building			
Toluene	0.00187	0.039	0.0000734
Tetrachloroethene	0.00398	0.039	0.0001563
Chloroform	0.00718	0.039	0.0002821
Used Oil Storage Area			
Benzene	0.04632	0.013	0.000602
Toluene	0.33579	0.013	0.004365
Ethylbenzene	0.02084	0.013	0.000271
Xylene	0.10035	0.013	0.001305
Cumene	0.00131	0.013	0.000017
Trimethylbenzene	0.01582	0.013	0.000206

6.4 Source Parameters

Table 6.7 presents a summary of the source details used in the Calpuff model. Emissions from the filling of the mixer tank have been modelled as a point source, as emissions would be released via the tank network vent (assumed to be at building height). Fugitive emissions inside the building and from the DAF carbon filter outlet have been modelled as a volume source.

Table 6.7 - Calpuff Source Parameters

Emission Source	Source Type	UTM Coordinates (X,Y m)	Other Details
Organics Buildings			
Vent	Point	301370, 6263436	Height of building, 5 m/s exit velocity, 0.1 m diameter
Building	Volume	301365, 6263450	Height of 4.0 m and initial vertical and horizontal spread of 2.0 m and 5.0 m (approximately one-quarter of the building

Emission Source	Source Type	UTM Coordinates (X,Y m)	Other Details
			dimensions)
Used Oil Storage			
All odour emission sources (filling, breathing, DAF unit)	Volume	301410, 6263437	Height of 5.0 m and initial vertical and horizontal spread of 2.8 m and 5.0 m (approximately one-quarter of the building dimensions)

6.5 Modelled Receptors

Receptor Groups R1 and R2 as modelled in the noise assessment (refer to Figure 5.1) have been considered in the air quality assessment. A gridded receptor grid of 50 m x 50 m has been used for the Calpuff output data to provide a ground level concentration plot.

6.6 Modelling Results

Table 6.8 presents predicted ground level concentrations for the modelled pollutants. Figure 6.2 presents a predicted concentration plot for odour. The results indicate compliance for all modelled sensitive receptors and modelled compounds.

Table 6.8 - Predicted Results – Ground Level Concentrations

Compound	Predicted Concentrations		Unit	Averaging Time	Criteria
	Receptor Group 1	Receptor Group 2			
Odour	0.8	0.2	OU	Peak, 99th Percentile	2.0
Toluene	3.8	1.4	µg/m^3	Max 1-hour	360
Tetrachloroethene	0.1	< 0.1	µg/m^3	Max 1-hour	3,500
Chloroform	0.2	0.1	µg/m^3	Max 1-hour	900
Benzene	0.5	0.2	µg/m^3	Max 1-hour	29
Ethylbenzene	0.2	0.1	µg/m^3	Max 1-hour	8,000
Xylene	1.1	0.4	µg/m^3	Max 1-hour	190
Cumene	< 0.1	< 0.1	µg/m^3	Max 1-hour	21
Trimethylbenzene	0.2	0.1	µg/m^3	Max 1-hour	2,200

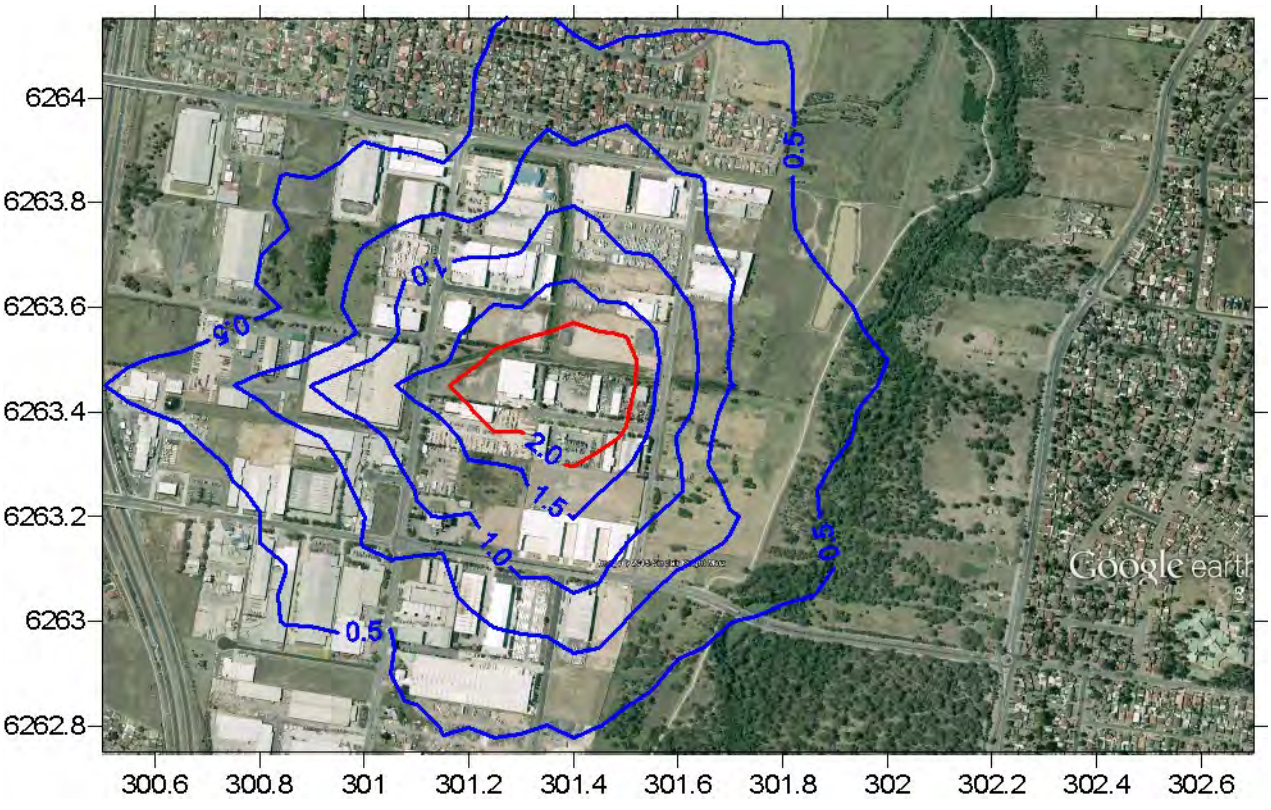

Figure 6.2: Predicted Ground Level Odour Concentrations	
Scenario: Worst-Case	**Averaging Time:** Peak, 99th Percentile
Location: Glendenning	**Units:** OU
Pollutant: Odour	**Criteria:** 2.0 OU

7 Conclusion

Computational air and noise modelling has been undertaken for the proposed liquid waste facility and depot at 14 Rayben Street, Glendenning. The results and findings of the assessment can be summarised as follows:

- the nearest sensitive receptors are located to the north, approximately 420 metres from the proposed development site;
- noise modelling indicates compliance at the nearest sensitive receptors using a highly conservative approach (all potential sources operating simultaneously and under worst-case meteorology);
- air sampling at the existing Seven Hills site (which is to be replaced by the new Glendenning facility) indicates that the highest odour emission rates occur during the filling of liquid waste tanks. VOCs that were identified in the air samples include chloroform, tetrachloroethene and toluene;
- air quality modelling of odour and VOCs indicate compliance with the ambient air quality criteria.

Overall, based on the results of the air and noise modelling, the site represents a suitable location for the proposed liquid waste facility.

Appendix A - Acoustic Glossary

APPENDIX A: GLOSSARY OF ACOUSTIC TERMINOLOGY	
A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (0.00002N/m^2).
dB(A)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Facade Noise Level	Refers to a sound pressure level determined at a point close to an acoustically reflective surface (in addition to the ground). Typically a distance of 1 metre is used.
Free Field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally as measured outside and away from buildings.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.
L_{Aeq} Equivalent Continuous Sound Level	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. For a steady sound with small fluctuations, its value is close to the average sound pressure level.
$L_{A90,T}$	This is the dB(A) level exceeded 90% of the time, T.
$L_{A10,T}$	This is the dB(A) level exceeded 10% of the time, T.
$L_{A50, T}$	This is the dB(A) level exceeded 50% of the time, T.
L_{WA}	The A-weighted sound power level in dB.

Appendix B - Air Quality Glossary

APPENDIX B: GLOSSARY OF AIR QUALITY TERMINOLOGY	
Conversion of ppm to mg/m^3	Where R is the ideal gas constant; T, the temperature in kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows: $$\mu g\ m^{-3} = (P/RT) \times \text{Molecular weight} \times (\text{concentration in ppm})$$ $$= \frac{P \times \text{Molecular weight} \times (\text{concentration in ppm})}{62.4 \times (273.2 + T°C)}$$ For the purposes of the air quality assessment all conversions were made at 25°C.
g/s	Grams per second
mg/m^3	Milligrams (10^{-3}) per cubic metre. Conversions from mg/m^3 to parts per volume concentrations (ie, ppm) are calculated at 25 °C as required by the SEPP(AQM).
$\mu g/m^3$	Micrograms (10^{-6}) per cubic metre. Conversions from $\mu g/m^3$ to parts per volume concentrations (ie, ppb) are calculated at 25 °C.
ppb	Parts per billion.
ppm	Parts per million.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
50th percentile	The value exceeded for 50 % of the time.
NO_x	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (eg, NO to NO_2).
VOC	Volatile Organic Compounds. These compounds can be both toxic and odorous.

Appendix C – Noise Monitoring Graphs

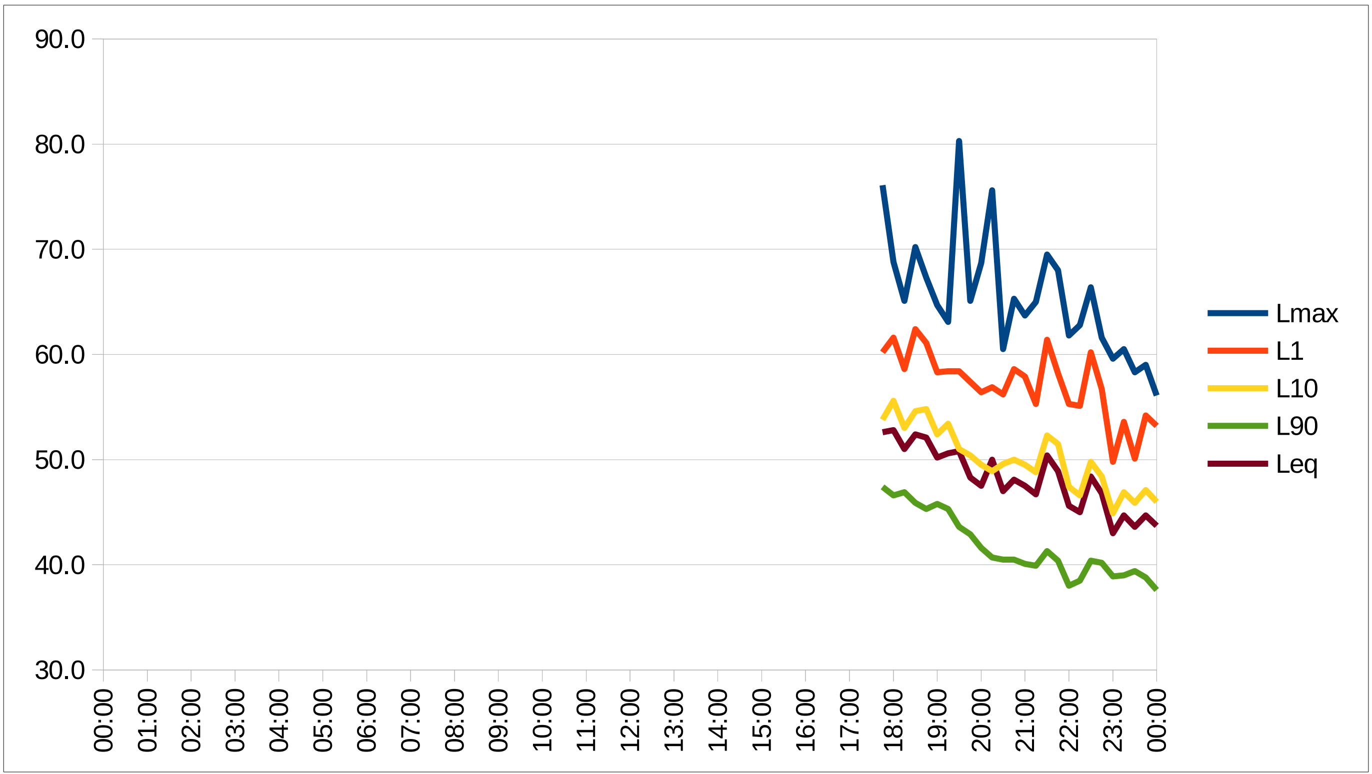

Figure C1: Measured Noise Levels – 12 May 2015

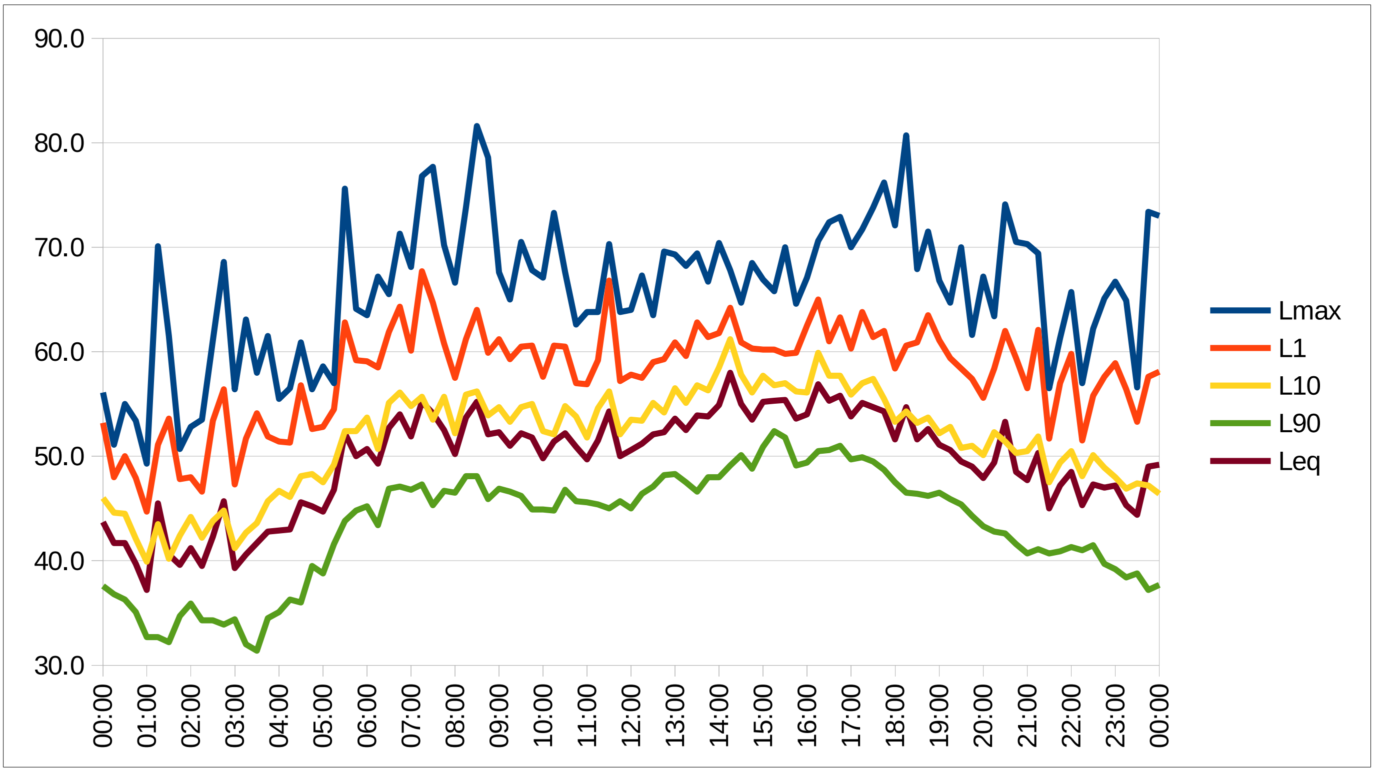

Figure C2: Measured Noise Levels – 13 May 2015

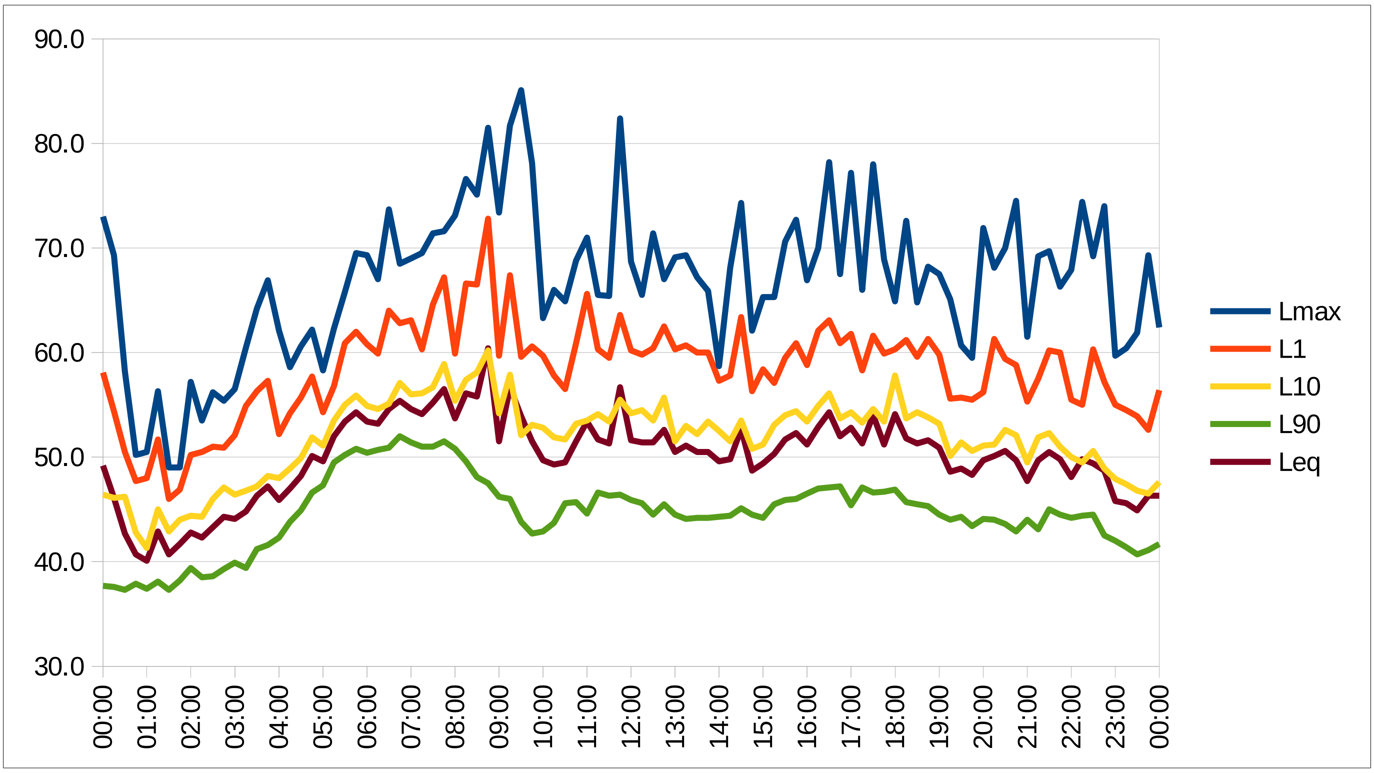

Figure C3: Measured Noise Levels – 14 May 2015

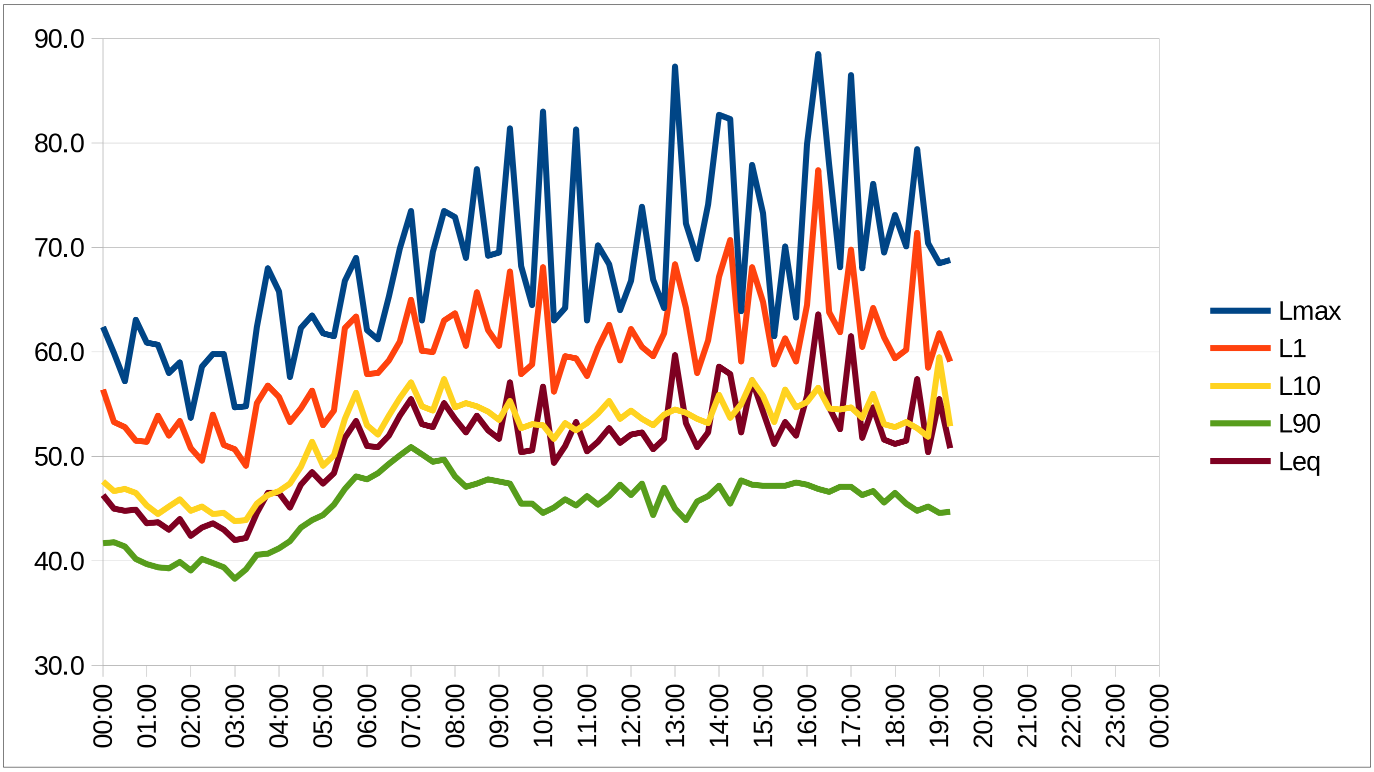

Figure C4: Measured Noise Levels – 15 May 2015