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Nulon Motor Oils Facility

Air Quality Impact Assessment

Report Number 610.17717-R01

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Air Quality Impact Assessment

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Commercial and Industrial Property (CIP), on behalf of Nulon Products Australia Pty Ltd (Nulon), to prepare an Air Quality Impact Assessment (AQIA) for the construction and operation of a warehouse to be located at Lot 8 within the Bringelly Road Business Park (Development Site).

Specifically, this report has been prepared to inform the State Significant Development Application (SSDA) for the construction and operation of a light industrial warehouse facility for automotive industry products, including the following:

- bulk fluid delivery and storage;
- blending;
- bottling and packaging;
- storage;
- dispatch and distribution; and
- ancillary office administration.

This AQIA has been prepared by SLR to determine potential air quality impacts associated with the proposed development, either:

- due to the construction (including bulk earthworks) of the Development Site; and
- due to potential impacts of air emissions from the development, in the event that the development has the potential to emit air pollutants during operations.

1.1 Secretary's Environmental Assessment Requirements

This report has been prepared as part of the Environmental Impact Statement (EIS) for the development proposal. NSW Department of Planning and Environment (DPE) issued Secretary's Environmental Assessment Requirements (SEARs) for this Project in December 2017 (SSD 8900). The aim of this report is to assess the potential impacts of the Development site on air quality and has been prepared in accordance with the guidelines discussed below. The report responds to the SEARs relevant to air quality, as shown in **Table 1**.

Table 1 Secretary's Environmental Assessment Requirements – Nulon Motor Oils Facility

Key Issue	Assessment Requirement	Addressed in Section
Air Quality	A description and assessment of all air quality impacts from the proposed operations and.	**Section 5**
	Details of dust control during site preparation and civil works.	**Section 4.2.4**

Source: SEARs for application number SSD 8900, December 2017.

The SEARs require that the assessment be performed in accordance with relevant policies, guidelines and plans including:

- Protection of Environment Operations (Clean Air) Regulation (2002); and
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC 2006).

2 PROJECT OVERVIEW

2.1 Regional Setting

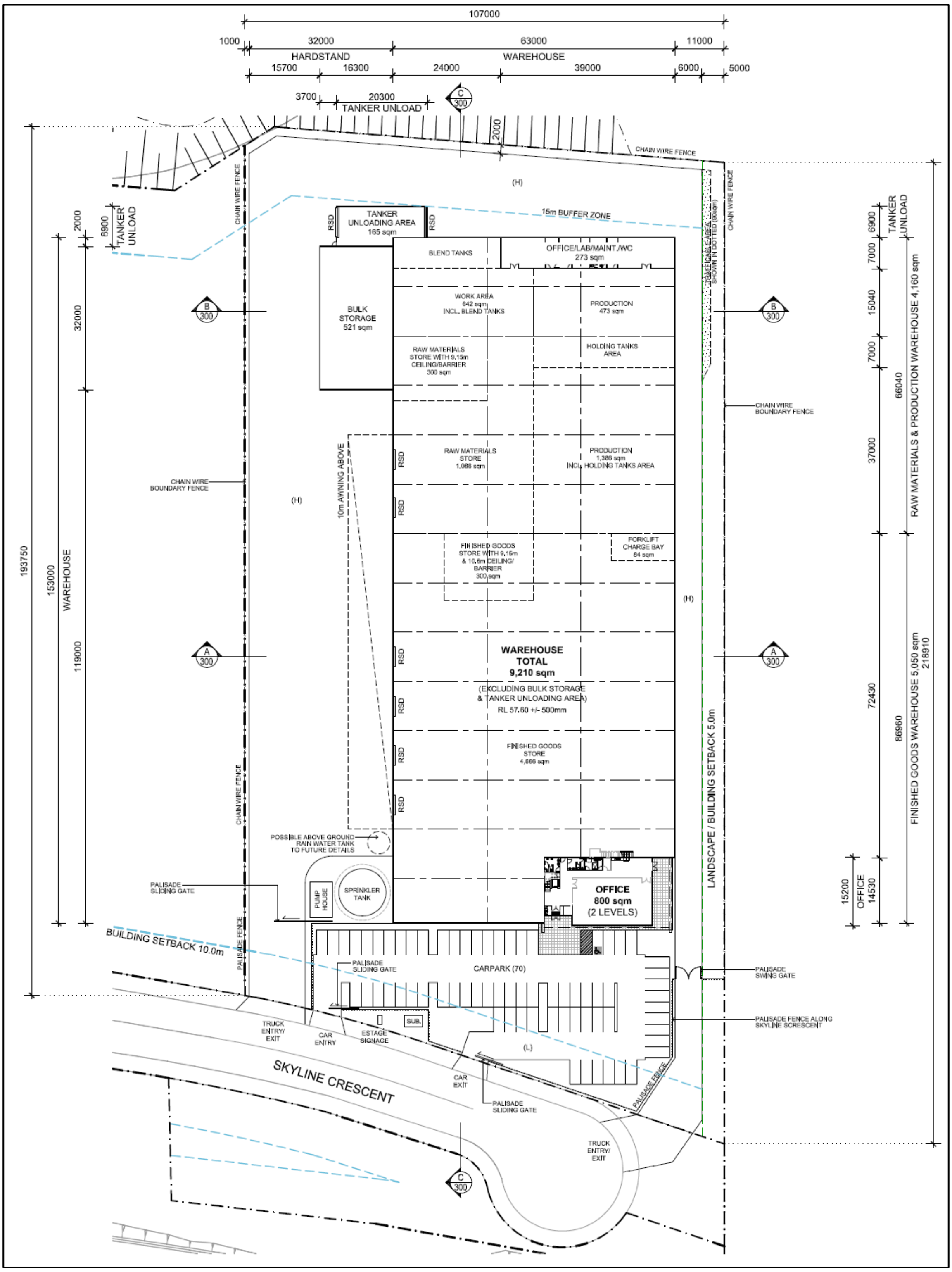
The Development Site will be constructed on Lot 8 of the Bringelly Road Business Hub. The local setting of the Development Site is shown in **Figure 1**.

Figure 1 Satellite Image of the Proposed Development Site

It is noted that the neighbouring plot to the east contains two existing residential buildings approximately 20 m and 50 m from the Development Site boundary. Residential areas are also located to the east and north of Development Site as shown in **Figure 1**.

The indicative layout of the Development Site is shown in **Figure 2**. It is noted that the raw material storage and production activities are proposed to be located towards the north of Lot 8, with the bulk storage area proposed to be located at the northwestern end of Lot 8, further away from the closest residential receptors.

Figure 2 Indicative Site Layout of the Proposed Development Site



Source: Site Plan, drawing # 2-319-277062-DA-002; created: 22.11.2017.

2.2 Construction Activities

This report assesses the air quality impacts due to the construction works for the Development Site, (see **Section 4**) which include the following:

- Removal of existing vegetation (including some trees).
- Earthworks across the Lot 8 (21,967 m^2);
- Building works for the warehouse facility with ancillary office space (approximately 10,360 m^2);
- Structure works for approximately 70 car parking spaces.

The construction works are anticipated to take place over a 12 week period. The proposed working hours for the construction period are 7:00am to 6:00pm, Monday to Friday, between 8:00am to 1:00pm on Saturdays and no work to be conducted on Sundays or public holidays.

It is noted that earthworks for the Development Site are already approved under a separate application SSD 6324, therefore the earthworks are not assessed within this application and not considered any further in this report.

2.3 Operational Activities

The operations at the Development Site will include the preparation of motor oil products for future retail sale off-site and will include:

- bulk fluid delivery and storage;
- blending;
- bottling and packaging;
- storage;
- dispatch and distribution; and
- ancillary office administration

The types of products and the respective volumes to be stored onsite are shown in **Table 2**.

Table 2 Dangerous Goods Classes or Materials Stored and Maximum Quantities

Description	Maximum Quantity (L)	Storage Method	Process type
Aerosols	35,000	0.5 L cans	Dispatched as received (i.e. no processing)
Hitec 3062	615	205 L drums	Repackaged into smaller packaging
Hydrochloric acid	400	205 L drums	Repackaged into smaller packaging
Caustic soda liquid	400	205 L drums	Repackaged into smaller packaging
Combustible liquids	1,066,025	Above ground storage tanks 1,000 L Intermediate bulk containers (IBCs) 205 L drums	Blended according to desired properties and packaged for dispatch

Source: Blackie Mendham 2017

Only the combustible liquids are blended to provide a product with the desired viscosities and properties for lubrication. The types of combustible liquids to be used in the production processes are:

- Vivasol 2046

- Mono Ethylene Glycol
- NB3070 Glycool 670

2.4 Sensitive Receptors

A number of residential properties have been identified as sensitive receptor locations in the area surrounding the Development Site, with the closest residences located approximately 20 m and 50 m from the closest Development Site boundary. The locations of these closest identified sensitive receptors are shown in **Figure 3**.

The impact of air emissions upon nearby sensitive receivers is dependent on the prevailing meteorological conditions (primarily wind speed and direction) but also the distance from the source to the receiver and any mitigation between the source and receiver. Such mitigation might be in the form of barriers that may act as a physical obstacle or result in changes to airflow, which may help in reducing air quality impacts.

For the purpose of this assessment, it is estimated that during construction activities, the total number of potentially impacted receptors is likely to be less than 10 (see **Section 4.2**).

Figure 3 Location of the Closest Identified Sensitive Receptor

2.5 Identification of Potential Air Emission Sources

As outlined in **Section 1**, the scope of this AQIA covers potential air quality impacts on surrounding sensitive receptors associated with the construction and operation of the Development Site.

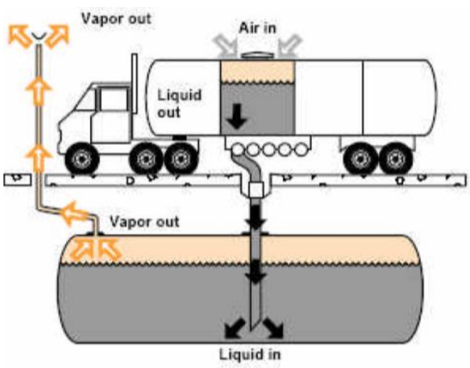
During the construction works, there is potential for fugitive dust emissions to be generated which could give rise to nuisance and/or health impacts for the surrounding residential areas if the impacts are inadequately managed. These potential impacts have been assessed in **Section 4**. Where diesel-powered mobile machinery and vehicles are being used, localised elevations in ambient concentrations of combustion-related pollutants would also be anticipated, but fugitive dust emissions generally have the greatest potential to give rise to downwind air quality impacts at construction sites.

During operations in the warehouse, emissions of volatile organic compounds (VOCs) and associated odour are anticipated, due to evaporative losses during blending, filling as well as working and standing losses from the storage tanks.

According to the National Pollutant Inventory's *Emission Estimation Technique Manual for Fuel and Organic Liquid Storage* (DEWHA 2012), working losses are the combined loss from filling and emptying a tank containing hydrocarbon liquids. As the liquid level increases, the pressure inside the tank increases and vapours containing VOCs are expelled from the tank. A loss during emptying occurs when air drawn into the tank becomes saturated with organic vapour and expands, thus exceeding the capacity of the vapour space.

Standing losses occur through the expulsion of vapour from a tank due to the vapour expansion and contraction as a result of changes in temperature and barometric pressure. This loss occurs without any change in the liquid level in the tank. An illustration of the working losses for solvent storage is shown in **Figure 4**.

Figure 4 Illustration of Working Losses for Solvent Storage



Source: DECCW 2009

3 LOCAL METEOROLOGICAL CONDITIONS

3.1 Wind Speed and Wind Direction

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) will also influence dispersion.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such stations are the Horsley Park Equestrian Centre Automatic Weather Station (AWS) and Badgerys Creek AWS, which are located approximately 11 km north and 11.5 km northwest of the Development Site respectively. Considering the relatively flat terrain between Development Site and Badgerys Creek AWS, it may be assumed that the wind conditions recorded at the Badgerys Creek AWS are a reasonable representation of the wind conditions experienced at the Development Site.

Annual wind roses for the years 2012 to 2016 along with seasonal wind roses compiled from data recorded by the AWS at Badgerys Creek during 2016 are presented in **Figure 5** and **Figure 7** respectively. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The following description of wind speeds at the Development site references the Beaufort Wind Scale, as outlined in **Table 3**. Use of the Beaufort Wind Scale is consistent with terminology used by the BoM.

Table 3 Beaufort Wind Scale

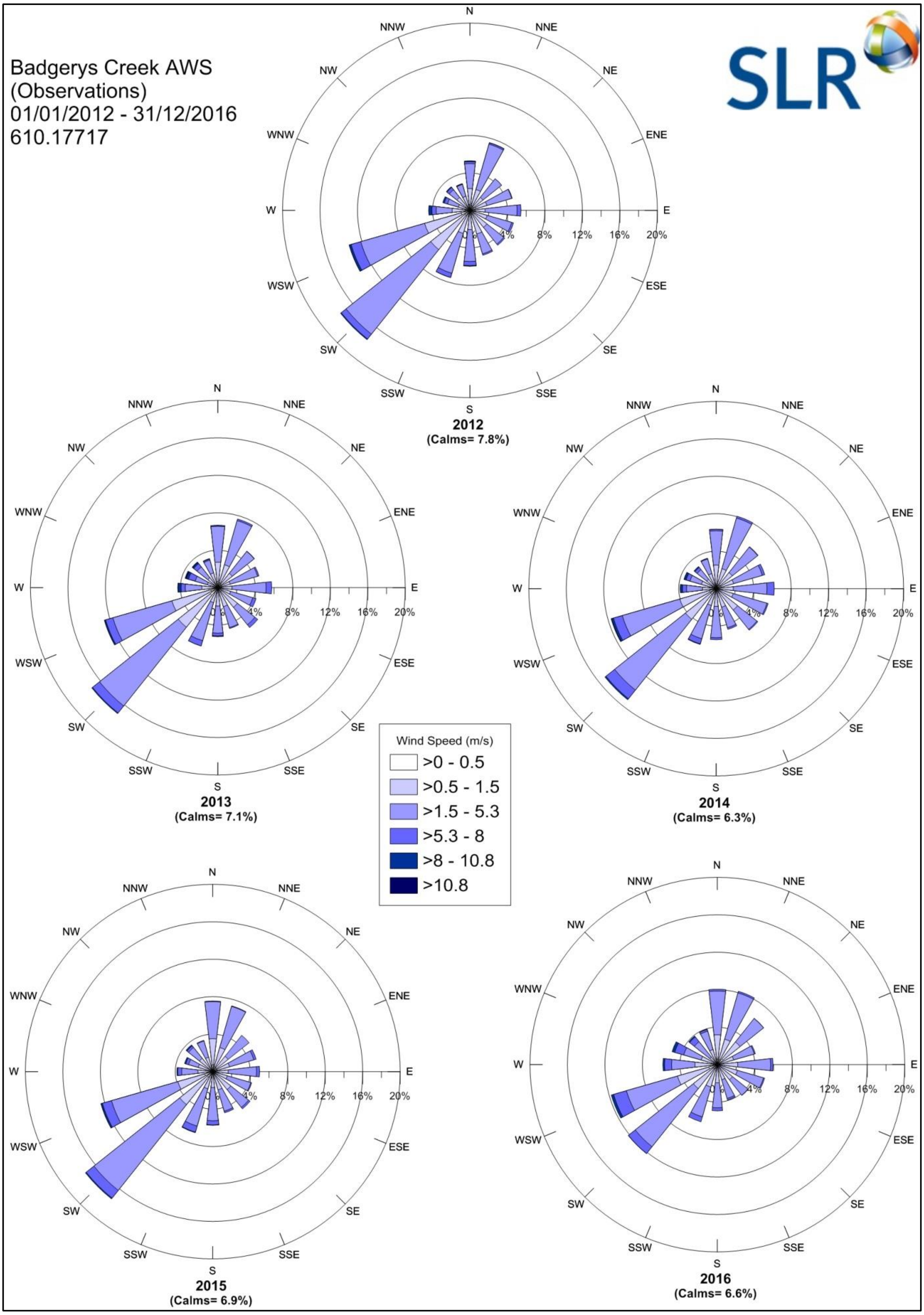
Beaufort Scale #	Description	m/s	Description on land
0	Calm	0-0.5	Smoke rises vertically
1	Light air	0.5-1.5	Smoke drift indicates wind direction
2-3	Light/gentle breeze	1.5-5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3-8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0-10.8	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.8	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

The wind roses for the years 2012 to 2016 (**Figure 5**) indicate the predominant wind directions in the area are consistently from between the west-southwest and southwest directions. Very low frequencies of winds from between the western and north-northwest directions were recorded across all years. The annual frequency of calm wind conditions was recorded to be between 6.3% to 7.8% for the years 2014 and 2012 respectively.

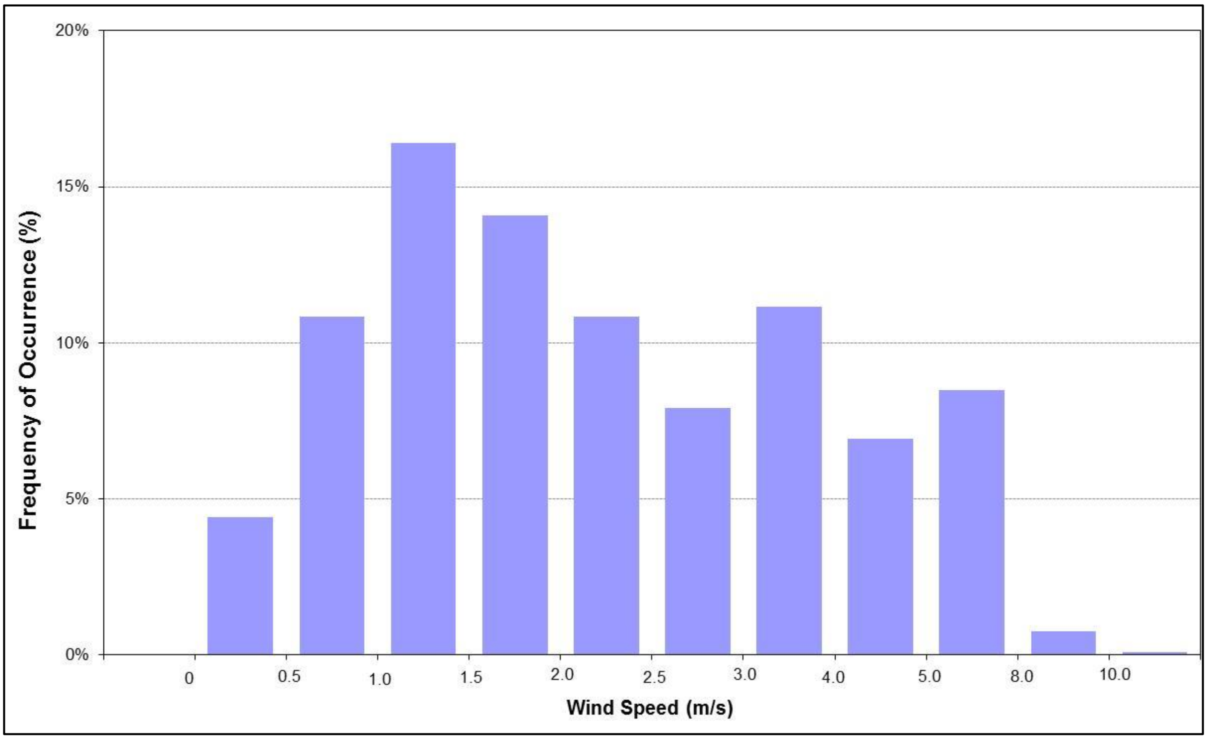
Winds from between the south-southeast and west directions, which would blow air emissions from the Development Site towards the nearest residential receptors occurred between 40% (2016) to 50% (2012).

Figure 5 Annual Wind Roses for Badgerys Creek AWS (2012 to 2016)



The wind speed frequency chart for 2016 is shown in **Figure 6**. Wind erosion of dust from exposed surfaces (ie, during the construction phase of the development) is usually initiated when wind speeds exceed the threshold friction velocity for a given surface or material, however a general rule of thumb is that wind erosion can be expected to occur above 5 m/s (USEPA 2006). The frequency of wind speeds exceeding 5 m/s over the year 2016 at Badgerys Creek AWS was approximately 16%.

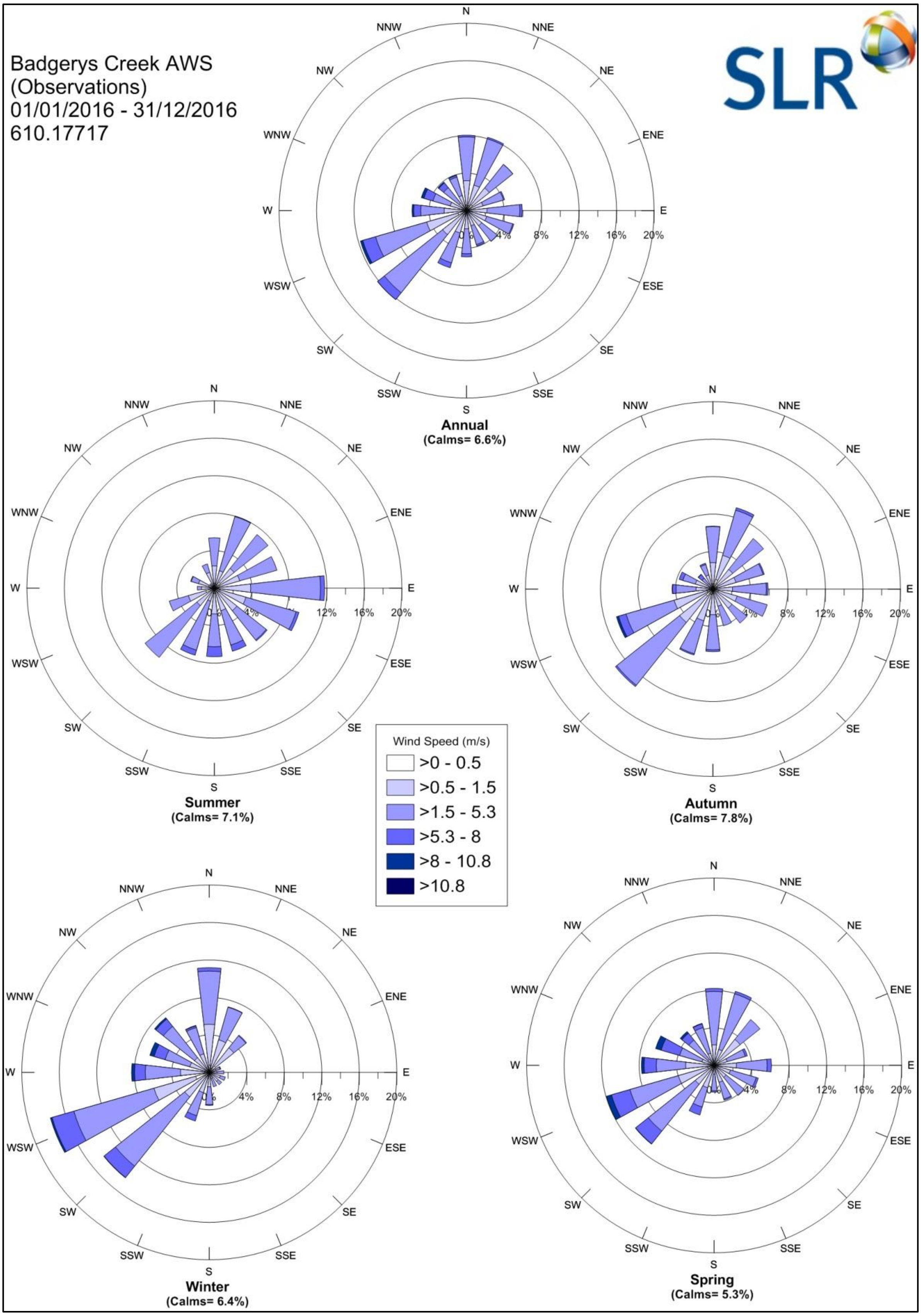
Figure 6 Wind Speed Frequency Chart for Badgerys Creek AWS - 2016



The seasonal wind roses for the year 2016 (**Figure 7**) indicate that:

- In summer, wind speeds ranged from light to moderate winds (between 0.5 m/s and 7.5 m/s). The winds blow from almost evenly from all directions, with the exception of winds from the northwest quadrant. Calm wind conditions were observed to occur for approximately 7% of the time during summer.
- In autumn, winter and spring, wind speeds range from light to fresh winds (between 0.5 m/s and 10.7 m/s). The majority of winds blew from the north-northeast and west-southwest directions. Calm wind conditions were observed to occur approximately 7.8%, 6.4% and 5.3% of the time during autumn, winter and spring respectively.

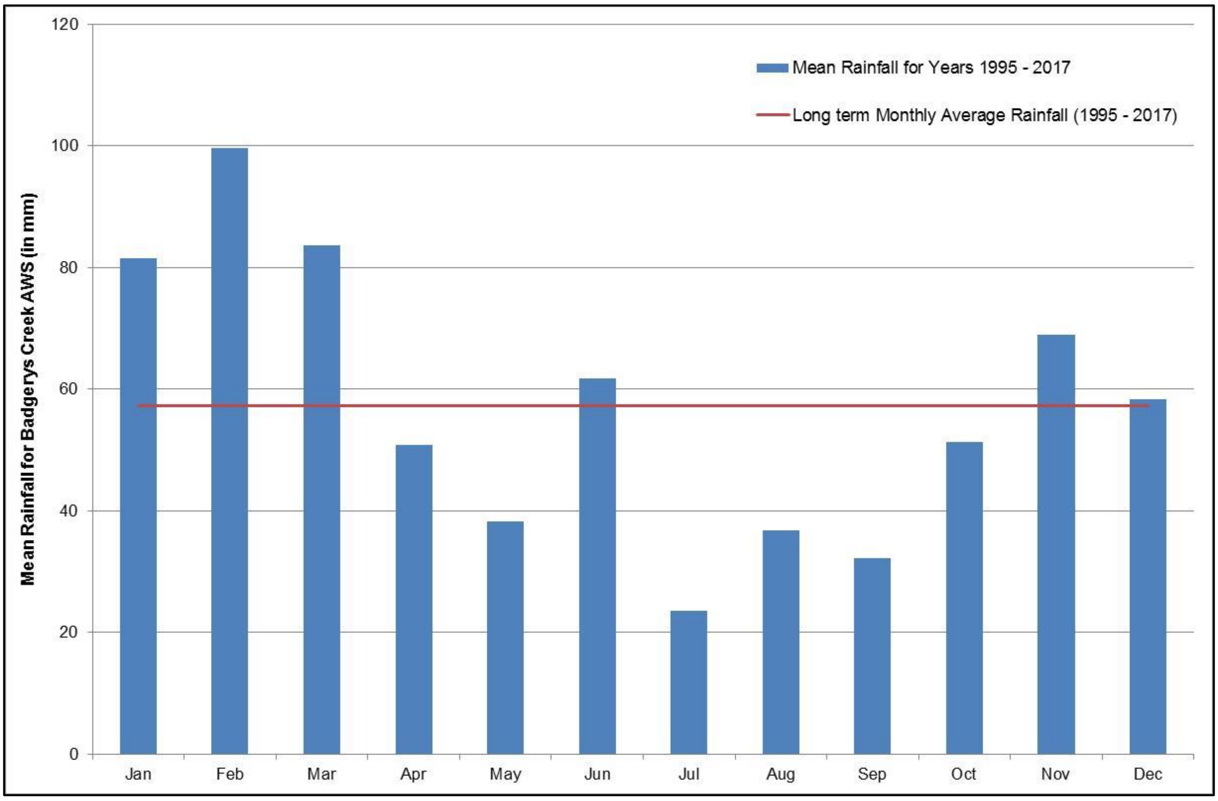
Figure 7 Annual and Seasonal Wind Roses for Badgerys Creek AWS (2016)



3.2 Rainfall

Dry periods (no rainfall) have the greatest potential for fugitive dust emissions during construction. The long term monthly rainfall averages recorded at Badgerys Creek AWS is shown in **Figure 8**. It is noted that generally the periods between April to May and July to October have recorded the lowest monthly rainfalls compared to long term monthly average rainfall.

Figure 8 Long term Mean Rainfall for Badgerys Creek AWS – 1995 to 2017



3.3 Summary

The 2016 wind patterns suggest that the construction and operations at the Development Site have the greatest potential to impact on receptors located towards the north and east of the Development Site during the months of autumn and winter, based on the low rainfall and conducive wind directions.

4 ASSESSMENT OF DUST EMISSIONS DURING CONSTRUCTION

The key potential air pollution and amenity issues associated with construction at the Development Site are:

- Annoyance due to dust deposition (soiling of surfaces) and visible dust plumes
- Elevated suspended particulate concentrations (PM_{10}) due to dust-generating activities

Modelling of dust from construction projects is generally not considered appropriate, as emission rates can vary significantly depending on a combination of the construction activity and prevailing meteorological conditions (ie rainfall and wind speed), which cannot be reliably predicted. The following sections therefore describe the methodology used to perform a qualitative assessment of the potential risks to air quality associated with dust from construction activities at the Development Site.

4.1 Construction Dust Risk Assessment Methodology

For this assessment, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM 2014) has been used to provide a qualitative assessment method (see **Appendix A** for full methodology). The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1**: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2**: Assess risk of dust effects from activities based on:
  a. the scale and nature of the works, which determines the potential dust emission magnitude; and
  b. the sensitivity of the area surrounding dust-generating activities.
- **Step 3**: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4**: Assess significance of remaining activities after management measures have been considered.

4.2 Construction Phase Dust Risk Assessment

4.2.1 Step 1 – Screening Based on Separation Distance

The nearest existing residential receptors have been identified as being located approximately 25 m east of the of the Development Site boundary.

As the sensitive receptors are located within 350 m from the boundary of the site, less than 50 m from the route used by construction vehicles on public roads, and within 500 m from the site entrance, further assessment is required.

4.2.2 Step 2a – Assessment of Scale and Nature of the Works

Based upon the above assumptions and the IAQM definitions presented in **Appendix A**, the dust emission magnitudes have been categorised as presented in **Table 4**.

Table 4 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Construction	Medium	Total building volume greater than 100,000 m^3. *Note: The height of warehouse building is proposed to be 13.7 m and total area of 10,360 m^2, equating to a total building volume of 142,000 m^3. Also, it is noted that onsite batching and sand blasting will be very unlikely to be employed, so a classification of 'medium' is considered to be more realistic based on the IAQM definition.*
Trackout	Medium	Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.

4.2.3 Step 2b – Risk Assessment

Receptor Sensitivity

Based on the criteria listed in **Table A1** in **Appendix A**, the sensitivity of the identified receptors in this study is concluded to be *medium* for health impacts and *medium* for dust soiling, as they include residential areas where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

Sensitivity of an Area

Using the classifications shown in **Table A2** in **Appendix A**, the sensitivity of the area to dust soiling is classified as '*medium*' and the sensitivity of the surrounding area to health effects (**Table A3** in **Appendix A**) has been classified as '*medium*'. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 16.9 µg/m^3 recorded at Bringelly Air Quality Monitoring Station (AQMS) (OEH 2017) and the anticipated number of receptors present (1-10 within 20 m for dust soiling, and 1-10 within 20 m for health impacts).

Risk Assessment

Given the sensitivity of the general area is classified as '*medium'* for dust soiling and *'medium'* for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 4**, the resulting risk of air quality impacts is as presented in **Table 5**. The results indicate that there is a medium risk of adverse dust soiling and human health impacts occurring at the off-site sensitive receptor locations if no mitigation measures were to be applied to control emissions from the building construction and trackout.

Table 5 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude		Preliminary Risk	
		Construction	Trackout	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium Risk	Medium Risk
Human Health	Medium			Medium Risk	Medium Risk

4.2.4 Step 3 - Mitigation Measures

Table 6 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a medium/high risk of adverse impacts. Not all these measures would be practical or relevant to the proposed Development Site, hence a detailed review of the recommendations should be performed as part of the development of the Construction Environmental Management Plan (CEMP) and the most appropriate measures adopted.

Table 6 Site-Specific Management Measures Recommended by the IAQM

1	**Communications**	
1.1	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H
1.2	Display the head or regional office contact information.	H
1.3	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	D
2	**Site Management**	
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
2.2	Make the complaints log available to the local authority when asked.	H
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	H
3	**Monitoring**	
3.1	Perform daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary.	D
3.2	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	H
3.3	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
4	**Preparing and Maintaining the Site**	
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
4.2	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	D
4.3	Keep site fencing, barriers and scaffolding clean using wet methods.	D
4.4	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H
4.5	Cover, seed or fence stockpiles to prevent wind erosion	H
5	**Operating Vehicle/Machinery and Sustainable Travel**	
5.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
5.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.3	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable	H
6	**Operations**	
6.1	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.2	Use enclosed chutes and conveyors and covered skips	H
6.3	Minimise drop heights from loading shovels and other loading or handling equipment anduse fine water sprays on such equipment wherever appropriate	H

7	**Waste Management**	
7.1	Avoid bonfires and burning of waste materials.	H
8	**Trackout**	
8.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	D
8.2	Avoid dry sweeping of large areas.	D
8.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
8.4	Record all inspections of haul routes and any subsequent action in a site log book.	D
8.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D

H = Highly recommended; D = Desirable

4.2.5 Step 4 - Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed 'residual impacts'. The results of the reappraisal are presented below in **Table 7**.

Table 7 Residual Risk of Air Quality Impacts from Construction

Impact	Sensitivity of Area	Residual Risk	
		Construction	Trackout
Dust Soiling	Medium	Low Risk	Low Risk
Human Health	Medium	Low Risk	Low Risk

The mitigated dust deposition and human health impacts for trackout and construction phase activities are anticipated to be *low*. For almost all construction activity, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

5 ASSESSMENT OF IMPACTS FROM WAREHOUSE OPERATIONS

As discussed in **Section 2.3**, air quality issues associated with the proposed processing operations predominantly relate to emissions of volatile organic compounds (VOCs). Emissions of VOCs can give rise to both adverse health impacts due to exposure to specific hydrocarbon compounds, as well as adverse impacts on local amenity levels due to the odorous nature of some vapour compounds.

Generally, the liquids to be handled and processed onsite would be similar to those handled at a car service station, albeit in a warehouse environment. These products are known to have low volatility because of their long chain hydrocarbon structures and high boiling points. The chemical structure of a material determines the evaporation rate of that material, i.e. the rate at which a material vaporises. For instance, the rate of vaporisation of butyl acetate is recorded to be 1 and that of water is recorded to be 0.3 (Safety Emporium 2016).

The various combustible liquids to be used within the warehouse for blending and production and their respective evaporation rates are shown in **Table 8**.

Table 8 Combustible Liquids and Evaporation Rates

Combustible Liquid	Evaporation Rate
Vivasol 2046[1]	0.01
Mono Ethylene Glycol[2]	0.01
NB3070 Glycool 670[2]	0.01

1 Source: VIVA 2017
2 Source: MEGlobal 2013

These products are likely to give rise to minimal VOC emissions due to breathing losses from the storage tanks and during production processes. CIP has confirmed that warehouse building will have a mix of naturaland mechanical ventilationfor the blending or filling process areas. To assess the risk of VOC emissions from the Development Site, the following “risk based” approach has therefore been adopted.

The risk-based assessment takes account of a range of impact descriptors, including the following:

Nature of Impact: does the impact result in an adverse, neutral or beneficial environment?

The nature of impact is anticipated to be *neutral* to the environment.

Receptor Sensitivity: how sensitive is the receiving environment to the anticipated impacts?

The nearest sensitive receptors to the Development Site include residences approximately 20 m (se **Section 2.4**) to the east. In terms of the methodology in **Appendix B**, the sensitivity of the surrounding residential areas to emissions from the Development Site should be considered *high*.

Magnitude: what is the anticipated scale of the impact?

Based on the low volatility of the products handled onsite, the magnitude of these emissions is likely to be *negligible*.

Given the above considerations, and the scale of operations, the potential impact of the Development Site on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 9**).

Table 9 Impact Significance

Magnitude / Sensitivity	Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Further it was noted that the raw material storage and production activities are proposed to be located towards the north of Lot 8, with the bulk storage area proposed to be located towards the north western end of Lot 8. This will ensure that any air impacts from the production activities are located as far as possible from the existing residential receptors.

Finally, a vegetative buffer exists between the Development Site and the existing sensitive receptors located to the north. This will assist in screening the existing residents to the north from any air impacts.

6 CONCLUSION

SLR was commissioned by CIP, on behalf of Nulon, to prepare an Air Quality Impact Assessment (AQIA) for the construction and operation of a warehouse to be located at Lot 8 within the Bringelly Road Business Park (Development Site).

Available meteorological data collected in close proximity to the Development site have been examined to provide an estimate of the prevailing wind environment in the region. This review indicated that winds from between the south-southeast and west directions, which would blow air emissions from the Development Site towards the nearest residential receptors occur between 40% to 50% of the time. In addition, construction activities at the Development Site have the greatest potential to impact on receptors located towards the north and east of the Development Site during the months of autumn and winter, based on the low rainfall and conducive wind directions during these seasons. Additional controls may be required (higher levels of watering for example) if construction occurs at these times.

The findings of the assessment are as follows:

- Off-site impacts associated with dust deposition and suspended particulate during the construction phase are anticipated to be *low* for trackout and building construction activities. A range of mitigation measures have been recommended for consideration as part of the CEMP.
- Based on the material types to be used in the production processes, the potential for offsite health or odour impacts due to VOC emissions from the operations at the Development Site is likely to *neutral*.
- The location of bulk storage and production activities towards the northern half of Development Site, will maximise the separation distance between these activities and the nearest sensitive receptors to the east.
- The existing vegetative buffer would also assist in screening any dust or other air emissions being blown towards the existing residences to the north.

Based on the above, it is concluded that the risk of any exceedances of air quality criteria at nearby residential areas due to air emissions from the Development Site is expected to be low.

7 REFERENCES

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- VIVA 2017, Material Safety Data Sheet, VivaSol 2046, CAS Registry Number: 64742-81-0, available online at https://www.vivaenergy.com.au/services/sds, accessed on 20 December 2017.

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects.

Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides "dust emissions magnitudes" for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Development, are as follows:

Demolition *(Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time)*:

- ***Large***: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- ***Medium***: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***Small***: Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks *(Covers the processes of soil-stripping, ground-levelling, excavation and landscaping)*:

- ***Large***: Total site area greater than 10,000 m^2, potentially dusty soil type (eg clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- ***Medium***: Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- ***Small***: Total site area less than 2,500 m^2, soil type with large grain size (eg sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction *(Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc)*:

- ***Large***: Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.
- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber).

Track-out *(The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network)*:

- ***Large***: More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.

- ***Medium***: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- ***Small***: Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

Note: No demolition of existing structures will be performed as part of this Development.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:

- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in **Table B-1Invalid source specified.**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A-1 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. *Examples: Dwellings, museums, medium and long term car parks and car showrooms.*	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. *Examples: Parks and places of work.*	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. *Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM10.*	*Examples: Public footpaths, playing fields, parks and shopping street.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place;
- any conclusions drawn from local topography;
- the duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts); and
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table B-2**. The sensitivity of the area should be derived for each of activity relevant to the project (ie construction and earthworks).

Table A-2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table B-3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (ie an annual average of 20 µg/m^3 for PM_{10}) the IAQM method has been modified slightly.

This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:

- any history of dust generating activities in the area;

- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A-3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc	Number of receptors [a,b]	Distance from the source (m)			
			<20	<50	<100	<350
High	15-22.5 µg/m³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<15 µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low
	-	1-10	Medium	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m); noting that only the highest level of area sensitivity from the table needs to be considered.
(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table B-4** (earthworks and construction) and **Table B-5** (track-out) to determine the risk category with no mitigation applied.

Table A-4 Risk Category from Earthworks and Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A-5 Risk Category from Track-out Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3 - Site-Specific Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the site is a low, medium or high risk site.

Step 4 – Residual Impacts

Following Step 3, the residual impact is then determined after management measures have been considered.

Nature of Impact

Predicted impacts may be described in terms of the overall effect upon the environment:

- **Beneficial**: the predicted impact will cause a beneficial effect on the receiving environment.
- **Neutral**: the predicted impact will cause neither a beneficial nor adverse effect.
- **Adverse**: the predicted impact will cause an adverse effect on the receiving environment.

Receptor Sensitivity

Sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes, for example, a high sensitivity to changes in air quality, but low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the following broad categories - Very high, High, Medium and Low.

Table B1 outlines the methodology used in this study to define the sensitivity of receptors to air quality impacts.

Table B1 Methodology for Assessing Sensitivity of a Receptor

Sensitivity	Impact	Criteria
Very High	Air Quality Impacts	Receptors of very high sensitivity to air pollution (e.g. dust or odour) such as: hospitals and clinics, and retirement homes.
High	Air Quality Impacts	Receptors of high sensitivity to air pollution, such as: schools, residential areas, food retailers, glasshouses and nurseries.
Medium	Air Quality Impacts	Receptors of medium sensitivity to air pollution, such as: farms / horticultural land, offices/recreational areas, painting and furnishing, hi-tech industries and food processing, and outdoor storage (ie new cars).
Low	Air Quality Impacts	All other air quality sensitive receptors not identified above, such as light and heavy industry.

Magnitude

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. Magnitude may be described quantitatively or qualitatively. Where an impact is defined by qualitative assessment, suitable justification is provided in the text.

Table B2 Magnitude of Impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

Significance

The risk-based matrix provided below illustrates how the definition of the sensitivity and magnitude interact to produce impact significance.

Table B-3 Impact Significance Matrix

Sensitivity [Defined by TableB1] \ Magnitude [Defined by Table B2]	Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance