BATTERY RECYCLING FACILITY

AIR QUALITY IMPACT ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 15225-A
VERSION C

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PREPARED FOR

LEDOX AUSTRALIA PTY LTD
C/- JBA URBAN PLANNING
173 SUSSEX STREET
SYDNEY NSW 2000

WILKINSON MURRAY

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GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criteria air pollutant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM_{10}) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts Per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

1.1 Project Background

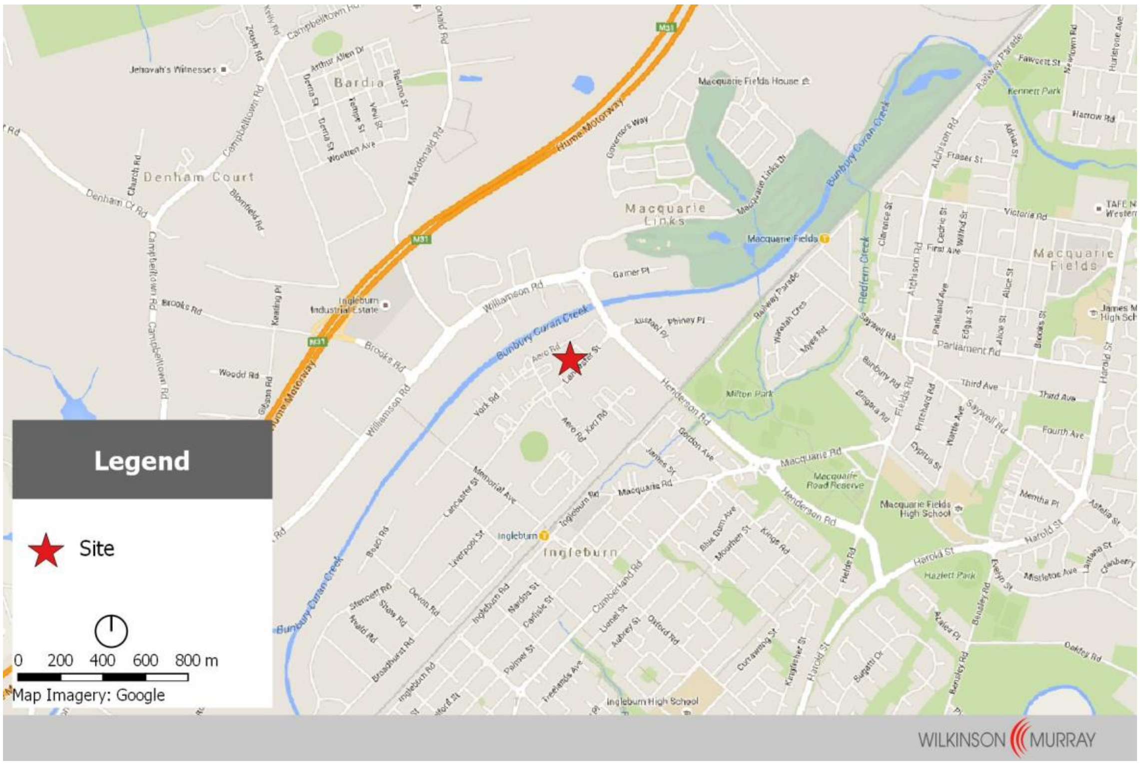
Ledox Australia Pty Ltd (the Client) is seeking approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction of a Battery Recycling Facility (the Project) at 10 Lancaster Street Ingleburn (the site). The site location is shown in Figure 1-1.

The Project was declared to be State Significant Development (SSD). Assessment and approval is being pursued in accordance with the EP&A Act. The Secretary's Environmental Assessment Requirements (SEARs) for the project have been issued and set out the environmental assessment requirements for the project.

This Air Quality Impact Assessment (AQIA) has been prepared to address the relevant SEARs in relation to the preparation of the Environmental Impact Statement (EIS) for the project, and was conducted in general accordance with the following:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005); and
- *Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Australia'* (TRC, 2011).

Figure 1-1 Site Location



2 THE PROJECT

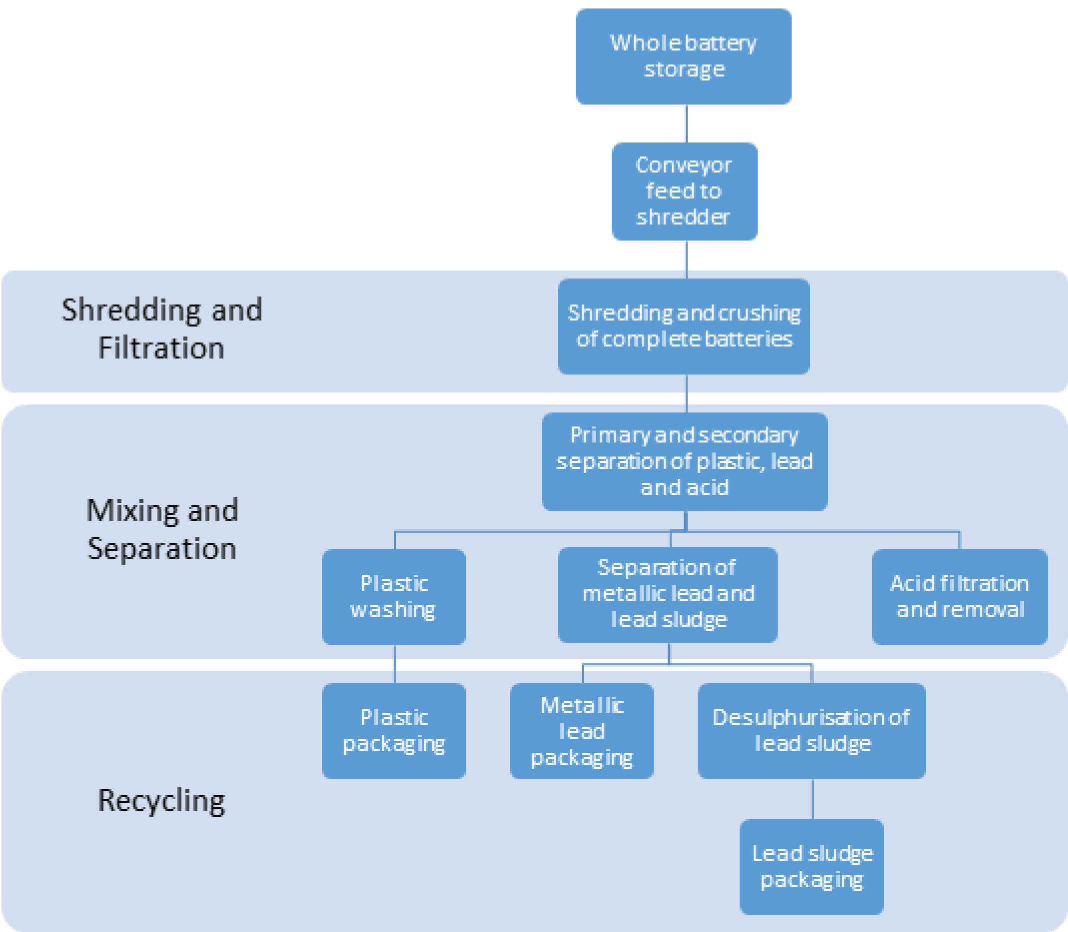
2.1 Operational Overview

The DA will seek consent for a battery recycling facility at the site. The proposed battery recycling facility will receive car batteries and the like, from distribution agents. The batteries will be broken down and recoverable components extracted for recycling and/or re-use. A diagram of the process and flow chart is shown in Figure 2-1.

The battery recycling process can be broken down into the following key stages:

1. Primary separation of plastic, lead and acid;
2. Washing and packaging of plastic;
3. Acid filtration, neutralisation, and storage;
4. Separation and packaging of metallic lead; and
5. De-sulphurisation and packaging of lead paste.

Figure 2-1 Process Flow



Source: Boo Yeoung Engineering

Only used car batteries will be recycled on site. Each battery comprises of recoverable lead and plastics which will be collected for reuse and waste materials that will require disposal. The facility will break down the batteries and output the following four materials:

- Plastic;
- Acid (sodium sulphate, Na_2SO_4);
- Metallic lead; and
- Lead paste.

The approximate breakdown of the components within the batteries is as follows (by weight) as shown in Table 2-1:

- Approximately 80% of the battery comprises lead plates and lead sludge that can be collected for reuse (40% being lead metal, 60% being lead paste);
- Approximately 5% of the battery comprises plastics that are recoverable for recycling; and,
- Approximately 15% of the battery is made of sulphuric acid.

Table 2-1 Battery Composition

Material	Weight (%)
Electrolyte (sulphuric acid)	15
Lead Sulphate	10
Lead Oxide	40
Lead Grid or Metal	30
Polypropylene	3
Heavy Plastics, Paper, Fibres etc.	2

The lead and plastic will be stored on site and exported overseas. The acid and water from the shredder is combined with sodium carbonate, to produce sodium sulphate. This sodium sulphate is then stored in the 'waste water tank' with water, and will be emptied by a private contracting company (HydroMet via UHM) who will handle the waste offsite.

It is intended to recover the lead plates and lead sludge to be transported off-site for re-processing into new car batteries. The processing capacity of the facility means that approximately 1,800 tonnes of lead could be recovered for recycling per month (where one tonne is approximately 60 batteries). Initial approval is sought for the processing of batteries to recover up to 1,500 tonnes of lead per month.

The residual waste materials will be removed by a suitably licenced contractor for disposal. Residual plastics may also be recycled, where appropriate recycling schemes are available locally.

2.1.1 Hours of Operation

The proposed operating hours for the development are 7:00am – 7:00pm Monday to Saturday.

2.1.2 Operational Traffic Generation

During the operation of the Project, up to 14 light vehicle movements are anticipated during the day; comprising seven movements in both the am and pm peak periods.

The Project is also expected to generate up to 10 heavy vehicle movement per week, associated with the delivery of batteries, and the outward shipping of recycled materials. All heavy vehicles would access the site via Roads and Maritime Services (RMS) approved B-Double routes along Lancaster Road, Henderson Road, Williamsons Road, Brooks Road, and the Hume Motorway.

2.2 Construction Overview

The Project will use the existing building on the site, and the existing entry and exit points onto Lancaster Street. Accordingly, the construction activities associated with the development will be minor, and will be primarily associated with the delivery and installation of the recycling plant.

There is potential for sections of the roof to be removed temporarily to facilitate the installation of large plant that cannot fit through the existing roller doors.

The construction of the Project is anticipated to take place over a period of approximately 6 months.

2.2.1 Construction Hours

All construction activities are proposed to be undertaken within the following standard construction hours:

- 7:00am – 6:00pm Monday to Friday;
- 8:00am – 1:00pm Saturday; and,
- No work on Sundays or public holidays.

3 SITE DESCRIPTION

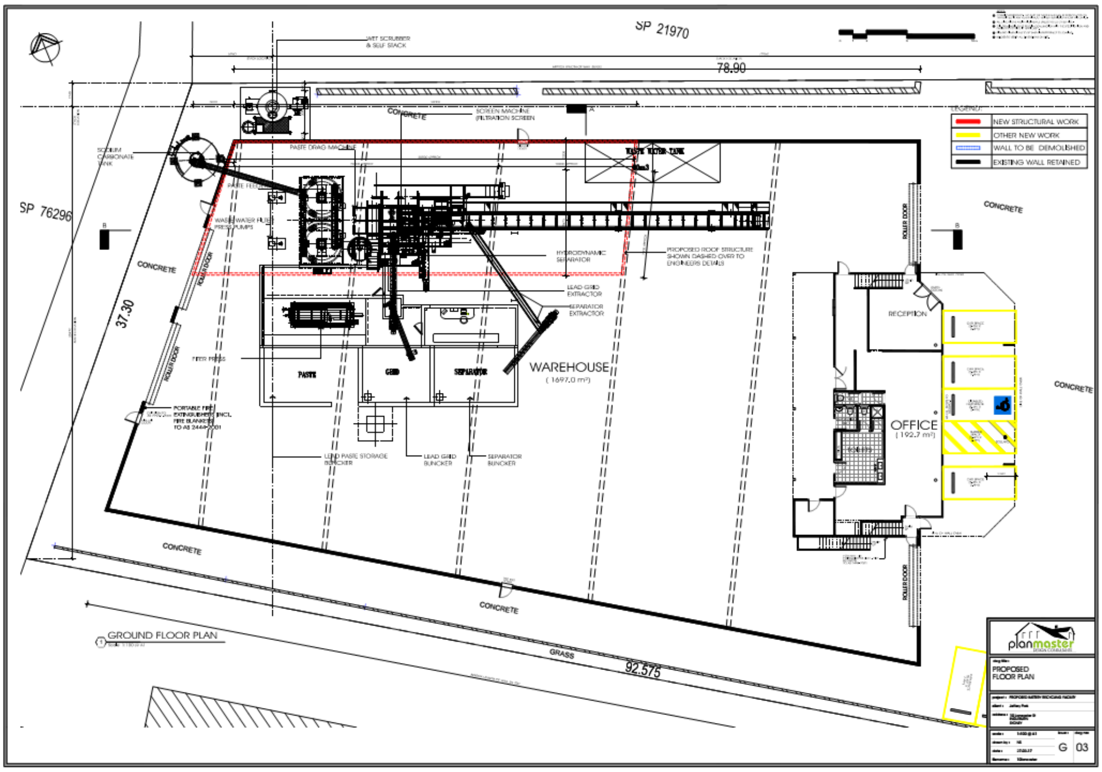
3.1 Site Location and Layout

The Site is located along the northern side of Lancaster Street, near the intersection with Henderson Road. and areas. The site is 0.38 hectares in size.

The existing building on the site features cast concrete walls, and a steel roof. Offices are located at the front of the building. Two large roller doors, one on either side of the offices, provide access to the main internal area.

The site layout is shown in Figure 3-1.

Figure 3-1 Site Layout



3.2 Surrounding Land Use and Sensitive Receptors

The land use immediately surrounding the site is industrial. Industrial receptors are located immediately adjacent to the site to the north, east, and west; and across Lancaster Street to the south. The nearest, and most potentially affected industrial receptors are identified in Table 3-1 and shown Figure 3-2.

The nearest residential receptor is located at 34 Aero Road, approximately 240 metres south of the Site. A number of additional sensitive residential receptors have been identified in the area surrounding the site. These are identified in Table 3-1 and shown in Figure 3-2.

Table 3-1 Sensitive Receptors

Receptor[1]	Address	Distance from Site
I1	8 Lancaster Street, Ingleburn	Boundary
I2	5-7 Lancaster Street, Ingleburn	Boundary
I3	14 Lancaster Street, Ingleburn	Boundary
I4	19 Aero Road, Ingleburn	30 m
R1	34 Aero Road, Ingleburn	240 m
R2	13 Redfern Street, Ingleburn	480 m
R3	27-29 Waratah Crescent, Macquarie Fields	890 m
R4	1 Macquarie Links Drive, Macquarie Links	790 m

1. I = Industrial, R = Residential.

Figure 3-2 Sensitive Receptors

4 AIR QUALITY CRITERIA

4.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) sets out applicable impact assessment criteria for a number of air pollutants.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the application air quality criteria for each pollutant.

4.2 Pollutants of Interest

Based on the emissions guarantee provided by the Client, particulate matter (PM_{10} and $PM_{2.5}$) and lead are identified as the only potential air pollutants from the Project.

4.3 NSW EPA Impact Assessment Criteria

The EPA Approved Methods specifies air quality assessment criteria for assessing impacts from a range of air pollutants. These criteria are typically adopted from the National Environment Protection Measures for Ambient Air Quality (NEPC, 1998).

Table 4-1 summarises the air quality criteria that are relevant to this study. The air quality criteria relate to the total concentrations of pollutants in the air and not just that from the project. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts.

Table 4-1 Impact Assessment Criteria

Pollutant	Averaging period	Criteria (µg/m^3)
Particulate matter ≤10 µm (PM_{10})	24 hours	50
	Annual	30
Lead	Annual	0.5

The above criteria are to be applied at the nearest existing or likely off-site sensitive receptors.

4.3.1 $PM_{2.5}$ Advisory Goals

The EPA Approved Methods (DEC, 2005) specifies no impact assessment criteria for particulate matter ≤ 2.5 µm ($PM_{2.5}$). However, the National Environmental Protection Council (NEPC) has developed an advisory National Environmental Protection Measure (NEPM) for $PM_{2.5}$, as follows:

- A maximum 24-hour average concentration of 25 µg/m^3; and,
- An annual average concentration of 8 µg/m^3.

The above goals for $PM_{2.5}$ concentrations have been adopted as impact assessment criteria in the recent updated to the Approved Methods (EPA, 2016). However, for proposal lodged prior to the gazettal of the updated Approved Methods, on 20 January 2017, these goals are considered advisory only.

4.4 Protection of the Environment Operations (Clean Air) Regulation 2010

The *Protection of the Environment Operations (Clean Air) Regulation 2010* (the Regulation) defines maximum allowable in-stack concentrations to control impacts from industry on ambient air quality. The Regulation forms part of the *Protection of the Environment Operations Act 1997* (POEO Act).

The Regulation sets out maximum permissible stack concentrations for a number of air pollutants, for various scheduled and non-scheduled activities.

The Project is a scheduled activity and, in accordance with *Part 5, Division 2* of the Regulation, the plant and activities associated with the Project would be in Group 6. The relevant stack concentration limits for general activities and plant on scheduled premises, as defined in Schedule 4 of the Regulation, relevant to the Project are presented in Table 4-2.

Table 4-2 Stack Concentration Limits for Scheduled Premises

Air Impurity / Pollutant	Activity or Plant	Group	Concentration
Solid particles / particulate matter	Any activity or plant (except as listed below)	Group 6	50 mg/m^3
	Any plant used for heating materials	Group 6	50 mg/m^3
	Any crushing, grinding, separating or materials handling activity	Group 6	20 mg/m^3
Type 1 substances / lead	Any activity or plant	Group 6	1 mg/m^3

Due to the battery breaking process, the applicable stack concentration limit for particulates is 20 mg/m^3. This limit is to be applied at the exit point of the stack. In accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DEC, 2007), it would be measured as a one-hour average concentration at reference conditions of 273 K and 101.3 kPa.

5 EXISTING ENVIRONMENT

5.1 Local Climate

Long term meteorological data for the area surrounding the Site is available from the Bureau of Meteorology (BOM) operated Automatic Weather Station (AWS) at the Holsworthy Control Range. The Holsworthy Control Range AWS is located approximately 5.6 kilometres north east of the Site and records observations of a number of meteorological data including temperature, humidity, rainfall, wind speed and wind direction.

Long-term climate statistics are presented in Table 5-1. Temperature data recorded at the Holsworthy Control Range AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 29.1°C. July is the coolest month with a mean daily minimum temperature of 4.8°C. February is the wettest month with an average rainfall of 109 mm falling over almost 7 days. There are on average 73 rain days per year, delivering 707 mm of rain.

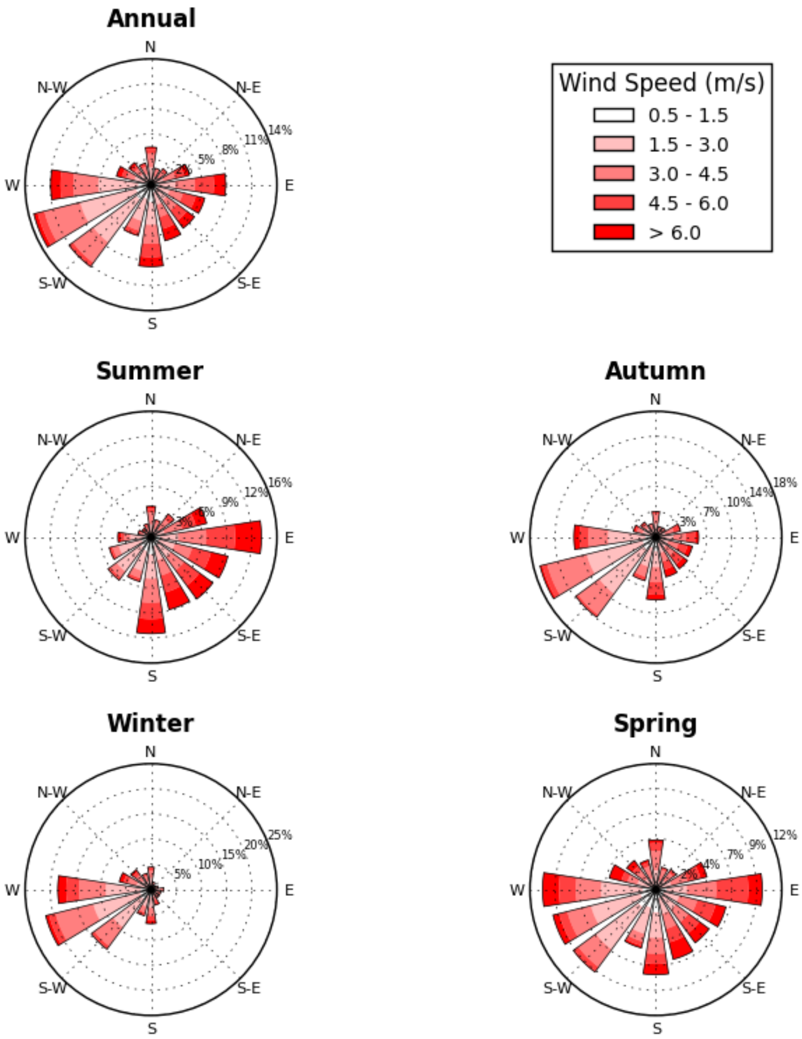
Table 5-1 Long-term climate averages – Holsworthy Control Range AWS

Observation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temperature (°C)	22.4	21.6	19.4	17.5	13.6	10.7	9.8	11.8	15.7	18.3	19.3	21.3	16.8
Humidity (%)	69	77	80	74	76	79	76	69	63	61	67	68	72
3pm Mean Observations													
Temperature (°C)	27.4	26.5	24.9	22.1	19.3	16.7	16.2	17.8	20.8	22.1	23.4	25.9	21.9
Humidity (%)	50	56	55	53	52	53	49	44	43	48	51	50	50
Daily Minimum and Maximum Temperatures													
Minimum (°C)	17.4	17.5	15.6	12.1	8.1	6.3	4.8	5.5	8.4	10.8	13.8	15.7	11.3
Maximum (°C)	29.1	28.1	26.4	23.5	20.6	17.8	17.4	19.1	22.3	24.3	25.5	27.5	23.5
Rainfall													
Rainfall (mm)	56.5	109.0	69.9	53.8	51.0	66.5	40.9	43.8	31.0	52.2	77.1	54.8	706.5
Rain days	5.6	6.9	7.1	6.8	5.4	6.5	5.6	4.5	4.2	5.9	7.9	6.3	72.7

Source: Bureau of Meteorology

Windrose plots showing the distribution of wind direction and wind speed at the Holsworthy Control Range AWS between 2009 and 2014 are presented in Figure 5-1.

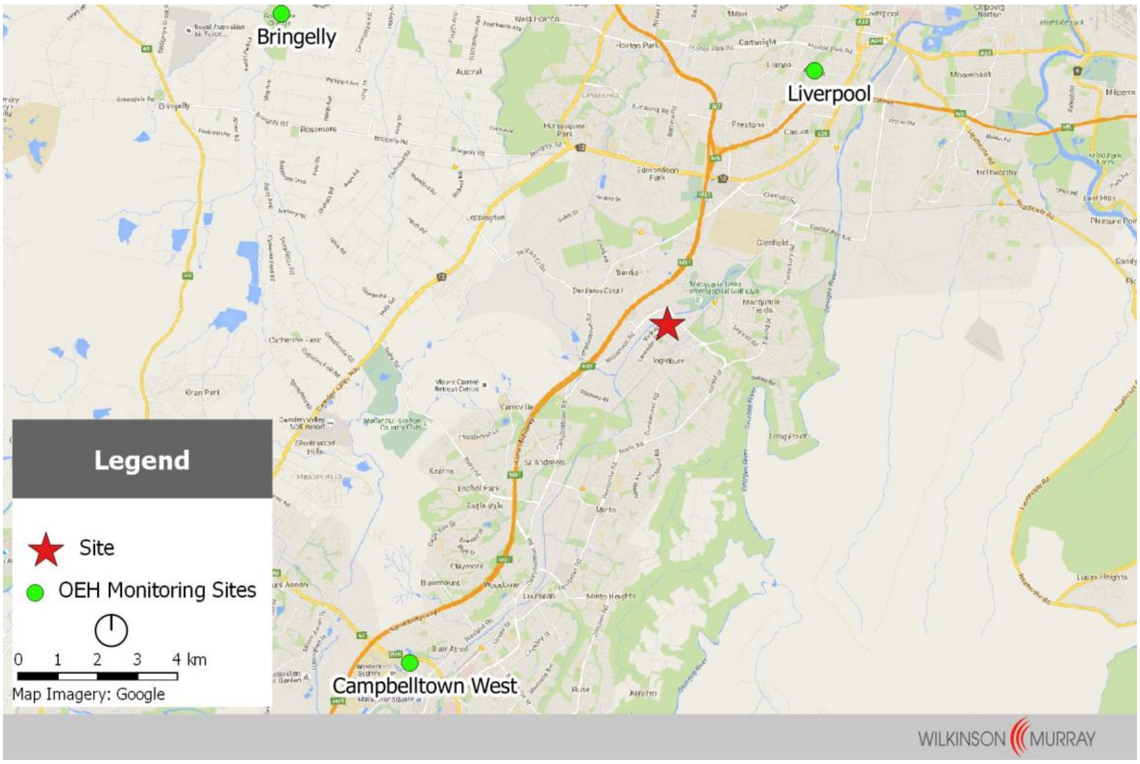
Figure 5-1 Windroses – Holsworthy Control Range AWS, 2009 – 2014



5.2 Local Ambient Air Quality

Air Quality monitoring data from the Office of Environment and Heritage (OEH) air quality monitoring stations at Liverpool and Campbelltown West have been used to characterise the ambient air quality in the area surrounding the Site. The OEH's Liverpool station is located approximately 7.4 kilometres north east of the Site, and the Campbelltown West station is located approximately 10.7 kilometres south west of the Site. The locations of the OEH monitoring stations in relation to the Site are shown in Figure 5-2.

Figure 5-2 OEH Monitoring Station Locations



The OEH monitoring station at Liverpool records ambient levels of ozone (O_3), oxides of nitrogen (NO_x), PM_{10}, $PM_{2.5}$, and carbon monoxide (CO). The Liverpool station does not measure ambient levels of sulfur dioxide (SO_2), and therefore; data from the OEH monitoring station at Campbelltown West has been used to establish the ambient SO_2 levels in the area surrounding the Project.

5.2.1 Particulate Matter

Table 5-2 presents a summary of the ambient concentrations of PM_{10} as measured at the OEH monitoring station in Liverpool. The data show that no exceedances of the 24-hour average goals for PM_{10} were measured during 2012 or 2014. During 2013 and 2015, a number of exceedances of the 24-hour average goals for PM_{10} were recorded.

All annual average concentrations of PM_{10} were below the goal.

Table 5-2 Existing Ambient PM_{10} Concentrations

Year	24-hour Average (goal = 50 µg/m³)			Annual Average (goal = 30 µg/m³)
	Minimum	Maximum	Exceedances	
2012	5.5	42.5	0	19.8
2013	5.2	98.5	3	21.0
2014	3.6	40.8	0	19.1
2015	3.6	68.6	1	18.5

Table 5-3 presents a summary of the ambient concentrations of $PM_{2.5}$ as measured at the OEH monitoring station in Liverpool. The data show that no exceedances of the 24-hour average goals for $PM_{2.5}$ were measured during 2012 or 2014. During 2013 and 2015, a number of exceedances of the 24-hour average goals for $PM_{2.5}$ were recorded.

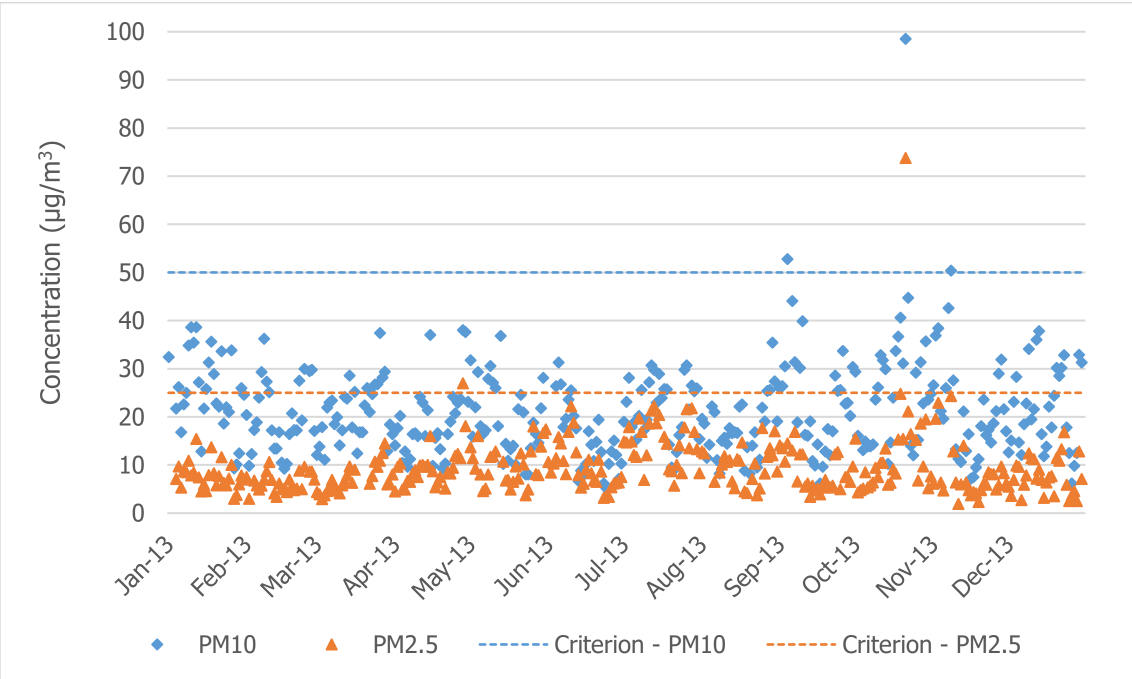
All annual average concentrations of $PM_{2.5}$ were above the goal.

Table 5-3 Existing Ambient $PM_{2.5}$ Concentrations

Year	24-hour Average (goal = 25 µg/m³)			Annual Average (goal = 8 µg/m³)
	Minimum	Maximum	Exceedances	
2012	1.6	24.9	0	8.5
2013	1.9	73.8	2	9.5
2014	2.7	24.3	0	8.7
2015	1.1	32.2	2	8.5

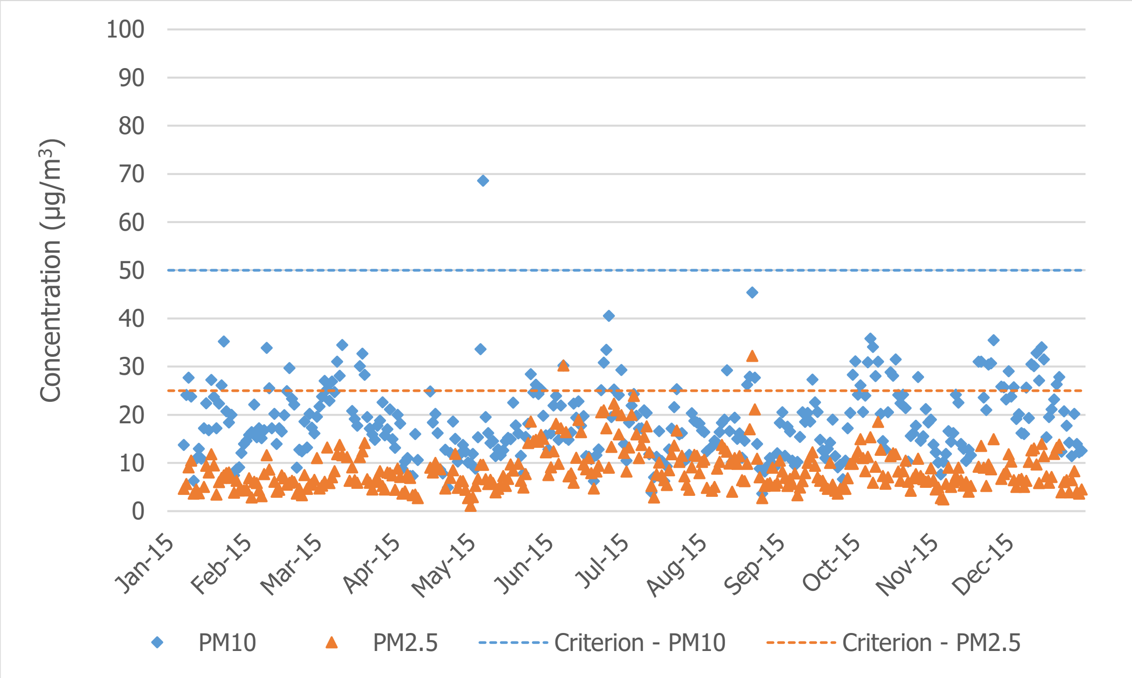
Figure 5-3 and Figure 5-4 show the distribution of PM_{10} and $PM_{2.5}$ concentrations during 2013 and 2015, respectively.

Figure 5-3 24-hour Average PM_{10} and $PM_{2.5}$ Concentrations - 2013



Exceedances of the 24-hour average goals for PM_{10} and $PM_{2.5}$ during 2013, as shown in Figure 5-3, were caused by bushfires in the Greater Sydney Metropolitan Region during between September and November.

Figure 5-4 24-hour Average PM_{10} and $PM_{2.5}$ Concentrations - 2015



The single exceedance of the 24-hour average goal for PM_{10} during 2015 appears to be an isolated event, and was most likely due to a short-term local event, such as construction activities.

5.2.2 Lead

Ambient concentrations of lead were measured at a number of sites in Sydney from 1983 to 2005. Following the introduction of unleaded fuels in 1985, annual average concentrations of lead decreased significantly, and by 2004, were typically less than 0.03 µg/m³ (DECCW, 2010). For assessment purposes, the ambient annual average lead concentration is taken to be 0.03 µg/m³.

6 MODELLING METHODOLOGY

6.1 Meteorological Modelling

6.1.1 TAPM

No meteorological observation data is available for the site. The Holsworthy Control Range AWS is located approximately 6 kilometres north east of the Project site. Therefore, site-specific meteorological data was generated through the use of a prognostic model. The prognostic model used was The Air Pollution Model (TAPM), developed and distributed by the Commonwealth Scientific and industrial Research Organisation (CSIRO).

TAPM is an incompressible, non-hydrostatic, primitive equations prognostic model with a terrain-following vertical coordinate for three-dimensional simulations. It predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of large scale meteorology provided by synoptic analyses. TAPM benefits from having access to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world.

The prognostic modelling domain was centred at 33.99° S, 150.87° E and involved four nesting grids of 30 km, 10 km, 3 km and 1km with 25 grids in the lateral dimensions and 25 vertical levels.

The TAPM model included assimilation of data collected at the Holsworthy Control Range AWS during the year 2012. This modelling year was chosen based on a long term meteorological analysis (see Appendix A).

6.1.2 CALMET

The three-dimensional prognostic wind field from the TAPM simulation was incorporated in a CALMET model as the initial guess wind field. CALMET was run using the 'No-Observations Approach' recommended by TRC (2011).

The CALMET domain was 10 x 10 km with a grid resolution of 0.15 km. Local land use and topographical data (SRTM 3) were used to produce realistic fine scale flow fields in the area surrounding the site.

6.2 Dispersion Modelling

CALPUFF is a non-steady state Gaussian puff dispersion model, developed for the US EPA and approved for use in DEC (2005). CALPUFF is considered an advanced dispersion model and is intended for use in situations where less advanced Gaussian plume models are not appropriate. CALPUFF is most often used in areas exhibiting one or more of the following features:

- Complex terrain;
- Recirculating coastal sea breezes;
- High frequency of calm winds; and,
- Buoyant line sources.

The topography to the north west of the Project is somewhat complex, and therefore CALPUFF has been selected as the dispersion model for this assessment.

6.2.1 Building Wake Effects

A number of large buildings are located on and nearby the Project site. Since a stack will be installed at the site, building wake effects are relevant to this assessment. Buildings on and nearby the Project site have been included in the dispersion model, and the BPIP PRIME algorithm has been used to capture building wake effects.

7 EMISSIONS TO AIR

As presented in Section 4.2, the potential air pollutants associated with the Project are particulate matter. These pollutants are primarily liberated from the batteries in the battery shredder.

7.1 Emissions to Air

The Client has provided an emissions guarantee for the Project. The operational emissions for the Project, as advised by the Client, are summarised in Table 7-1. It is noted that the emissions specification is based on the incorporation of a wet scrubber at the facility, with minimum extraction efficiencies of 92% and 60% for lead and particulate matter, respectively.

Table 7-1 Operational Air Pollutant Emissions

Pollutant	Stack Concentration (mg/m^3)	Emission Rate (g/s)
Particulates (PM_{10} & $PM_{2.5}$)	8.73	3.638×10^{-2}
Lead	0.90	3.750×10^{-3}

No data is available regarding the particle size distribution for particulate emissions. Therefore, it is assumed that $PM_{2.5}$ accounts for 50% of the PM_{10} emissions. This is conservative since there are no combustion sources associated with the Project.

The stack concentrations of the identified pollutants comply with the applicable limits as defined under the *Protection of the Environment Operations (Clean Air) Regulation 2010*.

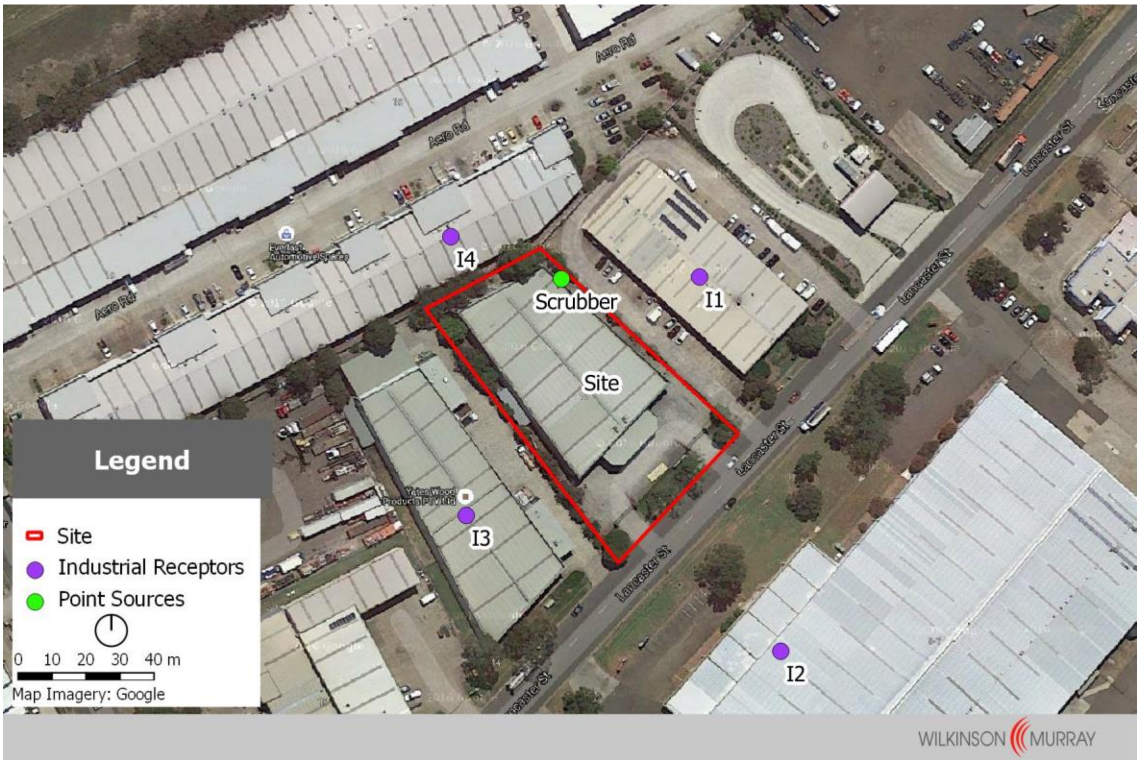
7.2 Source Locations and Characteristics

The scrubber and stack are proposed to be located on the outside of the main building, near the northern corner of the site. The location of the scrubber is shown in Figure 7-1. The location of the stack, in MGA56 coordinates, and the relevant stack parameters are presented in Table 7-2.

Table 7-2 Stack Parameters

Source	MGA56 Coordinates (m)		Height	Diameter	Exit Temperature	Exit Velocity
	Latitude	longitude				
Scrubber stack	302,849	6,236,894	16.1 m	0.6 m	303 K	14.7 m/s

Figure 7-1 Source Location



7.3 Fugitive Emissions

The Manufacturer and the Client have advised that, since the battery recycling machinery is essentially a "closed system", the likelihood of fugitive emissions is very low. During normal operations, there are only two significant openings in the plant: the opening where the whole batteries enter the plant, and the point where solid lead is ejected from the plant. At the point where the batteries are fed into the plant, water sprays and ventilation, connected to the scrubber system, are employed to control any emissions leaving the system. At the point where solid lead metal is collected from the process, large fabric bags are tightly fitted around the outlet to ensure that all material is captured.

It is recommended that measurements are conducted inside the building at the facility, once commissioned, to confirm that the plant is operating per the manufacturer's specifications and that no fugitive emissions are occurring.

If fugitive emissions are identified in the building, suitable controls would be identified and implemented. These controls would typically involve adding ventilation to the source(s) of fugitive emissions and ducting this ventilation to the scrubber system.

8 ASSESSMENT OF IMPACTS

The following sections present a quantitative assessment of the potential air quality impacts on nearby sensitive receptors from the operation of the project.

8.1 Predicted Ground Level Concentrations at Sensitive Receptors

The predicted incremental ground level concentrations of the identified air pollutants at sensitive receptors, due to the operation of the Project, are presented below. Also presented are the total ground level concentrations of pollutants, based upon the existing ambient air quality presented in Section 5.2.

8.1.1 Particulate Matter (PM_{10} and $PM_{2.5}$)

The predicted incremental and total ground level concentrations of PM_{10} are presented in Table 8-1.

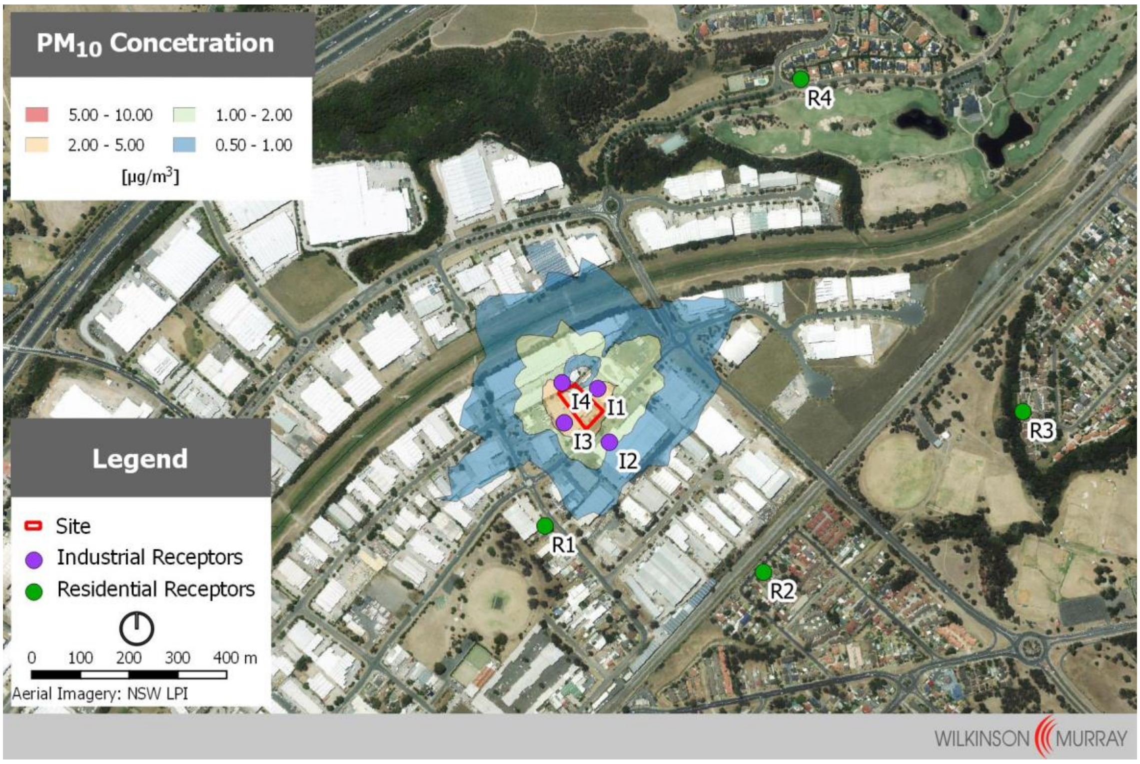
Table 8-1 Predicted Ground Level Concentrations – PM_{10}

Receptor		Incremental Impact (µg/m³)		Total Impact (µg/m³)		Complies?
	Period	24-hour	Annual	24-hour	Annual	
	Criteria	**50**	**30**	**50**	**30**	
I1		3.15	0.64	45.65	20.44	Yes
I2		2.49	0.28	44.99	20.08	Yes
I3		2.48	1.04	44.98	20.84	Yes
I4		2.92	0.65	45.42	20.45	Yes
R1		0.26	0.03	42.76	19.83	Yes
R2		0.13	0.01	42.63	19.81	Yes
R3		0.12	0.01	42.62	19.81	Yes
R4		0.1	0.01	42.6	19.81	Yes

Review of Table 8-1 indicates that the predicted ground level concentrations of PM_{10} comply with the impact assessment criteria for both 24-hour and annual averages. Further, the predictions indicate that PM_{10} levels at sensitive receptors due to the project are small compared to the existing ambient PM_{10} levels.

Contours of the incremental 24-hour PM_{10} concentrations, due to the Project, are shown in Figure 8-1.

Figure 8-1 Ground Level Concentration Contours – 24-hour Average PM_{10}



The predicted incremental and total ground level concentrations of $PM_{2.5}$ are presented in Table 8-2.

Table 8-2 Predicted Ground Level Concentrations – $PM_{2.5}$

Receptor		Incremental Impact (µg/m³)		Total Impact (µg/m³)	
	Period	24-hour	Annual	24-hour	Annual
	Criteria	**25**	**8**	**25**	**8**
I1		1.58	0.32	26.48	8.82
I2		1.25	0.14	26.15	8.64
I3		1.24	0.52	26.14	9.02
I4		1.46	0.33	26.36	8.83
R1		0.13	0.02	25.03	8.52
R2		0.07	0.01	24.97	8.51
R3		0.06	0.01	24.96	8.51
R4		0.05	0.01	24.95	8.51

The predicted total ground level concentrations of $PM_{2.5}$ exceed the advisory goals for both the 24-hour and annual averages. It is noted that the existing $PM_{2.5}$ levels exceed the advisory levels, and that the contribution from the Project is small.

8.1.2 Lead

The predicted incremental and total ground level concentrations of lead are presented in Table 8-3.

Table 8-3 Predicted Ground Level Concentrations – Lead

Receptor		Incremental Impact (µg/m³)	Total Impact (µg/m³)	Complies?
	Period	Annual	Annual	
	Criterion	**0.5**	**0.5**	
I1		0.08	0.11	Yes
I2		0.02	0.05	Yes
I3		0.11	0.14	Yes
I4		0.07	0.10	Yes
R1		0.00	0.03	Yes
R2		0.00	0.03	Yes
R3		0.00	0.03	Yes
R4		0.00	0.03	Yes

Review of Table 8-3 indicates that the predicted ground level concentrations of lead comply with the impact assessment criterion.

9 CONCLUSION

Wilkinson Murray has conducted an air quality impact assessment for a proposed battery recycling facility at 10 Lancaster Street, Ingleburn.

The assessment has been prepared to address the relevant SEARs in relation to the preparation of the Environmental Impact Statement (EIS) for the project, and was conducted in general accordance with the following:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005); and
- *Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Australia'* (TRC, 2011).

Pollutant emissions from the Project have been provided by the Client, in the form of an emissions guarantee. Additionally, the Client advises that there will be no fugitive emissions from the Project. It is recommended that measurements are conducted inside the building at the facility, once commissioned, to confirm that the plant is operating per the manufacturer's specifications and that no fugitive emissions are occurring.

Incremental and total ground level concentrations of identified pollutants were predicted at nearby sensitive receptors using TAPM meteorological simulations, and the CALPUFF modelling system. The results of the dispersion modelling indicate that the predicted ground level odour concentrations due to the operation of the project comply with the established criteria. Additionally, the stack concentrations of identified pollutants comply with the limits specified in the *Protection of the Environment Operations (Clean Air) Regulation 2010*.

10 REFERENCES

DEC 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, Department of Environment and Conservation NSW, Sydney, Australia.

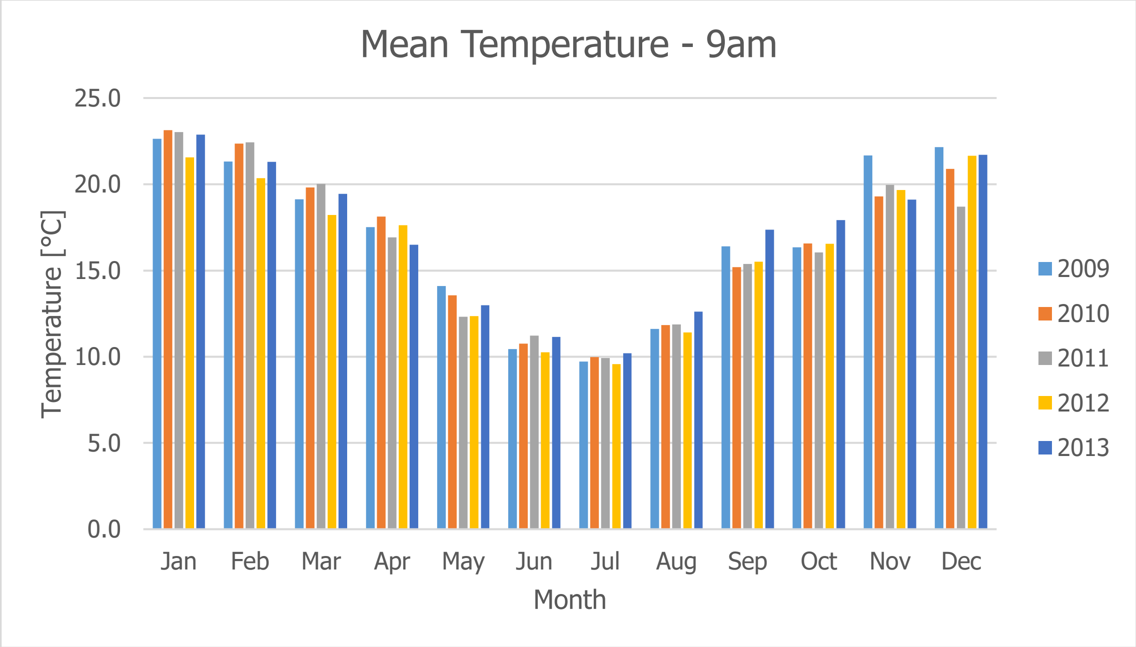
DECCW 2010, *Current Air Quality in New South Wales – A technical paper supporting the Clean Air Forum 2010*, Department of Environment, Climate Change and Water NSW, Sydney.

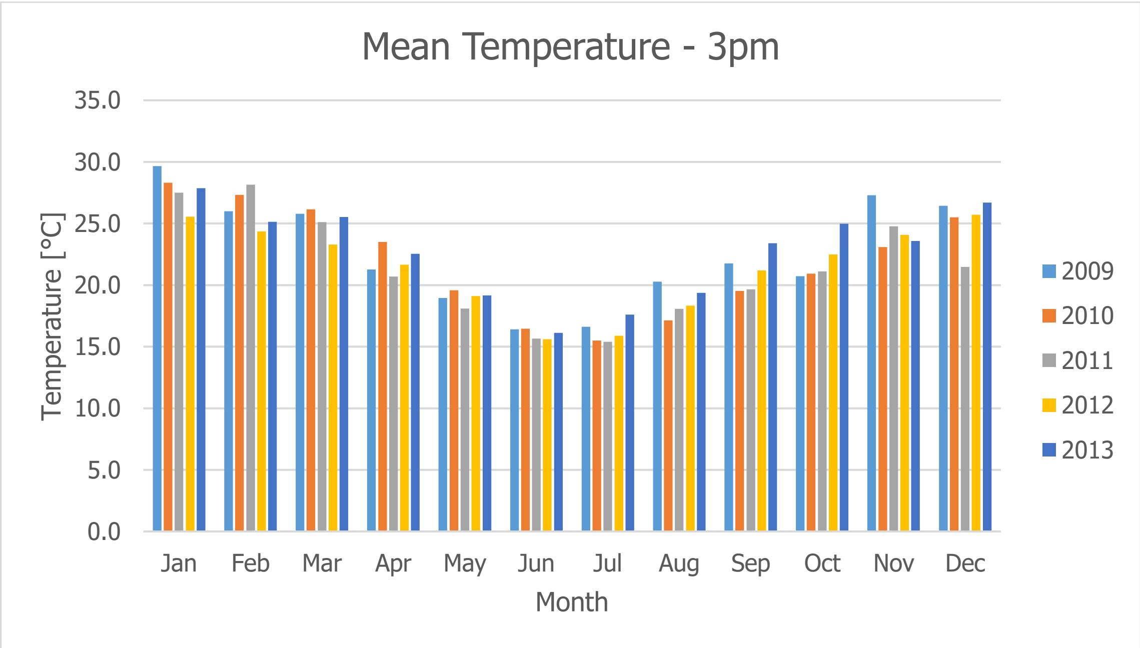
TRC, 2011, *Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Australia*, TRC Environmental Corporation, Lowell MA, USA.

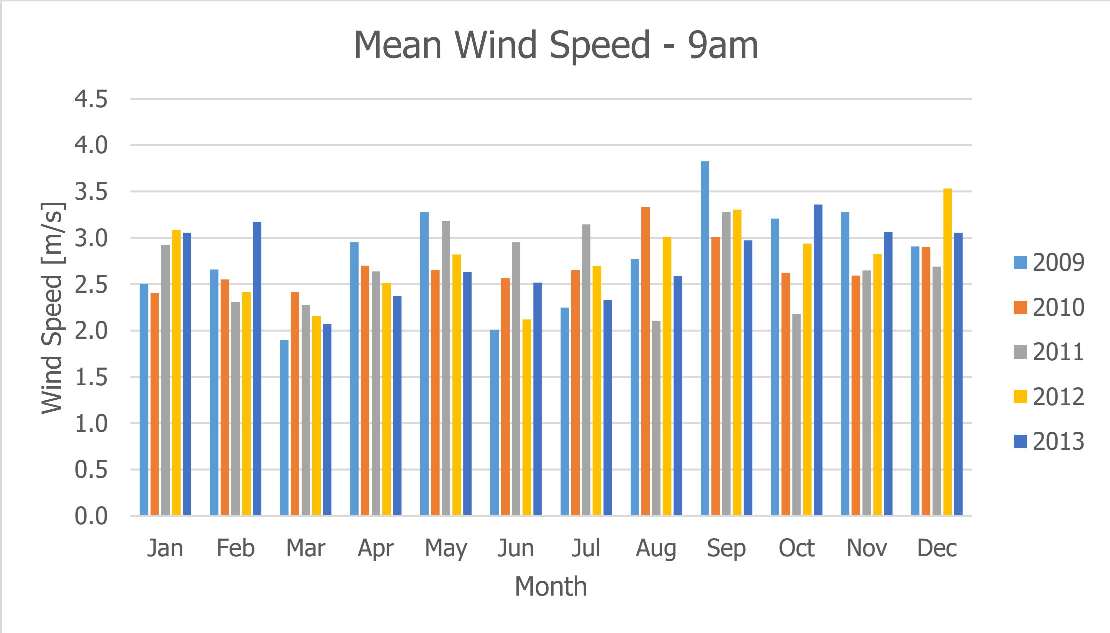
EPA Victoria 1986, *The AUSPLUME Gaussian Plume Dispersion Model*, First Edition, Environment Protection Authority of Victoria, Melbourne, Australia.

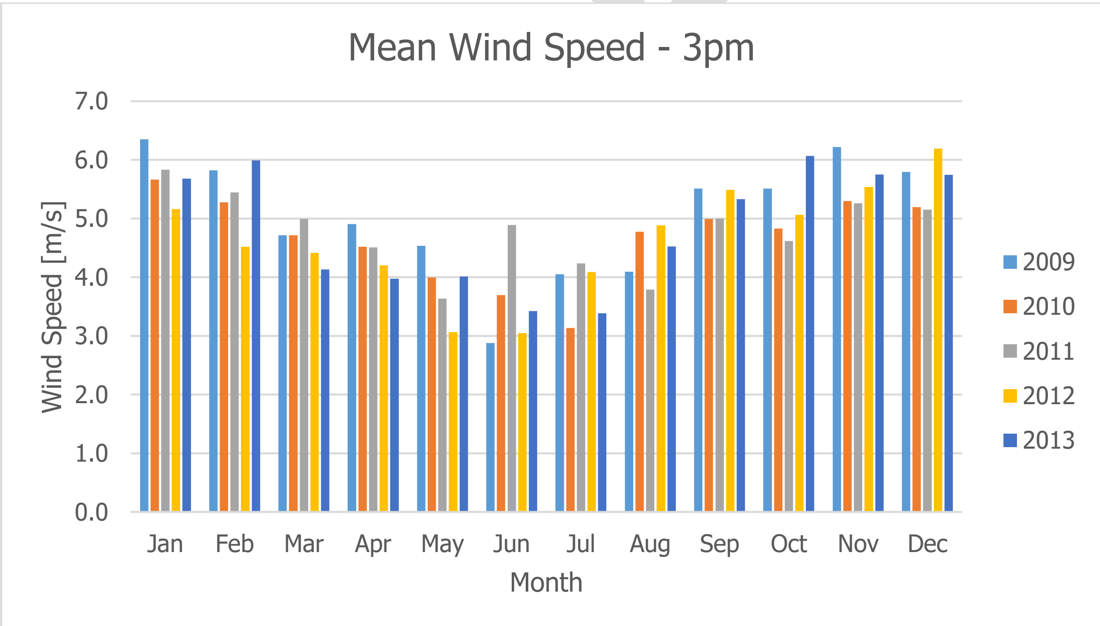
APPENDIX A

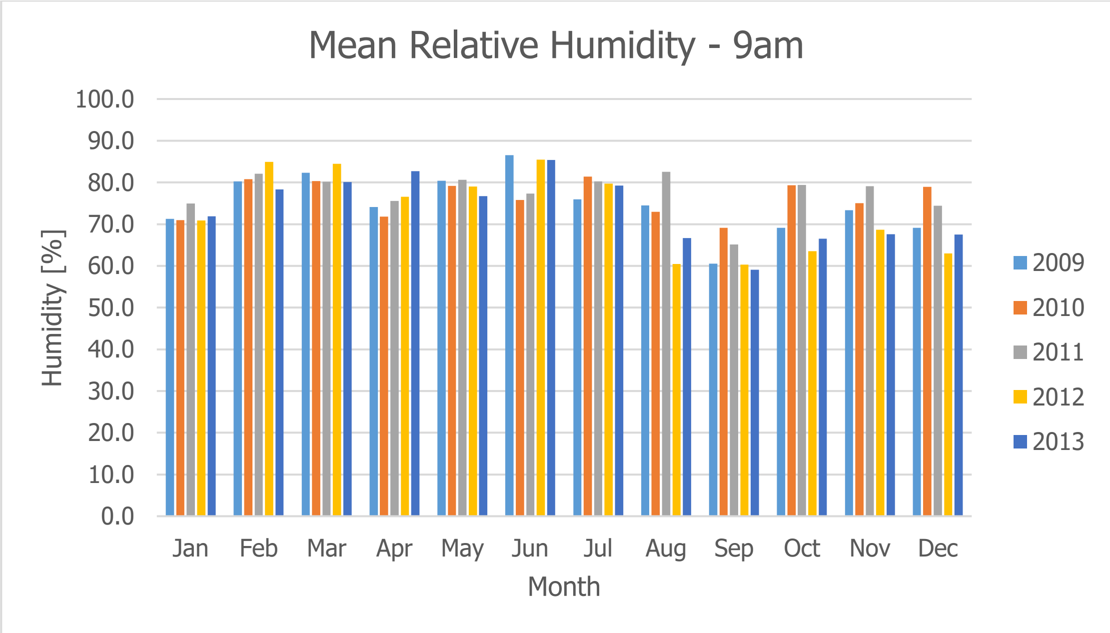
METEOROLOGICAL COMPARISON, HOLSWORTHY CONTROL RANGE AWS: 2009 – 2014

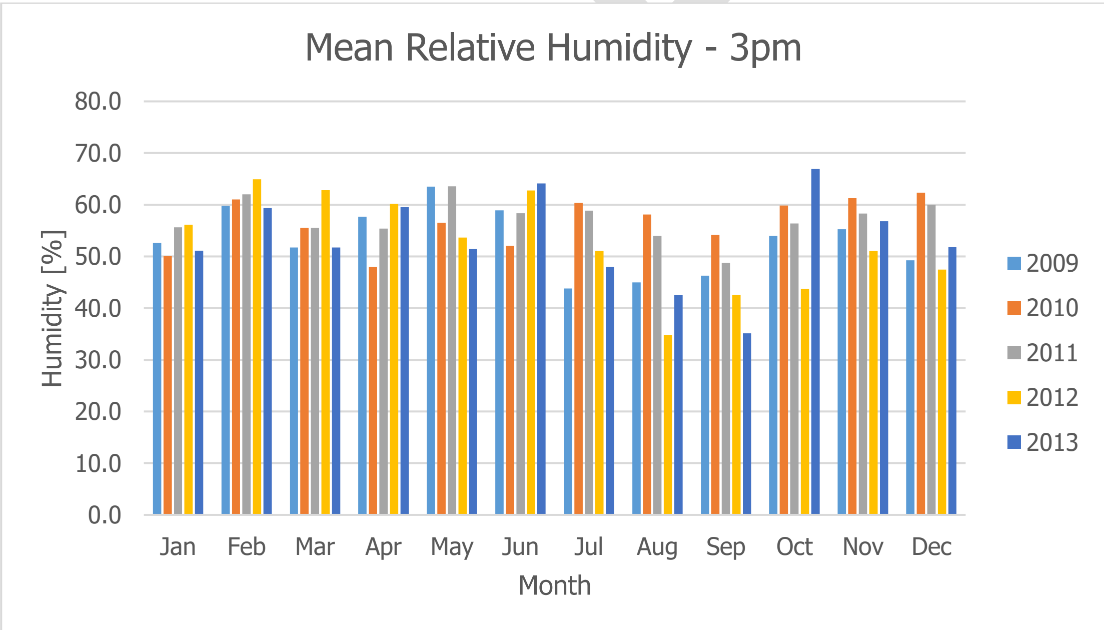

Mean Temperature - 9am
Temperature [°C]
25.0
20.0
15.0
10.0
5.0
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month
2009
2010
2011
2012
2013


Mean Temperature - 3pm
Temperature [°C]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month
2009
2010
2011
2012
2013


Mean Wind Speed - 9am
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Wind Speed [m/s]
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2009
2010
2011
2012
2013


Mean Wind Speed - 3pm
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Wind Speed [m/s]
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2009
2010
2011
2012
2013


Mean Relative Humidity - 9am
Humidity [%]
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2009
2010
2011
2012
2013


Mean Relative Humidity - 3pm
Humidity [%]
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2009
2010
2011
2012
2013