Appendix E

Air quality and greenhouse gas assessment

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PENRITH WASTE RECYCLING AND TRANSFER FACILITY
AIR QUALITY AND GREENHOUSE GAS ASSESSMENT

RAMBOLL ENVIRON

PENRITH WASTE RECYCLING AND TRANSFER FACILITY
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EXECUTIVE SUMMARY

Benedict Recycling Pty Ltd (Benedict Recycling) proposes to construct and operate a waste recycling and transfer facility at 46−48 Peachtree Road, Penrith, NSW (the Facility). Ramboll Environ Australia Pty Ltd (Ramboll Environ) has been commissioned by EMM Consulting Pty Ltd (EMM) on behalf of Benedict Recycling to conduct an air quality and greenhouse gas assessment of the proposed Facility.

Emissions of TSP, PM_{10}, $PM_{2.5}$ and odour were estimated for peak proposed operations associated with the Facility. Atmospheric dispersion modelling predictions of air pollution emissions for proposed operations were undertaken using the AERMOD dispersion model.

Existing air quality and meteorological conditions were analysed through a number of data resources, with particular weighting given to the Bureau of Meteorology Penrith Lakes and NSW Office of Environment and Heritage St Marys and Richmond monitoring stations.

The results of the dispersion modelling conducted indicated that the operation of the proposed Facility was unlikely to result in exceedances of the applicable NSW EPA assessment criteria for TSP, PM_{10} and dust deposition or the NEPM Reporting Goals for $PM_{2.5}$ at any of the surrounding residential receptors. The potential for an additional exceedance day for 24-hour average $PM_{2.5}$ concentration was predicted for the commercial/industrial receptors immediately adjacent to site boundary, however exposure for a 24-hour period at these locations is not likely to occur.

Potential odour impacts from the Facility were conservatively assessed, with resultant predicted odour concentrations well below applicable impact assessment criterion.

A greenhouse gas quantification assessment was undertaken for the Facility. The annual Scope 1 and Scope 3 emissions at full production represent approximately 0.0005% of total GHG emissions for NSW and 0.0001% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2013.

1. INTRODUCTION

Benedict Recycling Pty Ltd (Benedict Recycling) proposes to construct and operate a waste recycling and transfer facility at 46–48 Peachtree Road, Penrith, NSW (the Facility). Ramboll Environ Australia Pty Ltd (Ramboll Environ) has been commissioned by EMM Consulting Pty Ltd (EMM) on behalf of Benedict Recycling to conduct an air quality and greenhouse gas assessment of the proposed Facility.

This report provides:

- characterisation of the existing environment, specifically the existing air quality, prevailing meteorology and regulatory context;
- review of potential emission sources and mitigation measures;
- calculation of annual particulate matter emissions from the proposed Facility;
- atmospheric dispersion modelling of emissions for proposed operations at Facility to predict potential air quality impacts at surrounding sensitive receptor locations; and
- quantification of greenhouse gas emissions from the peak operations of the Facility.

1.1 Study objectives

The objective of the study is to identify the potential air quality and greenhouse gas related impacts associated with the project, satisfy the Secretary's Environmental Assessment Requirements (SEARs) and to make recommendations for additional mitigation and management measures if required.

1.2 Secretary's Environmental Assessment Requirements

The SEARs for the project are as follows:

- **Air Quality and Odour** – including
  - a quantitative assessment of potential air quality, dust and odour impacts of the Facility in accordance with relevant Environment Protection Authority guidelines;
  - the details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to a building;
  - A greenhouse gas assessment; and
  - details of proposed mitigation, management and monitoring measures.

The air quality requirements are specifically addressed in **Section 6**, **7**, **8** and **9** of the report with earlier sections providing the baseline information and study methodology. The greenhouse gas requirements are specifically addressed in **Section 10** of the report.

The air quality assessment is guided by the NSW Environment Protection Authority (NSW EPA) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ("the Approved Methods for Modelling"), (NSW EPA, 2016).

2. PROJECT DESCRIPTION AND LOCAL SETTING

2.1 Project Description

Benedict Recycling proposes to construct and operate a waste recycling and transfer facility on the site and undertake ancillary activities. The proposal will have two main components:

- waste recycling and transfer; and
- ancillary activities including temporary storage of commercial vehicles.

The project setting and layout of the Facility are illustrated in **Figure 2-1** and **Figure 2-2** respectively.

2.2 Site components

The development will include the installation and use of the following site components:

- repairs to the existing concrete surface of the site where required;
- upgrade of the entry driveway at the south-east boundary to Peachtree Road;
- relocation of awning the on eastern boundary to the north-east boundary and subsequent extension;
- construction of an exit driveway at the south-west boundary to Peachtree Road;
- a surface water management system;
- landscaping;
- ten on-site parking spaces with eight spaces for staff and two spaces for visitors;
- two weighbridges at the site entry and one weighbridge at the site exit;
- a wheel wash at the site exit;
- two demountable weighbridge offices;
- product bays (stockpiles) with 4 m high block walls;
- waste and product stockpiles within product bays;
- a manual hand unloading area for small vehicles;
- truck tipping area where wastes will be temporarily stored prior to processing;
- a sprinkling site irrigation system to minimise airborne dust;
- a flip-flow screen waste sorter housed in the processing shed;
- block walls at the north-east and north-west site boundaries;
- 3 m block walls with colorbond automatic gates at the ingress and egress points;
- extension of 3 m colorbond fence at south-east corner;
- out-of-hours truck parking; and
- updating the existing sign.

2.2.1 Weighbridge and office area

Initially, two above-ground weighbridges will be used for incoming vehicles. Later, a third above-ground weighbridge will be installed for outgoing vehicles.

An above-ground self-contained wheel wash will be provided for trucks leaving the site. Water used in the wheel wash will be lost through evaporation and on tires leaving the wash. Periodic replenishment will be required. Sediment in the wheel wash will be regularly removed on an as-needs basis using an excavator.

A small ramp will be installed at the approach to the wheel wash. Light vehicles not using the wheel was and weighbridge will be able to cross the ramp to the light vehicle exit, without obstruction.

2.2.2 Processing shed

The majority of waste processing will occur in the existing shed, which is built of block walls and colorbond steel and enclosed on all sides. The shed is accessed to the north and east by roller doors and to the east by two pedestrian accessible doors.

Materials will enter the shed via an infeed hopper. The hopper will be installed at the north side of the processing shed. The site of the hopper is currently occupied by an awning, which will be removed prior to installation of the hopper.

The shed is approximately 26 m long, 16 m wide and 7 m high, with a floor area of approximately 420 m^2. The floor of the shed is level concrete. The processing shed will contain a flip-flow screen waste sorter (eg Finlay 883 flip flow screen or similar.

Processing within the shed is described in **Section 2.4.**

The shed is currently connected to water, sewer, power and telecommunications. The shed's existing amenities and office space will be refurbished as part of the development.

Modifications to the shed include:

- removal of an external awning at the north side of the shed;
- an opening at the north side of the shed to accommodate a hopper; and
- openings at the west side of the shed to connect to external product bays.

2.2.3 Site surfacing

The site's existing concrete surface is generally flat, sloping towards drainage to prevent pooling of water on site. The concrete surface will be cleaned prior to occupying the site and repaired where required. The site's existing surface water management system will be upgraded to prevent the release of untreated stormwater runoff.

2.2.4 Tipping areas and bays

There will be separate tipping areas for small vehicles and trucks. Small vehicles will be directed to the hand unloading area to the west of the processing shed. The truck tipping area will be in north-west corner of the site and will have block walls (4 m tall) on the northern and western sides.

Bays will be constructed on the site, with 4 m tall block walls enclosing stockpiles. The following bays will be located on the site:

- metal waste will be kept in a bin on the western edge of the site, south of the truck tipping area;
- aggregate/oversized materials and fines will be kept in separate bays to the south of the hand unloading area, directly west of the processing shed;
- excavated soils will be kept in a bay on the southern edge of the site, directly west of the processing shed; and
- vegetation and light waste will be kept in a bay in the north-east corner of the site. An existing awning on the eastern edge of the site will be relocated to the north-east corner of the site and extended, providing a roof over the bay. The roof of the awning will be approximately 5 m off the ground.

2.2.5 Car parking

Ten car parking spaces will be provided. The dimensions of car parking spaces will be in accordance with the relevant standards.

2.3 Waste materials, sources and quantities

2.3.1 Waste materials accepted

The waste recycling and transfer facility will accept 'Pre-classified general solid waste (non-putrescible)' as defined by EPA (2014a). This will mainly consist of the following wastes:

- co-mingled and segregated construction and demolition waste, including tiles, bricks, concrete, glass, metal, wood, asphalt, gyprock and vegetation and uncontaminated soils;

- co-mingled and segregated commercial and industrial waste from factories and commercial premises such as paper/cardboard, cloth, plastics, rubber, wood, suitable slags, concrete and asphalt batching wastes and the like;
- excavated natural materials (ENMs) including virgin natural excavated material (VENM) such as sand and sandstone which are generated during bulk earthworks and road and infrastructure construction and repair;
- vegetation waste;
- wood waste;
- metals; and
- rail ballast and spoils.

Waste that has a plant origin can be divided into:

- timber - wood that has been milled and used in buildings, pallets, etc;
- coarse vegetation - unprocessed coarse vegetation waste such as large branches, stumps and roots that take weeks or months to start to decompose/compost; and
- green waste - unprocessed vegetation waste such as grass clippings, leaves, small branches and weeds that may start to decompose/compost almost immediately.

'Vegetation waste' refers to coarse vegetation, green waste or a combination of both. The facility will receive much more coarse vegetation than green waste. The Penrith Waste Recycling and Transfer Facility will not accept council kerbside green bin waste or putrescible waste.

The facility will not accept putrescible or odorous waste. The small quantities of vegetation waste that are expected to be contained in loads of mixed waste would be separated and managed so that it does not start composting or producing odours.

The facility will not accept special, liquid, hazardous, restricted solid waste or general solid waste (putrescible).

2.3.2 Waste deliveries

The site will accept inert waste from councils, contractors and businesses and the general public. Accordingly, waste will be delivered to site by a variety of vehicles including:

- light vehicles such as cars with box trailers and utilities;
- single or dual axle heavy vehicles such as skip-bin trucks; and
- multiple axle combination heavy vehicles.

All vehicles delivering waste will be directed to the weighbridge where the load will be inspected for potential contaminants and classified. A ticket will be issued and the driver will be instructed where to deliver the waste within the site. The driver will then deliver the waste to the appropriate area where it will be tipped and will be closely inspected prior to the vehicle being directed back to the weighbridge area. Light vehicles will proceed to the designated 'hand unloading area' so that they can be manually unloaded safely in a location that is away from trucks, heavy machinery etc. Any rejected loads will be immediately reloaded for removal from the site and recorded in a 'rejected load' register. Vehicles will be re-weighed as they leave the site to determine the mass of the load delivered.

2.3.3 Incoming waste quality plan

Incoming waste will be inspected in two stages:

- a preliminary inspection of the incoming waste on the vehicle at the weighbridge; and
- an inspection of the incoming waste after it is tipped off but before it is added to the appropriate feed stockpile. The customer will be required to wait until the waste has passed the inspection.

Any incoming waste loads that are suspected to contain contaminants will be rejected and the customer will be required to take the contaminated load out of the waste recycling and transfer facility immediately.

The plan will include:

- Prevention actions such as:
  - a 'no asbestos' clause in supplier contracts, advising suppliers that asbestos containing materials will not be accepted;
  - installing warning signage;
  - training workers on waste inspection and asbestos awareness and management; and
  - education programs at material source locations to minimise the risk of asbestos containing materials such as fibro entering the supply chain and being imported onto the premises.
- Contingency actions if potential asbestos containing materials are identified, including a rejected load register and reporting to the EPA.
- Empowering waste inspectors to reject loads considered 'suspect' or odourous.

Products produced for direct use without further processing will be tested in accordance with requirements of the relevant resource recovery exemption.

2.4 Waste processing

Waste recycling and transfer facility processing will include the following steps:

- Waste will be inspected prior to being accepted on site and any loads suspected to contain material that cannot be accepted by the site will be rejected (see **Section 2.3.3**);
- Segregated wastes will be unloaded and inspected at stockpile areas where possible;
- Mixed waste will be unloaded at the truck tipping area and hand unloading area. Waste will be stored in the tipping area prior to processing in the processing shed;
- Waste deposited in the hand unloading area will be collected at the end of each day and taken to the shed for processing;
- Waste in the truck tipping area will be loaded into the hopper by mobile plant directed by traffic controllers;
- Waste processing will include sorting, screening. There will be no shredding or crushing on site;
- Sorting will mostly occur at the tipping area and within the processing shed. The screening plant will be used to handle and process the waste and products in the shed;
- Sorted aggregates/oversized materials and screened fines will be deposited directly into stockpiles through the western side of the shed; and
- Metals, excavated soils, vegetative waste, screened fines and aggregate products will generally be dispatched by heavy vehicle for sale or further processing at another facility. Some waste (less than 20% by mass) will not able to be recycled onsite (referred to as 'non-recyclable residues'). Non-recyclable residues will generally be dispatched to a licensed landfill by heavy vehicle.

2.5 Non-recyclable residue

Not all of the material delivered will be able to be separated to allow it to be recycled onsite. This material, or 'non-recyclable residue', will be less than 20% (by mass) of the waste delivered to the waste recycling and transfer facility for processing.

Non-recyclable residues will be stockpiled undercover.

2.6 Waste and product storage

It is proposed to accept up to 180,000 tpa of waste at the Facility. The proportions of each waste type will vary according to local waste demographics.

There will be two primary stockpile types:

- waste feed stockpiles; and
- product stockpiles.

There may also be some intermediate stockpiles formed during processing. These will be in the external bays along the western boundary of the shed. Maximum stockpile sizes by material types are presented in **Table 2-1**.

The products will be stored in external bays prior to quality testing and dispatch.

Table 2-1 Maximum stockpile sizes

Type	Average tonnes per day (t)	Maximum volume (m^3)
Excavated soils	198	210
Screened fines	156	100
Oversized materials/Aggregate	114	130
Vegetative waste (covered)	30	200
Metals	12	20
Light waste (covered)	90	300
Hand unloading area	N/A	80
Truck tipping area	N/A	500

2.7 Plant and equipment

Indicative equipment to be used at the waste recycling and transfer facility is listed in **Table 2-2**. This information has been used in noise and air quality assessments. The actual equipment used may vary but Benedict Recycling will ensure that noise and air quality emission compliance requirements are met.

Table 2-2 Indicative equipment and activities – site wide usage

Plant (or equivalent)	Number	Typical activities
Front end loader (e.g. Volvo L120 or equivalent)	1	Unloading and loading trucks Moving waste and products
Trucks (customers)	4–5	Delivering waste and dispatching products Returning to/leaving the site
13 t excavator (e.g. Komatsu PC130 or equivalent)	1	Sorting waste using a variety of excavator attachments Loading trucks
Screening plant inside shed	1	Sorting co-mingled waste

2.8 Internal traffic

Traffic movements within the site will be largely un-restricted with the entire site consisting of a hard sealed surface. The public vehicle access area, providing access to the hand-unloading facility, will be delineated from the heavy vehicle area.

Public pedestrian access will be limited to the hand-unloading area only, which will be appropriately signed to ensure members of the public remain within this area at all times.

2.9 Workforce and hours of operation

The following hours of operation are proposed:

- Accept waste deliveries and dispatch materials (but not process):
  - 6 am and 10 pm Monday to Friday;
  - 6 am and 5 pm Saturday;
  - 8 am to 4 pm Sunday; and
  - no deliveries or dispatch on public holidays.
- Waste processing:
  - 7 am to 6 pm Monday to Saturday; and
  - no processing on Sundays or public holidays.
- Accept (but not process) waste deliveries from night works:
  - 24 hours per day on limited occasions through the year.

Notwithstanding the above, the facility would normally operate from 6 am to 4 pm Monday to Saturday.
The Facility is expected to employ:

- Eight employees during normal single shift site operations (ie when the site is open from 6 am to 4 pm).
- Fifteen employees during two shift site operations (ie when the site is open from 6 am to 10 pm).
- Additional contractors when accepting waste between 10 pm and 6 am.

2.10 Construction activities

Project construction will require:

- installing gates and repairing fencing;
- refurbishing and modifying the processing shed;
- constructing waste and product bays;
- installing weighbridges and demountable offices;
- constructing exit driveway;
- upgrading the existing entry driveway;
- marking traffic/pedestrian circulation and parking bays;
- relocation and extension of the eastern awning;
- upgrading the surface water management system with two gross pollutant traps (GPTs), additional drains and associated stormwater pipes/pits; and
- landscaping.

The site is connected to mains water, sewer, electricity and telecommunications.

No significant ground excavation is anticipated, other than 2 m deep, 2 m wide and 3 m long excavations for GPTs and a relocated drainage pit. There will be minor ground disturbance associated with installing anchors for the demountable offices and relocated awning, installation of footings for weighbridges and relocation of stormwater pipes.

The construction timeframe would be approximately two months.

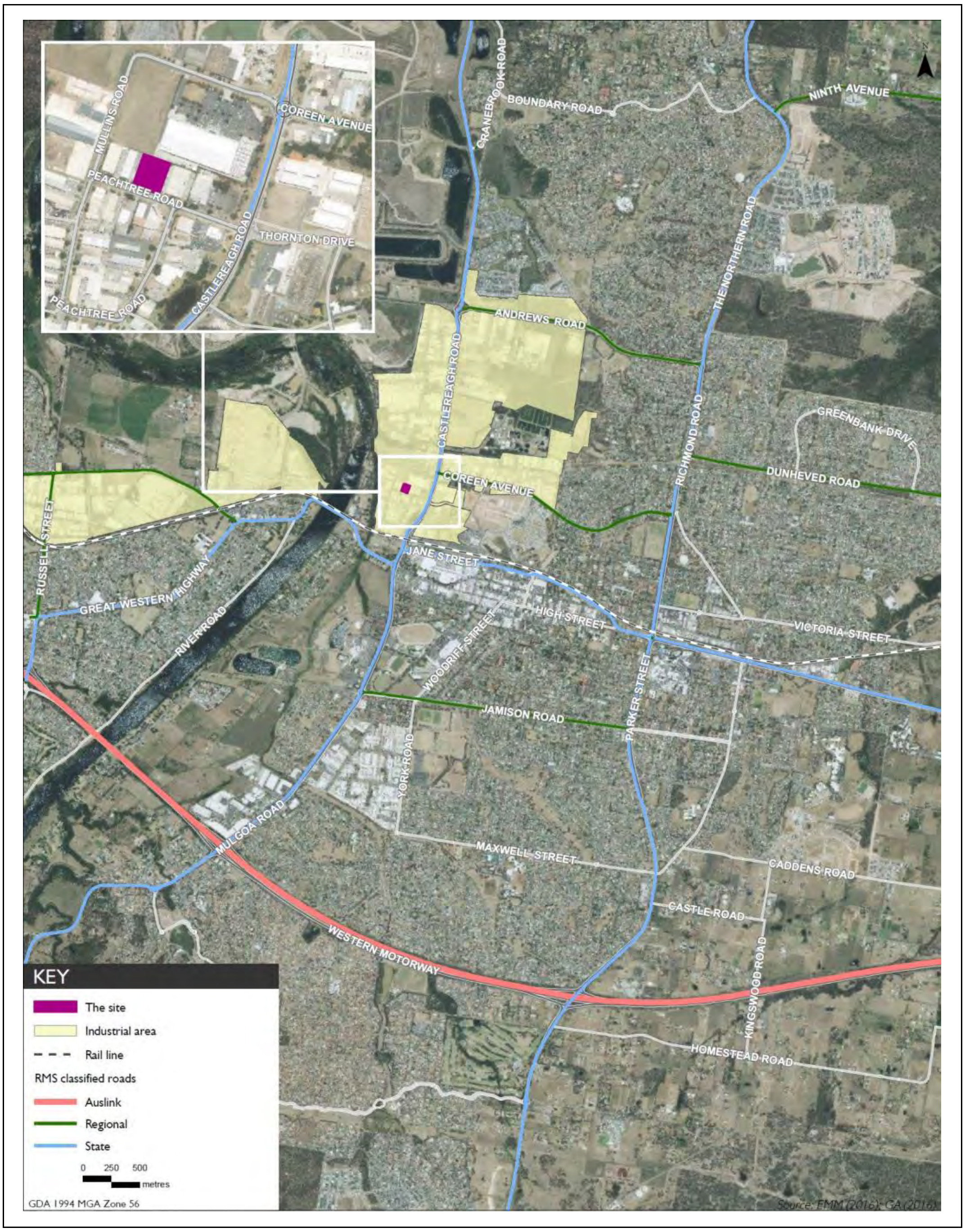


Figure 2-1: Site Location

Source: EMM (2016)

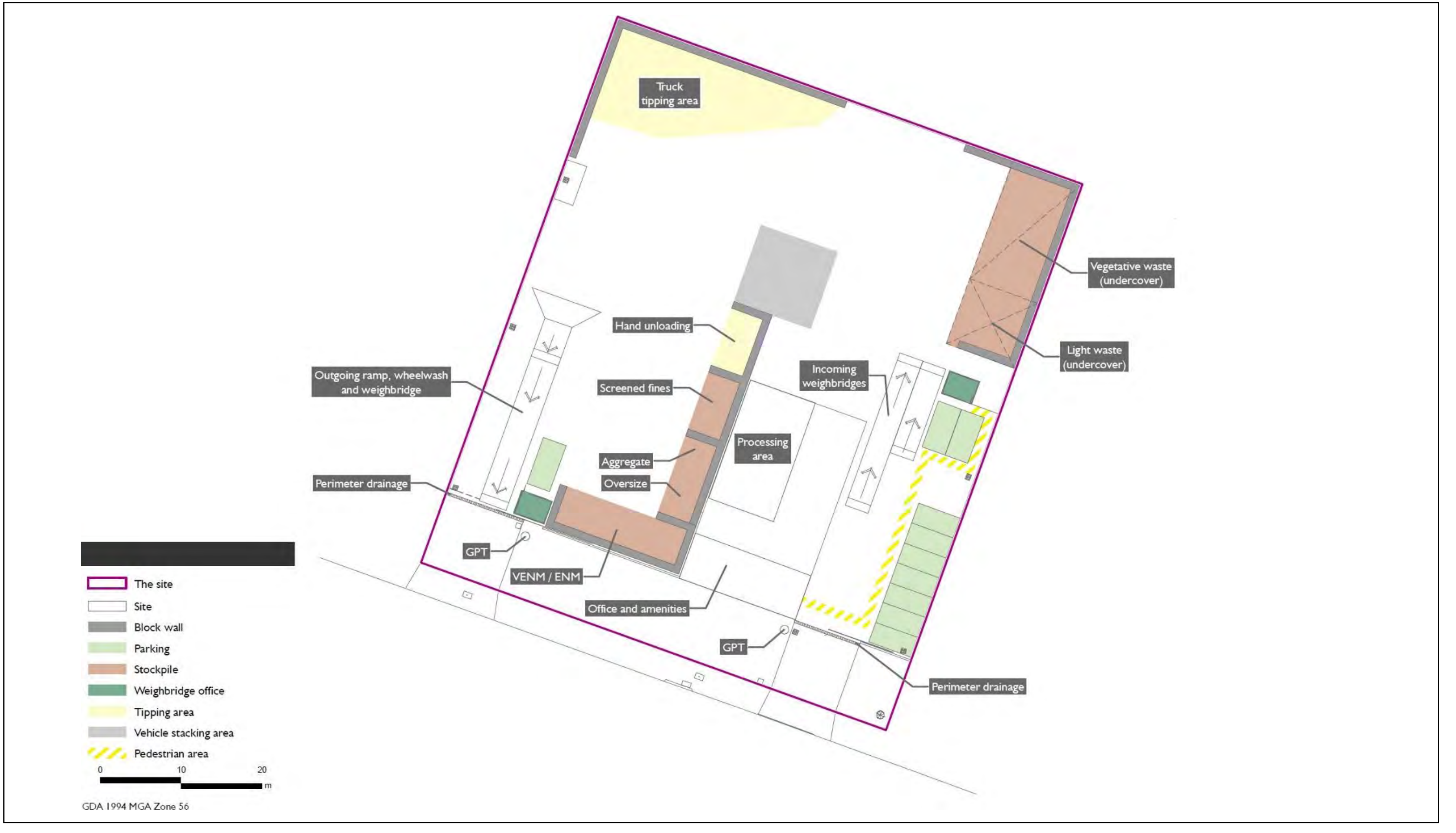


Figure 2-2: Proposed Site Layout

Source: EMM (2017)

2.11 Surrounding landuse and receptor locations

The site is within an industrial estate to the northwest of the Penrith central business district. The site was previously a scrap metal yard, and is currently used by an autowreckers. The land is covered by a concrete hard stand and a shed. The site covers 4,367 m^2 in area and is flat (approximately 26 m Australian Height Datum (AHD).

The neighbouring properties are a mixture of commercial and industrial operations. In addition to the closest surrounding commercial and industrial receptors, the closest residential and recreational receptors have also been included as discrete assessment locations. The selected receptor locations are presented in **Table 2-3** and illustrated in **Figure 2-3**.

Table 2-3 Sensitive receptor locations surrounding the site

Receptor ID	Location (m, MGA56S)		Elevation (m, AHD)	Receptor Type
	Easting	Northing		
1	285890	6263716	25	Commercial / Industrial
2	285913	6263717	25	Commercial
3	285969	6263718	25	Commercial
4	285992	6263719	28	Commercial
5	285937	6263720	25	Commercial / Industrial
6	285859	6263721	25	Commercial / Industrial
7	285827	6263722	26	Industrial
8	285839	6263723	25	Commercial / Industrial
9	285859	6263724	25	Commercial / Industrial
10	285931	6263725	24	Commercial
11	286593	6263726	30	Residential
12	286529	6263727	25	Residential
13	285651	6263728	29	Residential
14	285483	6263729	26	Residential
15	285130	6263730	26	Residential
16	285581	6263731	31	Recreation
17	285731	6263732	27	Recreation

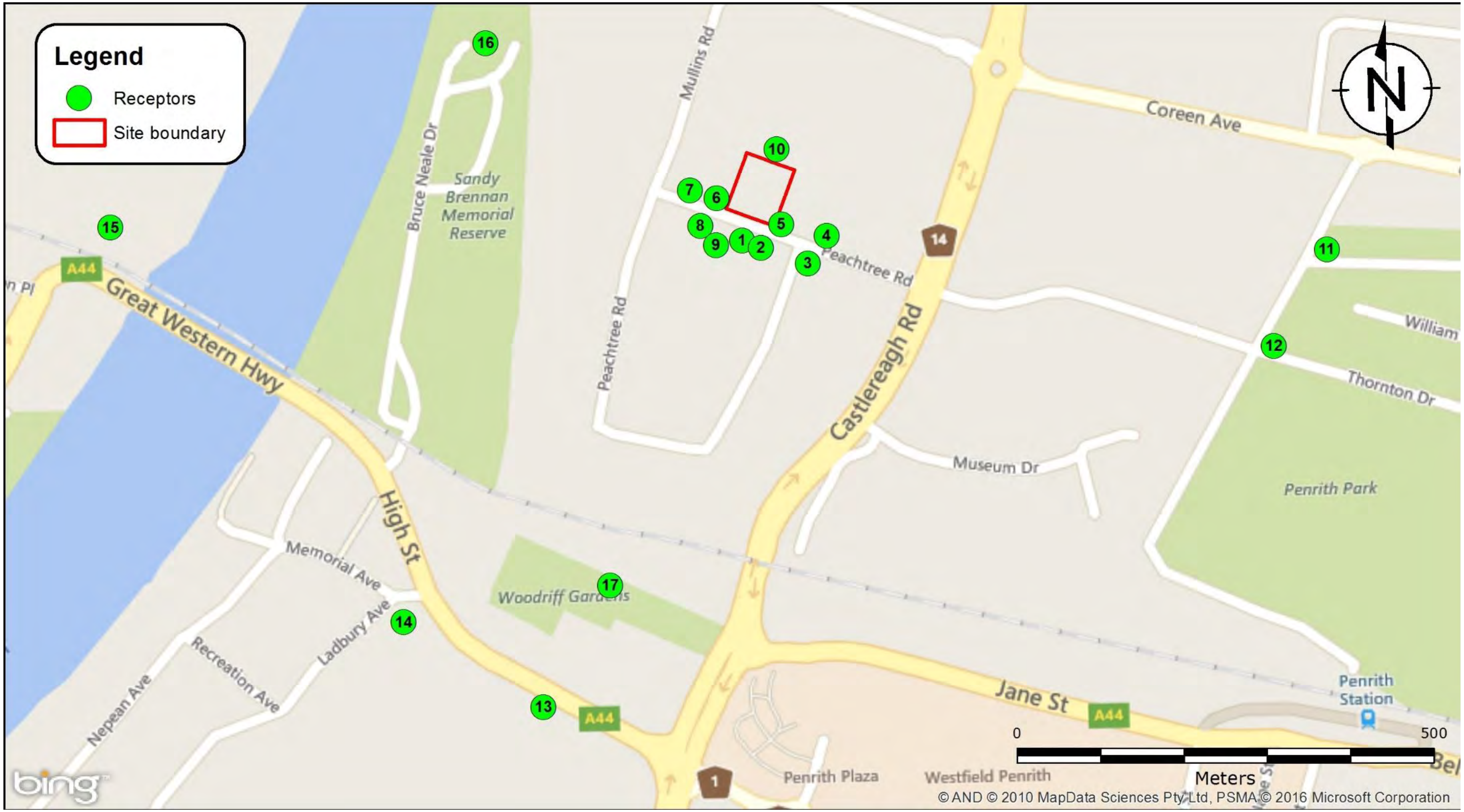


Figure 2-3: Surrounding sensitive receptor locations

3. AIR QUALITY ASSESSMENT CRITERIA

The project must demonstrate compliance with the impact assessment criteria outlined in the Approved Methods for Modelling (EPA, 2016). The impact assessment criteria are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being.

The Approved Methods for Modelling specifies that the impact assessment criteria for 'criteria pollutants[1]' are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be presented, requiring consideration of existing ambient background concentrations for the criteria pollutants assessed.

For this assessment, focus has been given to the emissions of primary particulate matter (PM), including total suspended particulate matter (TSP) and particulate matter with an equivalent aerodynamic diameter of less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$). Dust deposition, as a result of the TSP emissions, is also assessed.

Relevant ambient air quality criteria applicable to the Facility are presented in this section. For proposed developments within NSW, ground level assessment criteria specified by the NSW EPA within the *Approved Methods for Modelling* are applicable. These assessment criteria are designed to maintain an ambient air quality that allows for adequate protection of human health and well-being.

3.1 Goals applicable to airborne particulate matter

Air quality limits for PM are typically given for various particle size metrics, including TSP, PM_{10} and $PM_{2.5}$. PM_{10} and $PM_{2.5}$ require specific consideration due to their health impact potential.

The impact assessment criteria for TSP, PM_{10} and $PM_{2.5}$ are prescribed in the Approved Methods for Modelling. The PM_{10} and $PM_{2.5}$ criteria are consistent with the $PM_{2.5}$ reporting standards issued by the National Environmental Protection Council (NEPC) (NEPC, 2003). The National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) $PM_{2.5}$ reporting standards were first published as advisory goals in 2003 for the purpose of supporting the monitoring and evaluation of ambient $PM_{2.5}$ concentrations ahead of the setting ambient air quality standards for this pollutant. The AAQ NEPM was varied in December 2015 to adopt these 'advisory reporting standards' as formal standards for $PM_{2.5}$ (NEPC, 2015).

The air quality criteria applied for PM in this assessment are presented in **Table 3-1**.

[1] 'Criteria pollutants' is used to describe air pollutants that are commonly regulated and typically used as indicators for air quality. In the Approved Methods the criteria pollutants are TSP, PM_{10}, NO_2, SO_2, CO, ozone (O_3), deposition dust, hydrogen fluoride and lead.

Table 3-1 Impact assessment criteria for PM

Pollutant	**Averaging Period**	**Concentration (µg/m³)**	**Reference**
TSP	Annual	90	NSW EPA(1)(2)
PM_{10}	24 hours	50	NSW EPA(1)
	24 hours	50	NEPM(3)
	Annual	25	NSW EPA(1)
	Annual	25	NEPM(3)
$PM_{2.5}$	24 hours	25	NEPM(3)
	Annual	8	NEPM(3)

Note 1: NSW EPA, 2016 *Approved Methods for Modelling*

Note 2: NSW EPA impact assessment criterion based on the subsequently rescinded National Health and Medical Research Council (NHMRC) recommended goal

Note 3: NEPC, 2015, *National Environment Protection (Ambient Air Quality) Measure,* as amended

3.2 Dust deposition criteria

Nuisance dust deposition is regulated through the stipulation of maximum permissible dust deposition rates. The NSW EPA impact assessment goals for dust deposition are given in **Table 3-2** illustrating the allowable increment in dust deposition rates above ambient (background) dust deposition rates which would be acceptable so that dust nuisance could be avoided.

Table 3-2 Impact assessment criteria for dust deposition

Averaging Period	**Maximum Increase in Deposited Dust Level**	**Maximum Total Deposited Dust Level**
Annual	2 g/m^2/month	4 g/m^2/month

Source: Approved Methods for Modelling, EPA 2016

3.3 Criteria for Odour Mixtures

The odour performance criteria are expressed in terms of odour units. The detectability of an odour is defined as a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit (OU). An odour criterion of less than 1 OU would theoretically result in no odour impact being experienced.

A concentration of 7 OU means that the sample requires a dilution with clean air 7 times to become odour free; thus an odour concentration expressed as 7 OU coincides with a dilution-to-threshold (D/T) ratio of 7, and 2 OU equates to a D/T ratio of 2 (and so on).

The NSW Technical Framework - Assessment and Management of Odour from Stationary Sources recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU (NSW DEC, 2006). Although the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU, experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 OU is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours) (NSW DEC 2006).

Odour performance criteria are designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population.

As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent criteria are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas.

Where a number of the factors simultaneously contribute to making an odour "offensive", an odour goal of 2 OU at the nearest residence (existing or any likely future residences) is appropriate, which generally occurs for affected populations equal or above 2000 people. The EPA odour performance criteria are therefore based on considerations of risk of odour impact rather than on differences in odour acceptability between urban and rural areas.

Odour performance goals for various population densities are outlined in Table 7.5 of the Approved Methods for Modelling (EPA, 2016), and summarised in **Table 3-3**. They are expressed as the 99th percentile value, nose response time average (approximately one second).

For this assessment, an odour performance criteria of 2 OU is adopted.

Table 3-3 EPA odour performance criteria vs. population density

Population of Affected Community	Odour Performance Criteria (OU[1])
Urban area (> 2000)	2
500 – 2000	3
125 – 500	4
30 – 125	5
10-30	6
Single residence (< 2)	7

Source: Approved Methods for Modelling, EPA 2016

Note 1: Odour concentration over a nose response time averaging period (1 second), with permissible frequencies of occurrence at 99th percentile for Level 2 assessments

4. CLIMATE AND DISPERSION METEOROLOGY

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. Emission generation rates are particularly dependent on wind energy and on the moisture budget, which is a function of rainfall and evaporation rates.

A combination of local area observational data and meteorological modelling techniques were used. Details regarding the meteorological modelling are presented in **Section 4.1**.

The following data were used in the meteorological analysis:

- 1-hour average meteorological data and historical climate data from the BoM Automatic Weather Station (AWS) at Penrith Lakes (Station Number 067113) and Richmond RAAF Airport (Station Number 067105) located 2.9 km north-northwest and 17.9 km north-northeast of the Facility respectively.

4.1 Meteorological Modelling

Section 4.1 of EPA (2016) specifies that meteorological data representative of a site can be used in the absence of suitable on-site observations. Data should cover a period of at least one year with a percentage completeness of at least 90%. Site representative data can be obtained from either a nearby meteorological monitoring station or synthetically generated using the CSIRO prognostic meteorological model The Air Pollution Model (TAPM).

As stated, hourly average meteorological data from the BoM Penrith Lakes and Richmond RAAF locations were obtained. Data from the Penrith Lakes AWS was used as the primary resource, with observations from the Richmond RAAF AWS adopted for cloud cover observations.

To supplement these meteorological observation datasets, the CSIRO meteorological model TAPM was used to generate parameters not routinely measured, specifically the vertical temperature profile.

TAPM was configured and run in accordance with the Section 4.5 of the Approved Methods for Modelling, with the following refinements:

- Modelling to 300 m grid cell resolution (beyond 1 km resolution specified).
- Inclusion of high resolution (90 m) regional topography (improvement over default 250 m resolution data).

The TAPM vertical temperature profile for every hour was adjusted by first substituting the predicted 10 m above ground temperature with hourly recorded temperature at 10 m (sourced from the Penrith Lakes AWS). The difference between the TAPM predicted temperature and the measured 10 m temperature was applied to the entire predicted vertical temperature profile. This modified vertical profile was used in combination with the ambient air temperature throughout the day to calculate convective mixing heights between sunrise and sunset.

4.2 Prevailing Wind Regime

A wind rose showing wind speed and direction data recorded at the Penrith Lakes AWS is presented in **Figure 4-1**. The annual recorded wind pattern is dominated by southwesterly airflow. A less common north to east quadrant airflow component is also experienced. The highest wind speeds recorded are most frequently experienced from the south to west quadrant. The average recorded wind speed for 2015 was 2.2 m/s, with a frequency of calm conditions (wind speeds less than 0.5 m/s) occurring in the order of 14% of the time.

Additional inter-annual, seasonal and diurnal wind roses for the Penrith Lakes AWS are provided in **Appendix 1**.

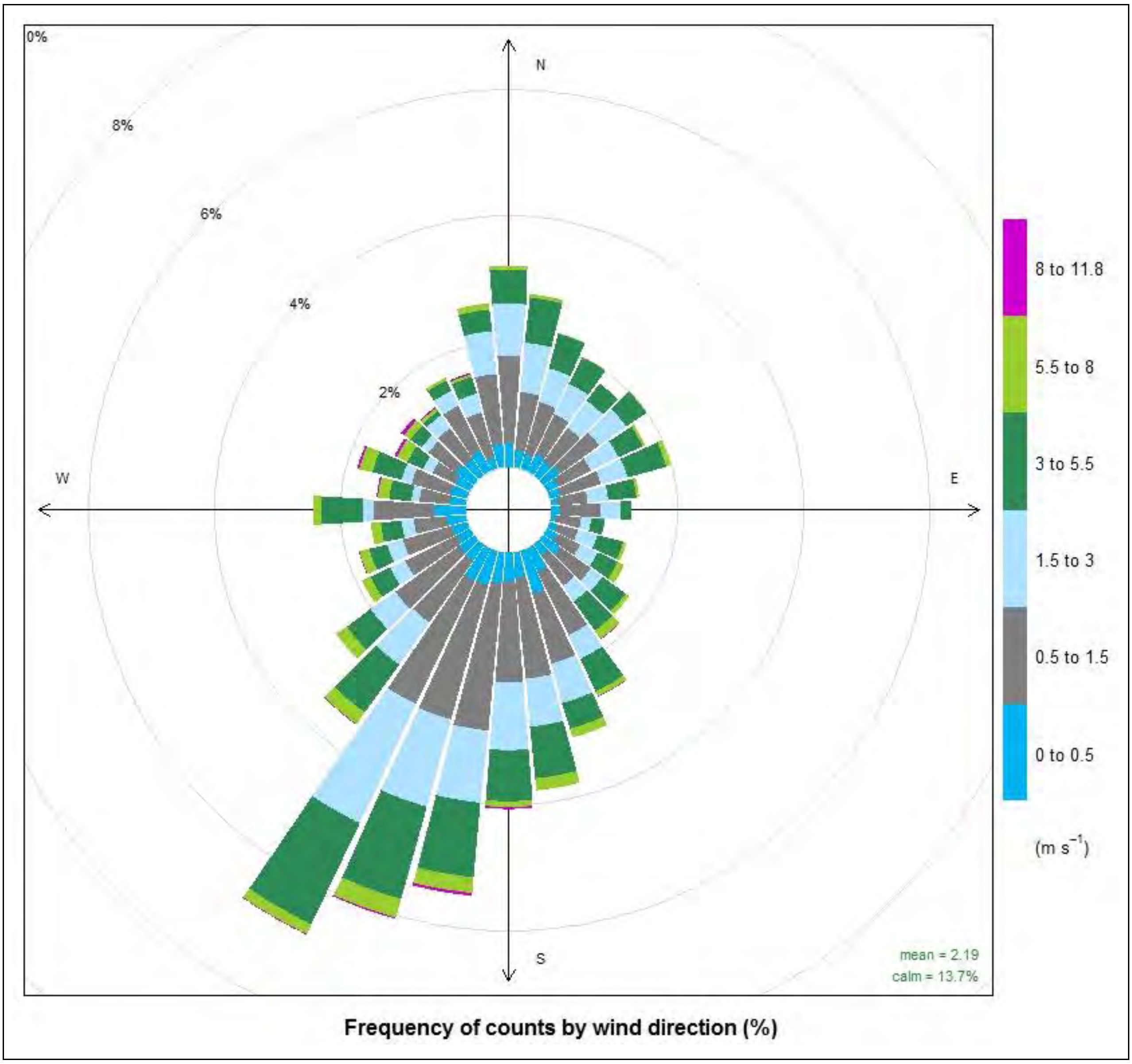


Figure 4-1: Annual Average Wind Rose – Penrith Lakes BoM AWS – 2015

Seasonal and diurnal (dividing the day into night and day) wind roses for the meteorological dataset are presented within **Appendix 1**.

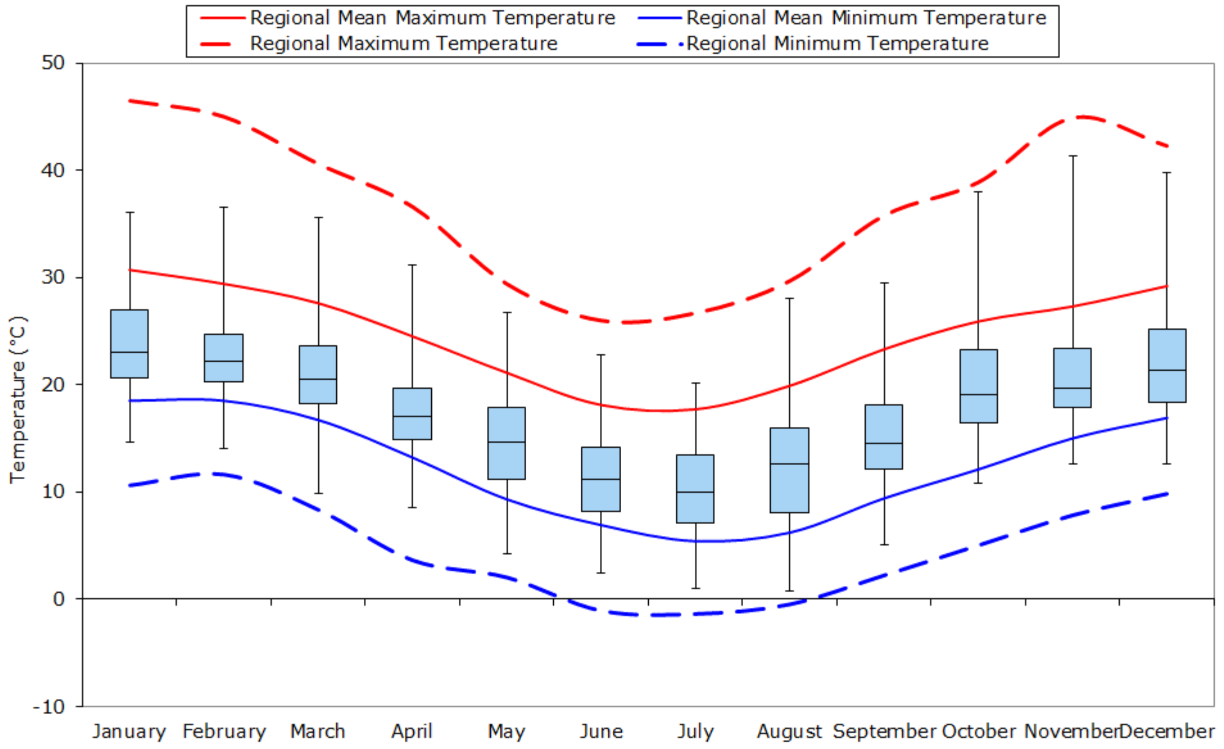
Seasonal variation in wind speed and direction is evident in the recorded data from the Penrith Lakes BoM AWS. The southwesterly airflow is evident in all seasons, with a particular dominance in autumn, winter and spring. The northeasterly airflow is most common in spring and summer. Wind speeds are typically lowest during the autumn and winter months, with the lowest average wind speed and highest occurrence of calm conditions at this time. Wind speeds are highest during the spring and summer months.

Diurnal variation is notable in both recorded wind speed and direction. Wind speeds are higher during the daylight hours than at night. Daylight hours are experience a mixture of north to northeast and southwest aligned airflow. Night time hours experience a dominance of southwesterly air flow.

4.3 Ambient Temperature

Monthly mean minimum temperatures are in the range of 5°C to 19°C, with mean maxima of 18°C to 31°C, based on the long-term average record from the BoM Penrith Lakes climate station. Peaks occur during summer months with the highest temperatures typically being recorded between November and February. The lowest temperatures are usually experienced between June and August.

The 2015 Penrith Lakes BoM temperature dataset has been compared with long-term trends recorded at the Penrith Lakes climate station to determine the representativeness of the dataset. **Figure 4-2** presents the monthly variation in recorded temperature during 2015 compared with the recorded station mean, minimum and maximum temperatures. There is good agreement between temperatures recorded during 2015 and the recorded historical trends, indicating that the dataset is representative of conditions likely to be experienced in the region.



Note: 2015 data from Penrith Lakes are illustrated by the 'box and whisker' indicators. Boxes indicate 25th, median and 75th percentile temperature values while upper and lower whiskers indicate maximum and minimum values. Maximum and minimum temperatures from long-term measurements at Penrith Lakes are depicted as line graphs.

Figure 4-2: Temperature Comparison between Penrith Lakes AWS 2015 dataset and Historical Averages (1995-2016) – Penrith Lakes

4.4 Rainfall

Precipitation is important to air pollution studies since it impacts on dust generation potential and represents a removal mechanism for atmospheric pollutants.

Based on historical data recorded at Penrith Lakes, the area is characterised by moderate rainfall, with a mean annual rainfall of approximately 730mm, and an annual rainfall range between 500mm and 1,010mm. Rainfall is most pronounced in between November and February, with lower rainfall during mid-winter to early spring. According to the long term records, an average of 133 rain days occur per year.

To provide a conservative (upper bound) estimate of the airborne particulate matter concentrations occurring due to the Facility, wet deposition (removal of particles from the air by rainfall) was excluded from the dispersion modelling simulations undertaken in this report.

4.5 Atmospheric Stability

Atmospheric stability refers to the degree of turbulence or mixing that occurs on the atmosphere and is a controlling factor in the rate of atmospheric dispersion of pollutants.

The Monin-Obukhov length (L) provides a measure of the stability of the surface layer (i.e. the layer above the ground in which vertical variation of heat and momentum flux is negligible; typically about 10% of the mixing height). Negative L values correspond to unstable atmospheric conditions, while positive L values correspond to stable atmospheric conditions. Very large positive or negative L values correspond to neutral atmospheric conditions.

Figure 4-3 illustrates the seasonal variation of atmospheric stability derived from the Monin-Obukhov length calculated by AERMET for the Facility. The diurnal profile presented illustrates that atmospheric instability increases during daylight hours as convective energy increases, whereas stable atmospheric conditions prevail during the night-time. This profile indicates that the potential for atmospheric dispersion of emissions would be greatest during day time hours and lowest during evening through to early morning hours.

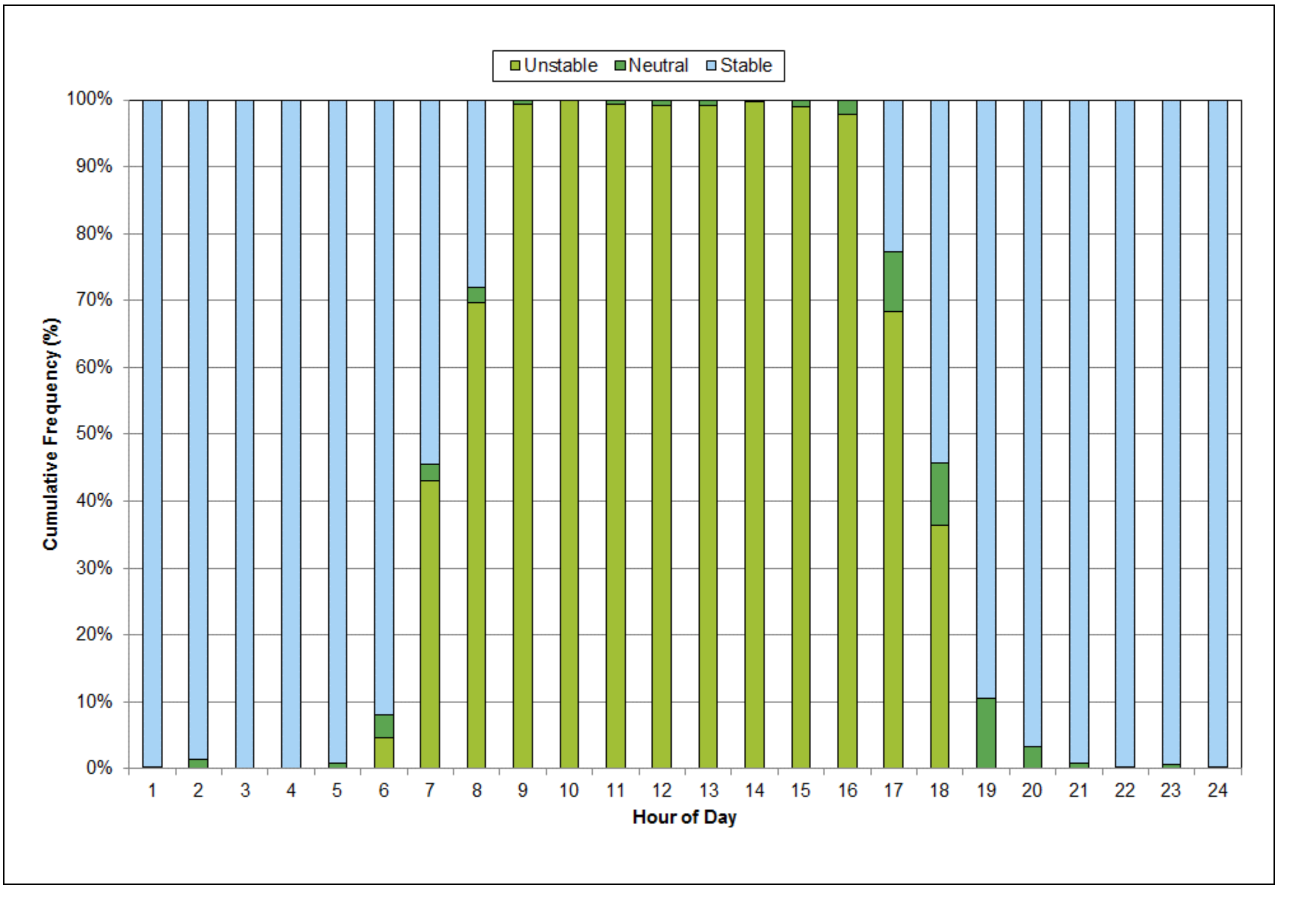
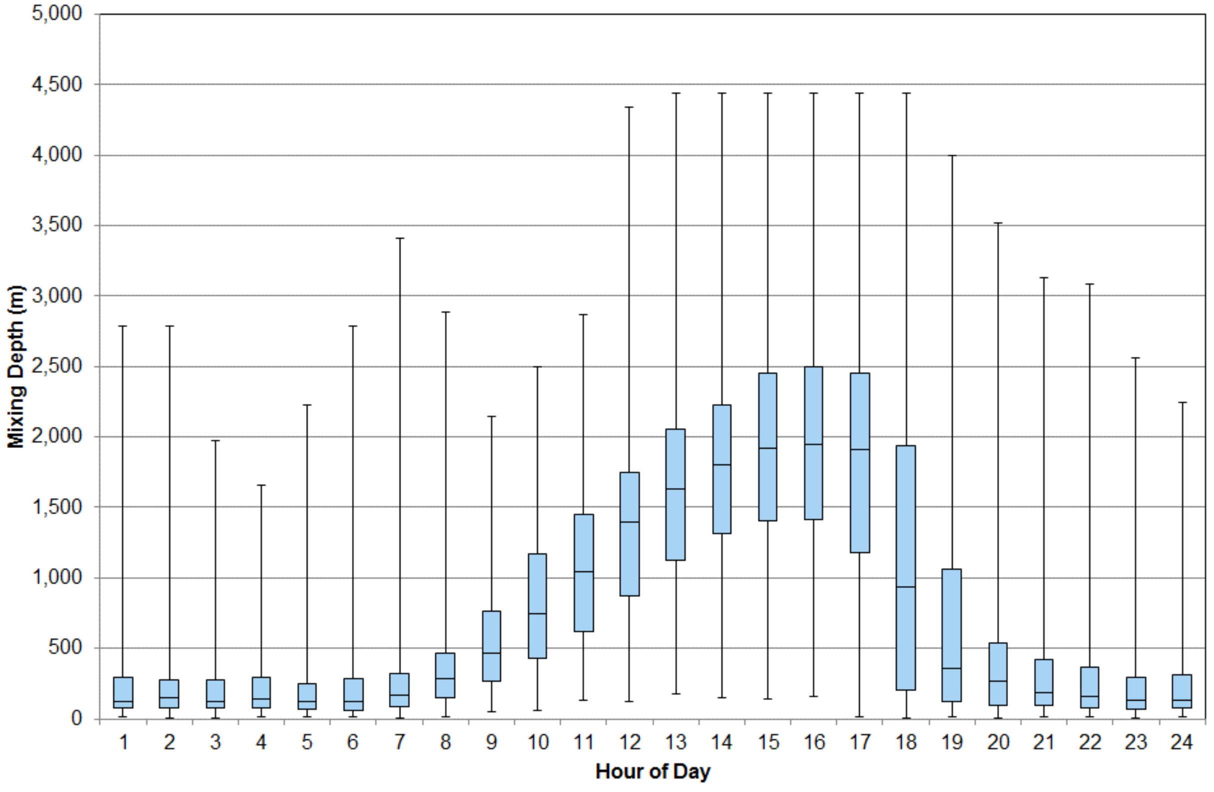


Figure 4-3: AERMET-Calculated Diurnal Variation in Atmospheric Stability– Facility 2015

4.6 Mixing Depth

Hourly-varying atmospheric boundary layer depths were generated for the Facility by AERMET, the meteorological processor for the AERMOD dispersion model (see **Section 7.1** for further information), using a combination of surface observations from the Penrith Lakes BoM AWS, sunrise and sunset times and adjusted TAPM-predicted upper air temperature profile.

The variation in average boundary layer depth by hour of the day for the Facility is illustrated in **Figure 4-4**. It can be seen that greater boundary layer depths are experienced during the day time hours, peaking in the mid to late afternoon. Higher day-time wind velocities and the onset of incoming solar radiation increases the amount of mechanical and convective turbulence in the atmosphere. As turbulence increases so too does the depth of the boundary layer, generally contributing to higher mixing depths and greater potential for atmospheric dispersion of pollutants.



Note: Boxes indicate 25th, Median and 75th percentile of AERMET-calculated mixing height data while upper and lower whiskers indicate maximum and minimum values.

Figure 4-4: AERMET-Calculated Diurnal Variation in Atmospheric Mixing Depth – Facility

5. EXISTING AIR QUALITY ENVIRONMENT

The quantification of cumulative air pollution concentrations and the assessment of compliance with ambient air quality limits necessitate the characterisation of baseline air quality. Given that particulate matter emissions represent the primary pollutant of concern generated by the proposed Facility, it is pertinent that existing sources and ambient air pollutant concentrations of these pollutants are considered.

5.1 Existing sources of atmospheric emissions

The National Pollutant Inventory (NPI) database identifies 11 reporting sources of air pollution emissions in the surrounding 10km from the site. Of those, the industrial activities listed in **Table 5-1** are reported to contribute emissions of particulate matter to the local environment.

Table 5-1 Neighbouring air pollution emission sources – NPI database

Industry Name	Location	Activities	Distance / direction from the Facility
Boral Emu Plains Quarry	Emu Plains	Crushing, grinding and separating works.	1km west-northwest
Chemcolour Industries Australia Pty Ltd	St Marys	Chemical manufacturing	7.5km east
National Foods Milk Penrith	Penrith	Receival, processing, packaging and distribution of liquid whole and modified milk products.	0.5km southeast
O-I Sydney Plant (Owens Illinois)	Penrith	Manufacture and supply of glass containers for beverages and food. Technologies include furnaces, forming, annealing, surface treatment, automatic product inspection and packaging.	1.8km northeast
Rocla Emu Plains	Emu Plains	Concrete products manufacture	2km west

In addition to the above operations, the surrounding local industrial zones contain smaller particulate matter emission sources such as concrete batching plants and scrap metal recycling facilities. Finally, it is considered that the following sources also contribute to particulate matter emissions in the vicinity of the proposed Facility:

- Dust entrainment and tyre and break wear due to vehicle movements along public roads;
- Petrol and diesel emission from vehicle movements along public roads;
- Wind generated dust from exposed areas within the surrounding region;
- Seasonal emissions from household wood burning fires;
- Sea salts contained in sea breezes.

More remote sources which contribute episodically to suspended particulates in the region include dust storms and bushfires. Whereas dust storms predominately contribute primary particulates from mechanical attrition, bushfires are a source of fine particulates including both primary particulates and secondary particulates formed by atmospheric gas to particle conversion processes.

5.1.1 Neighbouring materials recycling facilities

Annual particulate matter emissions for the 2014-2015 reporting period each of the NPI-reporting facilities are presented in **Table 5-1**. The NPI database only presents emissions of PM_{10} and $PM_{2.5}$. To estimate TSP emissions, a simple assumption that PM_{10} equates to 50% of TSP emissions has been made for the Boral Emu Plains Quarry, O-I Sydney Plant and Rocla Emu Plains operations. Due to the fact that PM_{10} and $PM_{2.5}$ emissions are equal for the Chemcolour Industries and National Foods facilities, it is assumed that TSP emissions are also equal, however given the low relative magnitude of reported particulate emissions from these two facilities, this assumption is not considered critical.

Table 5-2: Annual particulate matter emissions – neighbouring NPI-reporting facilities

Facility	Annual emissions (kg/year)		
	TSP	**PM_{10}**	**$PM_{2.5}$**
Boral Emu Plains Quarry	237,608	118,804	4,679
Chemcolour Industries Australia Pty Ltd	61	61	61
National Foods Milk Penrith	109	109	109
O-I Sydney Plant (Owens Illinois)	95,540	47,770	2,620
Rocla Emu Plains	44,077	22,038	182

Ground level concentrations and deposition rates arising from these NPI-reporting facilities were predicted through the dispersion model established to assess emissions from the site (see **Section** 7). In the absence of source characteristics, source locations or operational details, emissions were evenly distributed across each site through the use of volume sources in the dispersion model. Emissions were released on a continuous basis. On this basis, the results of the modelling should be viewed as conservatively high, in particular for 24-hour average predictions. Model predictions of TSP, PM_{10} and $PM_{2.5}$ at each of the selected sensitive receptors are presented in **Table 5-3**.

Table 5-3 Incremental particulate matter concentration results – neighbouring NPI-reporting facilities

Receptor ID	Incremental concentrations due to neighbouring NPI-reporting facilities				
	TSP Annual Average µg/m³	PM_{10} Maximum 24-hr µg/m³	PM_{10} Annual Average µg/m³	$PM_{2.5}$ Maximum 24-hr µg/m³	$PM_{2.5}$ Annual Average µg/m³
R1*	5.3	7.1	2.7	0.3	0.1
R2*	5.2	6.9	2.6	0.3	0.1
R3*	4.9	6.5	2.5	0.3	0.1
R4*	5.0	6.6	2.5	0.3	0.1
R5*	5.2	6.9	2.6	0.3	0.1
R6*	5.6	7.6	2.8	0.3	0.1
R7*	5.8	7.9	2.9	0.3	0.1
R8*	5.6	7.5	2.8	0.3	0.1
R9*	5.5	7.3	2.7	0.3	0.1
R10*	5.5	7.4	2.7	0.3	0.1
R11	3.7	4.7	1.9	0.2	0.1
R12	3.5	4.3	1.8	0.2	0.1
R13	4.4	5.9	2.2	0.3	0.1
R14	5.4	7.7	2.7	0.3	0.1
R15	15.2	20.5	7.6	0.8	0.3
R16	8.9	12.7	4.5	0.5	0.2
R17	4.6	6.8	2.3	0.3	0.1

Note: * denotes industrial/commercial receptor

The particulate matter predictions from these NPI-reporting sources are combined with the ambient monitoring data (see subsequent sections) and site-only increment model predictions (**Section 8**) to assess cumulative impacts at surrounding receptor locations.

5.2 Background PM_{10} and $PM_{2.5}$

Ambient PM_{10} and $PM_{2.5}$ concentrations are recorded by the NSW OEH at a number of monitoring stations across western Sydney. The closest monitoring station to the site is located at St Marys, approximately 9km to the southwest. With regards to particulate matter monitoring, the St Marys station only records concentrations of PM_{10}. The closest NSW OEH monitoring station that records $PM_{2.5}$ concentrations is located at Richmond, approximately to the 15km north-northeast. In the absence of site specific monitoring data, daily-varying concentrations of PM_{10} (St Marys) and $PM_{2.5}$ (Richmond) have been collated for the period between 2010 and 2015.

The daily varying (24-hour average) PM_{10} and $PM_{2.5}$ concentrations recorded at the St Marys and Richmond monitoring stations are illustrated in **Figure 5-1** and **Figure 5-2** respectively.

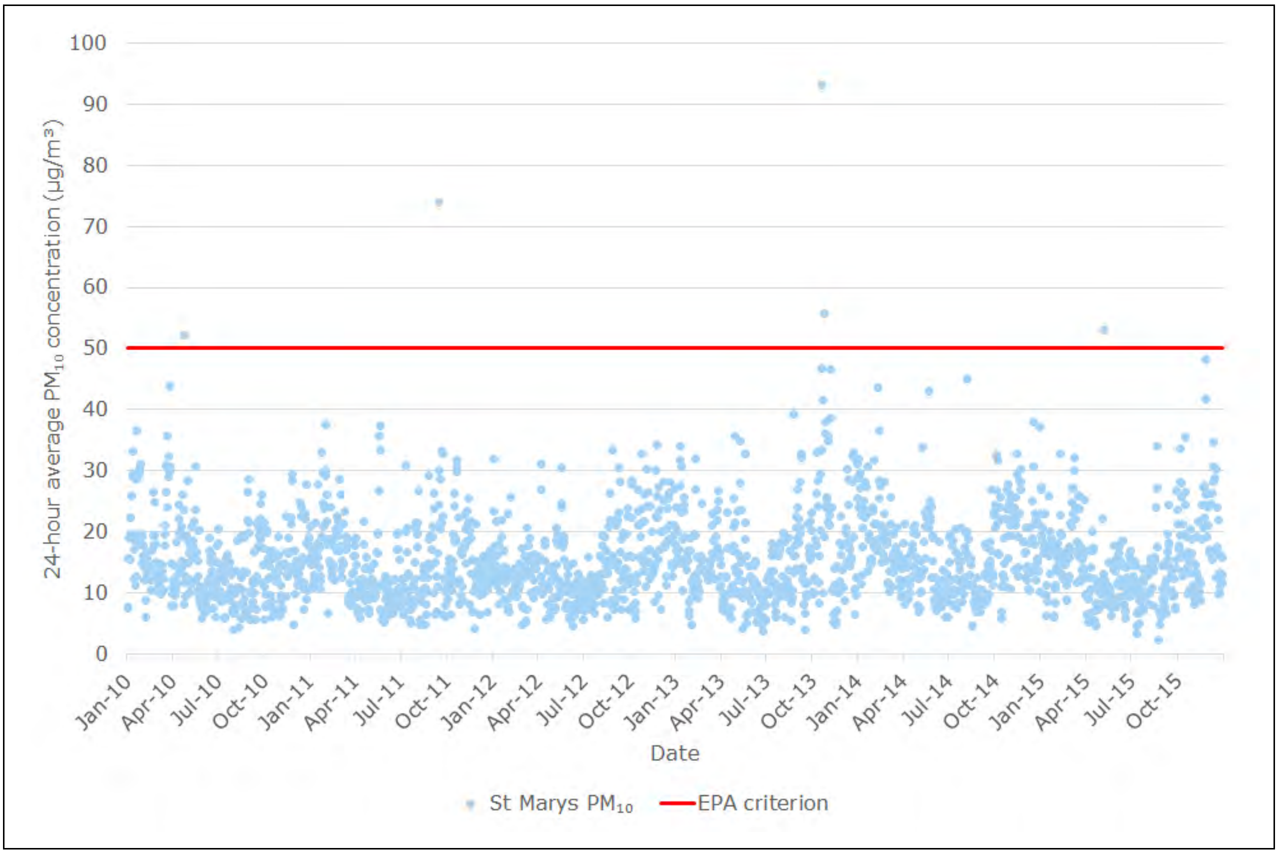


Figure 5-1: Time-series of 24-hour Average PM_{10} Concentrations recorded at NSW OEH St Marys station – 2010 to 2015

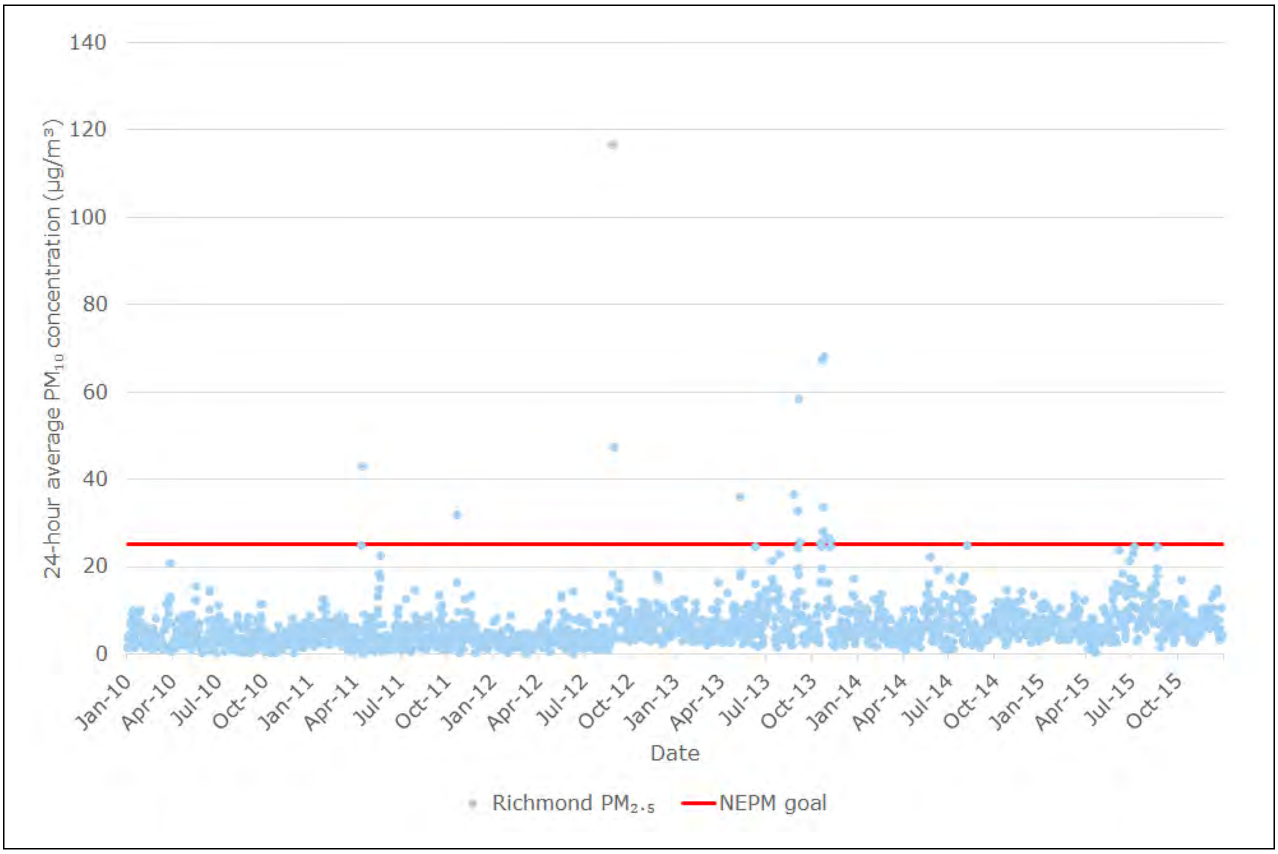


Figure 5-2: Time-series of 24-hour Average $PM_{2.5}$ Concentrations recorded at NSW OEH Richmond – 2010 to 2015

It can be seen from the **Figure 5-1** and **Figure 5-2** that both PM_{10} and $PM_{2.5}$ concentrations fluctuate on a daily basis throughout the presented period. Occasional exceedances of the NSW EPA criterion (PM_{10}) and NEPM goal ($PM_{2.5}$) occur, attributable to regional-scale events such as bushfires, hazard reduction burns and dust storms. The number of days per year where the recorded concentration exceeded the applicable criteria at each station is listed in **Table 5-4**. It can be seen that the greatest number of exceedance days occurred in 2013, which was notable for widespread bushfire activity across NSW.

Table 5-4: Number of criteria exceedance days for St Marys (PM_{10}) and Richmond ($PM_{2.5}$) NSW OEH monitoring stations - 2010 to 2015

Year	**PM_{10} (St Marys)**	**$PM_{2.5}$ (Richmond)**
2010	1	0
2011	1	2
2012	0	2
2013	2	14
2014	0	0
2015	1	0

Percentile statistics of the data recorded between 2010 to 2015 at the NSW OEH St Marys (PM_{10}) and Richmond ($PM_{2.5}$) monitoring stations are presented in **Table 5-5**.

Table 5-5: PM_{10} and $PM_{2.5}$ monitoring data statistics – NSW OEH St Marys (PM_{10}) and Richmond ($PM_{2.5}$) monitoring stations - 2010 to 2015

Statistic	**PM_{10} (St Marys)**	**$PM_{2.5}$ (Richmond)**
Maximum	93.0	116.7
99.9^{th} percentile	55.4	66.4
99.5^{th} percentile	43.2	30.0
99^{th} percentile	36.5	24.6
90^{th} percentile	24.5	10.8
75^{th} percentile	18.8	7.7
50^{th} percentile	13.9	5.1
Period Average	15.3	6.1

The frequency distribution of recorded PM_{10} and $PM_{2.5}$ concentrations between 2010 and 2015 are illustrated in **Figure 5-3** and **Figure 5-4** respectively. These figures show that PM_{10} concentrations in the region were below 30µg/m^3 approximately 96% of the time, while $PM_{2.5}$ concentrations were below 15µg/m^3 approximately 97% of the time between 2010 and 2015.

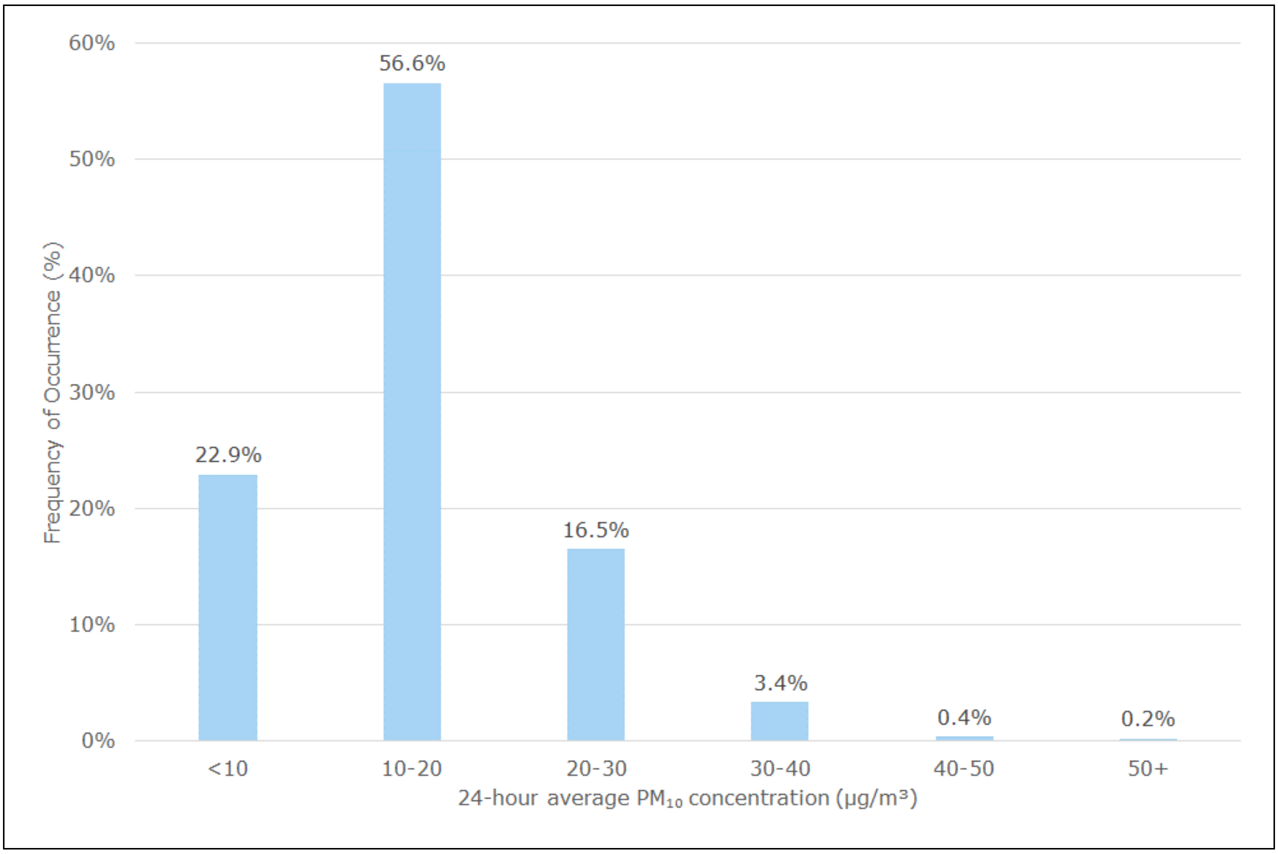


Figure 5-3: Frequency distribution of 24-hour Average PM_{10} Concentrations recorded at NSW OEH St Marys station – 2010 to 2015

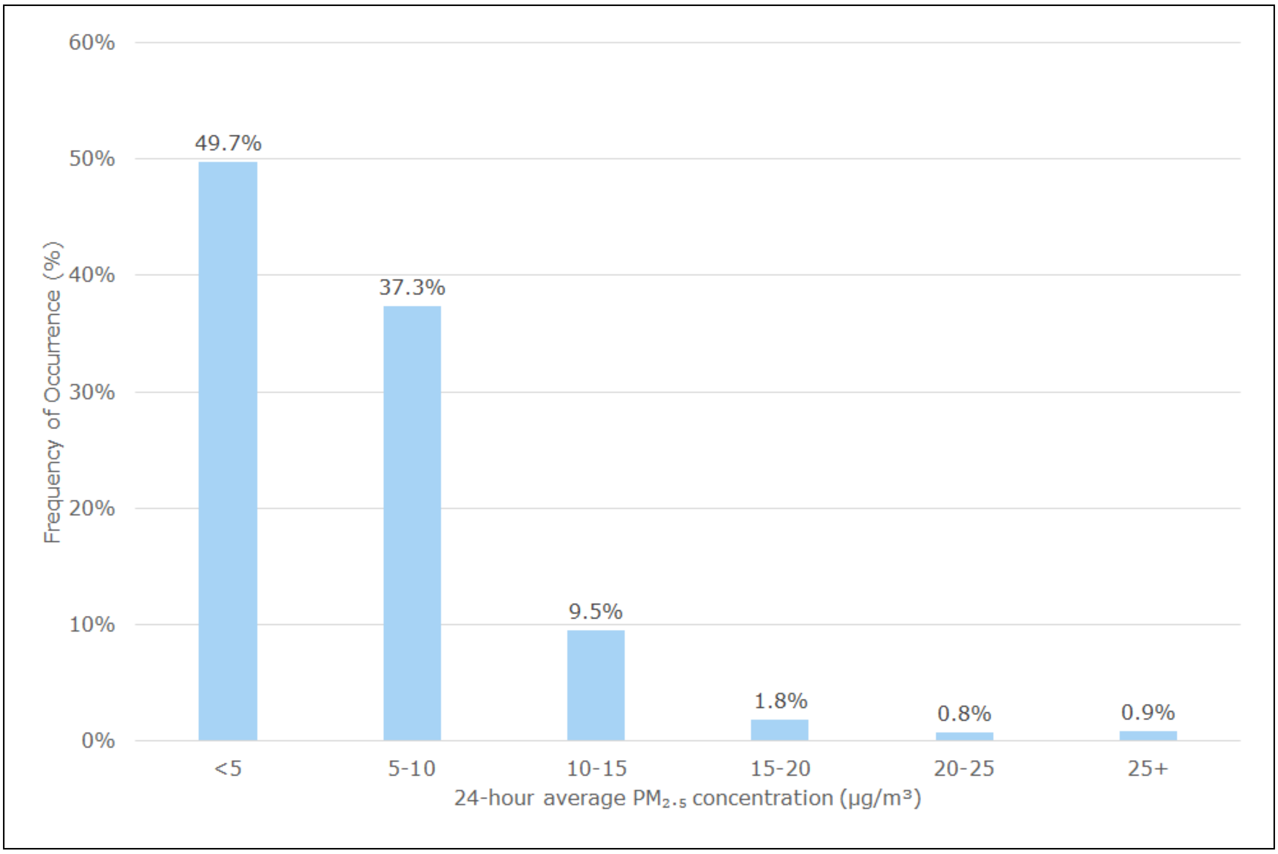


Figure 5-4: Frequency distribution of 24-hour Average $PM_{2.5}$ Concentrations recorded at NSW OEH Richmond – 2010 to 2015

The annual average PM_{10} and $PM_{2.5}$ concentrations for the 2010 to 2015 period were 15.3µg/m^3 and 6.1µg/m^3 respectively.

5.3 Background TSP

Historically, the NSW OEH recorded concurrent 24-hour average TSP and PM_{10} concentrations on a one-in-six day sampling regime in the Sydney Metropolitan Region, with this monitoring discontinuing in 2004. NSW OEH quarterly air quality monitoring reports for 2003 and 2004 were reviewed for concurrent PM_{10} and TSP concentrations. This data highlighted that on average, the ratio of PM_{10} to TSP concentrations was approximately 0.48. In the absence of local TSP monitoring data, the PM_{10}/TSP relationship from the 2003-2004 NSW OEH monitoring reports has been applied to the St Marys PM_{10} monitoring data (**Section 5.2**). The annual average TSP concentration adopted as background is therefore 31.9µg/m^3.

5.4 Background Dust Deposition

There is no dust deposition monitoring data available suitable to quantify baseline levels in the local area surrounding the site. Modelling has therefore focussed on the incremental contribution from proposed operational emissions only. This is suitable for assessment against the NSW EPA incremental criterion of 2g/m^2/month, expressed as an annual average.

6. OPERATIONAL EMISSIONS ESTIMATION

Fugitive dust sources associated with the operation of the Facility were principally quantified through the application of emission estimation techniques (specifically the United States Environmental Protection Agency (US-EPA) AP-42 Chapter 13.2.4 – Aggregate Handling and Storage Piles (US-EPA 2006). Particulate matter emissions were quantified for each particle size fraction, with the TSP size fraction also used to provide an indication of dust deposition rates. Fine and course particulate matter (PM_{10} and $PM_{2.5}$) were estimated using ratios for the different particle size fractions available within the literature (principally the US-EPA AP-42).

6.1 Sources of Operational Emissions

Air emissions associated with the Facility would primarily comprise fugitive particulate matter releases. Potential sources of emission were identified as follows:

- Vehicle entrainment of particulate matter due to the haulage of material along the sealed surface of the Facility;
- Unloading of material to the raw material storage areas in the yard;
- Handling and transfer of raw material to the processing shed hopper;
- Screening plant operations within the main shed;
- Loading and transfer of screened material to stockpiles;
- Loading of product to truck for dispatch;
- Odour emissions from the storage of certain materials (assumed to be 100% green waste for this assessment - see **Section 6.5**);
- Diesel fuel combustion by on-site plant and equipment; and
- Wind erosion associated with stockpiled materials.

6.2 Emission Scenario

A single emissions scenario, focusing on peak Facility operations, has been assessed in this report to quantify maximum potential impacts in the surrounding environment. Construction emissions would be negligible for the site and have not been considered further in this assessment.

Details on the assumptions made for the operational scenario are listed within **Appendix 2**.

6.3 Emission Reduction Factors

Benedict Recycling propose to install misters inside the shed and an automatic sprinklers system in the external areas that will dampen all working and trafficable areas. The screening plant will be contained with the shed at the site. The shed is enclosed on all sides and has a roller door facing the yard that will be open all day. Therefore, only a partial enclosure control factor can be applied.

On the basis of the above information, the following emission reduction factors were applied to account for proposed controls at the Facility:

- Screening plant and screened material handling within the shed – 70% reduction for enclosure (NPI, 2012); and
- Water spraying at stockpiles, screening plant and material handling - 50% reduction for water sprays (NPI, 2012).

6.4 Particulate Matter Emissions

A summary of Facility-related emissions by source type is presented in **Table 6-1** and illustrated in **Figure 6-1**. Control measures proposed for implementation, as documented in **Section 6.3**, have been taken into account in the emission estimates.

Table 6-1 and **Figure 6-1** highlight that, for proposed operations, the most significant source of emissions are associated with screening activities in the main shed, truck movements on paved surfaces and diesel combustion emissions. Further details regarding emission estimation factors and assumptions are provided in **Appendix 2**.

Table 6-1 Calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions

Emissions source	Calculated emissions (kg/annum) by Source		
	TSP	PM_{10}	$PM_{2.5}$
Material delivery - truck	116.7	22.4	5.4
Material delivery - cars	34.8	6.7	1.6
Truck unloading - yard	135.0	49.5	7.4
Raw material handling - yard	135.0	49.5	7.4
Material transfer to shed - FEL	73.8	14.2	3.4
Raw material hopper loading - shed	135.0	49.5	7.4
Screening - shed	337.5	116.1	21.5
Screened material handling - shed	40.5	14.9	2.2
Stockpile loading – yard	135.0	49.5	7.4
Dispatch truck loading	135.0	49.5	7.4
Material transportation from site	28.5	5.5	1.3
Wind erosion - exposed surfaces and stockpiles	55.3	27.6	4.1
Diesel combustion	272.1	272.1	249.4
Total	**1,634.1**	**726.9**	**326.2**

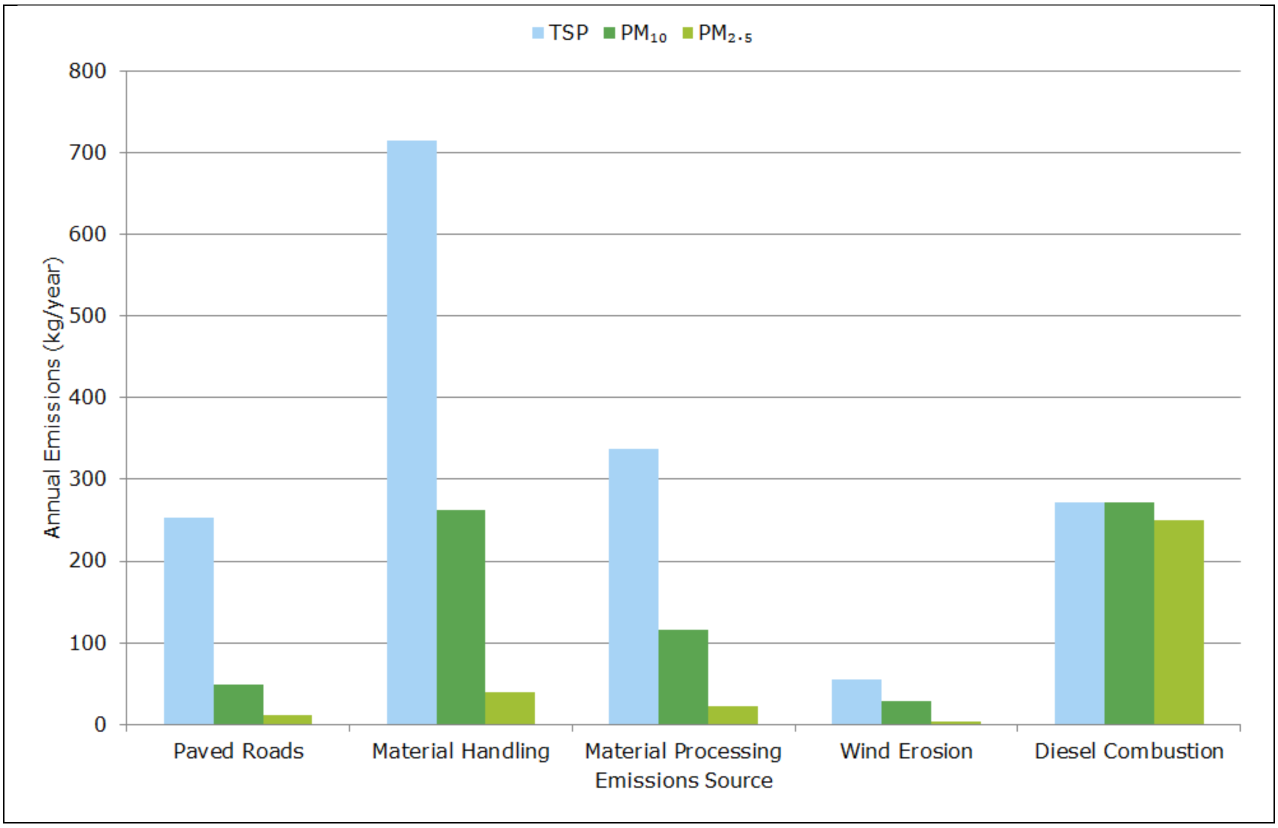


Figure 6-1: Comparison of calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions by source type

6.5 Odour Emissions

The majority of material received by the facility will be inert construction, demolition, commercial and industrial wastes. The proposed facility will not accept odour generating materials, such as putrescible wastes, and will not generate odours onsite, such as through the composting of green waste. Only small amounts of green waste will be stockpiled and measures will be implemented to prevent vegetation waste (including green waste) composting. Therefore, very little or no odour will be emitted from the facility.

However, the SEARs require "a quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines". Some level of odour emission needed to be assumed to enable a quantitative assessment to be prepared.

Nevertheless, odour emissions have been quantified for this assessment for the waste streams with the highest odour potential, being green waste, although only small quantities will be delivered to the site and there will be no composting on site.

To quantify odour emission rates from the storage of odourous materials, a literature review of recent odour impact assessments involving green waste storage in NSW was undertaken. A summary of relevant odour emission rates are presented in **Table 6-2**.

Table 6-2 Odour Emission Rates – Green Waste Storage

Site	Specific Odour Emission Rate ($OU.m^3/m^2/second$)	Type	Reference
SITA Kemps Creek	0.134	Greenwaste area	Holmes Air Science, 2007
Spring Farm Advanced Resource Recovery Technology Facility	1.279	Greenwaste area	Pacific Environment, 2013
Veolia Camellia Recycling Facility	0.28	Dry Waste	CH2M Hill, 2013
Euchareena Road Resource Recovery	0.2	Green waste delivery bays	Heggies, 2009

It can be seen from the odour emissions rates presented in **Table 6-2** that a range of variability exists for green waste storage. The maximum odour emission rate presented in **Table 6-2**, 1.279$OU.m^3/m^2$/second, will be adopted in this assessment as a conservative assumption.

In order to quantify odour emissions, an assumed total green waste stockpile area 450m^3 (three 150m^3 stockpiles) has been assumed. This assumption is highly conservative, as the site will only stockpile a maximum of one 150m^3 of green waste at any given time.

7. OPERATIONS ASSESSMENT METHODOLOGY

7.1 Dispersion Model Selection and Application

The atmospheric dispersion modelling completed within this assessment used the AMS/US-EPA regulatory model (AERMOD) (US-EPA, 2004). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

Predicted concentrations were calculated for a regular Cartesian receptor grid covering a 2 km by 2 km computational domain centred over the proposed Facility, with a grid resolution of 50 m applied. Additionally, concentrations were predicted at the sensitive receptor locations listed in **Table 2-3**.

Simulations were undertaken for the 12 month period of 2015 using the AERMET-generated file based largely on the Penrith Lakes AWS meteorological monitoring dataset as input (see **Section** 4 for description of input meteorology).

7.2 Modelling Scenarios

As identified in **Section 6**, a single emission scenario has been developed to estimate peak operational emissions of TSP, PM_{10}, $PM_{2.5}$ and odour from the proposed Facility. The air dispersion modelling has predicted ground-level concentrations and deposition rates for this scenario.

7.3 Source and Emissions Data

The methodology and results of the emissions inventory developed for this study are presented in **Section 6** and **Appendix 2**. The spatial allocation of emissions was based on the layout of the proposed Facility presented in **Figure 2-2**. Material handling and wind erosion emissions were varied by wind speed, with higher emissions occurring during periods of higher wind speed.

7.4 Presentation of Model Results

Dispersion simulations were undertaken to predict the concentrations of TSP, PM_{10} $PM_{2.5}$, odour and dust deposition. Incremental Facility-related concentrations and deposition rates occurring due to the proposed operations were modelled. Model results are expressed as the maximum predicted concentration for each averaging period at the selected assessment locations over the 2015 modelling period.

The results are presented in the following formats:

- Tabulated results of particulate matter concentrations and dust deposition rates at the selected assessment locations are presented and discussed in **Section 8**.
- Isopleth plots, illustrating spatial variations in Facility-related incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates are provided in **Appendix 3**. Isopleth plots of the maximum 24-hour average concentrations presented in **Appendix 3** do not represent the dispersion pattern on any individual day, but rather illustrate the maximum daily concentration that was predicted to occur at each model calculation point given the range of meteorological conditions occurring over the 2015 modelling period.

Odour impacts are expressed as a 99^{th} percentile 1-second average (nose response) concentration for comparison with the EPA odour performance criterion of 2 OU. Predicted 1-hour average concentrations were converted to nose response averages using the peak-to-mean ratio of 2.3, as per Table 6.1 of the NSW EPA Approved Methods for Modelling.

7.5 Cumulative impacts assessment

Cumulative impacts in the environment surrounding the Facility have been assessed in the following way:

- For each hour of the modelling period, predicted incremental concentrations from the Facility and neighbouring NPI-reporting emission sources have been paired in time at each sensitive receptor location;
- For 24-hour average PM_{10} and $PM_{2.5}$, each project plus NPI predicted concentration has been paired with every individual 24-hour average recorded PM_{10} and $PM_{2.5}$ concentration in the NSW OEH St Marys and Richmond 2010 to 2015 monitoring datasets (**Section 5.2**). A frequency analysis of potential cumulative PM_{10} and $PM_{2.5}$ was derived and compared with ambient background to determine potential frequency of any criterion exceedance (further discussion in **Section 8.2**).
- For annual average pollutants, the annual average project plus NPI predicted concentration is paired with the applicable ambient annual average background concentration (**Section 5.2** and **Section 5.3**).

8. DISPERSION MODELLING RESULTS

8.1 Incremental (site-only) results

Predicted incremental TSP, PM_{10}, $PM_{2.5}$ and odour concentrations and dust deposition rates from Facility operations are presented in **Table 8-1** for each of the selected receptor locations.

It can be seen from the results presented in **Table 8-1**, all pollutants and averaging periods are below the applicable NSW EPA assessment criterion at all neighbouring receptors. Predicted concentrations are negligible at all surrounding residential and recreational receptors (receptors 11 to 17).

It is noted however that, with the exception of dust deposition and odour, the applicable assessment criteria are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in **Section 8.2**.

To further illustrate the magnitude of short-term impacts arising from the facility, the frequency of occurrence of facility-only 24-hour average PM_{10} and $PM_{2.5}$ concentrations is illustrated in **Figure 8-1** and **Figure 8-2**. It can be seen from these figures that predicted 24-hour average concentrations at all selected receptor locations are typically lower than 5µg/m³ for PM_{10} and 2.5µg/m³ for $PM_{2.5}$. Receptors 5 and 10, the closest receptors to the eastern and northern boundaries respectively, are typically lower than 10µg/m³ for PM_{10} and 5µg/m³ for $PM_{2.5}$.

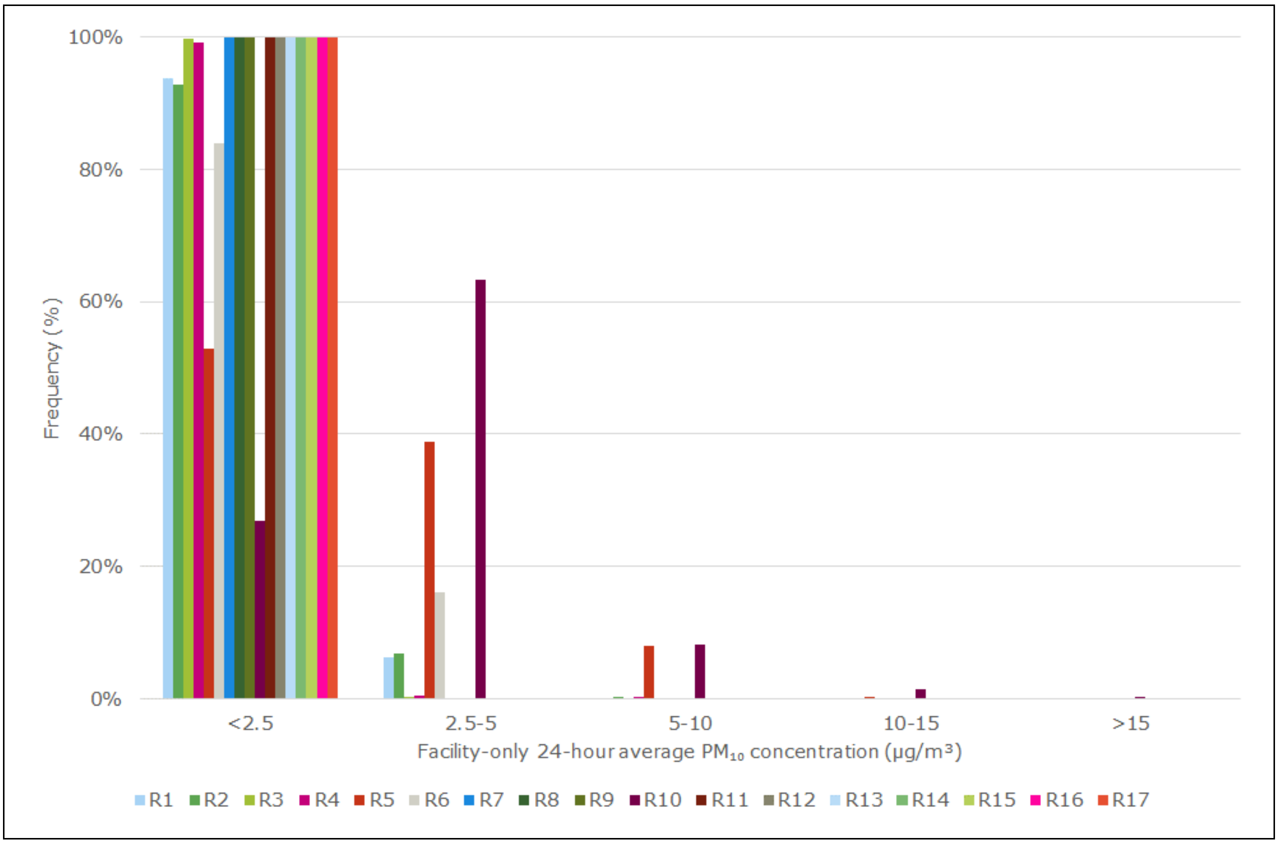


Figure 8-1: Frequency of facility-only incremental 24-hour average PM_{10} concentrations at surrounding receptor locations

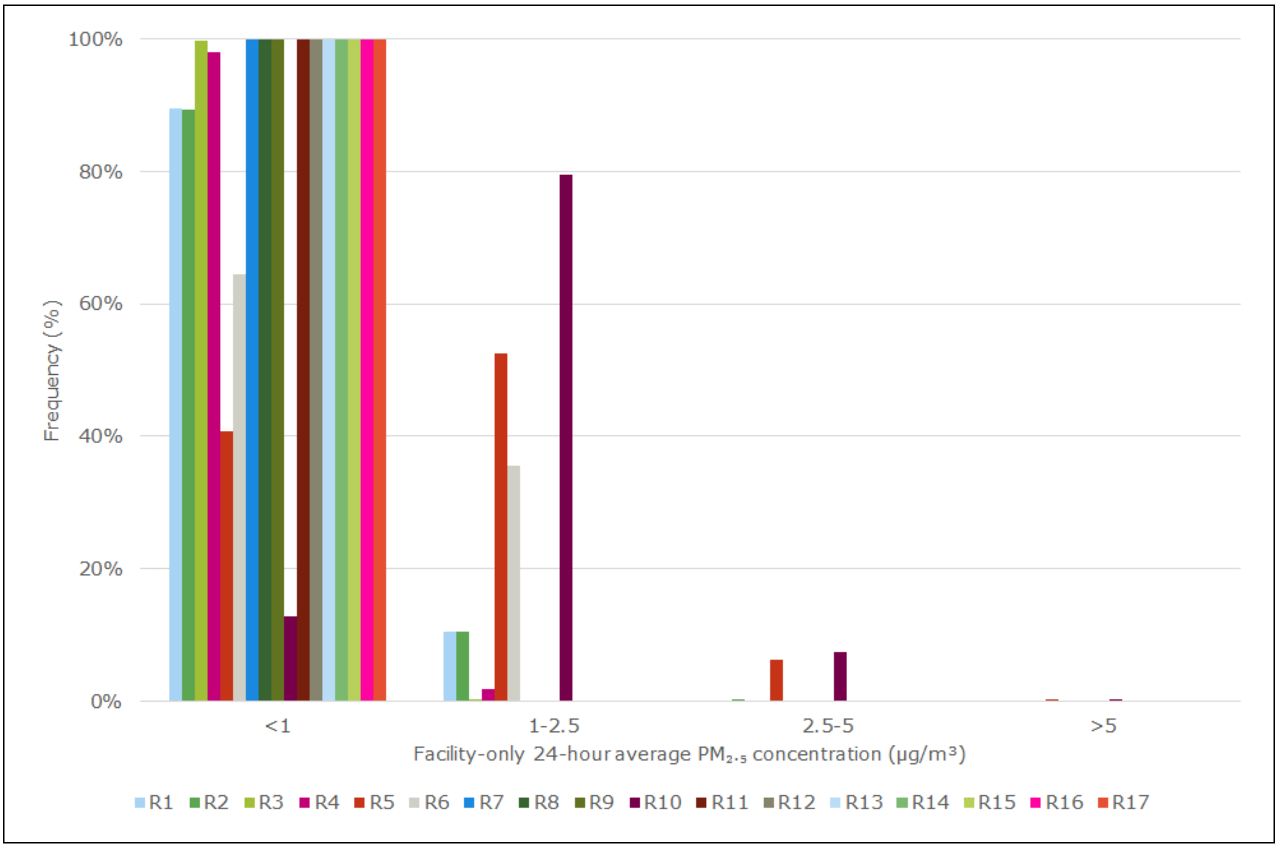


Figure 8-2: Frequency of facility-only incremental 24-hour average $PM_{2.5}$ concentrations at surrounding receptor locations

Table 8-1 Incremental (facility-only) concentration and deposition results

Receptor ID	Incremental Concentration/Deposition due to Facility						
	TSP Annual Average µg/m³	PM_{10} Maximum 24-hr µg/m³	PM_{10} Annual Average µg/m³	$PM_{2.5}$ Maximum 24-hr µg/m³	$PM_{2.5}$ Annual Average µg/m³	Deposition - Annual Average g/m²/month	Odour - 99th Percentile 1-second (OU)
Criteria+	**90**	**50**	**25**	**25**	**8**	**2**	**2**
R1*	3.2	4.6	1.3	1.8	0.6	0.5	1
R2*	3.0	6.6	1.2	2.7	0.6	0.5	1
R3*	1.2	2.7	0.5	1.2	0.2	0.2	<1
R4*	1.5	5.3	0.6	2.3	0.3	0.2	<1
R5*	6.7	11.5	2.8	5.2	1.3	1.1	1
R6*	4.7	4.6	1.9	2.2	0.9	0.8	1
R7*	1.7	1.7	0.7	0.8	0.3	0.3	1
R8*	1.7	2.0	0.7	0.9	0.3	0.3	1
R9*	1.7	1.9	0.7	0.9	0.3	0.3	1
R10*	7.8	17.2	3.4	5.7	1.5	1.4	1
R11	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
R12	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<1
R13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
R14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
R15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
R16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
R17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1

+ – Criteria for TSP, PM_{10} and $PM_{2.5}$ are applicable to cumulative concentrations.

* - Commercial/industrial receptor location

8.2 Cumulative (site + neighbouring sources + ambient background) results

8.2.1 24-hour average concentrations

Cumulative impacts for 24-hour average PM_{10} and $PM_{2.5}$ have been evaluated using a statistical approach which presents the likelihood of the proposed site operations causing additional exceedances of the 24-hour average assessment criteria of 50µg/m^3 and 25µg/m^3 for PM_{10} and $PM_{2.5}$ respectively. To provide an analysis of the likelihood of compliance with the NSW EPA assessment criterion for 24-hour average PM_{10} (50 µg/m^3) and $PM_{2.5}$ (25 µg/m^3), every predicted 24-hour average concentration (365 individual concentrations) has been paired with every recorded 24-hour average concentration detailed in **Section 5** (2,146 for PM_{10}, 2,087 for $PM_{2.5}$).

Each combination of model prediction and recorded concentration (783,290 potential combinations for PM_{10}; 761,755 potential combinations for $PM_{2.5}$) has been collated. The process assumes that any background value from the data set could occur on any given day of the proposed operations.

In order to determine the likelihood of criteria exceedance for cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations, the frequency of occurrence of criteria exceedance for the following have been compared:

- Existing ambient concentrations (NSW OEH St Marys and Richmond datasets);
- Existing ambient + model predicted NPI-sources concentrations; and
- Existing ambient + model predicted NPI + model predicted project operational concentrations.

These three frequency values are illustrated in **Figure 8-3** and **Figure 8-4** for PM_{10} and $PM_{2.5}$ concentrations respectively. The frequency of exceedance and increase in days of exceedance attributable to proposed site operations emissions are presented in **Table 8-2** and **Table 8-3** for PM_{10} and $PM_{2.5}$ concentrations respectively.

The results of the frequency analysis for cumulative PM_{10} and $PM_{2.5}$ concentrations highlight the following points:

- For cumulative 24-hour average PM_{10}, the frequency of additional exceedance is equivalent to 0.7 days day per year or less at all commercial/industrial receptors, and zero for all residential receptor locations; and
- For cumulative 24-hour average $PM_{2.5}$, the frequency of additional exceedance is equivalent to 1.6 days day per year or less at all commercial/industrial receptors, and zero for all residential receptor locations. The frequency analysis for cumulative 24-hour average $PM_{2.5}$ indicates that receptors 1, 2, 5, 6 and 10 could experience an additional exceedance day per year.

The cumulative frequency analysis therefore indicates that emissions from the proposed facility are unlikely to result in an additional exceedance for 24-hour average PM_{10} in the surrounding environment. Emissions of $PM_{2.5}$ may result in an increase in exceedance by one day per year at the receptors immediately adjacent to site boundary, with no increase in exceedance predicted at receptors further afield. It is noted that the surrounding receptors are commercial/industrial and exposure continuously over 24-hours at these locations will not occur.

The potential for cumulative impacts above the applicable criteria in the surrounding environment is therefore negligible.

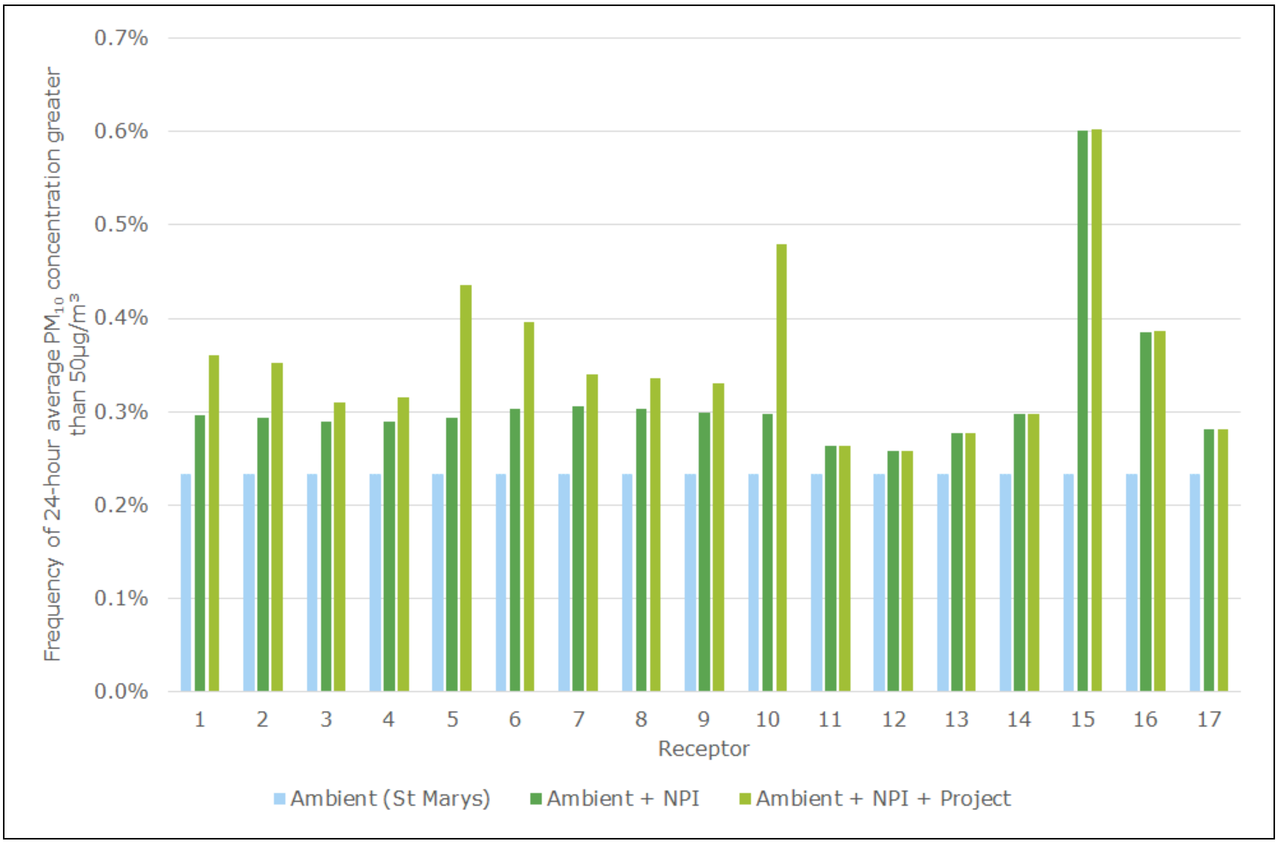


Figure 8-3: Frequency of 24-hour average PM_{10} concentration greater than NEPM goal ($50 \mu g/m^3$) – ambient, ambient + NPI and ambient + NPI + project

Figure 8-4: Frequency of 24-hour average $PM_{2.5}$ concentration greater than NEPM goal ($25 \mu g/m^3$) – ambient, ambient + NPI and ambient + NPI + project

Table 8-2: Change in frequency of 24-hour average PM_{10} concentrations greater than NSW EPA assessment criterion

Receptor	Ambient (St Marys)	Ambient + NPI	Ambient + NPI + Project	Increase due to Project	Number of additional days exceedance
R1*	0.2%	0.3%	0.4%	0.1%	0.2
R2*	0.2%	0.3%	0.4%	0.1%	0.2
R3*	0.2%	0.3%	0.3%	0.0%	0.1
R4*	0.2%	0.3%	0.3%	0.0%	0.1
R5*	0.2%	0.3%	0.4%	0.1%	0.5
R6*	0.2%	0.3%	0.4%	0.1%	0.3
R7*	0.2%	0.3%	0.3%	0.0%	0.1
R8*	0.2%	0.3%	0.3%	0.0%	0.1
R9*	0.2%	0.3%	0.3%	0.0%	0.1
R10*	0.2%	0.3%	0.5%	0.2%	0.7
R11	0.2%	0.3%	0.3%	0.0%	0
R12	0.2%	0.3%	0.3%	0.0%	0
R13	0.2%	0.3%	0.3%	0.0%	0
R14	0.2%	0.3%	0.3%	0.0%	0
R15	0.2%	0.6%	0.6%	0.0%	0
R16	0.2%	0.4%	0.4%	0.0%	0
R17	0.2%	0.3%	0.3%	0.0%	0

* - Commercial/industrial receptor location

Table 8-3: Change in frequency of 24-hour average $PM_{2.5}$ concentrations greater than NSW EPA assessment criterion

Receptor	Ambient (Richmond)	Ambient + NPI	Ambient + NPI + Project	Increase due to Project	Number of additional days exceedance
R1*	0.9%	0.9%	1.2%	0.3%	1.1
R2*	0.9%	0.9%	1.1%	0.3%	1.0
R3*	0.9%	0.9%	1.0%	0.1%	0.4
R4*	0.9%	0.9%	1.0%	0.1%	0.5
R5*	0.9%	0.9%	1.3%	0.4%	1.5
R6*	0.9%	0.9%	1.3%	0.4%	1.4
R7*	0.9%	0.9%	1.1%	0.2%	0.7
R8*	0.9%	0.9%	1.1%	0.2%	0.7
R9*	0.9%	0.9%	1.0%	0.2%	0.7
R10*	0.9%	0.9%	1.3%	0.4%	1.6
R11	0.9%	0.9%	0.9%	0.0%	0
R12	0.9%	0.9%	0.9%	0.0%	0
R13	0.9%	0.9%	0.9%	0.0%	0
R14	0.9%	0.9%	0.9%	0.0%	0
R15	0.9%	0.9%	0.9%	0.0%	0
R16	0.9%	0.9%	0.9%	0.0%	0
R17	0.9%	0.9%	0.9%	0.0%	0

* - Commercial/industrial receptor location

8.2.2 Annual average concentrations

The predicted annual average concentrations from proposed site emissions, neighbouring NPI-reporting emission sources plus ambient background are presented in **Table 8-4**. The results show that all cumulative annual average concentrations are below the applicable impact assessment criteria for all modelling scenarios across all sensitive receptor location.

The contribution to cumulative annual PM_{10} and $PM_{2.5}$ of the site, NPI sources and ambient predicted increments are illustrated in **Figure 8-5** and **Figure 8-6** respectively. It can be seen that ambient concentrations dominate the predicted cumulative concentrations at each receptor location.

Table 8-4: Predicted cumulative annual average concentrations

Receptor	Cumulative annual average predicted concentrations (µg/m^3)		
	TSP	PM_{10}	$PM_{2.5}$
Criteria	**90**	**25**	**8**
R1*	40.4	19.3	6.8
R2*	40.1	19.1	6.8
R3*	38.0	18.3	6.4
R4*	38.4	18.4	6.5
R5*	43.8	20.7	7.5
R6*	42.2	20.0	7.1
R7*	39.4	18.9	6.5
R8*	39.2	18.8	6.5
R9*	39.1	18.7	6.5
R10*	45.2	21.4	7.7
R11	35.6	17.2	6.2
R12	35.4	17.1	6.2
R13	36.3	17.5	6.2
R14	37.3	18.0	6.2
R15	47.1	22.9	6.4
R16	40.9	19.8	6.3
R17	36.6	17.6	6.2

* - Commercial/industrial receptor location

Figure 8-5: Contribution to predicted cumulative annual average PM_{10} concentrations

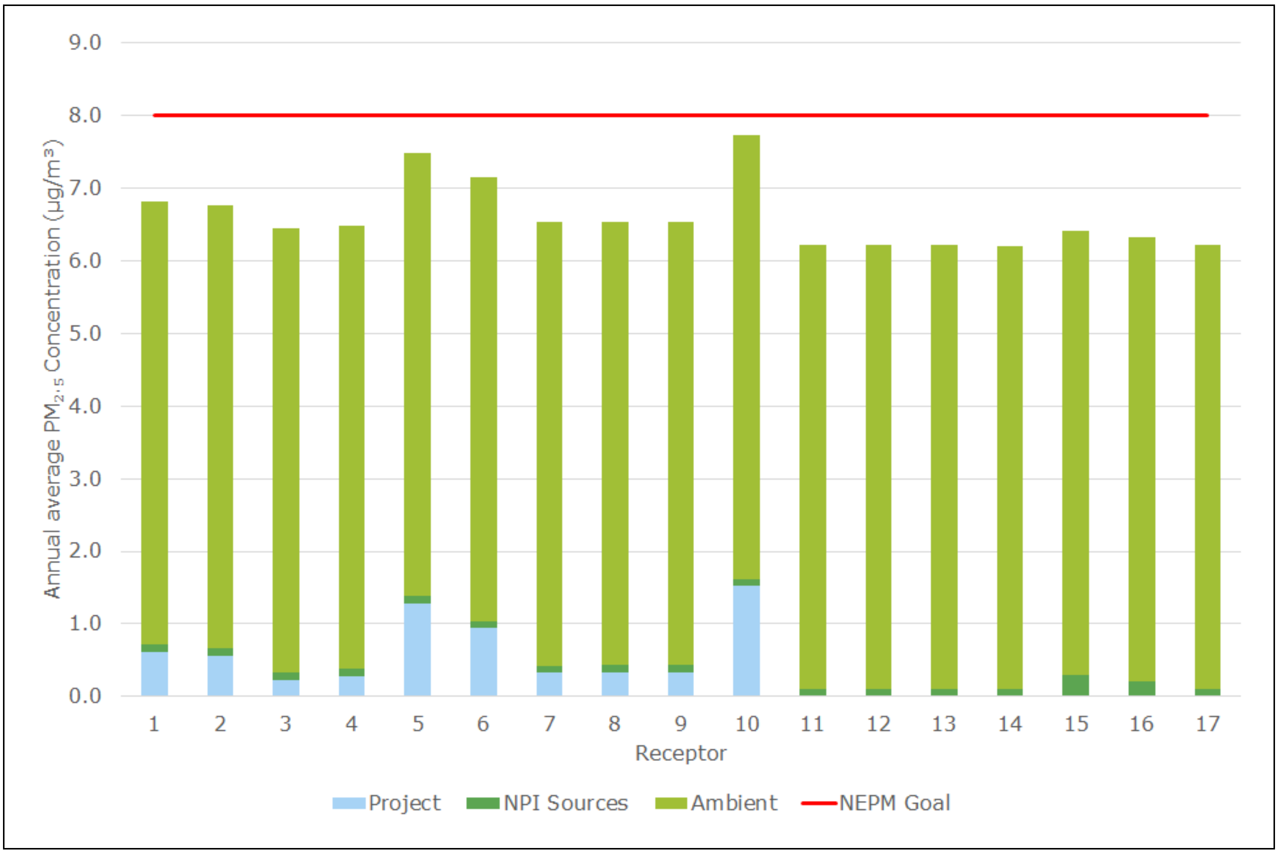


Figure 8-6: Contribution to predicted cumulative annual average $PM_{2.5}$ concentrations

8.3 Peak day operations

The preceding sections of this assessment present the likely impacts from the site during typical average operations. While the annual production of material would be limited to 180,000 tpa, the magnitude of material processed in a given 24-hour average period may fluctuate based on the demand of market. Benedict Recycling estimate that peak daily operations could increase from an average rate of 600 t/day to 1,500 t/day. A screening assessment of the potential maximum 24-hour PM_{10} and $PM_{2.5}$ impacts that could be experienced during a peak operational day (1,500 tpd) by the following steps:

- Annual calculated emission rates for average day operations (as per **Section 6**) were up-scaled by a factor of 2.5 (1,500/600); and
- Peak emission rates were run through the complete 12-month modelling period to pair maximum potential emissions with worst case dispersion conditions (i.e. highly conservative modelling scenario).

The results of the screening peak day modelling scenario are presented in **Table 8-5**. Further, the difference between maximum 24-hour PM_{10} and $PM_{2.5}$ concentrations for the average and peak scenarios at the closest residential receptors (R11 to R17) is presented in **Figure 8-7.**

The screening modelling exercise results highlight that concentrations would increase relative to the assessed average day operations, by a factor of up to 2.5 in keeping with the emissions increase. However at all residential receptors (R11 to R17) where 24-hour average impacts could be experienced, the magnitude of increase is considered minor (at most 0.2 $\mu g/m^3$ for PM_{10} and 0.1 $\mu g/m^3$ for $PM_{2.5}$). Consequently, the occurrence of peak day operations would not alter the conclusion that the potential for impacts above applicable criteria in the surrounding environment as a result of the proposed site is negligible, as per **Section 8.2**.

Table 8-5: Incremental (facility-only) peak day concentrations		
Receptor	**Maximum 24-hour average predicted concentrations (µg/m^3)**	
	PM_{10}	**$PM_{2.5}$**
Criteria	**50#**	**25#**
R1*	11.3	4.5
R2*	16.1	6.6
R3*	6.7	3.0
R4*	12.9	5.7
R5*	28.6	13.0
R6*	11.5	5.5
R7*	4.2	2.0
R8*	4.9	2.3
R9*	4.7	2.2
R10*	35.0	13.2
R11	0.3	0.1
R12	0.4	0.2
R13	0.1	0.1
R14	0.1	0.1
R15	0.1	<0.1
R16	0.2	0.1
R17	0.2	0.1

* - denotes industrial/commercial receptor
\# - criteria is applicable to cumulative concentrations

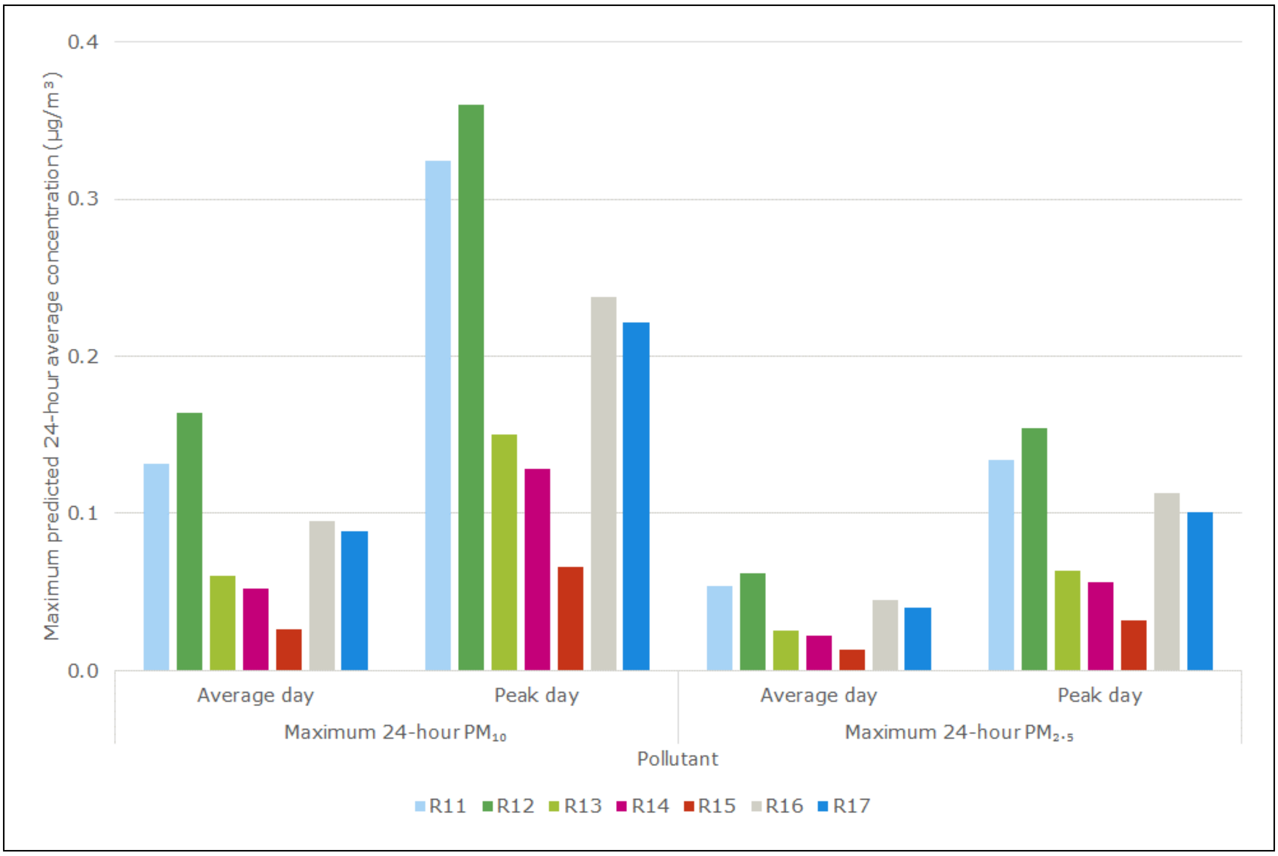


Figure 8-7: Comparison of average and peak day operations at surrounding residential receptors - PM_{10} and $PM_{2.5}$ concentrations

9. EMISSIONS MITIGATION

9.1 Particulate matter emission control

Section 6.3 lists the mitigation measures proposed to manage particulate matter emissions during operations at the site. These controls were incorporated into the modelling wherever an appropriate emission reduction factor was available.

Predicted concentrations of PM_{10} and $PM_{2.5}$ arising from operations at the site are low at all surrounding receptors, suggesting that the control of these particle size fractions is effective at managing potential particulate matter-related health impacts. \

9.2 Odour generation control

The following management measures will be applied so that vegetation waste will not start to compost or produce odours within the facility:

- No odorous waste will be accepted;
- The minor amounts of vegetation waste (including green waste) that will be accepted at the facility as part of mixed loads will be segregated and stored in the shed;
- Vegetation waste will not be stored on site for extended periods;
- Vegetation waste will be dispatched to another facility licensed to accept vegetation, as soon as there is enough to fill a truck;
- vegetation waste will be monitored daily for any signs that composting is occurring (odour or increased temperature) and if this occurs, the stockpile will be broken apart and arrangements will be made immediately for the material to be dispatched from site in a smaller truck.

10. GREENHOUSE GAS ASSESSMENT

10.1 Introduction

The estimation of greenhouse gas (GHG) emissions for the proposed Facility is based on the National Greenhouse Accounts Factors (NGAF) workbook (DoE, 2015). The methodologies in the NGAF workbook follow a simplified approach, equivalent to the "Method 1" approach outlined in the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines (DoE 2014). The Technical Guidelines are used for the purpose of reporting under the National Greenhouse and Energy Reporting Act 2007 (the NGER Act).

For accounting and reporting purposes, GHG emissions are defined as 'direct' and 'indirect' emissions. Direct emissions (also referred to as Scope 1 emissions) occur within the boundary of an organisation and as a result of that organisation's activities. Indirect emissions are generated as a consequence of an organisation's activities but are physically produced by the activities of another organisation (DoE, 2015). Indirect emissions are further defined as Scope 2 and Scope 3 emissions. Scope 2 emissions occur from the generation of the electricity purchased and consumed by an organisation. Scope 3 emissions occur from all other upstream and downstream activities, for example the downstream extraction and production of raw materials or the upstream use of products and services.

Scope 3 is an optional reporting category and should not be used to make comparisons between organisations (WBCSD, 2004), for example in benchmarking GHG intensity of products or services. Typically, only major sources of Scope 3 emissions are accounted and reported by organisations. Specific Scope 3 emission factors are provided in the NGAF workbook for the consumption of fossil fuels and purchased electricity, making it straightforward for these sources to be included in a GHG inventory, even though they are a relatively minor source.

10.2 Estimated emissions

The GHG emissions sources included in this assessment are presented in **Table 10-1**. representing the most significant sources associated with the Project. Emission are estimated using the methodologies outlined in the NGAF workbook, using fuel energy contents and scope 1, 2 and 3 emission factors for diesel, gasoline and electricity generation in NSW.

Table 10-1: GHG emission sources

Scope 1	Scope 2	Scope 3
Direct emissions from fuel combustion (diesel) by onsite plant and equipment	Indirect emissions associated with the consumption of purchased electricity	Indirect upstream emissions from the extraction, production and transport of diesel fuel.
		Indirect upstream emissions from electricity lost in delivery in the transmission and distribution network.
		Indirect downstream emissions generated from off-site transportation of product
		Indirect emissions generated from employee travel

The adopted activity data for the emission estimates is presented in **Table 10-2**.

An estimate of diesel consumption from product transportation has been made based on the NSW average fuel consumption rate for articulated trucks of 56.9 L/ 100 km

(ABS, 2015[2]). An upper estimate of annual vehicle kilometres travelled (VKT) is based on a nominal return trip distance to market (50 km) and the number of trips per day (22 movements incoming and outgoing).

An estimate of diesel consumption from employee travel is based on the NSW average fuel consumption rate for passenger vehicles of 10.7 L/ 100 km (ABS, 2015). An upper estimate of annual vehicle kilometres travelled (VKT) is based on a nominal commute distance of 20 km, 306 workdays per annum and 8 on-site employees.

Table 10-2: Estimated activity data for GHG emissions

Production (tonnes/annum)	On-site Diesel (kL/annum)	Electricity (kWh/annum)	Product Transport Diesel (kL/annum)	Employee Travel Fuel (kL/annum)
180,000	270	288,000	192	37

The estimated annual GHG emissions for each source is presented in **Table 10-3**. The annual Scope 1 and Scope 3 emissions at full production represent approximately 0.0006% of total GHG emissions for NSW and 0.0001% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2014[3].

Table 10-3: Summary of estimated annual GHG emissions (tonnes CO_2-e / annum)

Scope 1 emissions	Scope 2 emissions	Scope 3 emissions			
On-site Diesel	Electricity	On-site Diesel	Electricity	Product Transport (Diesel)	Employee Travel
724	248	55	37	556	125

Note: GHG emissions are reported in tonnes of carbon dioxide equivalents (t CO2-e). Non-CO_2 gases are converted to CO_2-e by multiplying the quantity of the gas by its Global Warming Potential (GWP) – see Table 26 of the NGAF workbook.

[2] http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0

[3] http://ageis.climatechange.gov.au/

11. CONCLUSIONS

Ramboll Environ was commissioned by EMM to undertake an Air Quality Impact Assessment for the proposed Facility at Penrith on behalf of Benedict Recycling.

Emissions of TSP, PM_{10}, $PM_{2.5}$ and odour were estimated for peak proposed operations associated with the Facility. Atmospheric dispersion modelling predictions of air pollution emissions for proposed operations were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the operation of the proposed Facility was unlikely to result in exceedances of the applicable NSW EPA assessment criteria for TSP, PM_{10} and dust deposition or the NEPM Reporting Goals for $PM_{2.5}$ at any of the surrounding residential receptors. The potential for an additional exceedance day for 24-hour average $PM_{2.5}$ concentration was predicted for the commercial/industrial receptors immediately adjacent to site boundary, however exposure for a 24-hour period at these locations is not likely to occur.

Potential odour impacts from the Facility were conservatively assessed, with resultant predicted odour concentrations well below applicable impact assessment criterion.

A greenhouse gas quantification assessment was undertaken for the Facility. The annual Scope 1 and Scope 3 emissions at full production represent approximately 0.0005% of total GHG emissions for NSW and 0.0001% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2014.

12. REFERENCES

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US-EPA (2011). AP42 Emission Factor Database, Chapter 13.2.1 Paved Roads, United States Environmental Protection Agency, 2011.

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13. GLOSSARY OF ACRONYMS AND SYMBOLS

Approved Methods	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW
AHD	Australian Height Datum
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
Benedict Recycling	Benedict Recycling Pty Ltd
CO_2-e	Carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DoE	Department of Environment
EIS	Environmental impact statement
EPA	Environmental Protection Authority
EMM	EMM Consulting Pty Limited
GADDC	Guidance on the Assessment of Dust from Demolition and Construction
IAQM	Institute of Air Quality Management
µg	Microgram (g x 10-6)
µm	Micrometre or micron (metre x 10-6)
m^3	Cubic metre
NGAF	National Greenhouse Accounts Factors
NPI	National Pollutant Inventory
OEH	NSW Office of Environment and Heritage
OU	Odour unit
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
Ramboll Environ	Ramboll Environ Australia Pty Ltd
SEARs	Secretary's Environmental Assessment Requirements
SSDA	State Significant Development Application
TAPM	"The Air Pollution Model"
TSP	Total Suspended Particulates
The Facility	Proposed Penrith Recycling Facility
US-EPA	United States Environmental Protection Agency
VKT	Vehicle Kilometres Travelled

APPENDIX 1
WIND ROSES

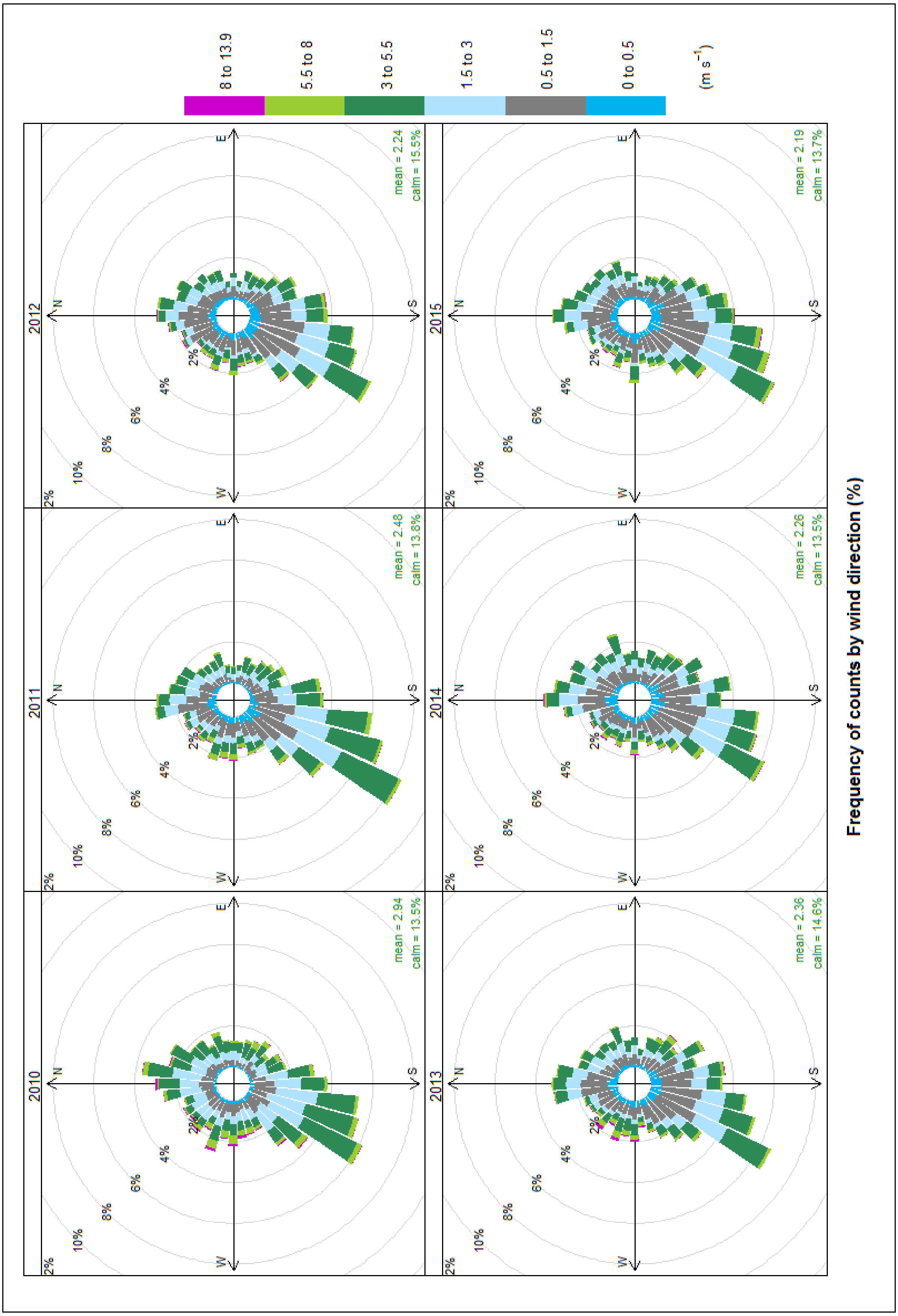


Figure A1.1 Annual Wind Roses – Penrith Lakes BoM AWS – 2010 - 2015

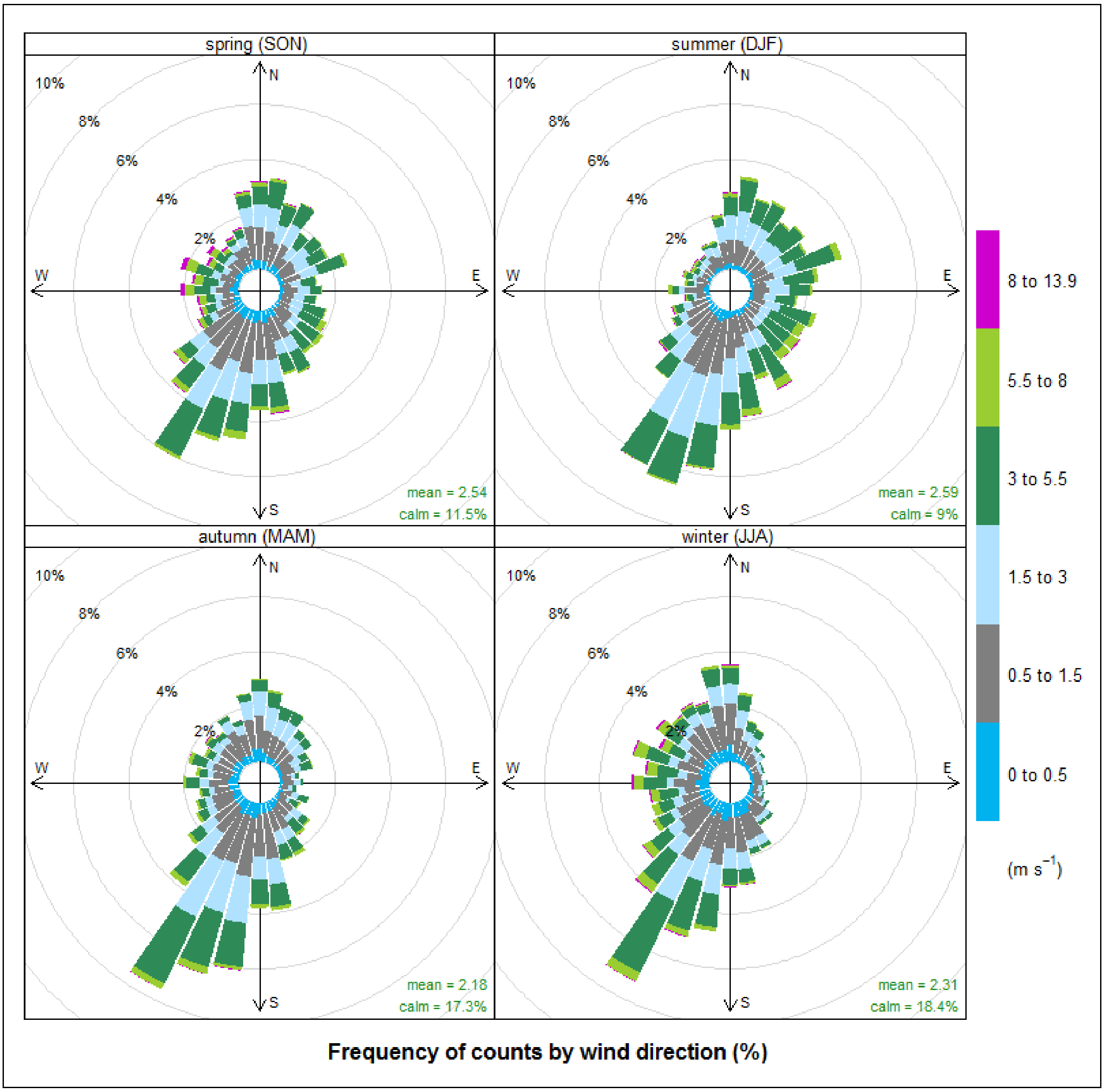


Figure A1.2 Seasonal Wind Roses – Penrith Lakes BoM AWS – 2010 - 2015

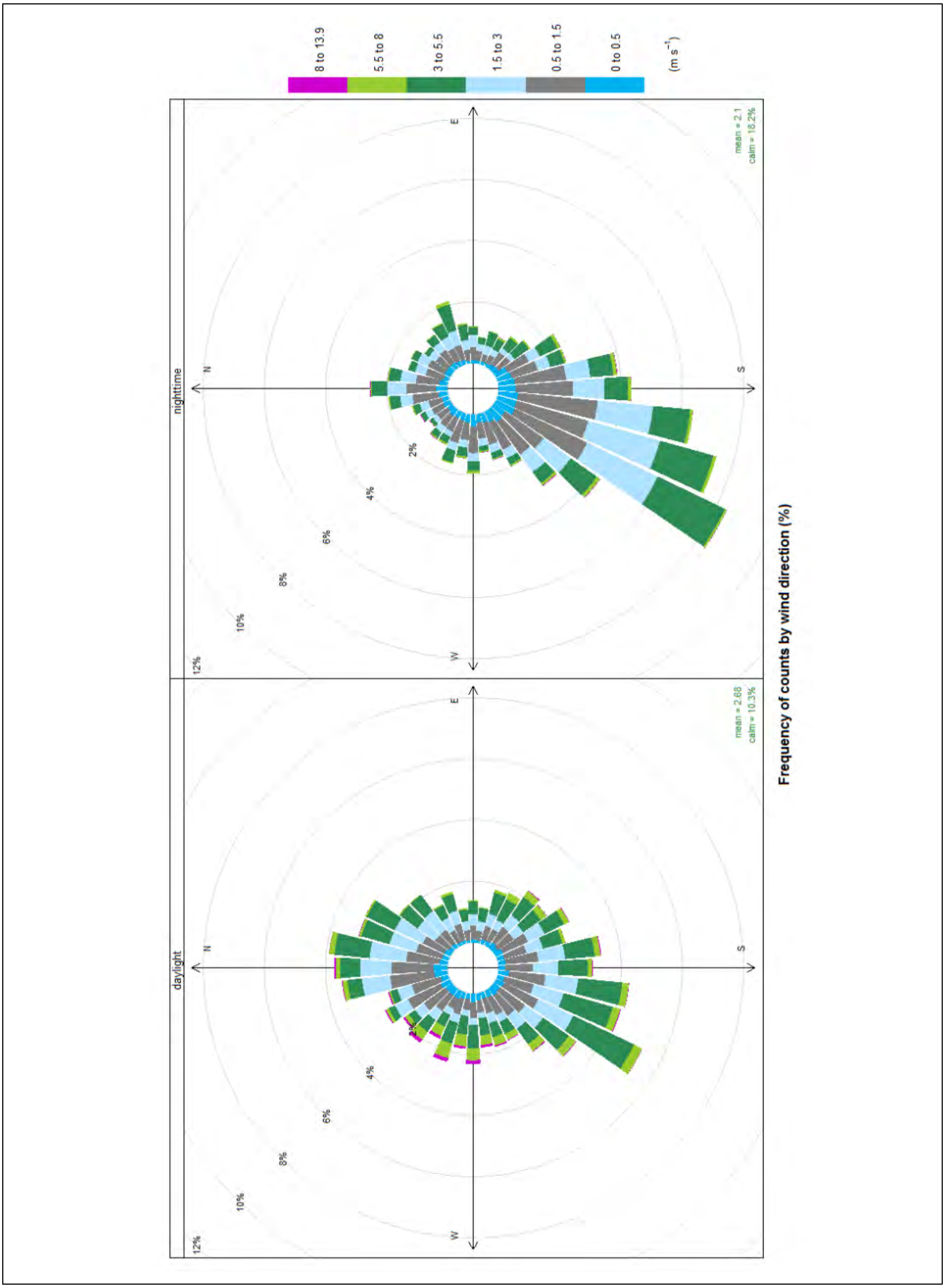


Figure A1.3 Diurnal Wind Roses – Penrith Lakes BoM AWS – 2010 - 2015

APPENDIX 2
EMISSIONS INVENTORY

Introduction

Air emission sources associated with the Facility were identified and quantified through the application of accepted published emission estimation factors, collated from a combination of United States Environmental Protection Agency (US-EPA) AP-42 Air Pollutant Emission Factors and NPI emission estimation manuals, including the following:

- NPI Emission Estimation Technique Manual for Mining (NPI, 2012);
- AP-42 Chapter 13.2.4 – Aggregate Handling and Storage Piles (US-EPA 2006);
- AP-42 Chapter 11.19.2 – Crushed Stone Processing and Pulverized Mineral Processing (US-EPA 2006b); and
- AP-42 Chapter 13.2.1 – Paved Roads (US-EPA 2011).

Particulate matter releases were quantified for TSP, PM_{10} and $PM_{2.5}$ using ratios for that particle size fraction available within the literature (principally the US-EPA AP-42), as documented in subsequent sections.

Sources of Particulate Matter Emissions

Air emissions associated with the Facility would primarily comprise fugitive particulate matter releases. Potential sources of emission were identified as follows:

- Vehicle entrainment of particulate matter due to the haulage of material along the sealed roads in the Facility;
- Unloading of material to the raw material storage areas in the yard;
- Handling and transfer of raw material to the processing shed hopper;
- Screening plant operations within the main shed;
- Loading and transfer of screened material to stockpiles;
- Loading of product to truck for dispatch;
- Odour emissions from the storage of certain materials (assumed to be 100% green waste for this assessment);
- Diesel fuel combustion by on-site plant and equipment; and
- Wind erosion associated with stockpiled materials.

Operational Assumptions

To compile an emissions inventory for existing and proposed operations at the site, the following general assumptions were made:

- Material deliveries/dispatch activities occur between 6am and 10pm. Processing operations between 7am and 4pm. 51 operational weeks per year;
- Wind erosion area for stockpiled materials of 0.13 ha
- Assumed average truck weights (average of loaded and unloaded weights) of 30 t and car deliveries of 3 t.
- Annual vehicle movements;
  - Delivery trucks – 13,770;
  - Cars – 33,354;
  - Product dispatch trucks – 6,732.

Particulate Matter Emission Factors Applied

The emission factor equations applied within the assessment are documented in this subsection. **Table A2.1** lists the uncontrolled emission factors that were applied for the two emission scenarios, references the source of the listed factors and whether the factor is derived from a specific equation or a published default emission factor.

Table A2.1 Emission Estimation Factors Applied

Emission Source	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Emission Factor Unit	Source of Factor
Material delivery - truck	0.04237	0.00813	0.00197	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Material delivery - cars	0.00521	0.00100	0.00024	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Truck unloading - yard	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Raw material handling - yard	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Material transfer to shed - FEL	0.02459	0.00472	0.00114	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Raw material hopper loading - shed	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Screening - shed	0.01250	0.00430	0.00080	kg/tonne	USEPA AP-42 11.19.2 - Screening Factor
Screened material handling - shed	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Stockpile loading – yard	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Dispatch truck loading	0.00150	0.00055	0.00008	kg/tonne	USEPA AP-42 11.19.2 –Material Transfer Factor
Material transportation from site	0.04237	0.00813	0.00197	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Wind Erosion - exposed surfaces and stockpiles	850.0	425.0	63.8	kg/ha/year	AP-42 11.9 - Wind erosion of exposed areas factor

Details relating to the emission equations referenced in **Table A2.1** are presented in the following sections.

Paved Roads Equation

The emissions factors for paved roads, as documented within AP42 Chapter 13.2.2 -"Paved Roads" (US-EPA 2011), was applied as follows:

$E = k\ (sL)^{0.91}(W)^{1.02}$

Where:

E = Emissions Factor (g/VKT)

sL = road surface silt loading (g/m^2)

W = mean vehicle weight (tonnes)

k = constant of 3.23 for TSP, 0.62 for PM_{10} and 0.15 for PM_{10}

Material parameters are listed in **Table A2.2**.

Diesel Calculations

Diesel combustion emissions of $PM_{2.5}$ are described in the tables below. It is assumed that 97% of PM_{10} emissions from diesel combustion is $PM_{2.5}$, emissions have been up-scaled accordingly.

Table A2.3 Likely Onsite Diesel Equipment and Fleet and $PM_{2.5}$ Emissions

Equipment	Number	Make (or similar)	Power Rating (kW)	Operating Hours	$PM_{2.5}$ Emission Factor (g/kWh) – USEPA Tier 2	NPI Load Factor	Annual Emissions (kg/year)
Front End Loader	1	Volvo L120	150	4,641	0.0002	0.5	69.6
Excavator	1	Komatsu PC130	72	4,641	0.0002	0.5	66.8
Screen	1	Finlay 883	72	2,754	0.0004	1	79.3

Emission Factor Source: NSW EPA (2014) Reducing Emissions from Non-road Diesel Engines. Prepared by ENVIRON Australia Pty Ltd.

Table A2.4 $PM_{2.5}$ Emissions – Trucks Moving Onsite

Equipment	PM Emission Factor (g/VKT) - 1996 ADR70/00	Annual VKT	Annual Emissions (kg/year)
Trucks moving on site	0.584	10,098	5.9

Emission Factor Source: NSW EPA (2012) Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year,On-Road Mobile Emissions.

Table A2.5 $PM_{2.5}$ Emissions – Trucks Idling Onsite

Equipment	Trucks onsite at any hour	Emission Factor PM (g/hr) - USEPA	Hours per year	Annual Emissions (kg/year)
Trucks Idling on site	5	1.196	4,641	27.8

Emission Factor Source: NSW EPA (2012) Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year, On-Road Mobile Emissions.

Recycling Facility Related Input Data

Material property inputs used in the emission equations presented in **Table A2.1** are detailed in **Table A2.2**. It is noted that minimal details relating to the material properties were available at the time of reporting. To compensate, values were adopted from the literature.

Table A2.2 Material Property Inputs for Emission Estimation Factors Applied

Material Properties	Units	Value	Source of Information
Moisture Content of material	%	2.1	AP42 13.2.4 default for stone quarrying and processing
Silt Loading of Paved Roads – Material Deliveries and Product Dispatch	g/m^2	0.6	Default baseline loading for roads with traffic <500 vehicles per day - US-EPA AP42 (2011)

Key operational details by process used in the emission calculations are listed in **Table A2.3**.

Table A2.3 Emission Estimation Activity Rates Applied for Emission Calculations

Process	Unit	Amount
Material delivery - truck	Annual VKT (km)	2,754
Material delivery - cars	Annual VKT (km)	6,671
Truck unloading - yard	Tonnes of material	180,000
Raw material handling - yard	Tonnes of material	180,000
Material transfer to shed - FEL	Annual VKT (km)	3,000
Raw material hopper loading - shed	Tonnes of material	180,000
Screening - shed	Tonnes of material	180,000
Screened material handling - shed	Tonnes of material	180,000
Stockpile loading – yard	Tonnes of material	180,000
Dispatch truck loading	Tonnes of material	180,000
Material transportation from site	Annual VKT (km)	6,069
Wind Erosion - exposed surfaces and stockpiles	Area (ha)	0.13

APPENDIX 3
INCREMENTAL ISOPLETH PLOTS

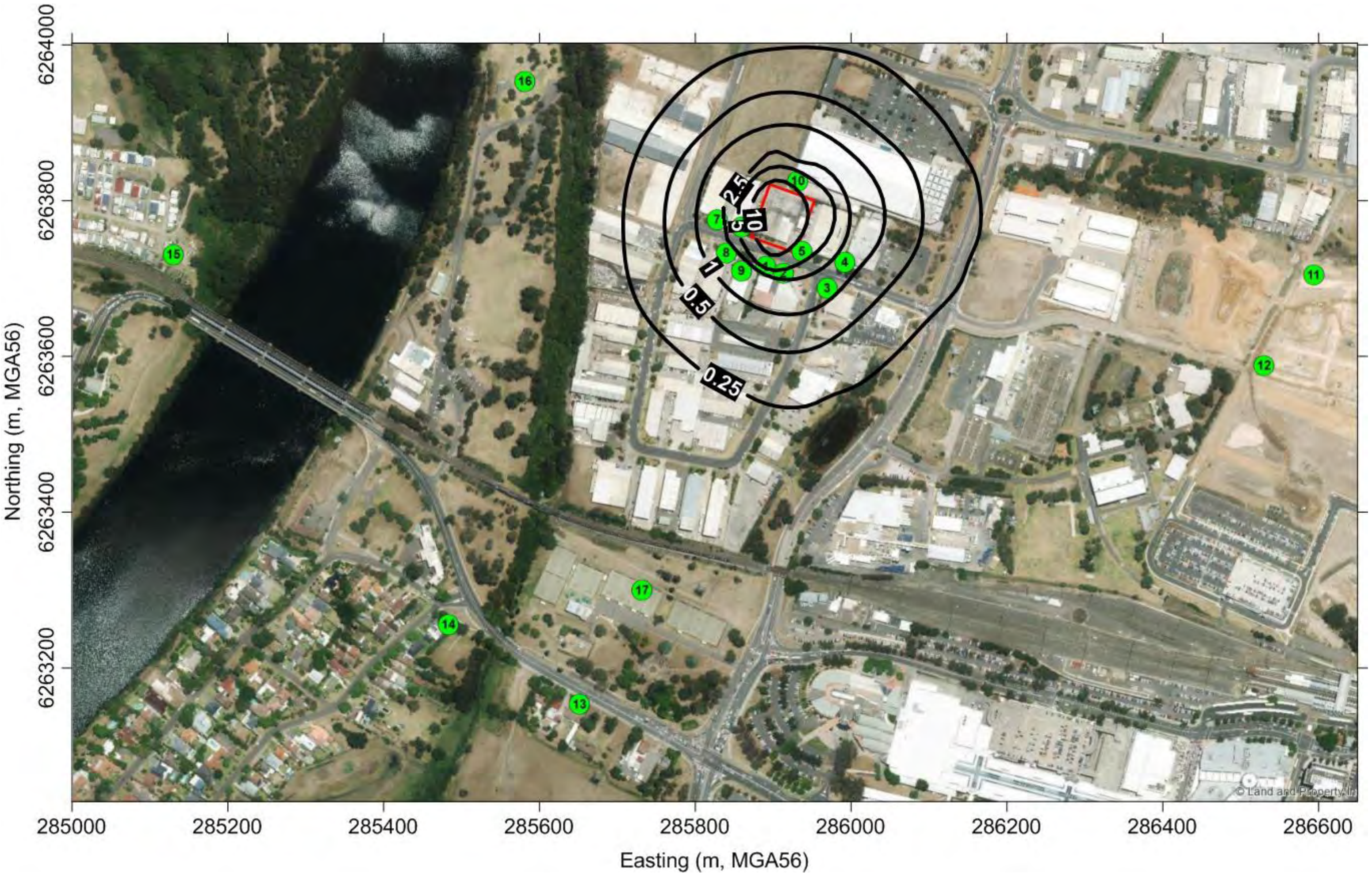


Figure A3.1 Predicted Incremental Annual Average TSP Concentrations (µg/m³)

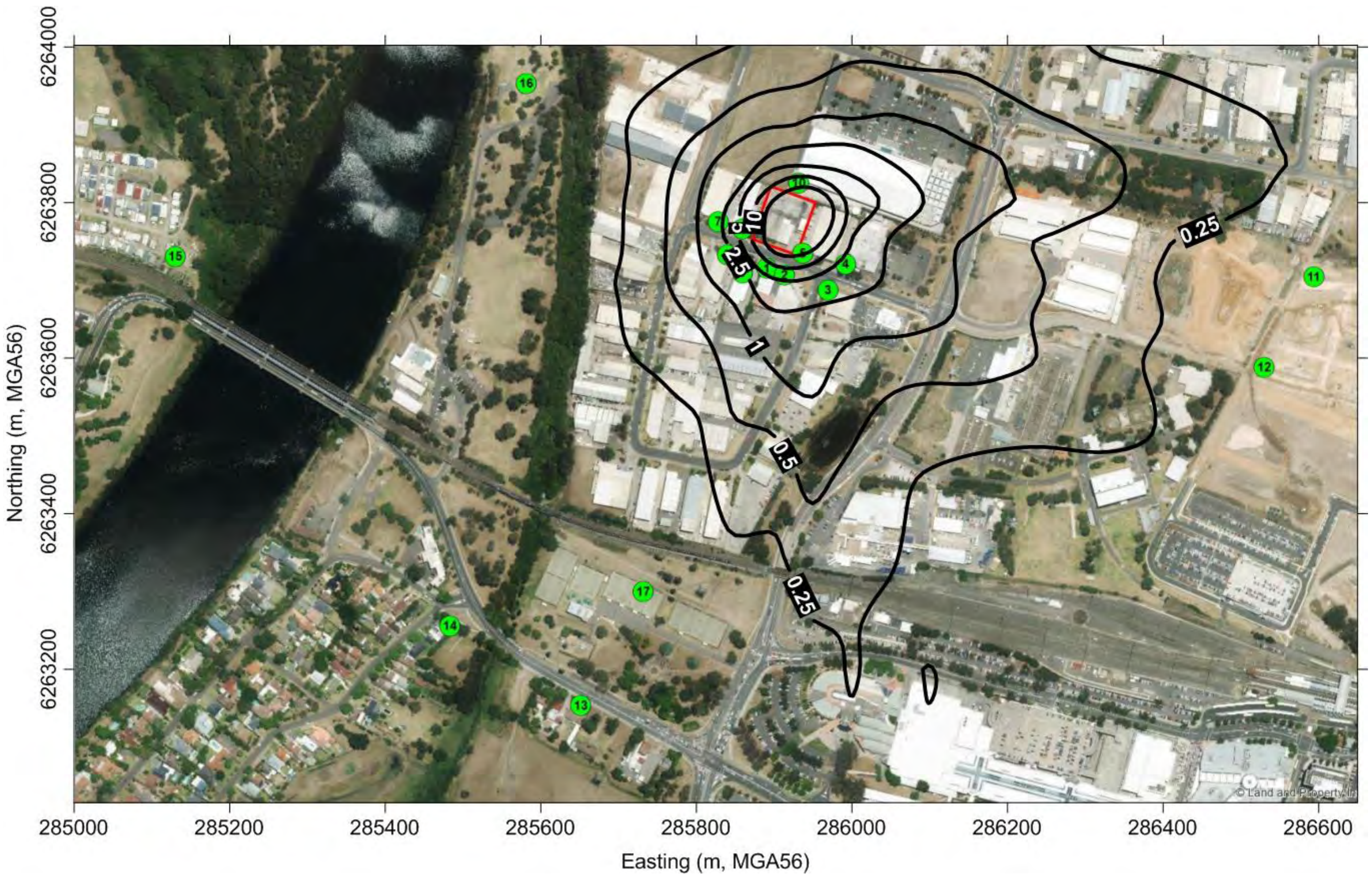


Figure A3.2 Predicted Incremental Maximum 24-hour Average PM_{10} Concentrations (µg/m³)

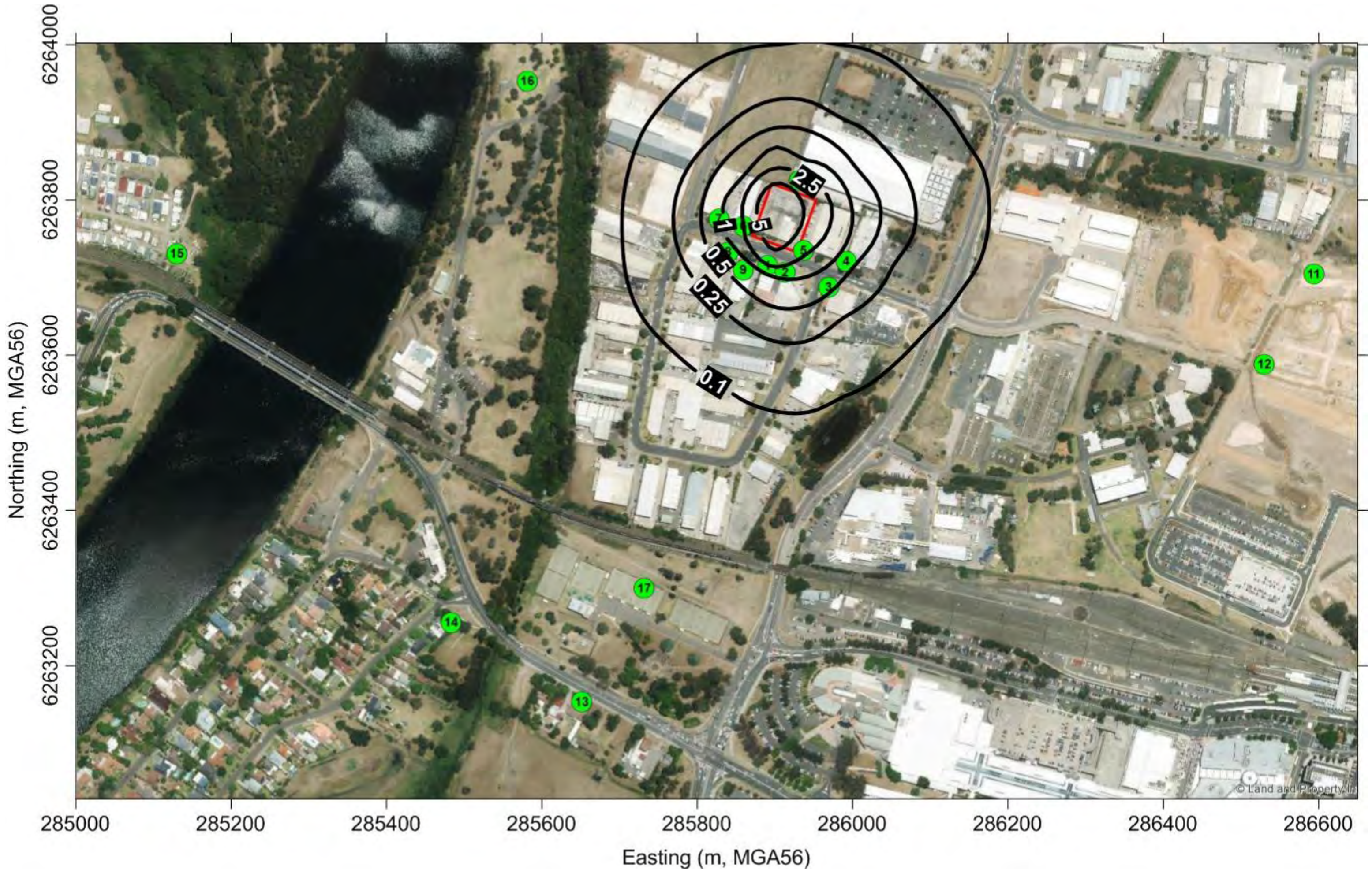


Figure A3.3 Predicted Incremental Annual Average PM_{10} Concentrations (µg/m³)

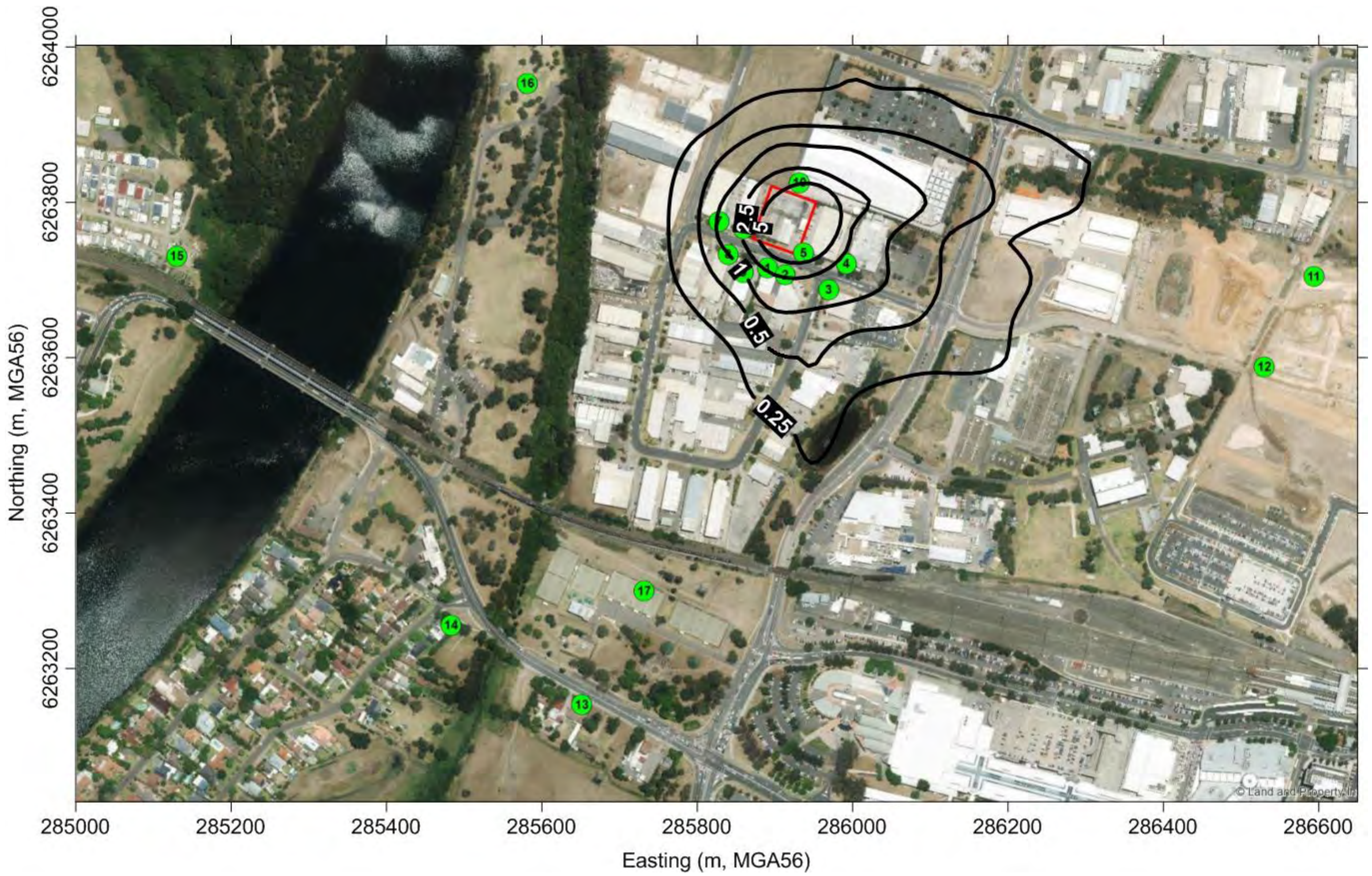


Figure A3.4 Predicted Incremental Maximum 24-hour Average $PM_{2.5}$ Concentrations (µg/m³)

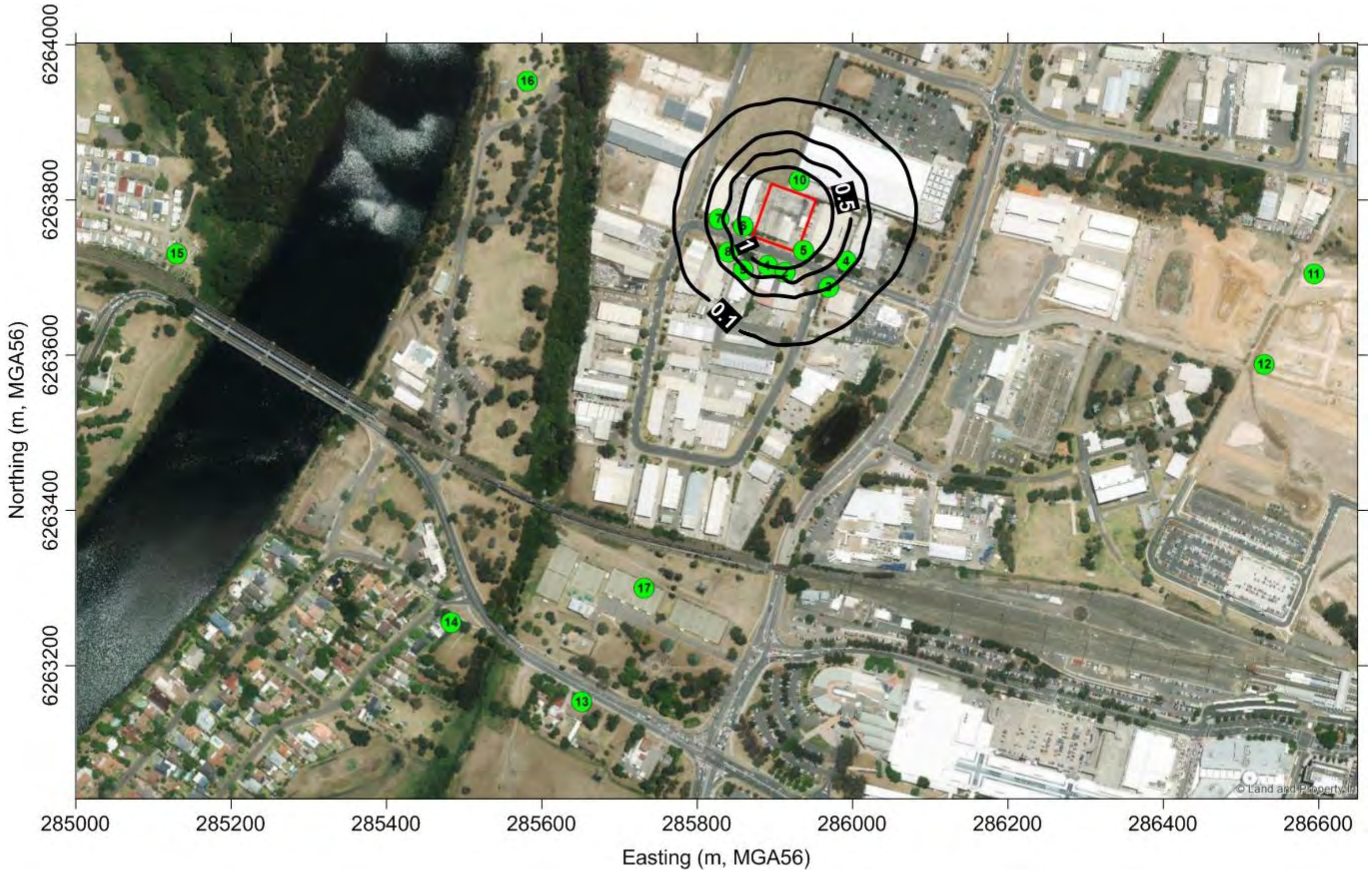


Figure A3.5 Predicted Incremental Annual Average $PM_{2.5}$ Concentrations (μg/m³)

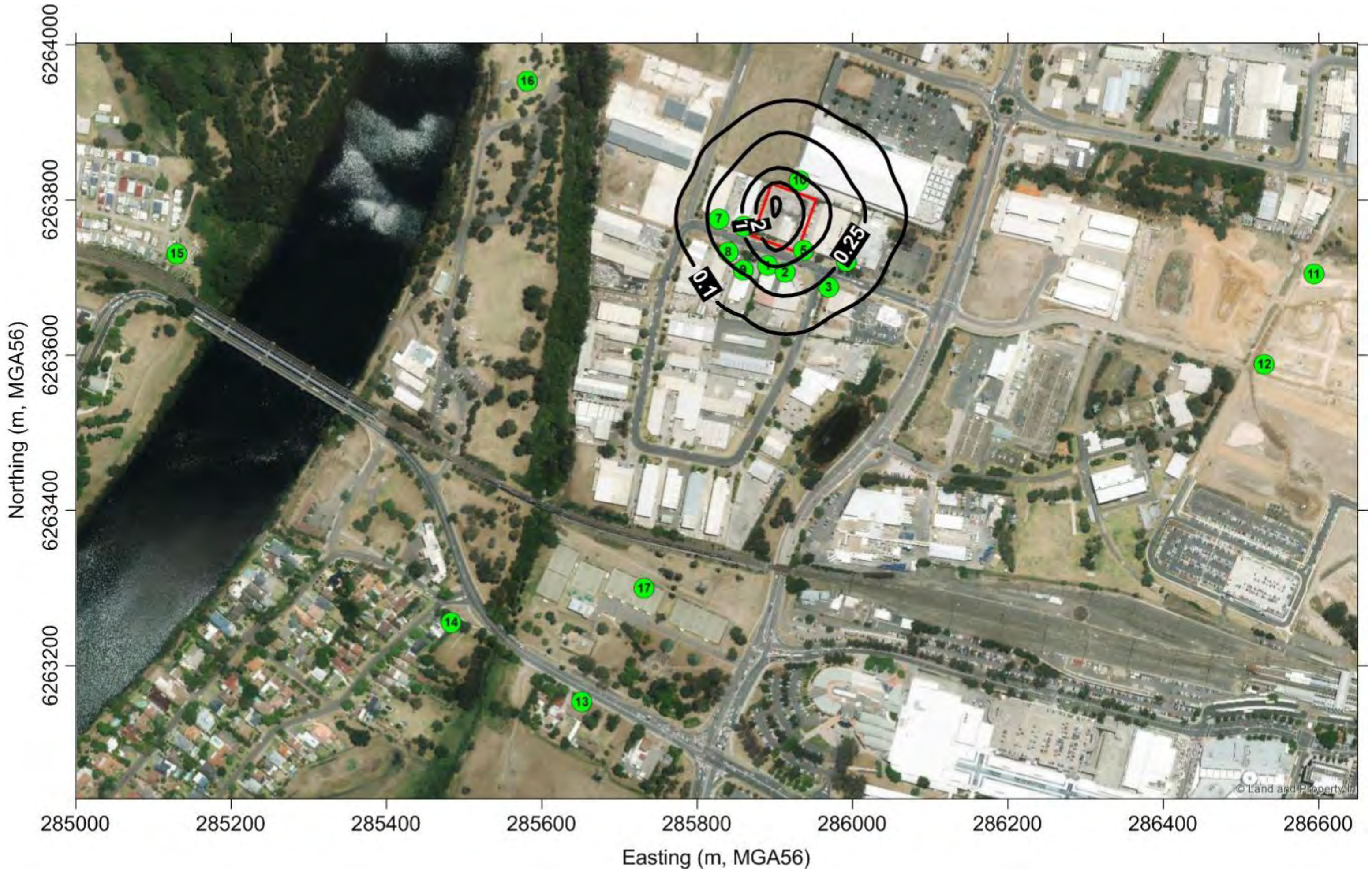


Figure A3.6 Predicted Incremental Annual Average Dust Deposition Levels (g/m²/month)

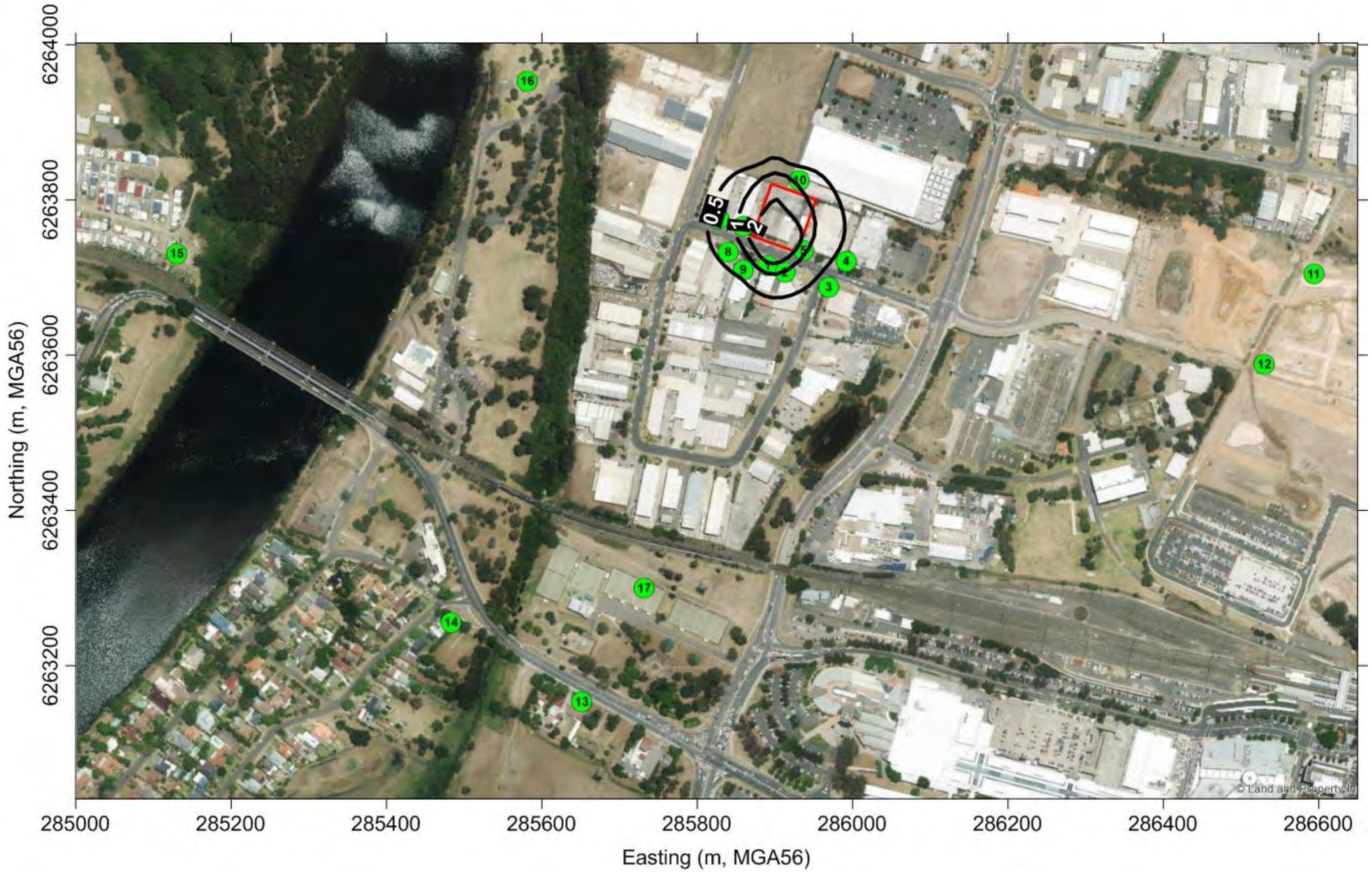


Figure A3.7 Predicted Incremental 99th Percentile 1-second Average Odour Concentrations (OU)

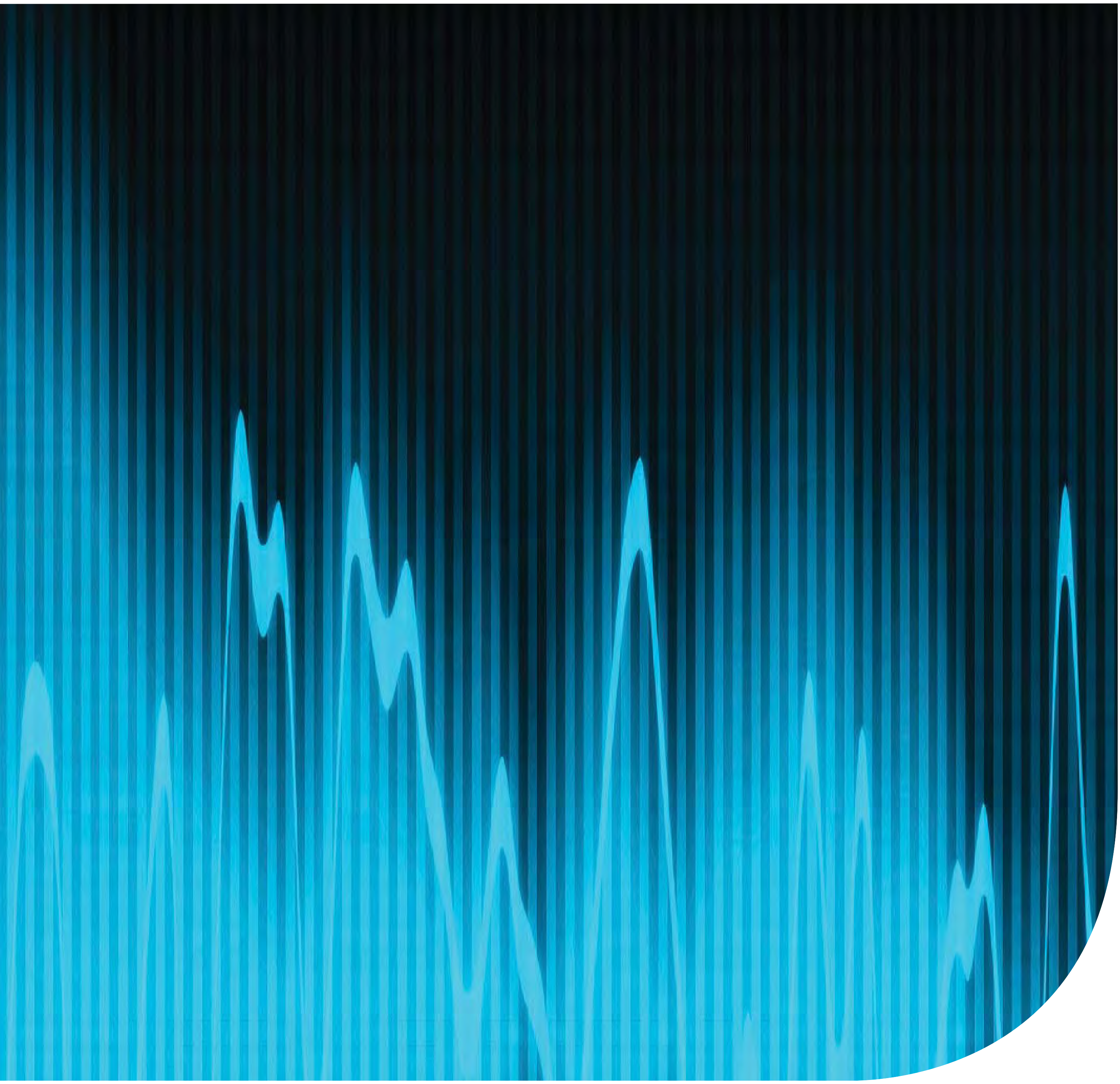
Appendix F

Noise impact assessment

Penrith Waste Recycling and Transfer Facility

46 Peachtree Road, Penrith | Noise Impact Assessment

Prepared for Benedict Recycling Pty Ltd | 26 May 2017



Noise Impact Assessment

Penrith Waste Recycling and Transfer Facility | 46 Peachtree Road, Penrith

Prepared for Benedict Recycling Pty Ltd | 26 May 2017

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Noise Impact Assessment

Final

Report J16099RP1 | Prepared for Benedict Recycling Pty Ltd | 26 May 2017

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Date	26 May 2017	Date	26 May 2017

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Tables

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Figures

1 Introduction

EMM Consulting Pty Limited (EMM) has been commissioned by Benedict Recycling Pty Ltd (Benedict) to prepare a noise impact assessment (NIA) suitable to accompany a Development Application (DA) for the proposed Waste Recycling and Transfer Facility, Penrith (the facility).

The site is located at Lot 45 DP 793931 (46 Peachtree Road, Penrith), within the Penrith City Council Local Government Area (LGA). The development will include construction and operation of the following components:

- a main processing shed which would contain the majority of waste processing activities and some stockpiles;
- a yard, stockpiles and parking area;
- two weighbridges at the site entry and a weighbridge at the site exit, a wheel-wash for the outbound traffic lane, two demountable offices and amenities;
- a sprinkling site irrigation system to minimise airborne dust; and
- general use areas (eg vehicle movement and stacking areas).

The operational area of the site would be concrete sealed.

This noise impact assessment supports a state significant development application (SSDA) for the facility under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979*. The minister for Planning, or his delegate, is the consent authority for the application. The facility will contribute to meeting the NSW Government's recycling strategies and targets.

Secretary's Environmental Assessment Requirements (SEARs) were issued by the Department of Planning and Environment (DPE) in July 2016 for the facility. The Environment Protection Authority (EPA) has also provided details of key issues requiring assessment for the facility. Table 1.1 provides the relevant assessment requirements and the section of the NIA report relevant to the specific requirement.

Table 1.1 Noise impact assessment requirements

Relevant authority and assessment requirement	Relevant section of NIA report
DPE	
Noise and vibration – including	
- a quantitative assessment of potential construction, operational and transport noise and vibration impacts in accordance with relevant Environmental Protection Authority guidelines; and	Chapters 3 to 9
- details and justification of the proposed noise mitigation and monitoring measures.	Chapter 9

Table 1.1 Noise impact assessment requirements

Relevant authority and assessment requirement	Relevant section of NIA report
EPA	
Describe baseline conditions	
Determine the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels in accordance with the NSW Industrial Noise Policy.	Section 4.2
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.	Chapter 8
The noise impact assessment report should provide details of all monitoring of existing ambient noise levels.	Section 4.2
Assess impacts	
Determine the project specific noise levels for the site.	Chapter 5
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 and other services.	Chapters 6, 7, 8
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.	Chapters 6, 7, 8
Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.	Chapters 6, 7, 9
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.	Chapter 9
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.	Chapters 6, 7, 8
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.	Chapter 8
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.	Chapter 9
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.	Chapter 8

2 Glossary of acoustic terms

A number of technical terms are required for the discussion of noise and vibration. These are explained in Table 2.1.

Table 2.1 Glossary of acoustic terms

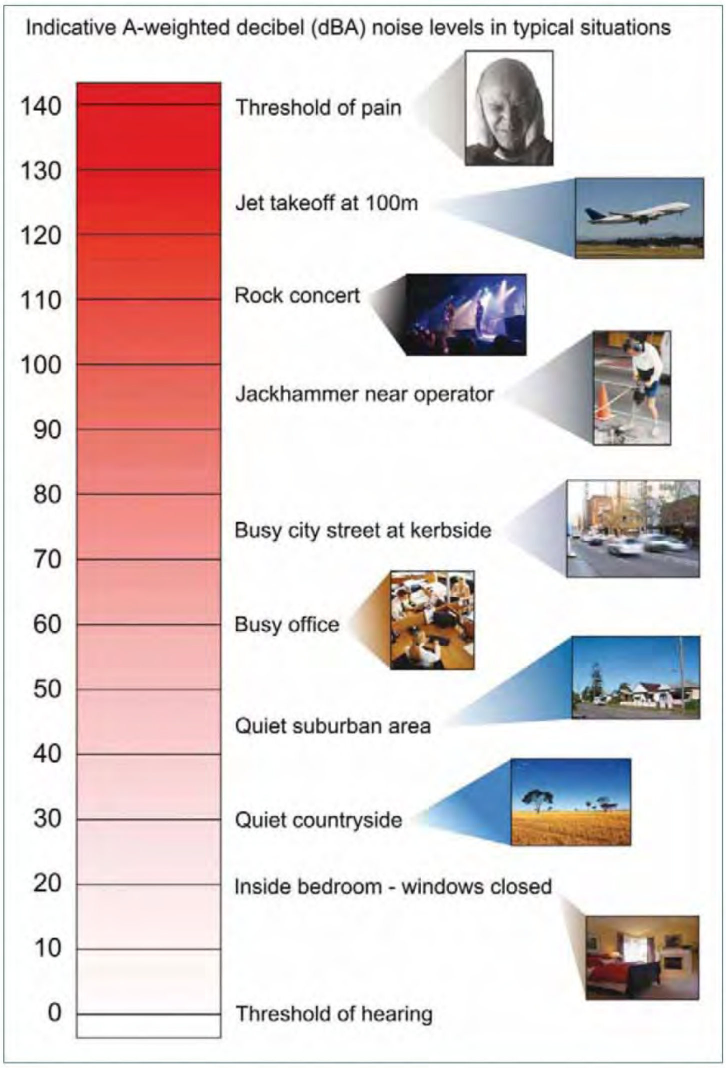
Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level exceeded for 1% of a measurement period.
L_{A10}	A 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{A90}	Commonly referred to as the background noise, this is the 'A-weighted' level exceeded 90% of the time.
L_{Aeq}	It is the 'A-weighted' energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. The $L_{eq,15min}$ descriptor refers to an L_{eq} noise level measured over a 15 minute period.
L_{Amax}	The 'A-weighted' maximum root mean squared sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels, the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels.

Table 2.2 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
1–2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

Examples of common noise levels are provided in Figure 2.1.



Source: Road Noise Policy (Department of Environment, Climate Change and Water (DECCW) 2011)

Figure 2.1 Common noise levels

3 Project and site description

3.1 Site operations and equipment

The site is located at 46 Peachtree Road, Penrith, legally described as Lot 45 DP 793931 (see Figure 4.1). The indicative site layout is shown in Figure 3.1.

The state significant development application seeks consent for the following components:

- repairs to the existing concrete surface of the site where required;
- upgrade of the entry driveway at the south-east boundary to Peachtree Road;
- relocation of awning the on eastern boundary to the north-east boundary and subsequent extension;
- construction of an exit driveway at the south-west boundary to Peachtree Road;
- a surface water management system;
- landscaping;
- ten on-site parking spaces with eight spaces for staff and two spaces for visitors;
- two weighbridges at the site entry and one weighbridge at the site exit;
- a wheel wash at the site exit;
- two demountable weighbridge offices;
- product bays (stockpiles) with 4 m high block walls;
- waste and product stockpiles within product bays;
- a manual hand unloading area for small vehicles;
- truck tipping area where wastes will be temporarily stored prior to processing;
- a sprinkling site irrigation system to minimise airborne dust;
- a flip-flow screen waste sorter housed in the processing shed;
- block walls at the north-east and north-west site boundaries;
- 3 m block walls with colorbond automatic gates at the ingress and egress points;
- extension of 3 m colorbond fence at south-east corner;
- out-of-hours truck parking; and
- updating the existing sign.

The facility will import inert general solid waste (non-putrescible) such as construction and demolition wastes, and selected commercial and industrial wastes, for processing (eg screening and sorting) to produce saleable recycled materials. The recycled materials produced will include soils, metals and dry paper/cardboard. These products will meet recycled material specifications while recovering a range of materials that would otherwise go to lower order land uses or be disposed to landfill.

No special, liquid, hazardous, restricted solid waste or general solid waste (putrescible), as defined in the NSW *Protection of the Environment Operations Act 1997* (POEO Act) and EPA (2014), would be accepted at the facility. No odorous waste will be accepted. All of the materials brought onto the site will be taken from the site as products or as rejects for disposal at an EPA licensed landfill. There would be no materials land-filled or otherwise disposed of anywhere within the site as a result of this proposal.

Benedict Recycling is applying to open at 6 am to allow waste that has been stored in the back of trucks overnight to be delivered to the facility after 6 am but before most building sites open at 7 am.

Public infrastructure projects such as road and rail construction and maintenance are generally scheduled to minimise delays to the public. As a result, the works often start in, or continue into, the evening and night. More rarely, large private civil project also have consent to undertake construction at night. These public and private projects generate large volumes of the types of waste that would be accepted by the facility, particularly excavated materials. As well as minimising inconvenience to public infrastructure users, night works can allow the efficient transport of inert wastes generated by civil works on the less busy road network.

Notwithstanding the above, the facility would normally operate from 6 am to 4 pm Monday to Saturday. Benedict Recycling is applying for longer opening hours to allow it to accept waste from these civil construction and maintenance projects in the evening (6 pm to 10 pm) on occasions and more rarely between 10 pm to 6 am. Penrith City Council would be notified prior to occasions when the facility is accepting waste between 10 pm to 6 am.

The facility may also accept waste from 8 am to 4 pm on Sunday if there is sufficient demand from the public. There will be no processing from 10 pm to 6 am, on Sundays, or on public holidays.

The key elements of the facility are summarised in Table 3.1.

Table 3.1 Key facility elements

Facility element	Description
Maximum processing rate	180,000 tonnes of waste per annum
Site components	• a main processing shed which would contain the majority of waste processing activities and some stockpiles (bins for special waste identifying during processing); • a yard, storage stockpiles and parking area; • two weighbridges at the site entry and a weighbridge at the site exit, a wheel-wash for the outbound traffic lane, two demountable offices and amenities; • a sprinkling site irrigation system to minimise airborne dust; and • general use areas (eg vehicle movement and stacking areas), including internal roads. The entire operational area of the site would be concrete sealed.

Table 3.1 Key facility elements

Facility element	Description
Hours of operation	Accept waste deliveries and dispatch materials (but not process): • 6 am and 10 pm Monday to Friday; • 6 am and 5 pm Saturday; • 8 am to 4 pm Sunday; and • no deliveries or dispatch on public holidays. Waste processing: • 7 am to 6 pm Monday to Saturday; and • no processing on Sundays or public holidays. Accept (but not process) waste deliveries from night works: • 24 hours per day on limited occasions through the year. Notwithstanding the above, the facility would normally operate from 6 am to 4 pm Monday to Saturday.
Employment	Eight employees during normal single shift site operations (ie when the site is open from 6 am to 4 pm). Fifteen employees during two shift site operations (ie when the site is open from 6 am to 10 pm). Additional contractors when accepting waste between 10 pm and 6 am.
Transport and access	Access will be via Peachtree Road. There would be an average of about 352 vehicle movements (ie 176 trips) daily, comprised of 218 light vehicle and 134 heavy vehicle movements for all site activities (waste receiving, products/rejects dispatch, employees and maintenance).

3.2 Site location and surroundings

The site is within an industrial precinct and covers 4,367 m^2. The site is flat (approximately 26 m Australian Height Datum (AHD)) and is covered by concrete, with a shed (which covers 450 m^2), an awning and an 18 m weighbridge in the south-east of the site. The site has a 61 m frontage to Peachtree Road and is surrounded on all sides by a 3 m high wall.

The site was previously used as a metal recycling yard by Metal One Recycling Pty Limited and is currently used by an autowrecker. The site is zoned IN1 General Industrial under the Penrith Local Environmental Plan 2010 (Penrith LEP).

The site is on a two lane road (Peachtree Road) which is a loop road that provides access to an industrial estate off Castlereagh Road. The site is surrounded to the east, west and south by factory units, a cleared and levelled block to the north-west and a Bunnings hardware store to the north-east.

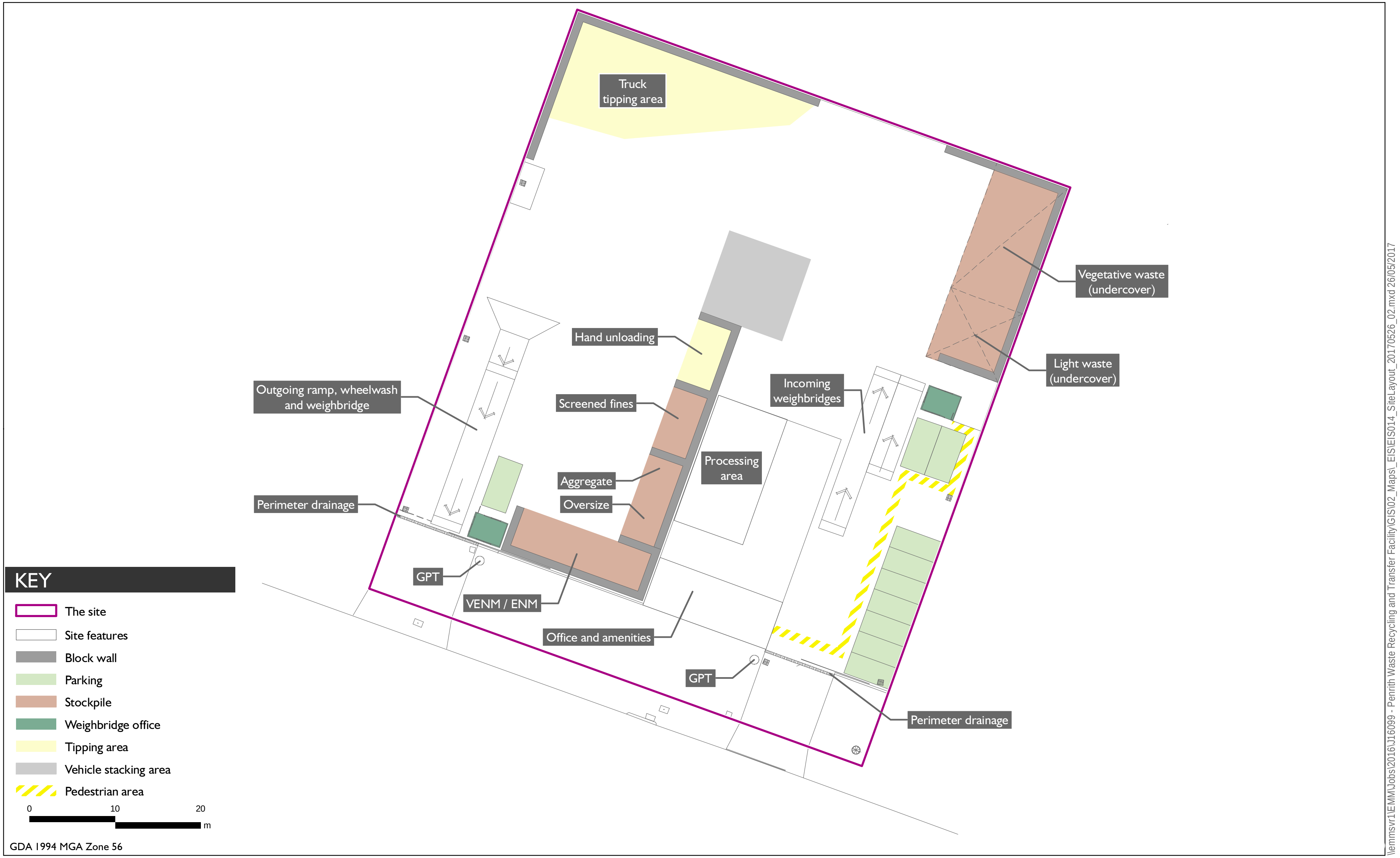
The nearest residences are approximately 620 m to the south-west along Memorial Avenue, and residences are being constructed approximately 620 m to the east on Thornton Drive.

3.3 Key noise matters

The broad potential noise matters for the facility are as follows:

- noise associated with construction activity;
- noise associated with the main operations, dominated by on-site waste recycling within the main building;
- noise associated with traffic travelling to and from the site during operation; and
- cumulative noise from all existing and proposed industrial operations part of the larger development precinct.

This noise impact assessment focuses on these potential matters. Its preparation included identification of representative noise assessment locations, noise measurements, derivation of suitable criteria in accordance with the Industrial Noise Policy (INP) (EPA 2000) and Interim Construction Noise Guideline (ICNG) (DECC 2009) and comparison of predicted noise emission levels at noise-sensitive receivers to appropriate noise criteria.



EMM

Site layout

Penrith Waste Recycling and Transfer Facility

Noise Impact Assessment

Figure 3.1

4 Existing environment

4.1 Noise sensitive receivers

The assessment locations adopted represent those most likely to be affected by the facility. Adherence with noise criteria at these locations would mean that noise criteria will be met at other surrounding noise-sensitive locations. The nearest potentially affected receivers are industrial and commercial premises surrounding the site. The nearest residences are located approximately 620 m south-west and 620 m east of the site. Representative assessment locations considered in the noise assessment are shown in Figure 4.1.

4.2 Existing noise levels

A key element in assessing potential noise impacts from industry is to quantify the existing ambient acoustic environment, including any existing industrial noise where present.

The existing acoustic environment (ie ambient noise) was characterised by long-term unattended noise monitoring. This was supplemented by observations made on site during noise logger deployment and collection.

Existing ambient noise levels for the residential area to the east of the site have previously been measured and reported in *Penrith Commuter Car Park Noise report* prepared by GHD (May 2016). This unattended noise monitoring location is shown in Figure 4.1.

Long-term noise monitoring was completed by EMM at one location in Penrith (south-west of the site) from 21 July to 5 August 2016 (Table 4.1). The long-term monitoring was completed using an ARL EL 316 Type 1 environmental noise logger (s/n 16-306-035). Results of the ambient noise survey have also been summarised in Table 4.2 based on data presented in the GHD report.

Several industrial developments currently operate in the area surrounding the site. Observations during EMM noise logger deployment identified the acoustic environment to be typical of a suburban area with natural noise sources (birds and insects), domestic pets (dogs barking), occasional local traffic movements and very distant traffic noise. EMM's observations confirm that the existing industrial noise is highly likely to be less than the Acceptable Noise Level (ANL) minus 6 dB for all assessment periods, ie the INP threshold level at which adjustment to amenity criteria is triggered.

Table 4.1 EMM noise logging details

Location	Approximate position with respect to the site
L1. 4A Recreation Avenue, Penrith	850 metres to the south-west

Table 4.2 Summary of measured ambient noise levels

Location	RBL, dB			Ambient (L_{Aeq}) noise level, dB		
	Day	Evening	Night	Day	Evening	Night
L1. 4A Recreation Avenue, Penrith	32	33	30	44	40	44
L2. 1 Museum Drive, Penrith	43	42	40	59	55	49

Note: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

The Rating Background Levels (RBL) and ambient $L_{Aeq,(period)}$ noise levels derived from long-term noise monitoring are summarised in Table 4.2. The daily noise data and charts are provided in Appendix A. The logging data was analysed in accordance with the INP, whereby data was excluded where rainfall and/or winds of greater than 5 m/s were recorded. This analysis was completed using weather data from the Bureau of Meteorology's Penrith Lakes Automatic Weather Station (AWS, Station ID 067113).

An attended noise measurement was also completed to gain an understanding of noise levels at residences near the corner of Memorial Avenue and Ladbury Avenue. This location is closer to the site and more exposed than the EMM logger position and is approximately identified as R14 in Figure 4.1. The background noise level at this location was 54 dB $L_{A90,15min}$ between 1:00 pm and 1:15 pm on 21 July 2016. The corresponding level at EMM's logger position was 33 dB and therefore indicates that this area has a noise environment more closely aligned with the logger to the south-east of the site (ie L2).

Noise monitoring and assessment locations

Penrith Waste Recycling and Transfer Facility

Noise Imapct Assessment

Figure 4.1

4.3 Meteorology

Noise propagation over large distances can be significantly affected by the prevailing weather conditions. Of most relevance are source to receiver winds, the presence of temperature inversions and drainage flow effects, as these conditions can enhance received noise levels. To account for these phenomena, the INP specifies meteorological analysis procedures to determine the prevalent weather conditions that enhance noise propagation in a particular area, with a view to determining whether they can be described as a 'feature' in the local area.

4.3.1 Wind

Wind has the potential to increase noise impacts at a receiver when it is light and stable, and blows from the direction of the noise source. As the wind strength increases, the noise produced by the wind usually obscures noise from most industrial and transport sources.

The prevailing wind directions in the area have been determined in accordance with Section 5 of the INP. The INP requires that winds of speeds up to 3 m/s with an occurrence greater than 30% of the time during any period (day, evening or night) in any season be assessed.

4.3.2 Analysis of prevailing winds

The INP recommends consideration of wind effects if they are a “feature” of the area. The INP defines feature as the presence of source-to-receiver wind speed (measured at 10 m above ground level) of 3 metres per second (m/s) or less, occurring for 30% of the time in any assessment period and season.

This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The INP requires that where wind is identified to be a feature of the area then assessment of noise impacts should consider the highest wind speed at or below 3 m/s, which is considered to prevail for at least 30% of the time.

Detailed analysis of winds was undertaken using weather data from the Bureau of Meteorology’s AWS at Penrith Lakes (Station ID 067113) which is approximately 3 km north-west of the site.

The prevailing wind data analysis was undertaken in accordance with INP methodologies and considered weather data over a one year period (2015). The analysis identified that winds during the day-time, evening and night-time periods are a feature of the area, as per the INP. Therefore, prevailing wind conditions are relevant and have been modelled accordingly (refer Section 4.3.5).

4.3.3 Temperature inversions

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions generally occur during the night-time and early morning periods during the winter months. A temperature inversion needs to occur for approximately 30% of the total night-time period during winter, or approximately two nights per week, for it to be a ‘feature’ characteristic of the area and require consideration according to the INP.

The frequency of temperature inversions was determined based on sigma-theta data obtained from the Bureau of Meteorology’s Penrith Lakes automatic weather station. Analysis of the data found that F or G stability class (temperature inversions) may occur for greater than 30% of the night-time period and, as such, has been considered in the prediction and assessment of noise emissions for the night and morning shoulder periods.

4.3.4 Drainage winds

The INP states that a default wind drainage value should be applied where sources are at a higher altitude than the assessment location with no intervening topography. All assessment locations are at a similar elevation to the subject site. Therefore, drainage winds have not been adopted in this assessment.

4.3.5 Modelled meteorological conditions

The relevant site specific meteorological conditions adopted based on the meteorological data analysis are presented in Table 4.3.

Table 4.3 Weather conditions considered in noise modelling

Assessment period	Meteorological condition	Air temperature	Relative humidity	Wind speed[1]	Wind direction[2]	Atmospheric Stability Class
Day	Calm	20°C	70%	0 m/s	N/A	D class
	Winds	20°C	70%	2.4 m/s	45°	D class
Evening	Calm	20°C	70%	0 m/s	N/A	D class
	Winds	20°C	70%	2.5 m/s	All	D class
Night/ Morning Shoulder	Calm	10°C	90%	0 m/s	N/A	D class
	Calm	10°C	90%	2.4 m/s	All	D class
	Temperature inversion	10°C	90%	0 m/s	N/A	F class

Notes: 1. Based on the upper 10th percentile wind speed of all winds present for 30% of the time during the relevant period.

2. Wind directions modelled are at 22.5° intervals from north (0°) based on data from the Penrith Lakes AWS.

5 Noise criteria

5.1 Operational noise

Industrial sites in NSW, including recycling facilities, are regulated by the local council, DPE and/or the EPA and usually have a licence and/or approval conditions stipulating noise limits. These limits are normally derived from operational noise criteria applied at assessment locations. They are based on INP guidelines (EPA 2000) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation.

The INP guidelines for assessing industrial facilities have been used for this assessment. With respect to the criteria, the guidelines state:

> They are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise with the noise criteria. Numerous other factors need to be taken into account in the determination. These factors include economic consequences, other environmental effects and the social worth of the development.

Assessment criteria depend on the existing amenity of areas potentially affected by a proposed development. Noise assessment criteria for industry are based on the following objectives:

- protection of the community from excessive intrusive noise; and
- preservation of amenity for specific land uses.

To ensure these objectives are met, the EPA provides two separate criteria: intrusiveness criteria and amenity criteria. A fundamental difference between the intrusiveness and the amenity criteria is the period they relate to:

- intrusiveness criteria — apply over 15 minutes in any period (day, evening or night); and
- amenity criteria — apply to the entire assessment period (day, evening or night).

5.1.1 Intrusiveness

The intrusiveness criteria require that $L_{Aeq(15\text{-}min)}$ noise levels from the facility during the relevant operational periods (ie day, evening and morning shoulder) do not exceed the RBL by more than 5 dB.

The adopted RBL for assessment locations R11 to R15 was derived from *Penrith Commuter Car Park Noise report* prepared by GHD dated May 2016. These locations were seen to accurately quantify the existing ambient acoustic environment of their respective areas, including any existing industrial noise. Where receptors have been grouped together in the following tables, it has been assumed that the ambient acoustic environment at these receptors is similar.

The RBLs and corresponding intrusive criteria for the facility are given in Table 5.1.

Table 5.1 Intrusive noise criteria

Location	Period[1]	Adopted RBL, dB(A)	Intrusive criteria dB(A), $L_{eq(15\text{-}min)}$
R11 to R15	Day	43	48
	Evening	42	47
	Night	40	45
	Morning shoulder[2]	42	47
L1	Day	32	37
	Evening	32	37
	Night	30	35
	Morning shoulder[2]	31	36

Note: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sundays and public holidays; morning shoulder: 6 am to 7 am.

2. The RBL adopted for the morning shoulder period has been taken as the midpoint of the RBLs determined for day and night-time periods in accordance with the INP Application Notes.

5.1.2 Amenity

The assessment of amenity is based on noise criteria specific to the land use. The criteria relate only to industrial noise and exclude road or rail noise. Where the measured existing industrial noise approaches recommended amenity criteria, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise.

Residential assessment locations potentially affected by the facility have been categorised in the INP urban amenity category (R11 to R15) and suburban amenity category (L1). As per the definitions provided in the INP, residential assessment locations were classified as "urban" since they are exposed to "*through traffic with characteristically heavy and continuous traffic flows during peak times*" and are located "*near commercial districts or industrial districts*". The corresponding recommended amenity criteria for the facility are given in Table 5.2.

Table 5.2 Amenity criteria

Type of Receiver	Indicative area	Time period	Recommended noise level dB(A), $L_{eq,(period)}$	
			Acceptable	Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial premises	All	When in use	70	75
Commercial premises	All	When in use	65	70
Active recreation	All	When in use	55	60
Passive recreation	All	When in use	50	55

5.1.3 Project specific noise level

The project-specific noise level (PSNL) is the more stringent of the calculated intrusive or amenity criteria. The PSNL for the daytime, evening periods are indicated in bold in Table 5.3.

Table 5.3 Project specific noise levels

Receiver	Period[1]	Intrusive criteria dB(A), $L_{eq(15\text{-}min)}$	Amenity criteria dB(A), $L_{eq,(period)}$	PSNL
R11 to R15 (Urban)	Day	**48**	65	**48**
	Evening	**47**	55	**47**
	Night	**45**	50	**45**
	Morning Shoulder	**47**	-	**47**
Industrial premise (R1 to R10)	When in use	-	**70**	**70**
Commercial premise	When in use	-	**65**	**65**
Active recreation	When in use	-	**55**	**55**
Passive recreation	When in use	-	**50**	**50**

Note: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; morning shoulder: 6 am to 7 am.

2. Urban amenity category used for R11 and R12 given their proximity to industry.

5.2 Construction noise and vibration

5.2.1 Construction noise

Construction the facility is estimated to take approximately 8 weeks. However, there are no significant excavation activities proposed (refer Section 3.3) and no construction activity will occur at night.

The NSW DECC Interim Construction Noise Guidelines (ICNG) (DECC 2009) provides guidance for the assessment and management of noise from construction works.

The ICNG suggests the following time restriction for construction activities where the noise is audible at residential premises:

- Monday to Friday 7.00 am to 6.00 pm;
- Saturday 8.00 am to 1.00 pm; and
- no construction work is to take place on Sundays or public holidays.

Table 5.4 is an extract from the ICNG and provides noise management levels for residential receivers for both recommended standard construction hours and outside of these periods. These time restrictions are the primary management tool of the ICNG.

Table 5.4 ICNG residential criteria

Time of day	Management level $L_{Aeq, 15min}$	How to apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

In summary, the ICNG noise level goals at residences for activities during the standard hours are 10 dB above the existing background levels. For activities outside of the recommended standard hours, the noise levels should be no more than 5 dB above the existing background levels.

Table 5.5 presents ICNG noise management levels for commercial and industrial receivers.

Table 5.5 ICNG noise management levels at commercial and industrial land uses

Land use	Management level, $L_{Aeq(15\text{-}min)}$
Industrial premises	External noise level 75 dB (when in use)
Offices, retail outlets	External noise level 70 dB (when in use)

Source: ICNG (DECC 2009).

The construction noise management levels (NMLs) for this assessment have been developed using the noise monitoring data provided in Section 4 and in accordance with the ICNG.

Table 5.6 Construction noise management levels

Receiver	Period	Representative RBL, dB	NML, $L_{Aeq,15min}$, dB
R11 to R15	Day	43	53 (noise affected) 75 (highly noise affected)
	Evening	42	N/A
	Night	40	N/A
L1	Day	32	42 (noise affected) 75 (highly noise affected)
	Evening	32	N/A
	Night	30	N/A
Offices, retail outlets	When in use	N/A	70
Neighbouring industrial premises (R1 to R10)	When in use	N/A	75

Notes: 1. N/A = not applicable since construction activity is not proposed to occur during these periods.

5.2.2 Construction vibration

Environmental Noise Management – Assessing Vibration: a Technical Guideline (DEC 2006) is based on potential vibration impacts of the facility have been assessed, with reference to the guidelines contained in *BS 6472 – 2008, Evaluation of Human Exposure to Vibration in Buildings (1–80Hz).*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, it is recommended the operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the Guideline provides examples of the three vibration types and has been reproduced in Table 5.7.

Table 5.7 Examples of types of vibration

Continuous vibration	Impulsive vibration	Intermittent vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, eg occasional dropping of heavy equipment, occasional loading and unloading.	Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

Source: Table 2.1 of Environmental Noise Management – Assessing Vibration: a Technical Guideline (DEC 2006).

i Continuous and impulsive vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to continuous and impulsive vibration (1–80 Hz). The criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Table 5.8 reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 5.8 Criteria for exposure to continuous and impulsive vibration

Place	Time	Peak velocity, mm/s	
		Preferred	Maximum
Continuous vibration			
Critical working Areas (eg hospital operating theatres, precision laboratories)	Day or night-time	0.14	0.28
Residences	Daytime	0.28	0.56
	Night-time	0.20	0.40
Offices	Day or night-time	0.56	1.1
Workshops	Day or night-time	1.1	2.2
Impulsive vibration			
Critical working Areas (eg hospital operating theatres, precision laboratories)	Day or night-time	0.14	0.28
Residences	Daytime	8.6	17.0
	Night-time	2.8	5.6
Offices	Day or night-time	18.0	36.0
Workshops	Day or night-time	18.0	36.0

Notes: 1. Root mean square (RMS) velocity (mm/s) and vibration velocity value (dB re 10^{-9} mm/s).

2. Values given for most critical frequency >8 Hz assuming sinusoidal motion.

ii Intermittent vibration

Intermittent vibration (as defined in Section 2.1 of the guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time.

Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking).

Section 2.4 of the guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted RMS (root mean square) acceleration levels over the frequency to calculate VDV range 1 Hz to 80 Hz. The following formula (refer section 2.4.1 of the guideline) was used:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

Where *VDV* is the vibration dose value in $m/s^{1.75}$, *a(t)* is the frequency-weighted RMS of acceleration in m/s^2 and *T* is the total period in a day (in seconds) during which vibration may occur.

The Acceptable VDV for intermittent vibration are reproduced in Table 5.9.

Table 5.9 Acceptable vibration dose values (VDV) for intermittent vibration

Location	Daytime		Night-time	
	Preferred value, $m/s^{1.75}$	Maximum value, $m/s^{1.75}$	Preferred value, $m/s^{1.75}$	Maximum value, $m/s^{1.75}$
Critical Areas	0.10	0.20	0.10	0.20
Residences	0.20	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1. Daytime is 7 am to 10 pm and night-time is 10 pm to 7 am.

2. These criteria are indicative only, and there may be a need to assess intermittent values against continuous or impulsive criteria for critical areas.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

iii Structural vibration

Most commonly specified "safe" structural vibration limits are designed to minimise the risk of threshold or cosmetic surface cracks, and are set well below the levels that have potential to cause damage to the main structure.

In terms of the most recent relevant vibration damage criteria, Australian Standard AS 2187.2—2006 *Explosives* - Storage *and Use - Use of Explosives* recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2* be used as they are "applicable to Australian conditions".

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 5.10 and graphically in Figure 5.1.

Table 5.10 Transient vibration guide values - minimal risk of cosmetic damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

The standard states that the guide values in Table 5.10 relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 5.10 may need to be reduced by up to 50%.

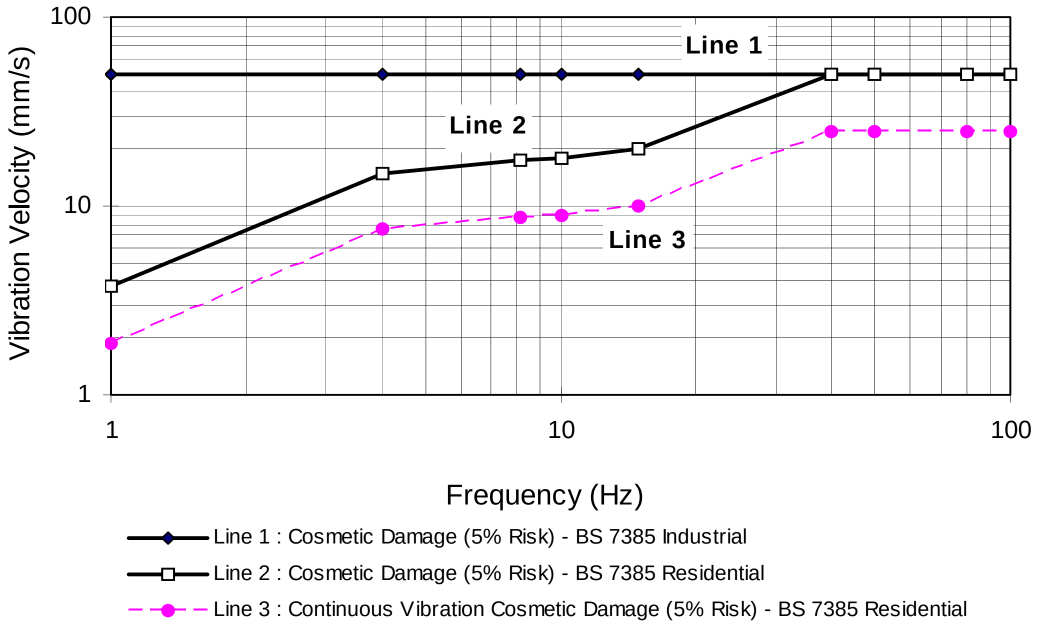


Figure 5.1 Graph of transient vibration guide vales for cosmetic damage

Sheet piling activities (for example) are considered to have the potential to cause dynamic loading in some structures (eg residences) and it may therefore be appropriate to reduce the transient values by 50%.

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for building types corresponding to Line 2 are reduced (Figure 5.1). Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 5.10, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the guide values in Table 5.10 should not be reduced for fatigue considerations.

In order to assess the likelihood of cosmetic damage due to vibration, AS2187 specifies that vibration measurements should be undertaken at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) should be compared with the criteria curves presented in Table 5.10.

It is noteworthy that extra to the guide values nominated in Table 5.10, the standard states that:

> Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.

Also that:

> A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.

iv Ground-borne noise

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. The ICNG provides guidance on the assessment of ground-borne noise and relevant internal noise levels for the evening and night-time periods above which management actions should be implemented.

It is understood that vibration-generating events, such as vibratory rolling and compacting, would occur during the daytime only. As such, ground-borne noise impacts are not expected at the nearest residences.

5.3 Sleep disturbance criteria

The facility will typically operate during the morning shoulder from 6 am to 7 am, which falls in the defined night-time period and, on occasion, deliveries and dispatch may occur during the night-time period. Therefore assessment of sleep disturbance is required in accordance with the INP and associated application notes.

The operational criteria described in Section 5.1, which consider the average noise emission of a source over 15 minutes, are appropriate for assessing noise from steady-state sources, such as engine noise from mobile plant and other equipment. However impact noise from sources such as a front end loader (FEL) loading trucks is intermittent (rather than continuous) and needs to be assessed using the L_1 or L_{max} noise metrics when determining the potential for sleep disturbance.

The INP *Application Notes* (last updated June 2013) recognise that the current sleep disturbance criteria is not ideal. The assessment of potential sleep disturbance is complex and poorly understood and the EPA believes that there is insufficient information to determine a suitable alternative criteria.

In the interim, the INP guideline suggests that the $L_{A1(1min)}$ level of 15 dB above the RBL is a suitable screening criteria for sleep disturbance for the night-time period. Guidance regarding potential for sleep disturbance is also provided in the NSW *Road Noise Policy* (RNP) (EPA 2011). The RNP references a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels below 50 to 55 dBA are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels of 65 to 70 dBA, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external L_{Amax} noise levels in the order of 60 to 65 dB calculated at the facade of a residence are unlikely to cause sleep disturbance affects.

If noise levels over the screening criteria are identified, then additional analysis should consider factors such as:

- how often the events would occur;
- the time the events would occur (between 10 pm and 7 am); and
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

Table 5.11 provides the sleep disturbance criteria for the residential assessment locations.

Table 5.11 Sleep disturbance criteria – residential assessment locations

Assessment location	Adopted RBL, dB[1]	Sleep disturbance criteria dB, L_{Amax}
R11 & R12	40	55
R13, R14 & R15	30	45

Notes: 1. Night-time RBL adopted.

5.4 Road traffic noise criteria

The principle guidance for assessing the impact of road traffic noise is the RNP. The site is accessible from Peachtree Road via Castlereagh Road. Castlereagh Road is a major heavy vehicle route and Peachtree Road is in the IN1 General Industrial zone and is suitable for heavy vehicles.

Table 5.12 presents the road noise assessment criteria reproduced, from Table 3 of the RNP, for Castlereagh Road.

Table 5.12 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{eq(15\text{-}hr)}$ 60 (external)	$L_{eq(9\text{-}hr)}$ 55 (external)

Source: EPA (2011).

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

5.4.1 Relative increase criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at assessment locations must be considered. Assessment locations experiencing increases in total traffic noise levels above those presented in Table 5.13 should be considered for noise mitigation.

Table 5.13 Relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{eq(15\text{-}hr)}$ +12 dB (external)	Existing traffic $L_{eq(9\text{-}hr)}$ +12 dB (external)

6 Operational noise assessment

6.1 Noise modelling method

This section presents the methods and assumptions used to model noise emissions from operation of the facility.

Noise modelling was based on three-dimensional digitised ground contours of the surrounding land. Noise predictions were carried out using Brüel and Kjær Predictor Version 11.00 noise prediction software. 'Predictor' calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The model has considered factors such as:

- the lateral and vertical location of plant;
- source to assessment location distances;
- ground effects;
- atmospheric absorption;
- topography of the site and surrounding area; and
- applicable meteorological conditions (refer to Section 4.3).

Plant and equipment was modelled at locations and heights representing maximum likely activity during operations using representative equipment sound power levels and quantities provided in Table 6.1. The sound power levels adopted have been taken from an EMM database of similar equipment.

Table 6.1 Operational plant and equipment sound power levels

Plant and equipment	Typical activities	Location	Assumed utilisation (per 15 minutes)	Quantity	Lw, $L_{Aeq(15\text{-}min)}$, dB
Main operations (daytime)					
Excavator	Sorting waste using a variety of excavator attachments Loading feed to processing plant	Outside in main yard	100%	1	104
Heavies sorter (screen)	Sorting co-mingled waste	Inside main shed	100%	1	101
Front-end loader (FEL)	Loading trucks Moving waste products	Outside in main yard	100%	1	108
Road truck	Returning to/leaving the site	Delivery/dispatch route	40%	1	104
	Unloading waste	Large truck tipping area	20%	1	104
Idling road truck	Standing at weighbridges	Weighbridges	10%	2	90
	Being loaded by FEL	Outside in main yard	60%	1	90

Table 6.1 Operational plant and equipment sound power levels

Plant and equipment	Typical activities	Location	Assumed utilisation (per 15 minutes)	Quantity	Lw, $L_{Aeq(15\text{-}min)}$, dB
Transporting product + deliveries (evening/morning shoulder)					
Front-end loader (FEL)	Loading trucks	Outside in main yard	75%	1	108
Road truck	Returning to/leaving the site	Delivery/dispatch route	20%	1	104
	Unloading waste	Large truck tipping area	10%	1	104
Idling road truck	Standing at weighbridges	Weighbridges	5%	2	90
	Being loaded by FEL	Outside in main yard	30%	1	90
Deliveries only (night)					
Road truck	Returning to/leaving the site	Delivery/dispatch route	10%	1	104
	Unloading waste	Large truck tipping area	5%	1	104
Idling road truck	Standing at weighbridges	Weighbridges	2.5%	2	90

Noise modelling was completed for daytime, evening, night and morning shoulder periods for the meteorological scenarios presented in Table 4.3. For context, a schematic of the noise model has been provided in Appendix B.

6.2 Noise modelling results and discussion

Predicted facility noise emission levels at the assessment locations shown in Figure 4.1 are provided in Tables 6.2 and 6.3. Noise modelling contours have been provided in Appendix C.

Table 6.2 Operational noise modelling results – daytime and evening

Assessment locations		Predicted operational noise level, dB					
		Daytime			Evening (Transporting + deliveries)		
ID	Type	Calm	Winds	Target noise level	Calm	Winds	Target noise level
R1	Industrial	62	62	70	59	59	70
R2	Commercial	63	63	65	60	60	65
R3	Industrial	53	53	70	50	50	70
R4	Industrial	48	48	70	45	45	70
R5	Industrial	60	60	70	57	57	70
R6	Industrial	61	61	70	58	58	70
R7	Industrial	53	53	70	50	50	70
R8	Industrial	61	61	70	59	59	70
R9	Industrial	59	59	70	56	56	70
R10	Commercial	61	61	65	58	58	65
R11	Residential	39	36	48	36	39	47
R12	Residential	39	36	48	36	39	47
R13	Residential	38	41	48	35	38	47
R14	Residential	38	40	48	35	37	47
R15	Residential	35	38	48	32	35	47
R16	Passive Recreation	41	44	50	38	40	50
R17	Active Recreation	43	45	55	40	4341	55

Table 6.3 Operational noise modelling results – night and morning shoulder

Assessment locations		Predicted operational noise level, dB							
		Night (Deliveries only)				Morning shoulder (Transporting + deliveries)			
ID	Type	Calm	Winds	Inversion	Target noise level	Calm	Winds	Inversion	Target noise level
R1	Industrial	45	45	45	70	59	59	59	70
R2	Commercial	47	47	47	65	60	60	60	65
R3	Industrial	39	40	40	70	49	49	49	70
R4	Industrial	35	35	35	70	43	43	43	70
R5	Industrial	47	47	47	70	57	57	57	70
R6	Industrial	48	48	48	70	58	58	58	70
R7	Industrial	39	39	39	70	49	49	49	70
R8	Industrial	45	45	45	70	59	59	59	70
R9	Industrial	45	45	45	70	55	56	56	70
R10	Commercial	47	47	47	65	57	57	57	65
R11	Residential	25	28	28	45	36	39	39	47
R12	Residential	26	29	29	45	36	39	39	47
R13	Residential	24	27	27	45	34	37	37	47
R14	Residential	23	26	26	45	34	37	37	47
R15	Residential	20	23	23	45	31	34	34	47
R16	Passive Recreation	28	30	30	50	37	40	40	50
R17	Active Recreation	26	29	29	55	39	41	41	55

Operational noise emission levels are predicted to meet the relevant PSNLs at all assessment locations.

Given predicted noise levels satisfy criteria, it is unlikely that noise emissions from the facility would cause adverse impacts at the assessment locations. Furthermore, all good practice and feasible and reasonable noise mitigation and management has been included in the project design (eg most operations occurring in a shed).

6.3 Sleep disturbance assessment

The loading and/or unloading of trucks during the night and morning shoulder periods has been assessed. Typical maximum noise events are likely to include impacts associated with loading/unloading activities. A typical impact L_{Amax} sound power level of 126 dB has been used to predict potential sleep disturbance impacts (Table 6.3), based on data sourced from EMM files.

Table 6.4 Predicted maximum noise levels at residential assessment locations

Assessment locations	Predicted L_{Amax} noise level, dB			L_{Amax}, noise criterion, dB
	Calm	Winds	Inversion	
R11	54	57	57	55 L_{Amax}
R12	54	57	57	
R13	53	55	55	
R14	51	53	53	
R15	47	50	50	

Noise modelling predicts that the INP sleep disturbance screening criteria will be met during calm weather, but exceeded at some locations during prevailing meteorological conditions. However, the RNP provides the following conclusion from the research on sleep disturbance:

> maximum internal noise levels below 50 to 55 dB(A) are unlikely to awaken people from sleep

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60 to 65 dB calculated at the facade of a residence are unlikely to cause sleep disturbance affects.

The highest predicted external maximum noise level from site is 57 dB under adverse weather conditions. This is only marginally above the EPA's screening criteria.

The results of background noise monitoring at the relatively quieter L1 location indicate that ambient noise levels in the area are steadily increasing from approximately 3 am each day and existing maximum noise levels at night are typically greater than 55 dB and above 70 dB on occasions, ie well above the highest predicted maximum noise level of 57 dB (L_{Amax}) from the facility. Therefore, the maximum noise levels from the facility will be within the levels already occurring in the area and the facility will not significantly increase the number of noise events during the night period. Therefore, sleep disturbance as a result of the facility is unlikely. Nonetheless, work practices during the night & morning shoulder periods will be appropriately managed to minimise such impact sounds.

6.4 Cumulative noise assessment

Potential cumulative noise impacts from existing and successive developments are considered by the INP procedures by ensuring that the appropriate noise criteria are established with a view to maintaining acceptable noise *amenity* levels. Therefore, the cumulative impact of the facility with existing industrial noise sources has been assessed in the determination of the acceptable amenity levels at the assessment locations.

As noted in Section 4.2, existing industrial noise levels were observed to be such that they do not require adjustment to the ANL as per Table 2.2 of the INP. Hence, cumulative impacts and amenity have been appropriately considered.

7 Construction noise and vibration assessment

7.1 Construction noise

Noise levels from proposed construction activities were predicted at the assessment locations.

Simultaneous operation of two delivery/haul trucks, two concrete trucks, one crane and one excavator (30 tonne) were used to represent typical construction activities and are considered to represent an acoustically worst-case 15-minute period during standard construction hours.

Representative sound power levels associated with these equipment used in noise modelling are summarised in Table 7.1.

Table 7.1 Representative equipment sound power levels

Equipment	$L_{Aeq(15\text{-}min)}$ Sound Power Level, dB
Delivery Truck	103
Concrete truck	113
Excavator	104
Crane	106

It has been assumed that construction activity will generally take place during standard construction hours. Activities outside standard construction hours may be permitted where there is a safety requirement or emergency work needs to be undertaken or where it can be demonstrated that construction activity will not cause noise impact at nearby residences.

Indicative construction noise emission predictions for the facility are provided in Table 7.2.

Table 7.2 Predicted construction noise

<table>
<tr><th rowspan="2">Assessment locations</th><th>Indicative construction noise level $L_{Aeq\ (15\ min)}$, dB</th><th>Construction noise management level, dB</th></tr>
<tr><th>Standard construction hours</th><th>Standard construction hours</th></tr>
<tr><td>R1</td><td>69</td><td rowspan="10">75 $L_{Aeq(15\ min)}$ (external)</td></tr>
<tr><td>R2</td><td>66</td></tr>
<tr><td>R3</td><td>54</td></tr>
<tr><td>R4</td><td>49</td></tr>
<tr><td>R5</td><td>64</td></tr>
<tr><td>R6</td><td>68</td></tr>
<tr><td>R7</td><td>58</td></tr>
<tr><td>R8</td><td>65</td></tr>
<tr><td>R9</td><td>66</td></tr>
<tr><td>R10</td><td>68</td></tr>
<tr><td>R11</td><td>40</td><td>53 $L_{Aeq(15\ min)}$ (noise affected)</td></tr>
<tr><td>R12</td><td>40</td><td>75 $L_{Aeq(15\ min)}$ (highly noise affected)</td></tr>
<tr><td>R13</td><td>40</td><td>53 $L_{Aeq(15\ min)}$ (noise affected)</td></tr>
<tr><td>R14</td><td>40</td><td>75 $L_{Aeq(15\ min)}$ (highly noise affected)</td></tr>
</table>

Table 7.2 Predicted construction noise

Assessment locations	Indicative construction noise level $L_{Aeq (15 min)}$, dB	Construction noise management level, dB
	Standard construction hours	Standard construction hours
R15	40	
R16	45	65 $L_{Aeq(15 min)}$ (external)
R17	42	60 $L_{Aeq(15 min)}$ (external)

Construction noise levels are predicted to be below the noise-affected management levels (Table 7.2). The predictions assume all equipment is operating simultaneously and at the nearest locations within the site to the relevant residential dwellings (R11–R15), it is likely that actual construction noise levels would be less than those predicted for the majority of the time. Notwithstanding, recommendations are provided in Section 9 to minimise construction noise from the facility.

7.2 Construction vibration

The exact methods and/or vibration generating equipment that will be utilised for construction are not known. Safe working distances for typical items of vibration intensive plant are listed in Table 7.3. The safe working distances are quoted for both "Cosmetic Damage" (refer British Standard BS 7385) and "Human Comfort" (refer British Standard BS 6472-1).

Table 7.3 Recommended safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Vibratory Roller	<50 kN (typically 1–2 tonnes)	5 m	15 to 20 m
	<100 kN (typically 2–4 tonnes)	6 m	20 m
	<200 kN (typically 4–6 tonnes)	12 m	40 m
	<300 kN (typically 7–13 tonnes)	15 m	100 m
	>300 kN (typically 13–18 tonnes)	20 m	100 m
	>300 kN (>18 tonnes)	25 m	100 m
Small hydraulic hammer	(300 kg - 5 to 12 tonne excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18 tonne excavator)	7 m	23 m
Large hydraulic hammer	(1,600 kg - 18 to 34 tonne excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Source: *Transport Infrastructure Development Corporation Construction's Construction Noise Strategy (Rail Projects), November 2007.*
Plant items shown are indicative to illustrate safe working distances, not all plant items will be used.

The safe working distances presented in Table 7.3 are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

In relation to human comfort response, the safe working distances in Table 7.3 relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed, as discussed in BS 6472-1.

The nearest industrial buildings are located approximately 10 m from the eastern and western property boundaries. The nearest residences are located approximately 620 m from the nearest point on the eastern property boundary.

A hand-held jack hammer will be used during construction to break the existing concrete slab required to construct the gross pollutant traps (GPTs) at the eastern and western sides of the southern boundary. This is the only vibratory equipment that will be used. As shown in Table 7.3, such activities further than 1 m from structures would satisfy safe working distances.

Vibration management measures are provided in Section 9.

8 Road traffic noise assessment

There are no residences fronting roads will experience a significant increase in road traffic volumes as a result of the facility. The *Penrith Traffic Impact Assessment* (EMM 2016) states that the predicted total traffic volume increase as a result of vehicles associated with operation of the facility is up to 0.6% on Castlereagh Road with an associated increase in heavy vehicles of 5%.

Traffic generated by the facility will not generate any noticeable increase in road traffic average noise levels at the nearest residential locations. This increase in traffic volume would lead to a negligible increase (<0.5 dB) in road traffic noise. Therefore, the impact of road traffic noise associated with the facility will be within the 2 dB allowable increase for land use developments (see Section 5.4).

9 Noise management

9.1 Construction noise and vibration

As described in Section 7, it is predicted that noise levels will satisfy the relevant noise goals during construction.

Notwithstanding, there are a range of mitigation measures that will be employed to reduce noise impacts. These include:

- scheduling construction activities such that the concurrent operation of plant is limited;
- properly maintaining plant to ensure rated noise emission levels are not exceeded;
- undertaking construction activities guided by AS2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*; and
- providing a contact telephone number on a sign at the front of the site which the public may use to seek information or make a complaint. A log of complaints should be maintained and actioned by the site superintendent in a responsive manner.

9.2 Adoption of general noise and vibration management practices

The *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* AS 2436-2010 sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of measures that could be implemented at the facility are listed below.

9.2.1 Universal work practices

Universal work practices to minimise noise and vibration emissions include:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;
- regular identification of noisy activities and adoption of improvement techniques;
- minimise the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact neighbours;
- minimising the use of equipment that generates impulsive noise;
- minimising the movement of materials and plant and unnecessary metal-on-metal contact; and
- minimising truck movements.

9.2.2 Plant and equipment

Measures to minimise noise emissions from plant and equipment include:

- choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks;
- operating plant and equipment in the quietest and most efficient manner;
- regularly inspecting and maintaining plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively;
- material drop heights will be minimised and dragging materials along the ground will be minimised;
- site contact details will be provided on a board at the front of the site;
- any noise-related complaints will be handled promptly; and
- a complaints register will be maintained.

These are standard practices and are widely implemented. They include minimising material drop heights to:

- minimise noise emissions;
- maximise (fuel and time) efficiency by not lifting loads any higher than required;
- reduce wear and prevent damage to site surfaces that requires costly repair; and
- prevent damage to vehicle trays by lowering the load as far as possible before releasing or tipping - truck drivers are generally quick to highlight when drop heights are not minimised.

Similarly, it is inefficient to drag materials along the ground rather than lifting them and quickly damages the site surface leading to costly repairs.

9.2.3 Work scheduling

Work scheduling to minimise the impact of noise include:

- scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events;
- scheduling work to coincide with non-sensitive periods;
- scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive;

- planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers;
- optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours; and
- conducting high vibration generating activities in continuous blocks, with appropriate respite periods as determined through consultation with potentially affected neighbours.

10 Conclusion

EMM has prepared a NIA to accompany a SSDA for the proposed Penrith Waste Recycling and Transfer Facility. This noise assessment has been prepared in accordance with the methodology outlined in the INP and associated Application Notes, as well as other relevant guidelines and standards.

Project specific noise levels (noise criteria) have been established based on the results of ambient noise monitoring and the methodology provided in the INP.

Operational noise levels have been assessed for the daytime, evening, night and morning shoulder periods during calm and adverse weather conditions. Operational noise emission levels are predicted to meet the relevant PSNLs at all assessment locations.

Sleep disturbance from operation of the facility during the morning shoulder period has been assessed. Internal maximum noise level events are predicted to be below those likely to wake residents.

An assessment of cumulative industrial noise from the facility together with other industrial noise sources in the vicinity was also conducted. The facility is not predicted to increase industrial noise levels above the relevant amenity criteria.

A quantitative approach has been taken regarding the assessment of construction noise from the facility. It is predicted that noise emission from proposed construction activity will be below the recommended noise management level at the assessment locations. Notwithstanding, recommendations have been provided regarding work practices to be considered to minimise construction noise from the facility.

The facility will result in additional traffic movements. However the increase will be minor in comparison to existing traffic volumes and the overall increase in road traffic noise level the facility at residences will be negligible.

References

Australian Standard AS 1055-1997, *Acoustics - Description and Measurement of Environmental Noise*.

Australian Standard AS 2436-2010, *Guide to Noise Control on Construction, Maintenance and Demolition Sites.*

EMM Consulting Pty Ltd (EMM) 2016, *Penrith Traffic Impact Assessment*. Report prepared for Benedict Recycling.

GHD Pty Ltd 2016, *Transport for NSW - Penrith Commuter Car Park Noise report.*

NSW Department of Environment and Climate Change 2009, *Interim Construction Noise Guideline.*

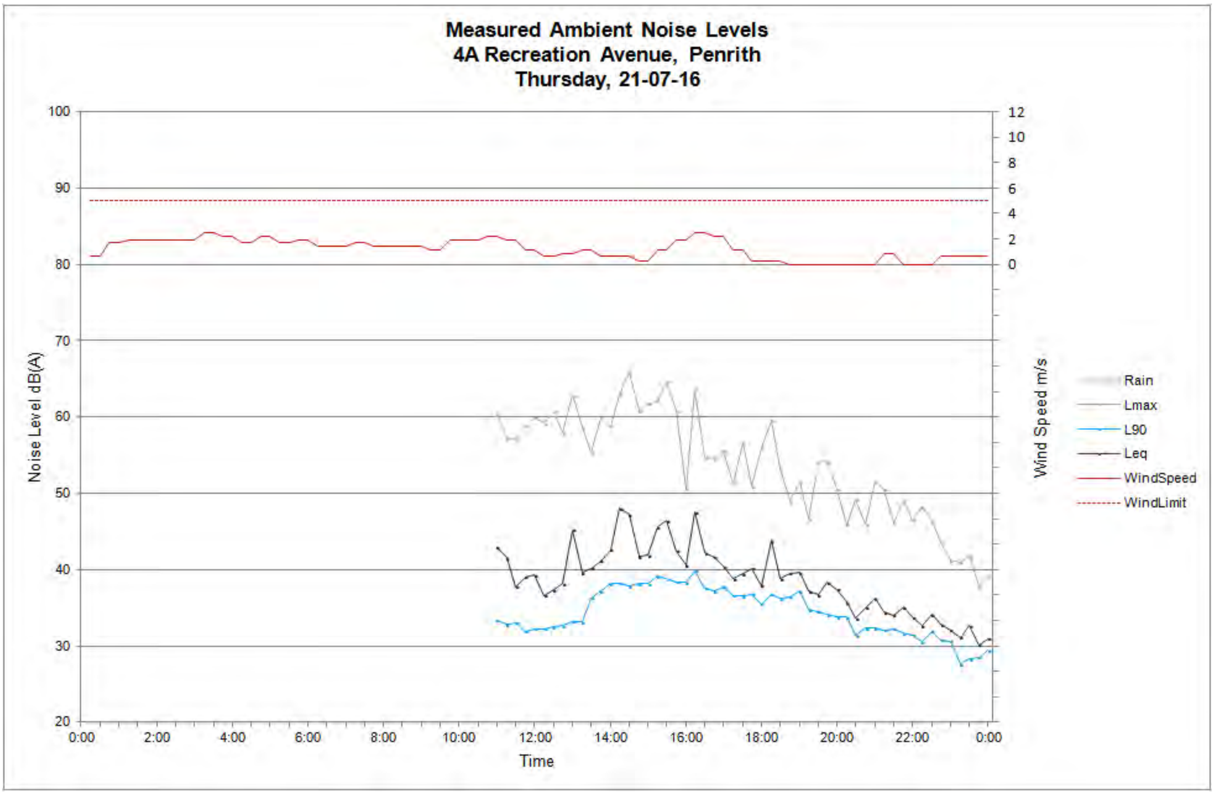
NSW Department of Environment and Conservation 2006, *Assessing Vibration: A Technical Guideline.*

NSW Department of Environment, Climate Change and Water 2011, *Road Noise Policy*.

NSW Environmental Protection Authority 2000, *Industrial Noise Policy.*

Appendix A

Daily unattended monitoring results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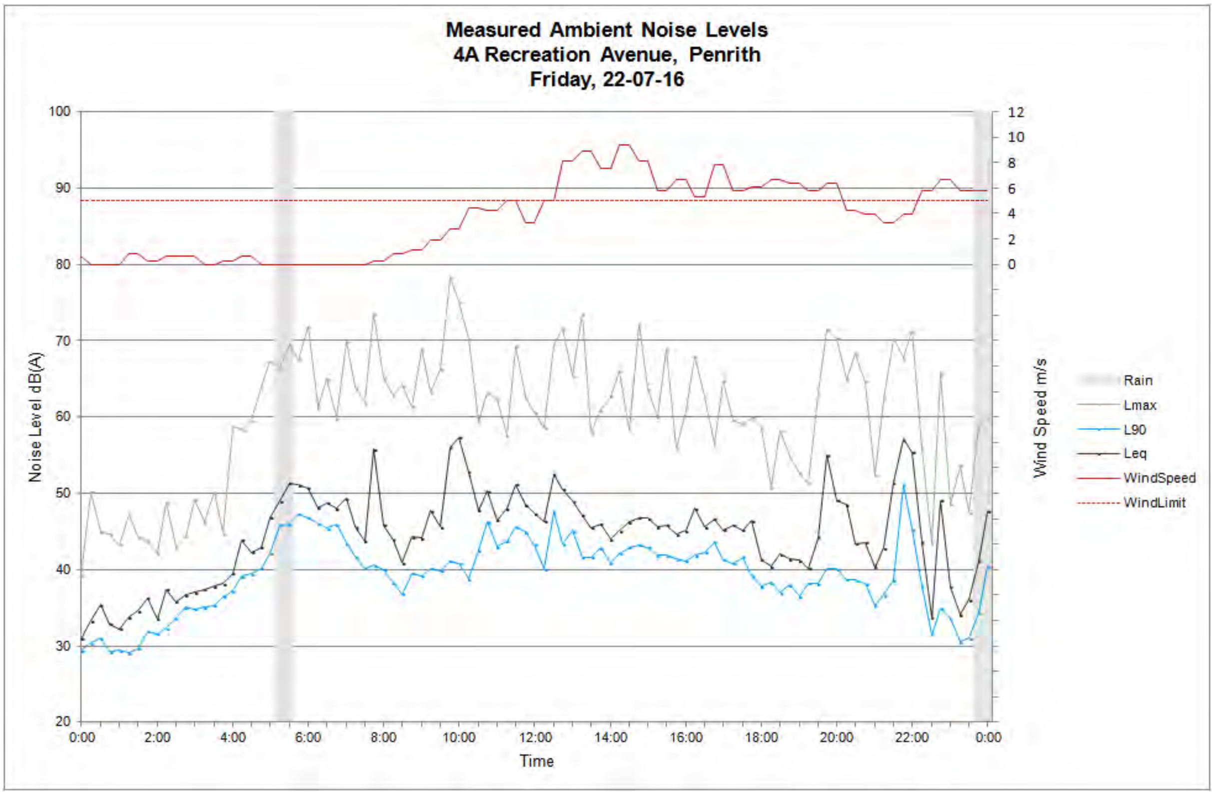
Time
Rain
Lmax
L90
Leq
WindSpeed
WindLimit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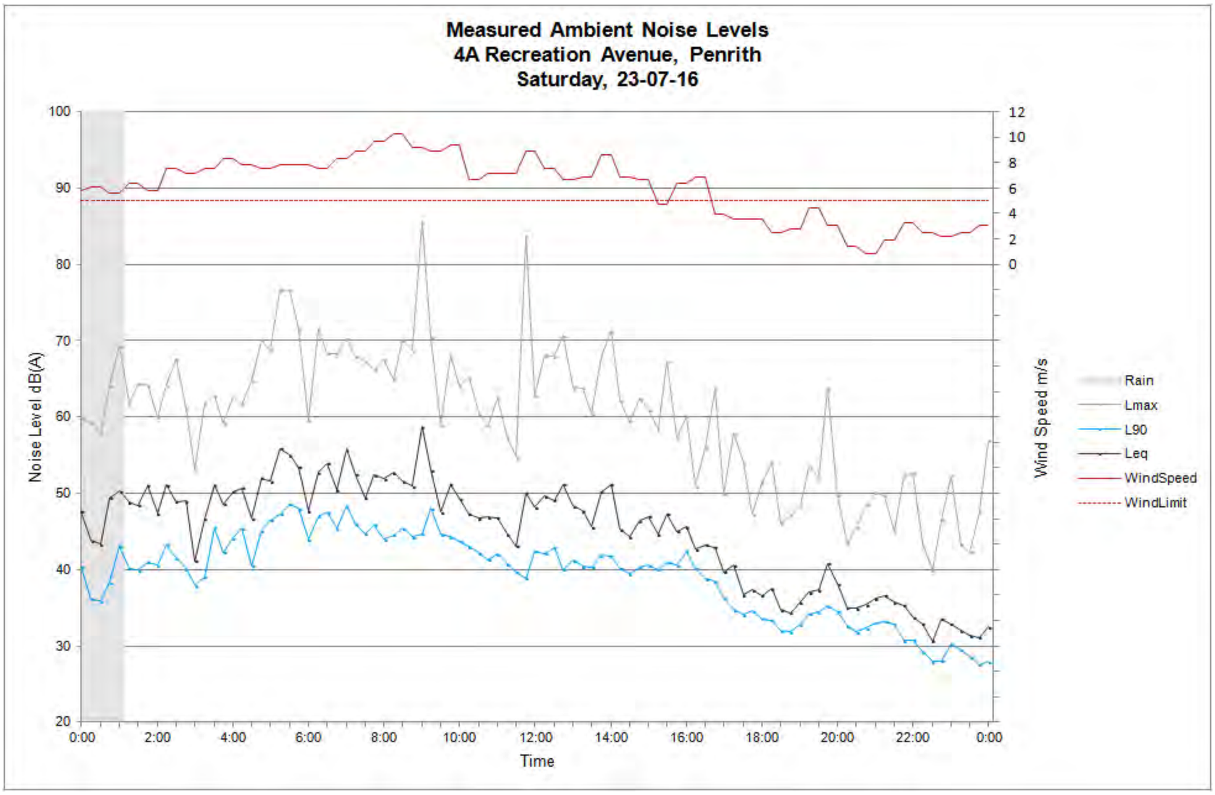
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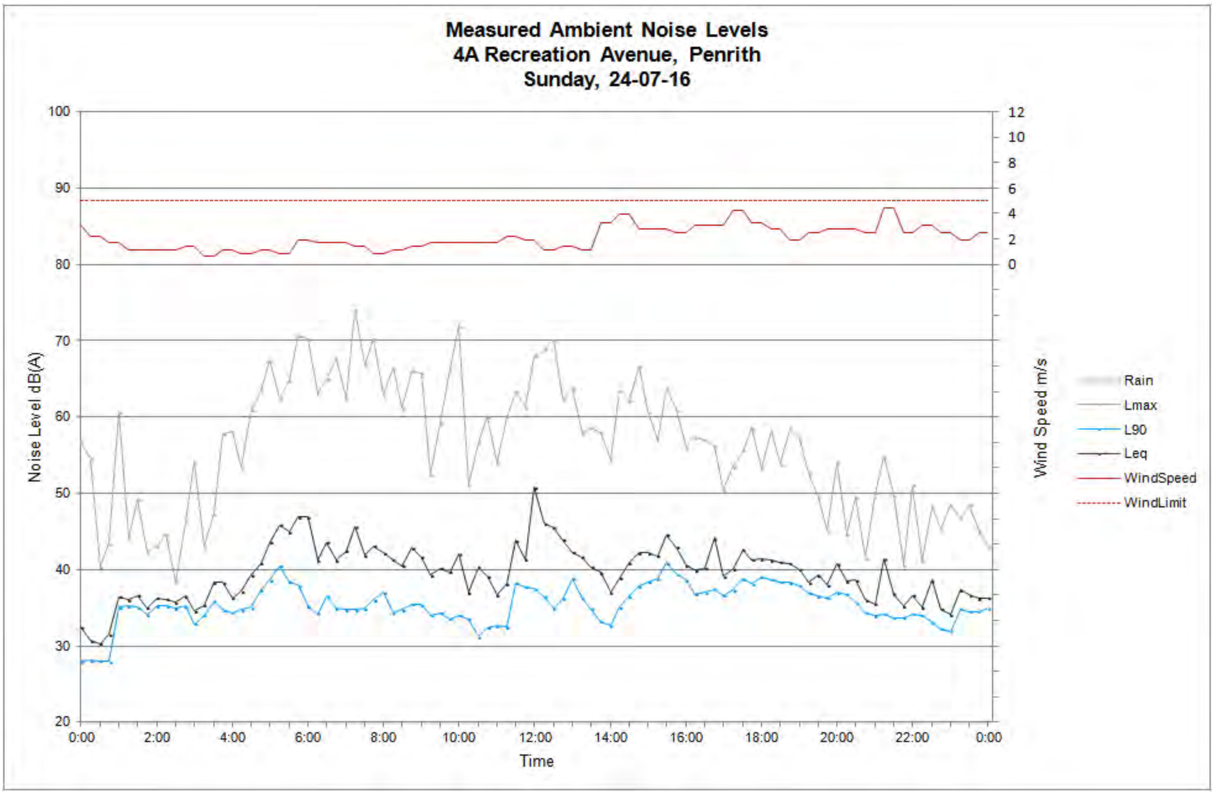
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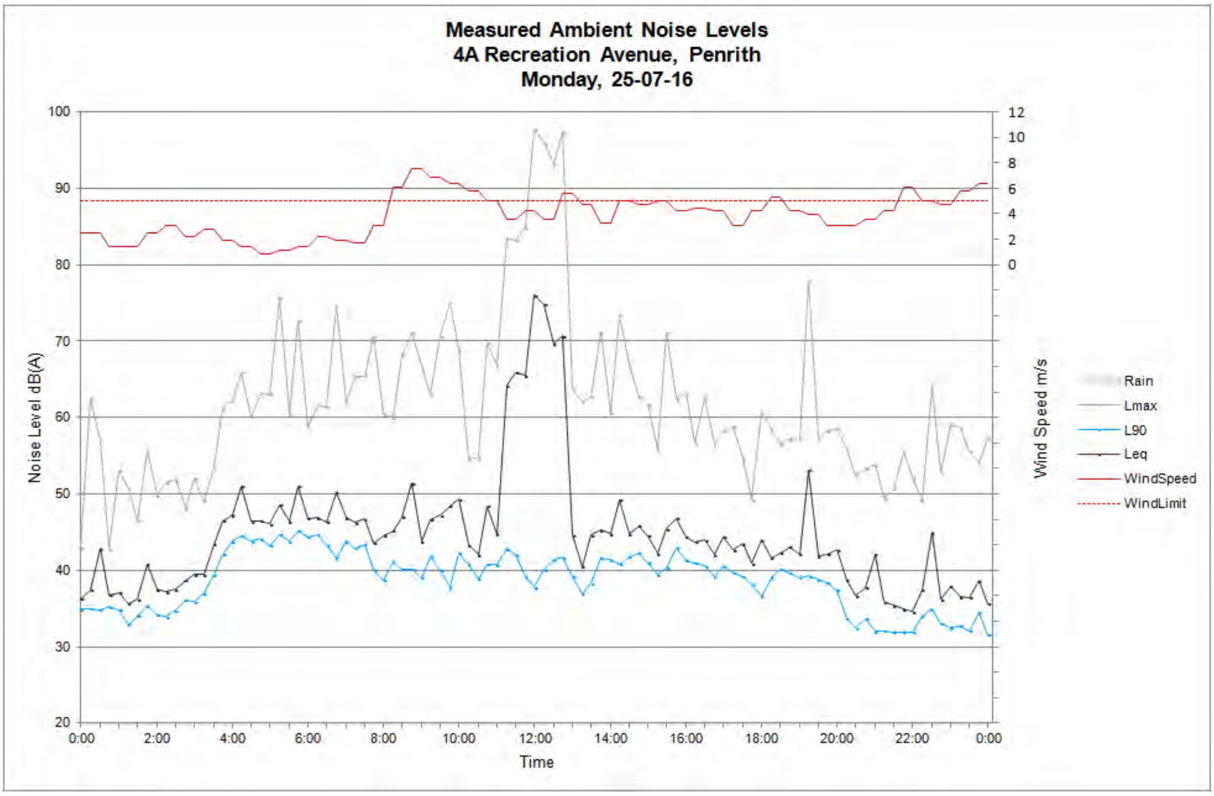
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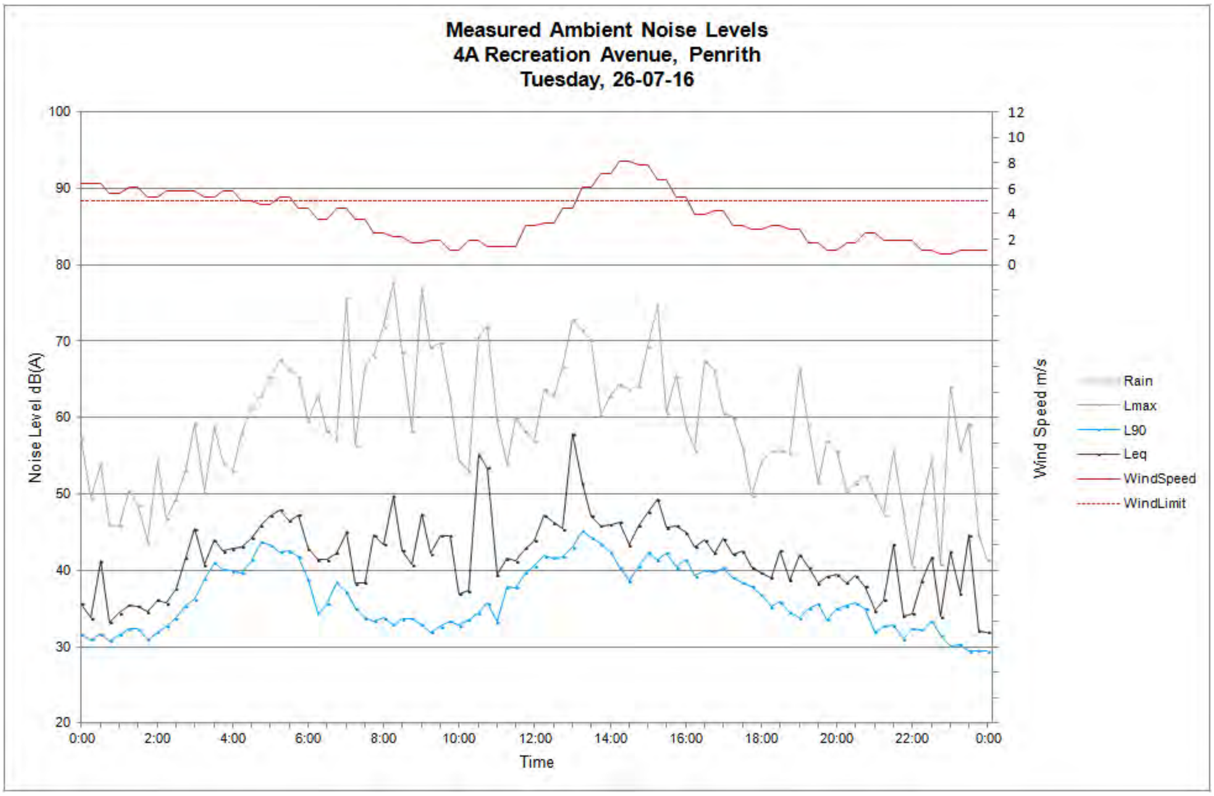
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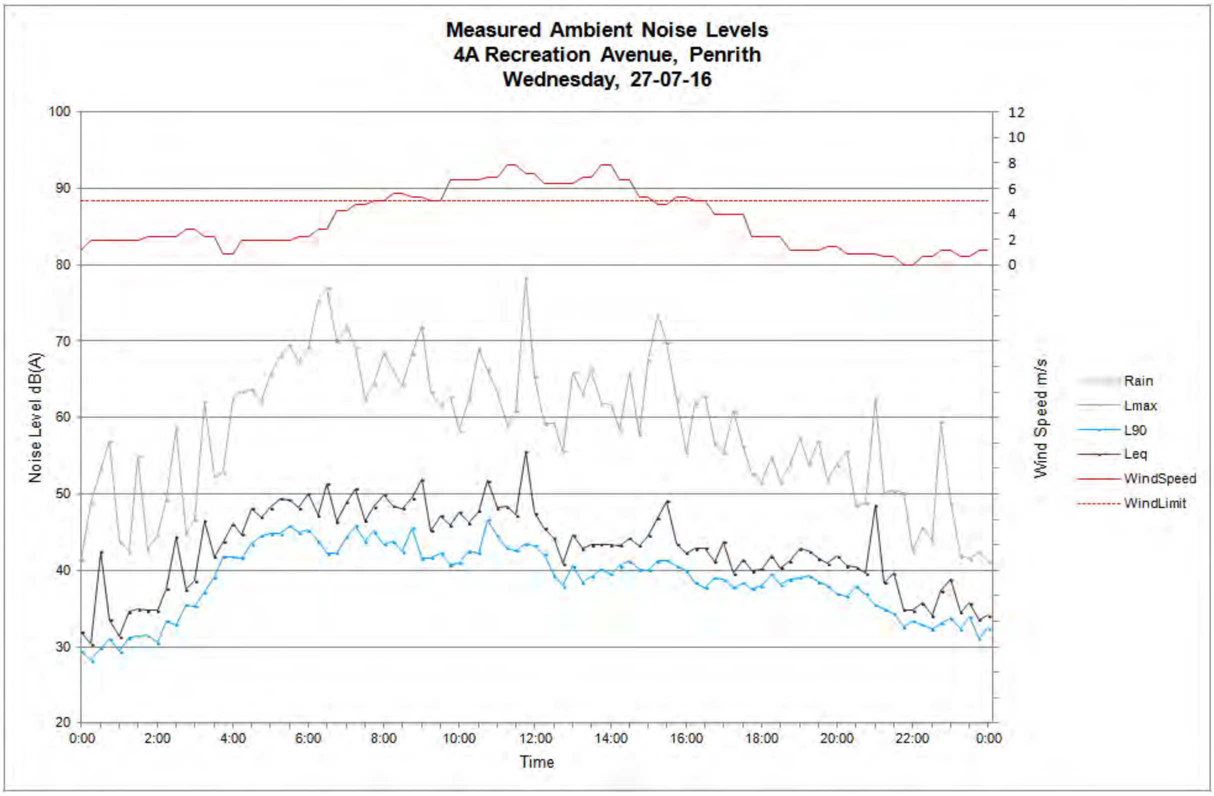

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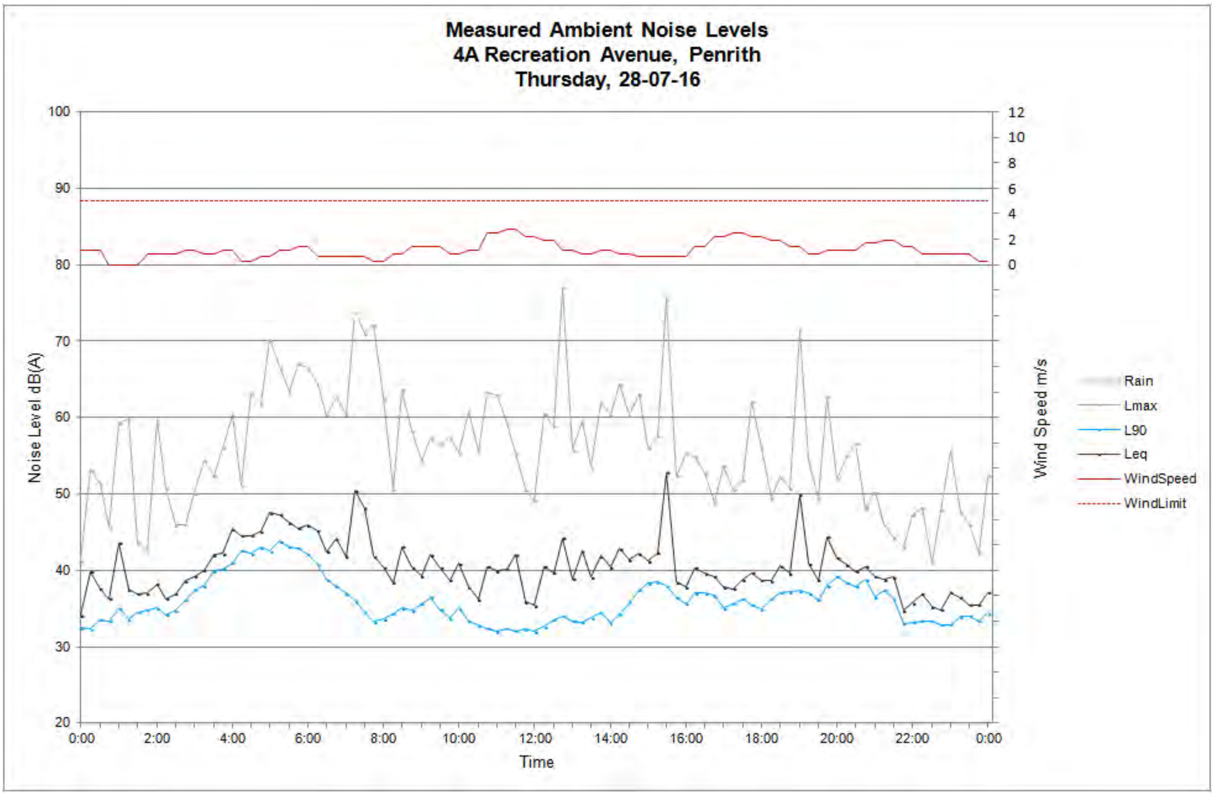

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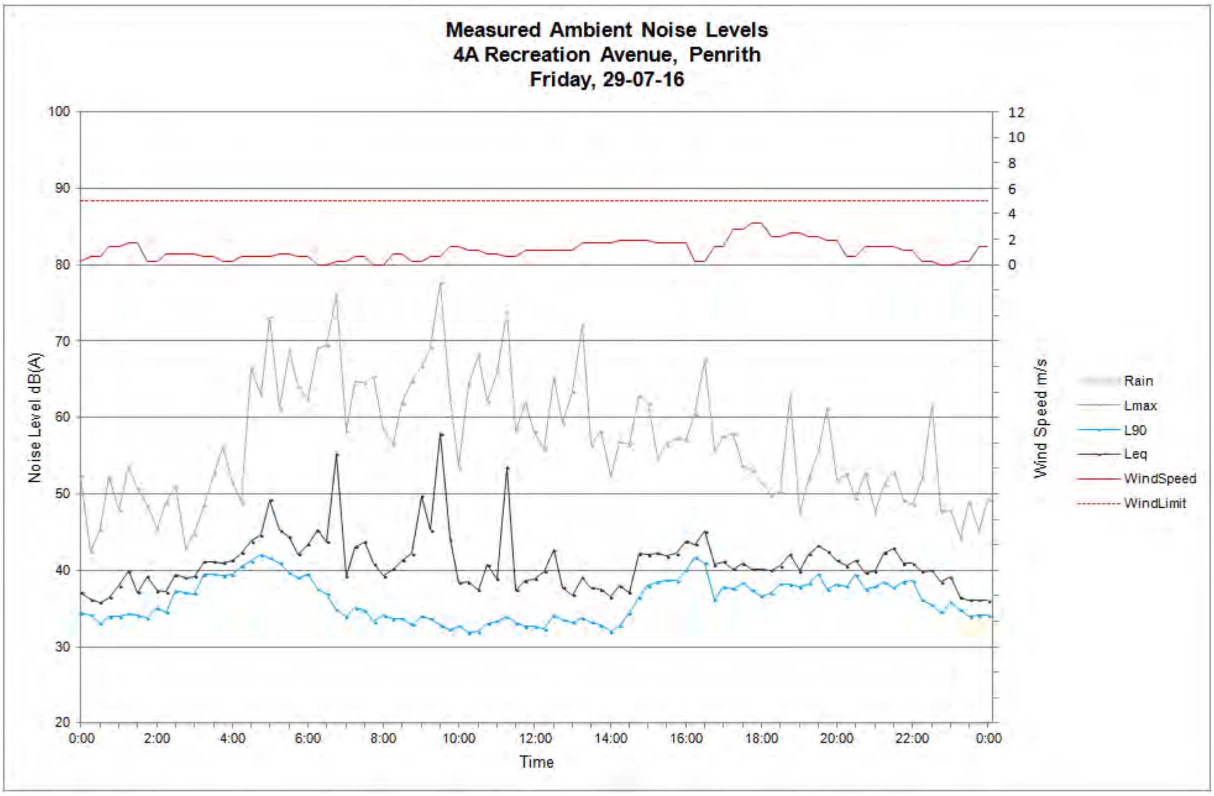
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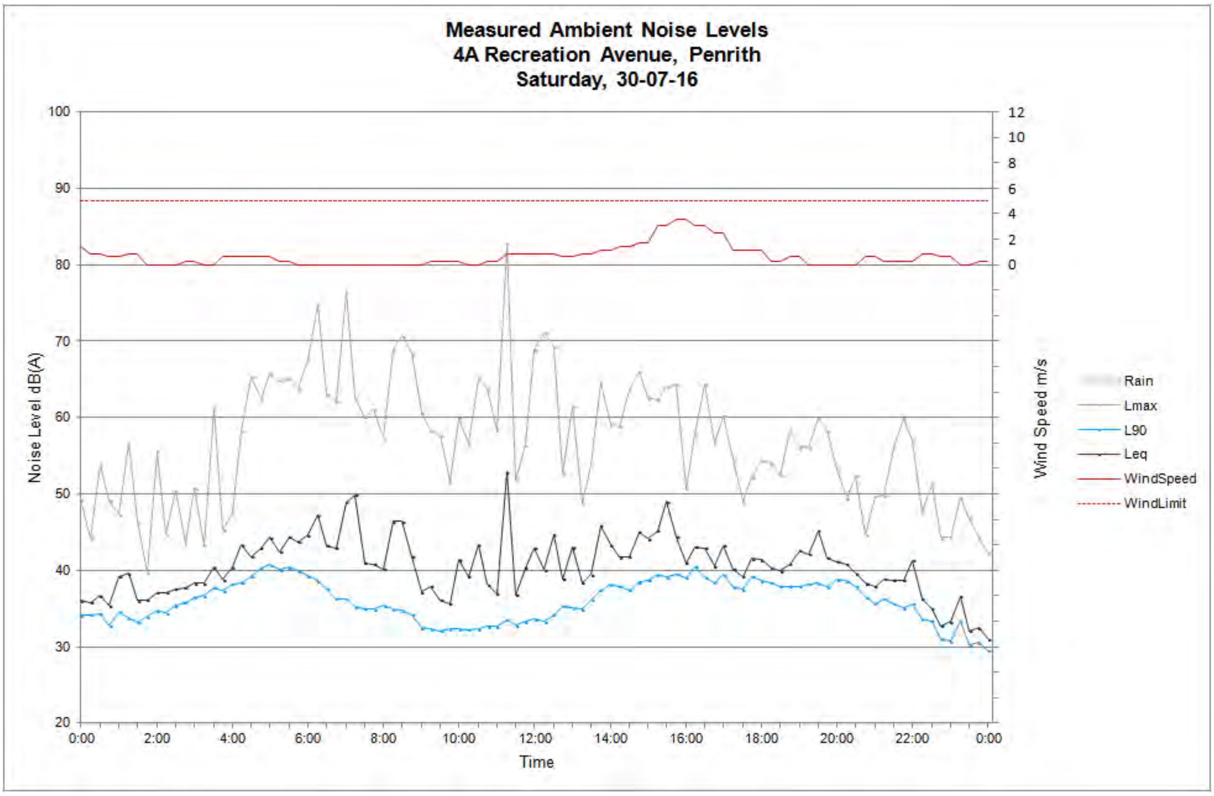
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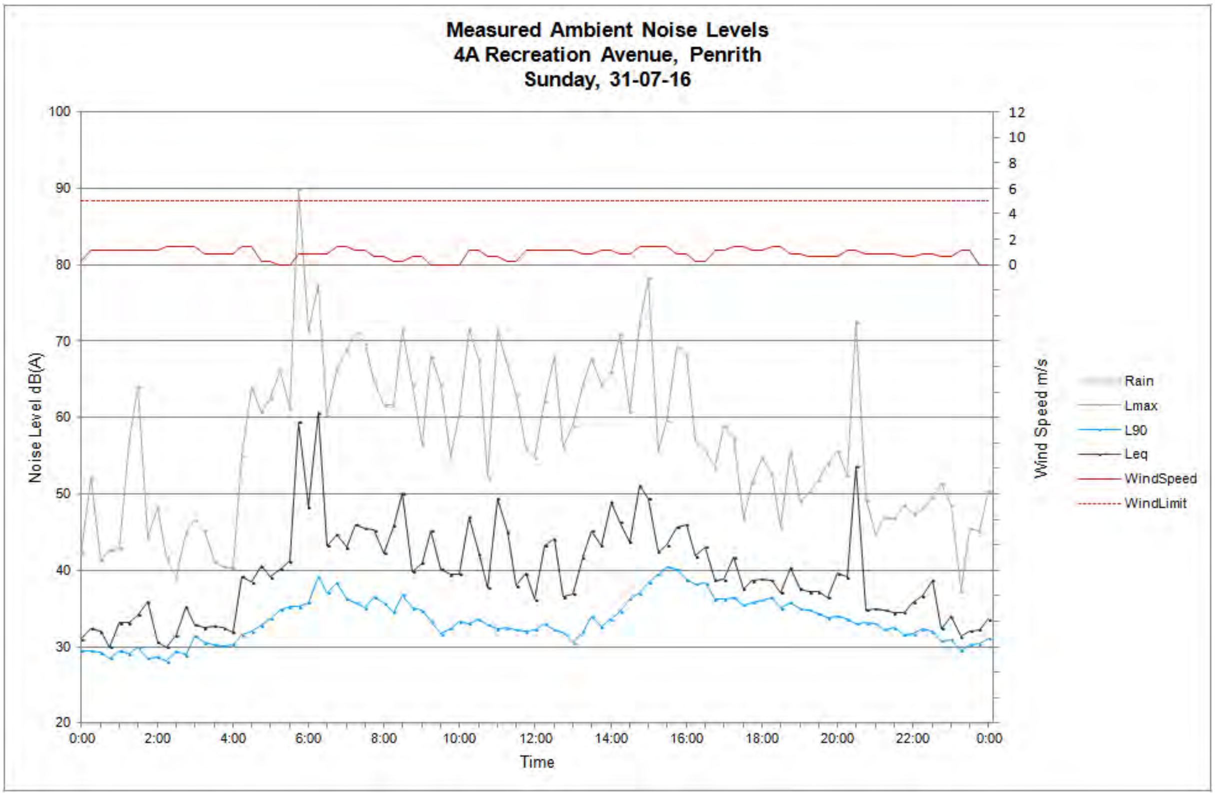

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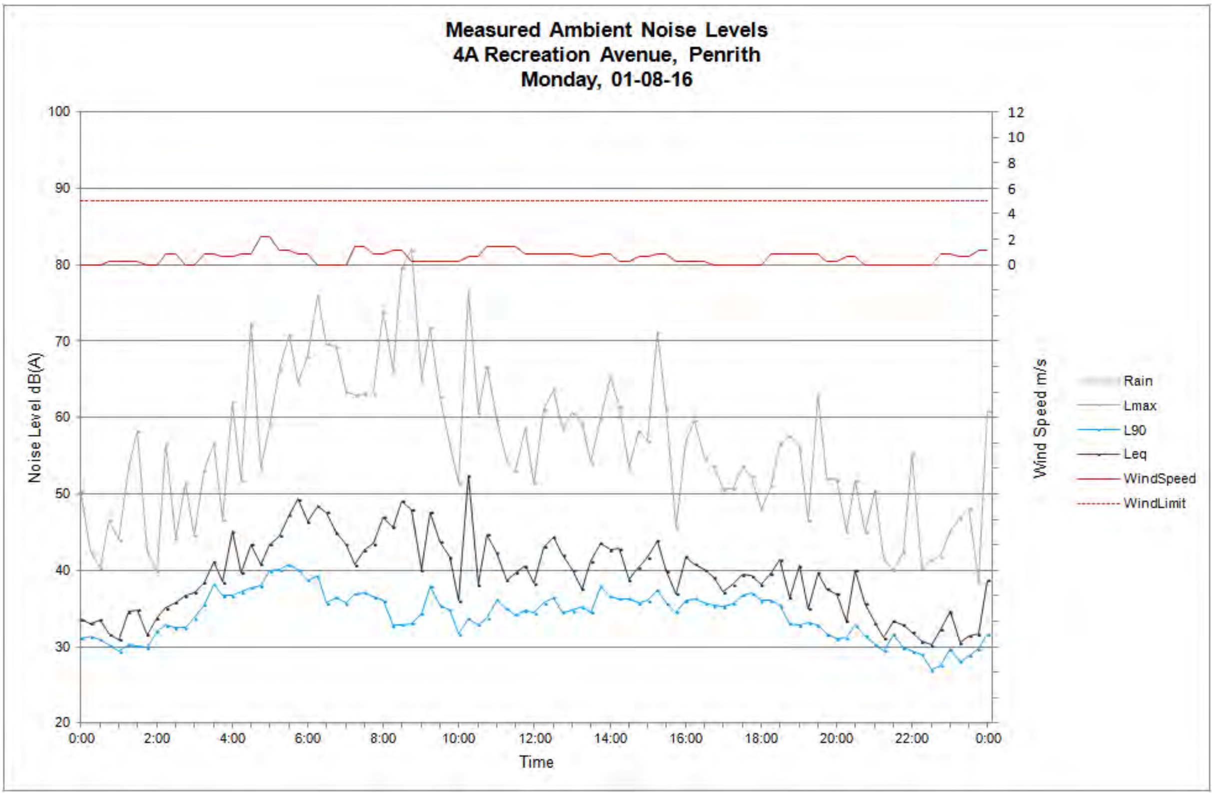

Measured Ambient Noise Levels
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Wind Speed m/s
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WindSpeed
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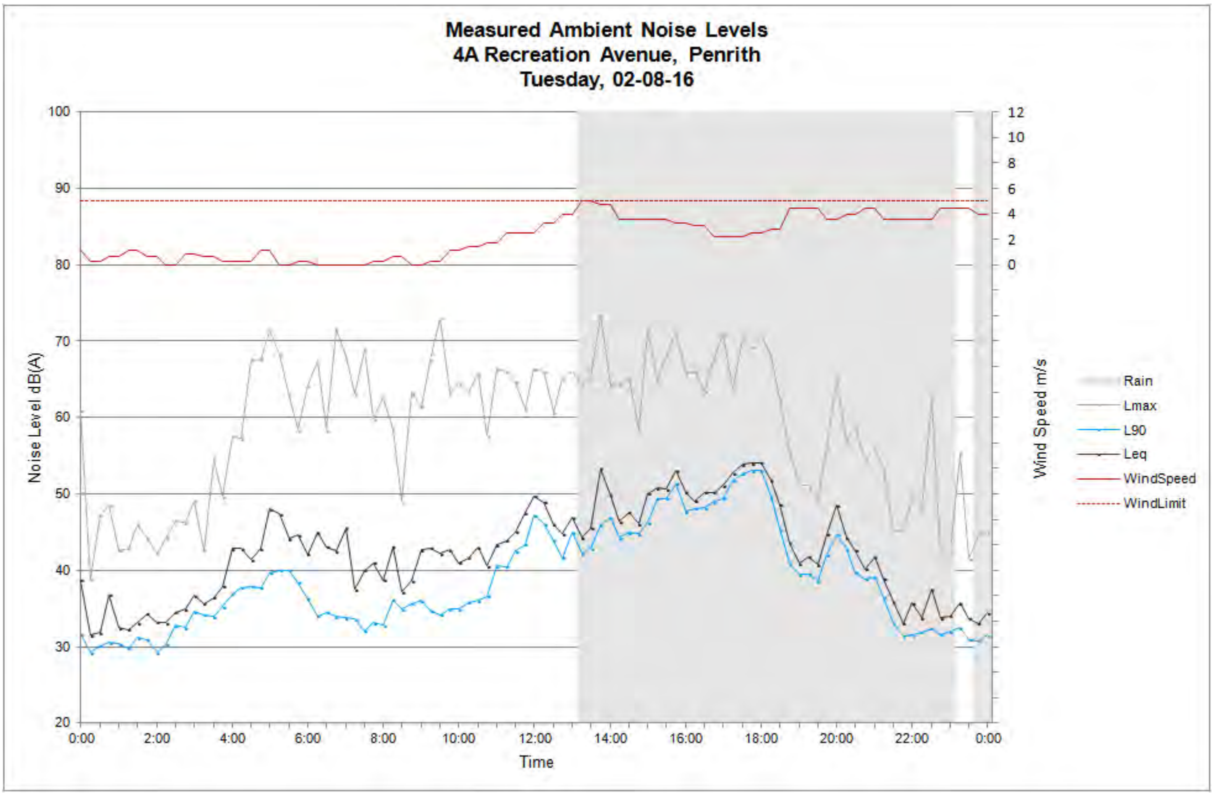
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Noise Level dB(A)
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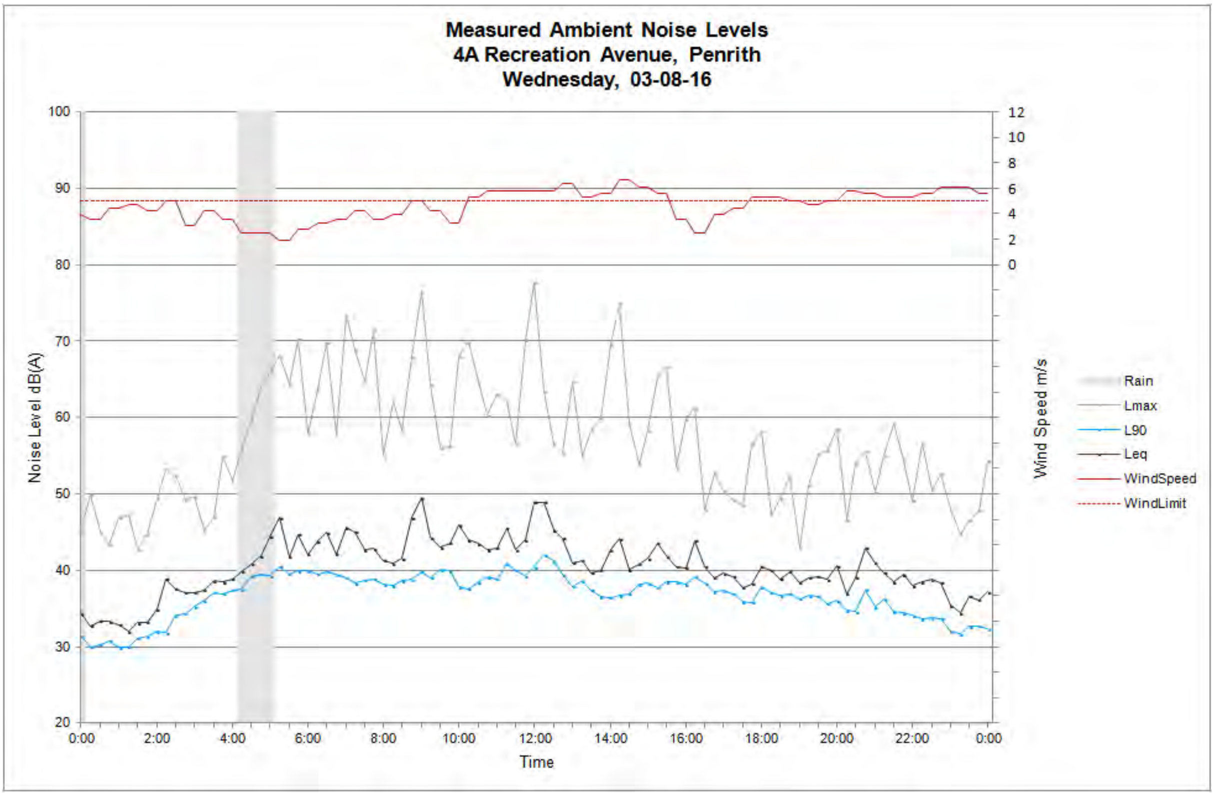
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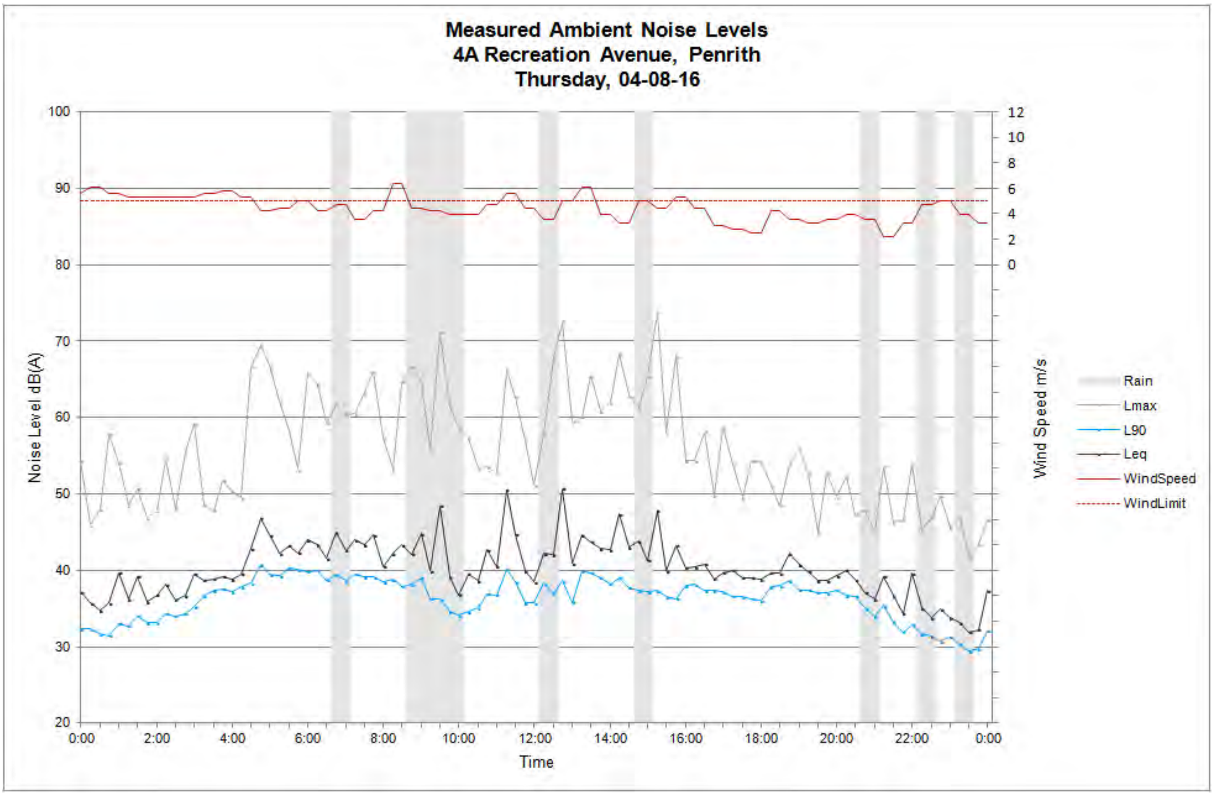
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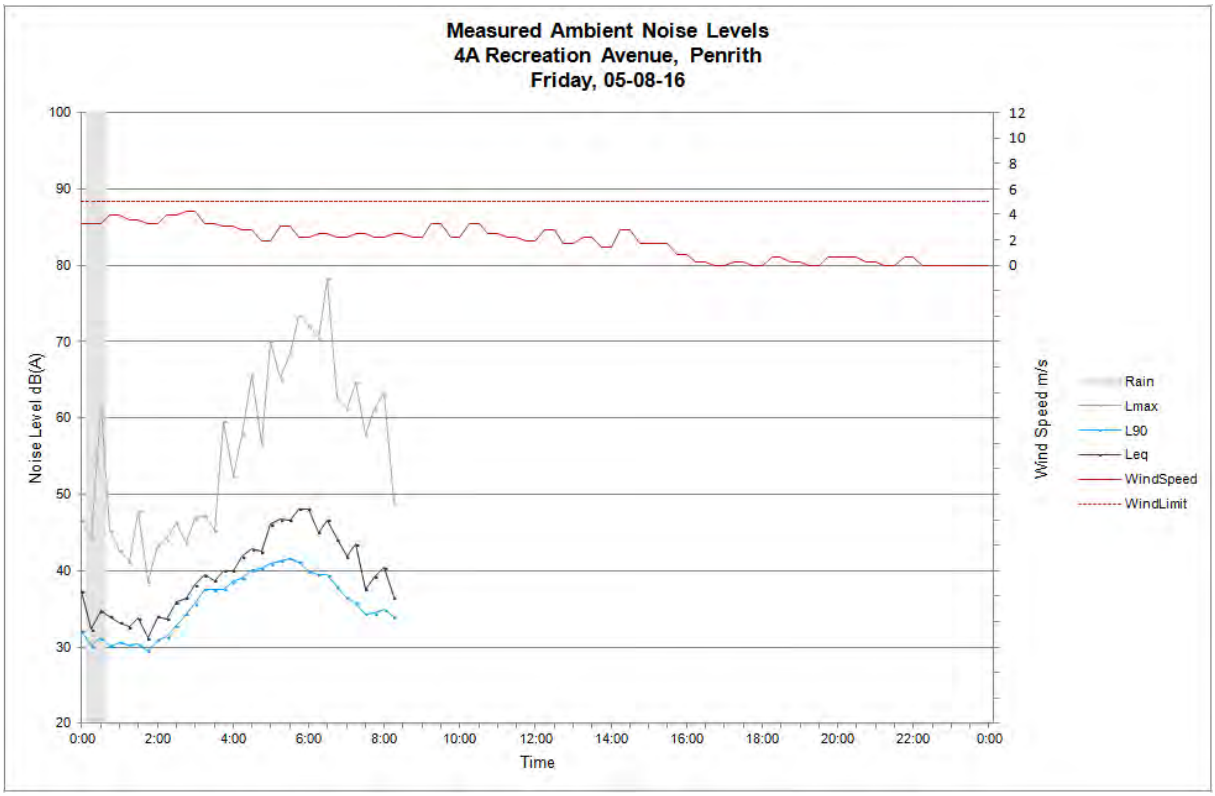
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Noise Level dB(A)
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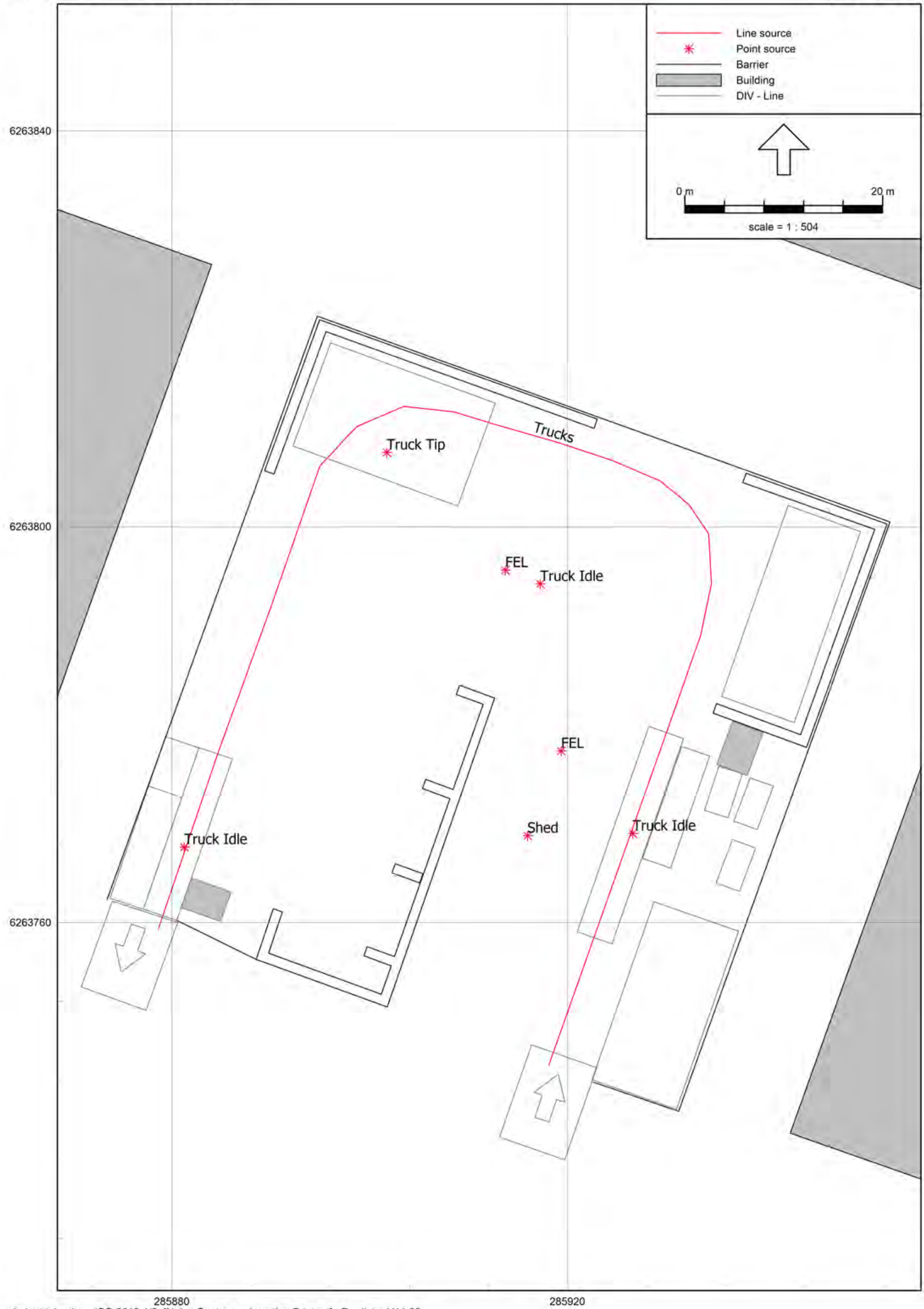
WindLimit

Appendix B

Noise modelling schematic



Industrial noise - ISO 9613.1/2, [Noise Contours - Location Printout] , Predictor V11.00

Appendix C

Noise contours

Worst-case noise contours – Day Calm $L_{Aeq(15\text{-}min)}$

Penrith Waste Recycling and Transfer Facility

Noise Imapct Assessment

Figure B.1

Worst-case noise contours – Day Winds $L_{Aeq(15\text{-}min)}$

Penrith Waste Recycling and Transfer Facility

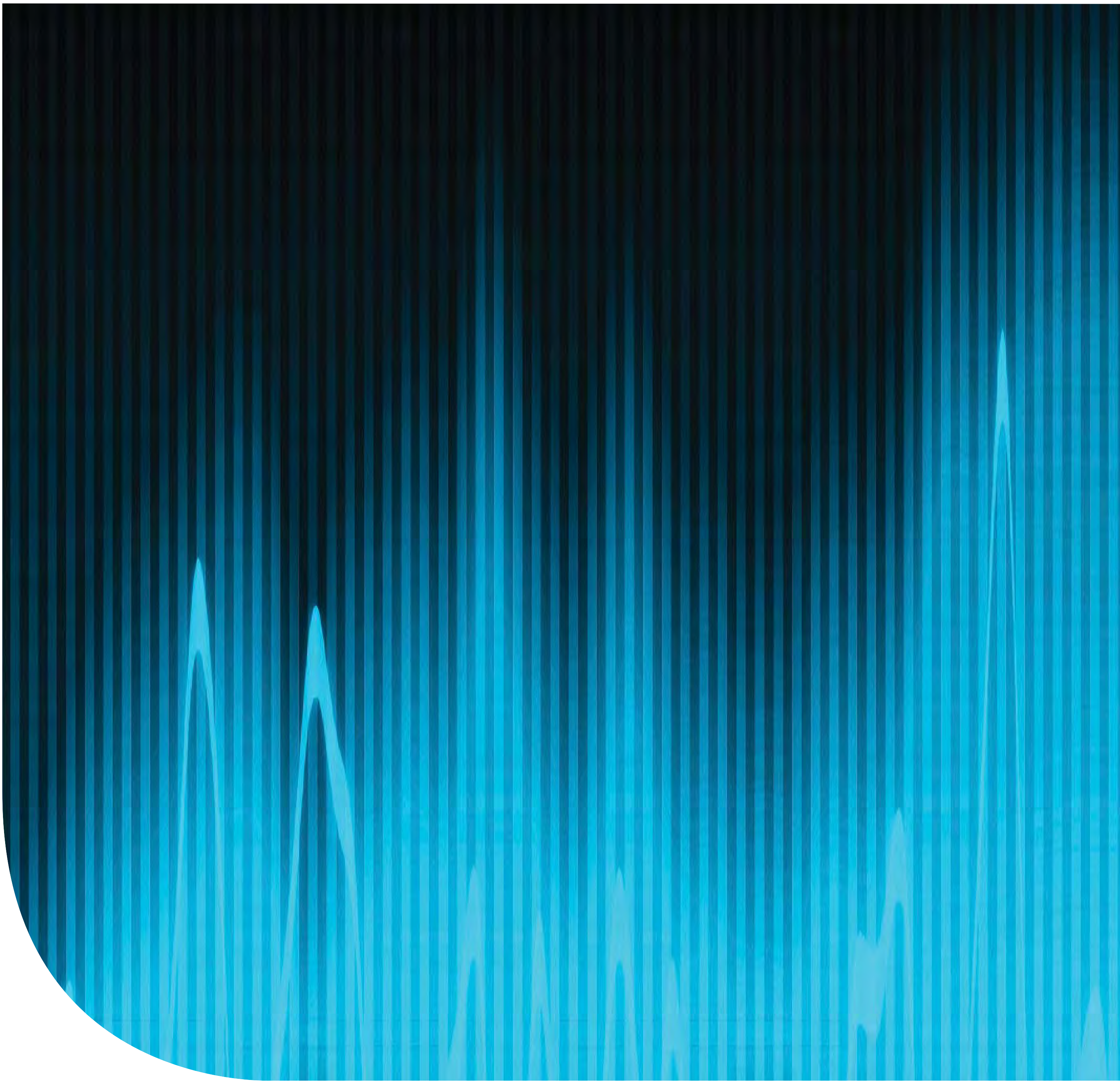
Noise Imapct Assessment

Figure B.1

SYDNEY
Ground floor, Suite 01, 20 Chandos Street
St Leonards, New South Wales, 2065
T 02 9493 9500   F 02 9493 9599

NEWCASTLE
Level 1, Suite 6, 146 Hunter Street
Newcastle, New South Wales, 2300
T 02 4907 4800   F 02 4907 4899

BRISBANE
Level 4, Suite 01, 87 Wickham Terrace
Spring Hill, Queensland, 4000
T 07 3839 1800   F 07 3839 1866



Appendix G

Water assessment

PROPOSED PENRITH WASTE RECYCLING AND TRANSFER FACILITY
46-48 PEACHTREE ROAD, PENRITH

ENVIRONMENTAL IMPACT STATEMENT

WATER MANAGEMENT REPORT

MAY 2017

Prepared by:

Mark Tooker
National Project Consultants Pty Ltd
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Email: npcon@npc.com.au

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FIGURES

APPENDIX

t: +61 2 9906 8611 f: +61 2 9906 7318
level 4 10-12 clarke street crows nest nsw 2065 australia
po box 1060 crows nest nsw 1585 australia
www.npc.com.au
national project consultants pty ltd abn 40 084 004 160

1. Introduction

Benedict Recycling Pty Ltd proposes to operate the Penrith Waste Recycling and Transfer Facility from an existing industrial lot at 46-48 Peachtree Road, Penrith (refer Figure 1).

This report deals with the water management issues and has been prepared by Mark Tooker of NPC to support a State Significant Development Application (SSDA) for the project.

2. Site Description

The site is an existing industrial property at 46-48 Peachtree Road Penrith within a IN1 General Industrial zoning (refer Figure 1). It has an area of 4,367m^2 and is currently used by an autowrecker. The site is relatively flat with a concrete hardstand covering the entire site outside the two sheds generally located in the south eastern area of the site (refer Figure 2).

The surface water on the site drains to the southern boundary via the stormwater drainage pipelines running along the eastern and western site boundaries (refer Figure 2). There are 450 x 450mm grated drainage inlet pits with bases lowered 150mm to incorporate sediment traps. The drainage lines run separately to the back of the kerb to discharge into the gutter in Peachtree Road. These discharges flow to a 3m long inlet pit in the Peachtree Road drainage system.

The Council pipe drainage system in Peachtree Road drains to the west into Peachtree Creek. The Cardno Overland Flow Flood Study for Council identified that the outlet to the Peachtree Road drainage system has a pipe capacity of a 1 year ARI storm (refer Figure 3).

3. Proposed Development

The proposed development will only accept General Solid Waste (Non Putrescible), as defined by the NSW Environment Protection Authority, for recycling, including soils, metals and dry paper/cardboard. No special, liquid, hazardous, restricted solid waste or general solid waste (putrescible) will be accepted at the site.

The layout of the proposed development is presented on Figure 4. The large central shed, concrete hardstand over the entire site and the existing drainage system will be retained in the development. The sheds and the drainage system will be upgraded by (refer Figure 4):

- pressure cleaning the site surface to remove the residual oil;
- capturing the main shed roof runoff into a rainwater tank for reuse for dust suppression on the site;
- cleaning out of existing drainage system to remove accumulated materials from previous use;
- installing grated drains across the two driveways to capture overland flows;
- installing gross pollutant traps (GPTs) at the eastern and western sides of the southern boundary for both drainage lines to remove sediments, oil and grease prior to discharge to the gutter;
- updating the drainage outlet pipes to the kerb;

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- including water efficient fixtures in any update of the site amenities.

The proposed new stormwater infrastructure on the site is presented on Figure 5.

These proposed measures for the drainage system will improve the runoff water quality and reduce the volume of runoff from the site. There will be no increase in impervious areas on the site for the proposed development.

4. Council Water Management Requirements

The Penrith Development Control Plan (DCP) 2014 details the requirements for surface water management and the water sensitive urban design (WSUD) approach for development. In Table C3.1 (on page C3-9), the Council requirements for an industrial development which is not increasing the impervious area by greater than 250m^2 are to incorporate water saving measures by installing water efficient labelling and standards (WELS) fixtures. These fixtures need to be 4 star dual flush toilets and taps and 3 star showerheads and urinals. There are no requirements in the DCP for runoff water quality or quantity controls for the proposed development.

The DCP requires further potable water use reductions by the incorporation of rainwater reuse to supplement the non-potable water uses.

No onsite detention is required because there will be no change in the area of impervious surfaces on the site and therefore no increase in the peak flow rate from the site. The DCP also does not require detention storage for this development.

5 Risk Assessment

5.1 Surface Water Management

5.1.1 Operation Phase - WSUD

The Penrith DCP does not require water quality treatment devices for this development. Notwithstanding this, the proposed stormwater drainage system and rainwater reuse system would improve the quality of the surface runoff discharged from the site and reduce the runoff volume.

The sumps in the drainage inlet pits would be the first line of treatment for the site runoff. Caorse materials and sediment would be trapped in the sumps.

Runoff from the site collected in the drainage inlet pits and grates across the driveways would be treated in the GPTs prior to discharge to the Peachtree Road drainage system. The introduction of the two GPTs (CDS Nipper or equivalent) at the site boundary on the two drainage lines would remove debris, sediment, suspended solids, nutrients, grease and oils (refer Figure 4). The GPTs would include facilities to remove grease and oil.

The GPTs and drainage inlet pits would be maintained regularly by the removal of accumulated materials. The GPTs would be serviced by a suction truck on a six monthly basis (or as required) and the sediment sumps in the drainage inlet pits would be cleared on a monthly basis (or as required).

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The majority of the pollutant load in runoff is discharged in small storms up to the 3 month ARI storms. Research has indicated that over 90% of the annual pollutant load is contained in frequent runoff up to the 3 month ARI storms. The onsite drainage system readily caters for these storms and grates across the two driveways will collect the overland surface flows. These flows will be treated in the GPTs. The proposed drainage system will have a in pipe capacity up to a 10 year ARI storm runoff.

No runoff detention storage is required by the Penrith DCP 2014 for this development. No onsite detention storage is required in any case because the development will not result in an increase in impervious areas and as such, there would be no increase in the site runoff flow rates.

5.1.2 Construction Phase

The proposed works on the site are limited to the installation of offices, weighbridges, block walls, a driveway, fitout of two existing sheds as well as a general clean-up of the site hardstands and drainage system.

The runoff control measures to be incorporated in an erosion and sediment control plan for the construction works onsite would include (refer Figure 6):-

- Geotextile cloth to cover the grate of all the drainage inlet pits onsite to remove fine sediment and debris in runoff;
- Gravel filled bags around the perimeter of all the drainage inlet pits on site to temporarily pond runoff locally and remove medium to coarse sediments from runoff;
- Gravel filled bags laid across the existing and proposed entry driveway at the site boundary to temporarily pond runoff locally and remove sediments from runoff; and
- Installation of a silt fence across the back of the kerb at the location of the new driveway construction to remove sediment from runoff prior to discharge to the gutter.

5.2 Site Water Balance

The facilty will have up to 8 personnel on site at any one time and will include 2 toilets, wash basins, kitchen, lunchroom and two offices. These will be refurbished. Any new water fixtures installed will comply with the WELS ratings required by Council which will be 4 star dual flush toilets and taps and 3 star showerheads and urinals.

The main non potable water use on the site will be use of water to suppress the generation of dust. The water usage for dust suppression on the site would be concentrated on the material storage areas, the large truck tipping area and general parts of the external hardstand area. It is estimated that the average annual water demand for this purpose would be approximately 350 m^3 (refer Appendix A).

The average annual supply of roof runoff from the main shed would be stored in a 10,000L rainwater tank with a pumped supply line to the dust suppression areas. It is estimated that the roof runoff would supply on average over 80% of the water use for dust suppression (refer Appendix A).

The potable water for the site will be supplied from the existing water mains in Peachtree Road and sewage from the amenities will be discharged to the existing sewer.

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The site water balance has been calculated based on the proposed development and details are provided in Appendix A.

The average annual runoff volume from the site under existing conditions has been estimated at approximately 2,419m^3.

In the developed scenario, the extent of runoff from the site will be reduced by capturing runoff and reusing it for dust suppression on the site. The estimated average annual reuse volume for dust suppression will be approximately 282m^3 reducing the average annual runoff volume to 2,137m^3. This reuse will reduce the average annual runoff volume from the site by 12%. This is a significant reduction in runoff volumes which has benefits for the capacity of the drainage system downstream and the water quality of the receiving waters.

The capturing of roof runoff will not provide sufficient water to cover the dust suppression water requirements. It is estimated that on average, up to 68m^3 of town water supply will be used each year for dust suppression. The reuse of site runoff provides 80% of the water required for dust suppression. The use of 3 and 4 star WELS water fixtures in the facilty will further reduce the potable water use on the site. This provides a benefit in reducing the demand on the water supply in terms of the volume available and the water reticulation available capacity.

5.3 Flooding

The site is nominated on Penrith Council plans as being within the "flood planning area". This indicates that the finished levels on the site are below the 100 year ARI flood level plus 0.5m freeboard. It is located within the flood fringe area.

The Penrith CBD Overland Flow Flood Study undertaken by Cardno for Council shows the flood extents for a range of flood severities. The flood extents for the 100 yr ARI and the PMF floods are presented on Figures 7 and 8.

The 100 yr ARI floodwaters do not inundate Peachtree Road at its site frontage. Even in the PMF flood, the floodwaters only pond on the road verge and on the grass area along the site frontage. This grass is not used as part of the recycling facility operation.

The Penrith LEP 2010 Clause 7.2 (4) Flood Planning requires compliance with the following requirements.

"(a) is compatible with the flood hazard of the land" – the site is elevated above the road and would have a low flood hazard given the shallow flood depths and low flow velocities;

"(b) is not located within a floodway" – the site is not located in a floodway;

"(c) is not likely to adversely effect flood behaviour" –the site is an existing industrial site and the development will retain the existing features of the site and will not create any adverse impacts on flood behaviour compared to existing conditions;

"(d) is not likely to signficantly alter flow distributions and velocities" – as mention in (c), the proposed development would retain the existing main features and hence would not signficantly change the existing flood conditions;

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"(e) is not likely to adversely effect safe and effective evacuation" – the flood behaviour would be unaffacted by the development and there would not be a signficant increase in workforce capacity on the site and as such, would not affect evacuation in a flood compared to existing conditions;

"(f) is not likely to signficantly detrimentially affect the environment" – the proposed facility would maintain the same main features onsite and hence would not detrimentally affect the environment, cause erosion or affect any riparian area;

"(g) is not likely to result in unsustainable social and econonmic costs to the community as a consequence of flooding" – the proposed site use is similar to the historic and current site use and hence there would not be any unsustainable impacts due to flooding;

"(h) incorporates appropriate measures to manage risk to life from floods" – signs would be installed in the office and lunchrooms indicating the site is located on flood liable land and in case of a flood, employees are to evacuate the site as directed by SES or Council personnel;

"(i) is consistent with any relevant floodplain risk management plan" – Council does not have a floodplain risk management plan covering the subject site, however the proposed development complies with Council's flood related requirements in the DCP.

The proposed development complies with all the Council LEP requirements for sites nominated within the flood planning area.

5.4 Acid Sulphate Soils

The site is not included in the Office of Heritage and Environment Acid Sulphate Soils Risk Maps because there is no underlying potential for this risk in the area of Penrith.

5.5 Salinity

The then Department of Infrastructure Planning and Natural Resources prepared a Salinity Potential Map for Western Sydney in 2002. This map indicates that the Recycling Facility site has a "Moderate Salinity Potential". This classification means that salinity processes may occur on the site. There is no evidence of soil salinity on the site. This issue will have been dealt with at the sub division construction stage in order to provide a lot which complied with the salinity guidelines.

The only excavation of the site subsoils will occur at the two GPT sites and the new driveway slab. The GPT's consist of stabilised materials which will be unaffacted by soil salinity. Impermeable sheeting would be placed under the driveway slab to avoid any salinity impacts.

5.6 Watercourses and Riparian Areas

The site is located within a planned industrial estate which has allocated space outside the lots for drainage and riparian corridors. The proposed development therefore will not adversely impact on watercourses or riparian corridors. The reuse of runoff for dust suppression will reduce the volume of runoff from the site.

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The Council's DCP does not require any onsite detention or water quality treatment of runoff on the site. The proposed reduction in runoff volume and treament of runoff from the site prior to discharge will contribute to the long term improvement in receiving water quality and bank stability.

5.7 Groundwater

The entire site is paved and hence will not allow any significant transport of pollutants from the site surface into the groundwater. The installation of the two GPT's will require excavation of relatively small quantities of soil about 2m below the existing slab level. This minor construction will have no signficant impact on groundwater. Also, the GPT's are sealed prefabricated units which would not cause any signficant impact on groundwater.

The proposed development, therefore, will not have any significant adverse impacts on groundwater flows or quality.

6 Summary of Mitigation Measures for the Proposed Development

The mitigation measures proposed to minimise the impact of the proposed works on the water related aspects of the environment are:

- a runoff erosion and sediment control strategy would be implemented during the construction phase to manage runoff which conforms to State Government best practice guidelines in the Blue Book;
- use of the existing runoff sediment traps in the existing drainage inlet pits to remove sediment and debris at the source;
- installation of grated drains across the two driveways to capture surface runoff before leaving the site;
- installation of two GPT's to remove sediment, debris, suspended solids, nutrients, grease and oil from runoff;
- reuse the main shed roof runoff for dust suppression on the site;
- reuse of runoff to reduce the potable water use;
- installation of water efficient fixtures to conform to Council requirements;
- connection to the sewerage system for onsite personnel amenities;
- no use of groundwater; and
- no use of water in the product processing.

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7. Conclusions

The proposed processing facility and mitigation measures have been formulated to minimise the impact on water related aspects of the site and downstream watercourses and riparian areas. As such, the proposed development will not have a significant adverse impact on:-

- stormwater runoff;
- groundwater;
- wastewater disposal;
- potable water demand;
- runoff volume and water quality;
- flooding;
- acid sulphate soils;
- salinity; and
- watercourses and riparian areas.

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FIGURES

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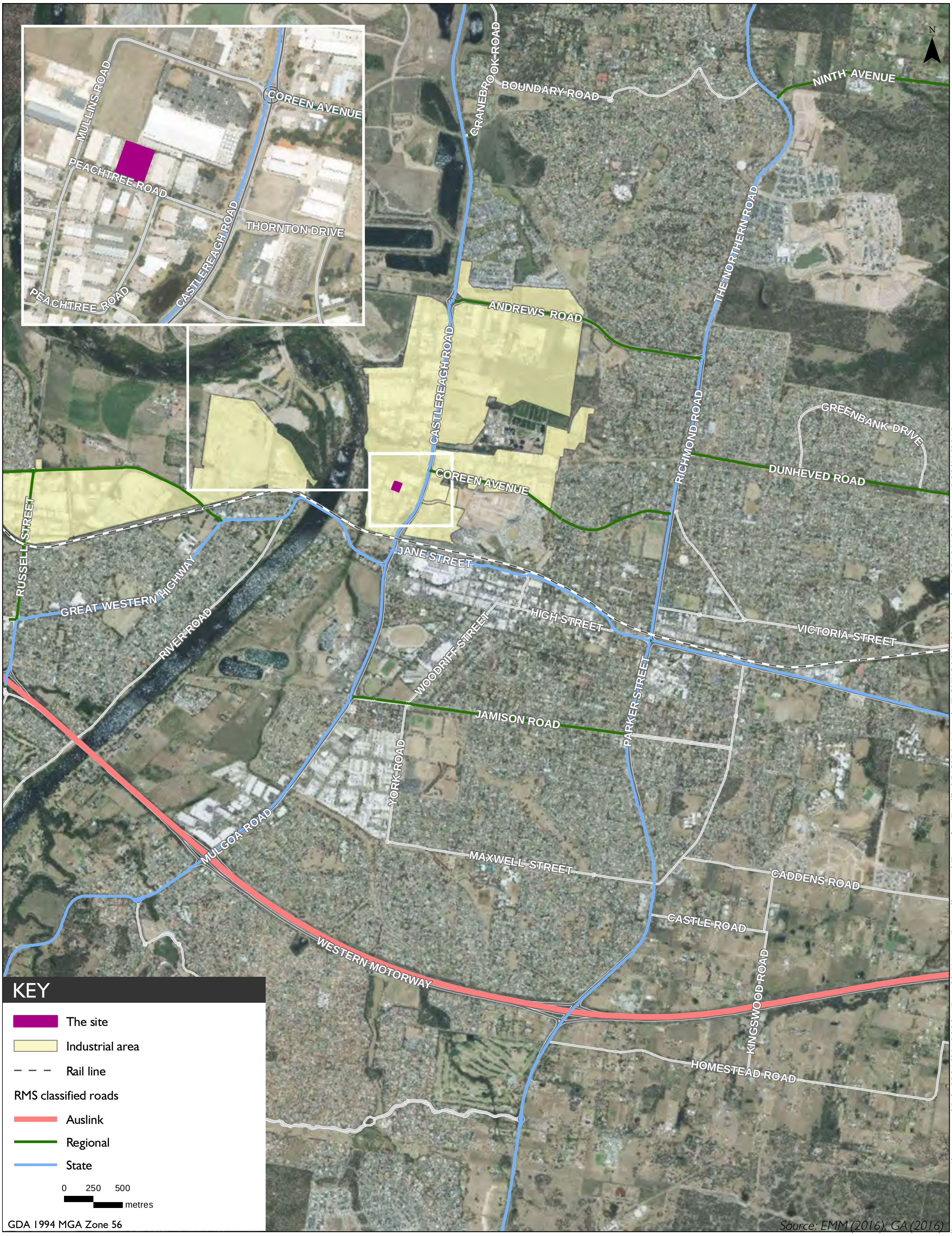
FIGURE 1



\\emgammsvr1\emgamm\Jobs\2016\J16099 - Penrith Waste Recycling and Transfer Facility\GIS\02_Maps_EIS\EIS007_SiteLocation_20161130_01.mxd 30/11/2016

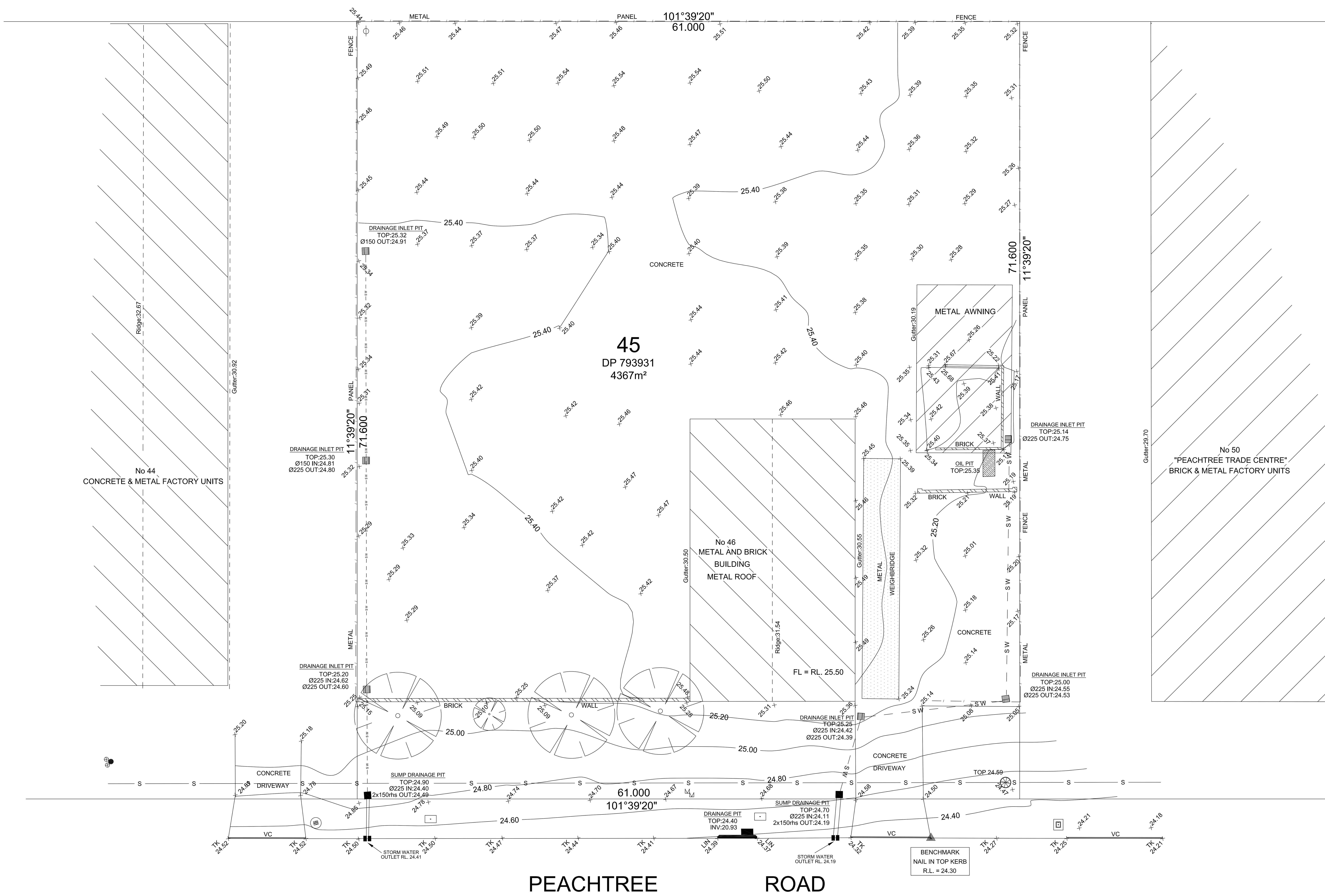
EMM

Site location

Penrith Waste Recycling and Transfer Facility
Environmental Impact Statement

A1

FIGURE 2



- STOP VALVE
- HYDRANT
- SEWER MANHOLE
- SEWER VENT
- COMMS. PIT
- SEWER INSPECTION POINT
- SIGN POST
- WATER METER

VC DENOTES VEHICULAR CROSSING
TK DENOTES LEVEL AT TOP OF KERB
LIN DENOTES LEVEL AT TOP OF LINTEL

—— S —— APPROX SEWER

— — — SW — APPROX STORMWATER

NOTES :

1. THIS DETAIL SURVEY IS NOT A 'SURVEY' AS DEFINED BY THE SURVEYING & SPATIAL INFORMATION ACT, 2002.
2. DATUM OF LEVELS : AUSTRALIAN HEIGHT DATUM
3. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY THE OFFICE OF LAND & PROPERTY INFORMATION (NSW) AND ARE SUBJECT TO FINAL SURVEY.
4. NO SEARCH MADE OF LOCATION AND NATURE OF TELEPHONE, ELECTRICITY, SEWER, WATER, GAS AND DRAINAGE RECORDS AT THE RELEVANT AUTHORITY. PRIOR TO ANY CONSTRUCTION THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR LOCATION OF SERVICES.
5. THE POSITION OF IMPROVEMENTS IN RELATION TO BOUNDARIES IS DIAGRAMMATIC ONLY.
6. VISIBLE, ACCESSIBLE SERVICES LOCATED ONLY
7. SIGNIFICANT TREES LOCATED ONLY.
8. NEIGHBOURING HOUSES, RIDGE AND ROOF POSITIONS ARE APPROXIMATE ONLY.
9. THIS TITLE BLOCK AND NOTES IS AN INTEGRAL PART OF THIS DRAWING WHICH IS NOT TO BE REMOVED.
10. CONTOURS ARE INDICATIVE ONLY. SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.

1:200

5 0 5 10 15 20 25

METRES

Site Detailed Survey

RHCO RICHARD HOGAN & CO.
SURVEYING & DEVELOPMENT CONSULTANTS
ABN 59 082 453 165
P.O. BOX 4365, Penrith Plaza, NSW 2750.
Phone: (02) 4732 6599
Web: www.rhco.com.au Email: admin@hoganco.com.au

SURVEYOR: SR/SA
DRAWN: SR
REDUCTION RATIO: 1:200 @ A1
CONTOUR INTERVAL: 0.2m
SHEET 1 OF 1

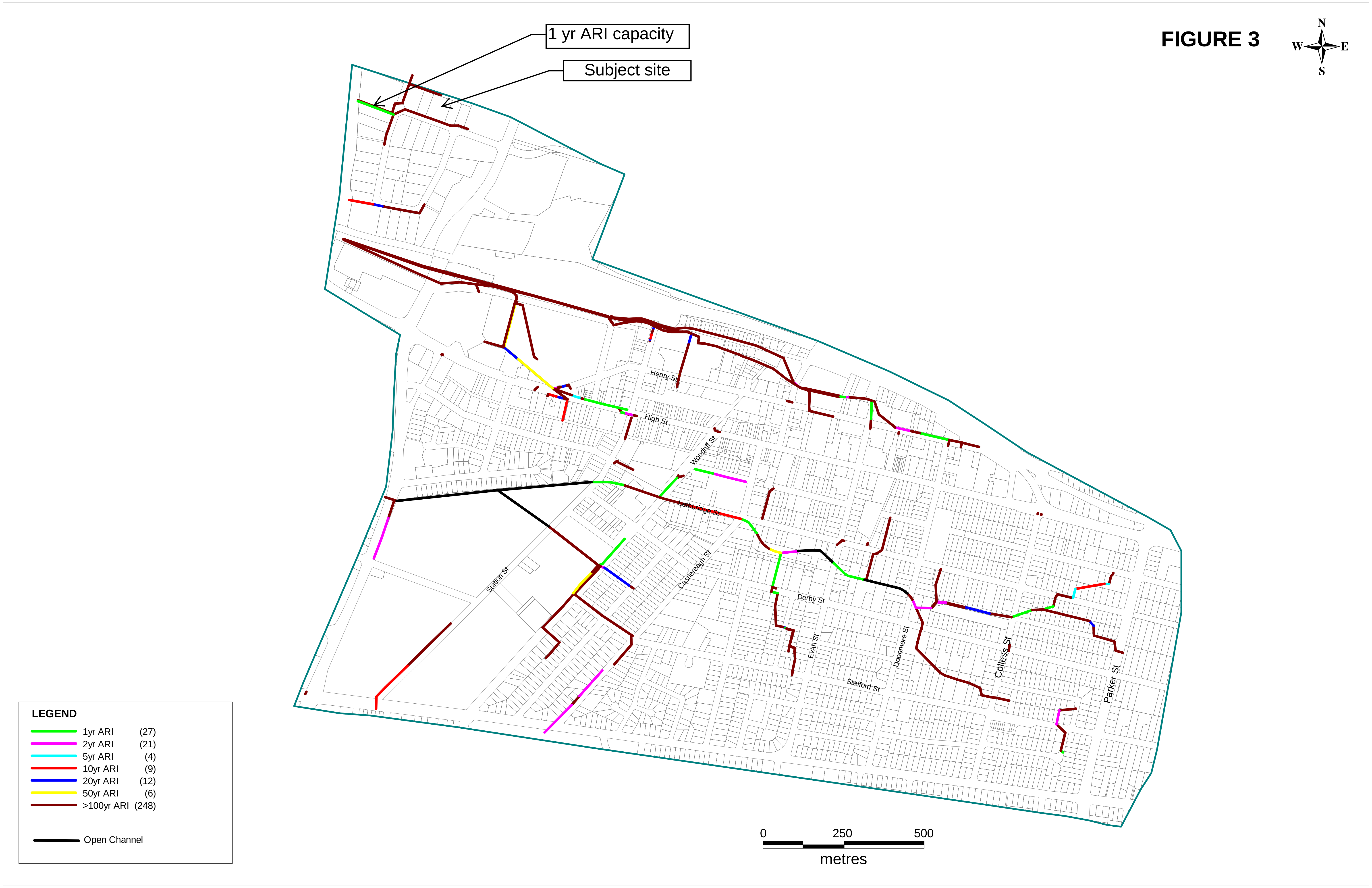
ORIGIN OF LEVELS:
BENCHMARK - NAIL IN TOP OF KERB
RL. = 24.30 (GNSS)
DATUM: AUSTRALIAN HEIGHT DATUM
DATE: 10.03.2017
VERSION No.: A

PLAN OF DETAIL AND LEVELS OVER
LOT 45 IN DP 793931 BEING
No. 46 PEACHTREE ROAD, PENRITH.

CLIENT: NSW RECYCLING
L.G.A.: PENRITH
JOB REF: 17147

CAD FILENAME: M:\J17401D 46 Peachtree Road, Penrith\survey\17147 - 46 Peachtree Road Penrith - DETAIL SURVEY.dwg

FIGURE 3



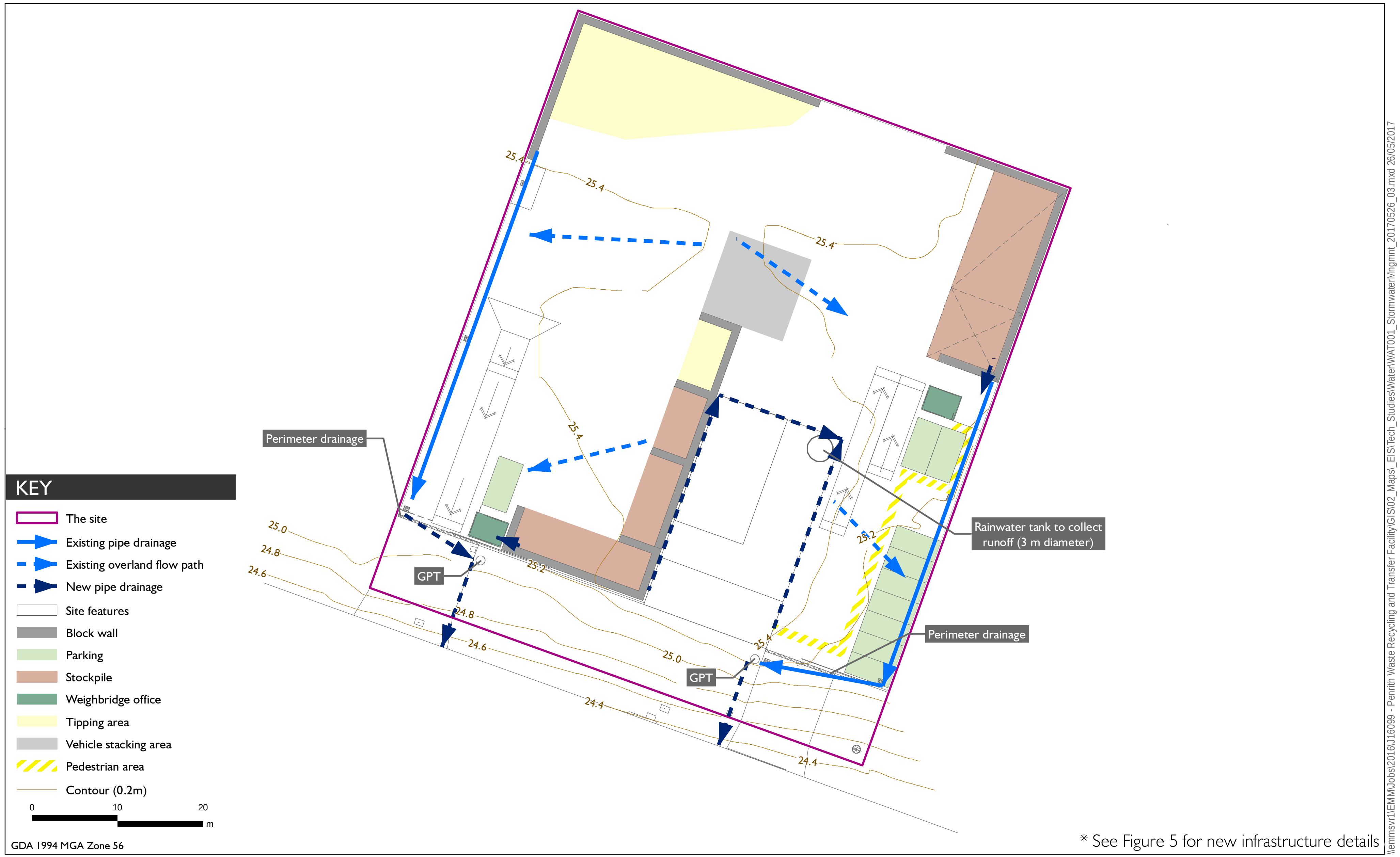
Cardno

W4735
June 2014

Penrith CBD Detailed Overland Flow Flood Study

PIPE CAPACITY ASSESSMENT
NOMINAL RETURN PERIOD (ARI)

FIGURE 4

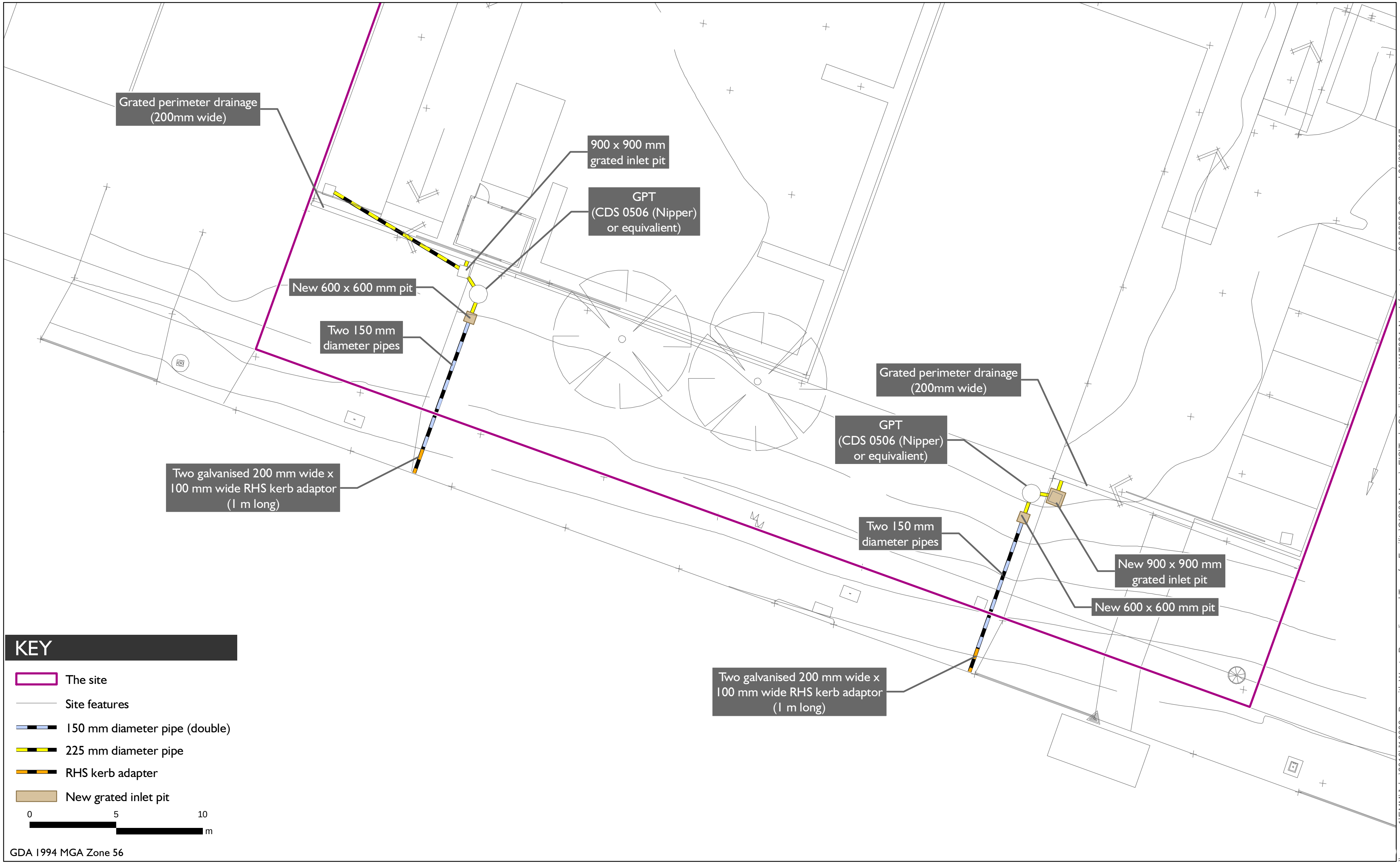


Stormwater management concept plan

Penrith Waste Recycling and Transfer Facility

Figure 4

FIGURE 5

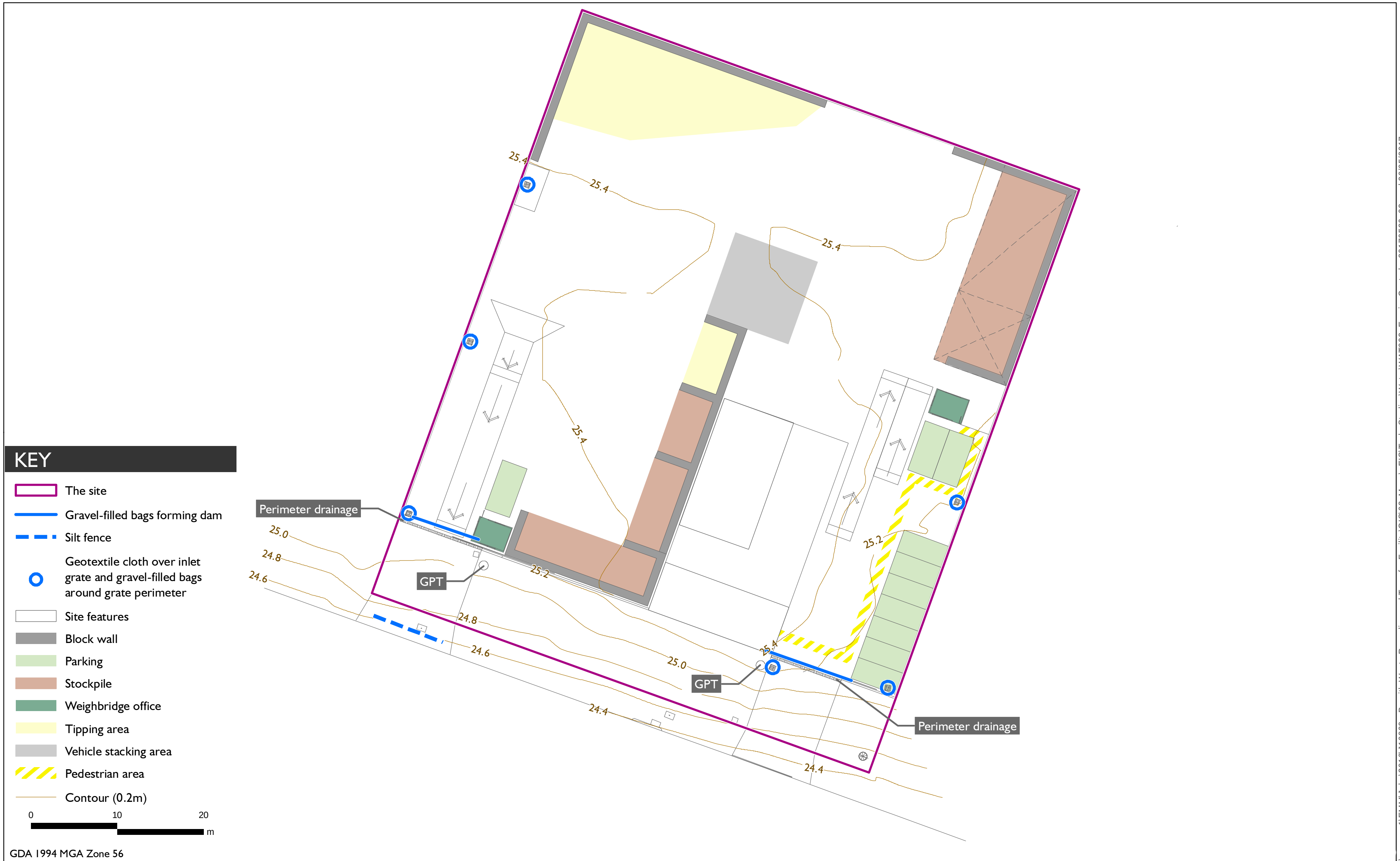


New stormwater infrastructure

Penrith Waste Recycling and Transfer Facility

Figure 5

FIGURE 6

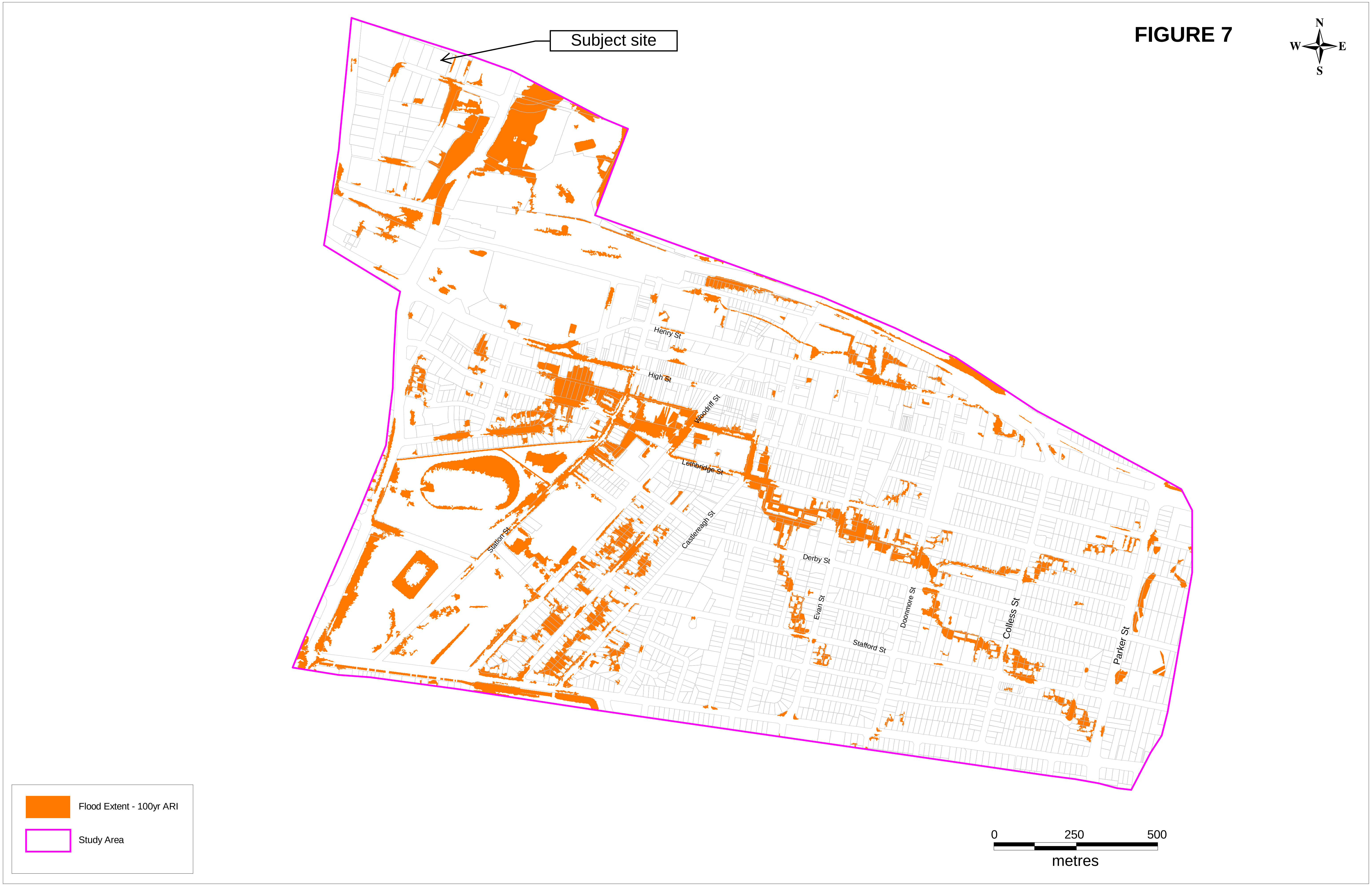


EMM

Erosion and sediment control plan

Penrith Waste Recycling and Transfer Facility

Figure 6



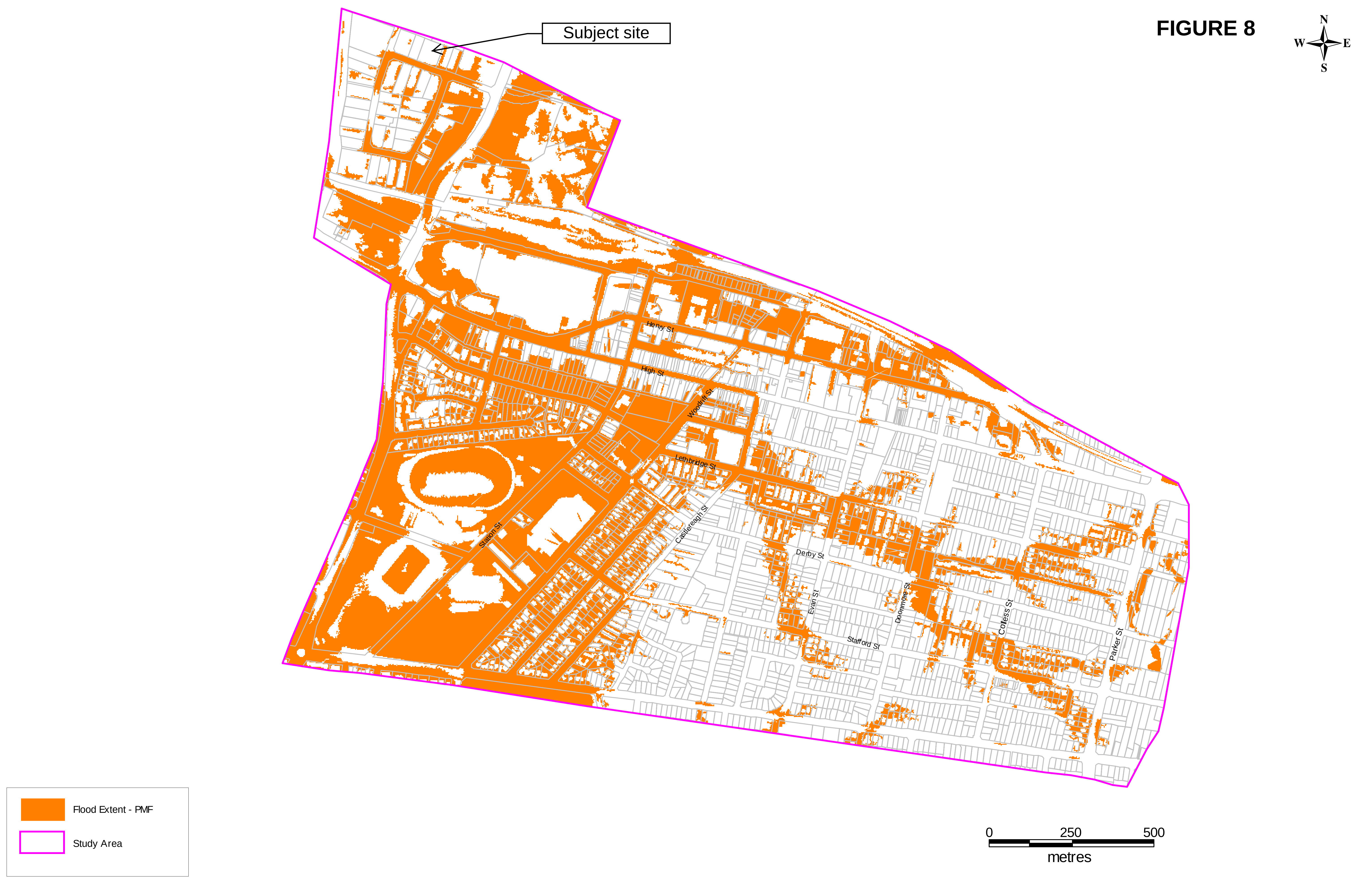
Cardno

W4735
July 2015

Penrith CBD Detailed Overland Flow Flood Study

FLOOD EXTENT- 100 YEAR ARI

FIGURE 8



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PMF FLOOD EXTENT

npc

APPENDIX A

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Site Annual Water Balance

1. Assumptions

Mean Annual Rainfall	802.7mm
Mean Number of Rainy Days	70 days
Mean Number of Dry Days	295 days
Annual Volumetric Runoff Coefficient	0.69
Area requiring dust suppression	2370m^2
Total Site Area	4367m^2
Roof Area for Rainwater collection	390m^2
Dust Suppression Water Application Rates	0.5L/m^2/dry day

2. Existing Conditions

Site Area (paved)	4367m^2
Average Annual Volumetric Runoff Coefficient	0.69
Average Annual Rainfall	802.7mm
Average Annual Runoff Volume	4367 x 0.69 x 0.8027 = 2419m^3

3. Non Potable Water Reuse

a. Rainwater capture from Main Shed Roof

Roof area	390m^2
Average Annual Rainfall	802.7mm
Average Annual Runoff Coefficient	0.9
Average Annual Volume available for rainwater reuse	282m^3

b. Dust Suppression Water Use.

Average dry days	295
Application area	2370m^2
Application rate	0.5L/m^2/dry day
Average annual water usage	350m^3
Rainwater reuse supplies proportion of dust suppression	80%

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4. Site Water Balance

a. Surface Runoff

Average Annual Site Runoff – existing conditions	2419m^3
Average Annual Rainwater reuse for dust suppression	282m^3
Average Annual Nett Site Runoff – after development	2137m^3

b. Potable Water Use

- Amenities 30m^3/yr
- Dust suppression 350-282 = 68m^3/yr
- Total 98m^3/yr

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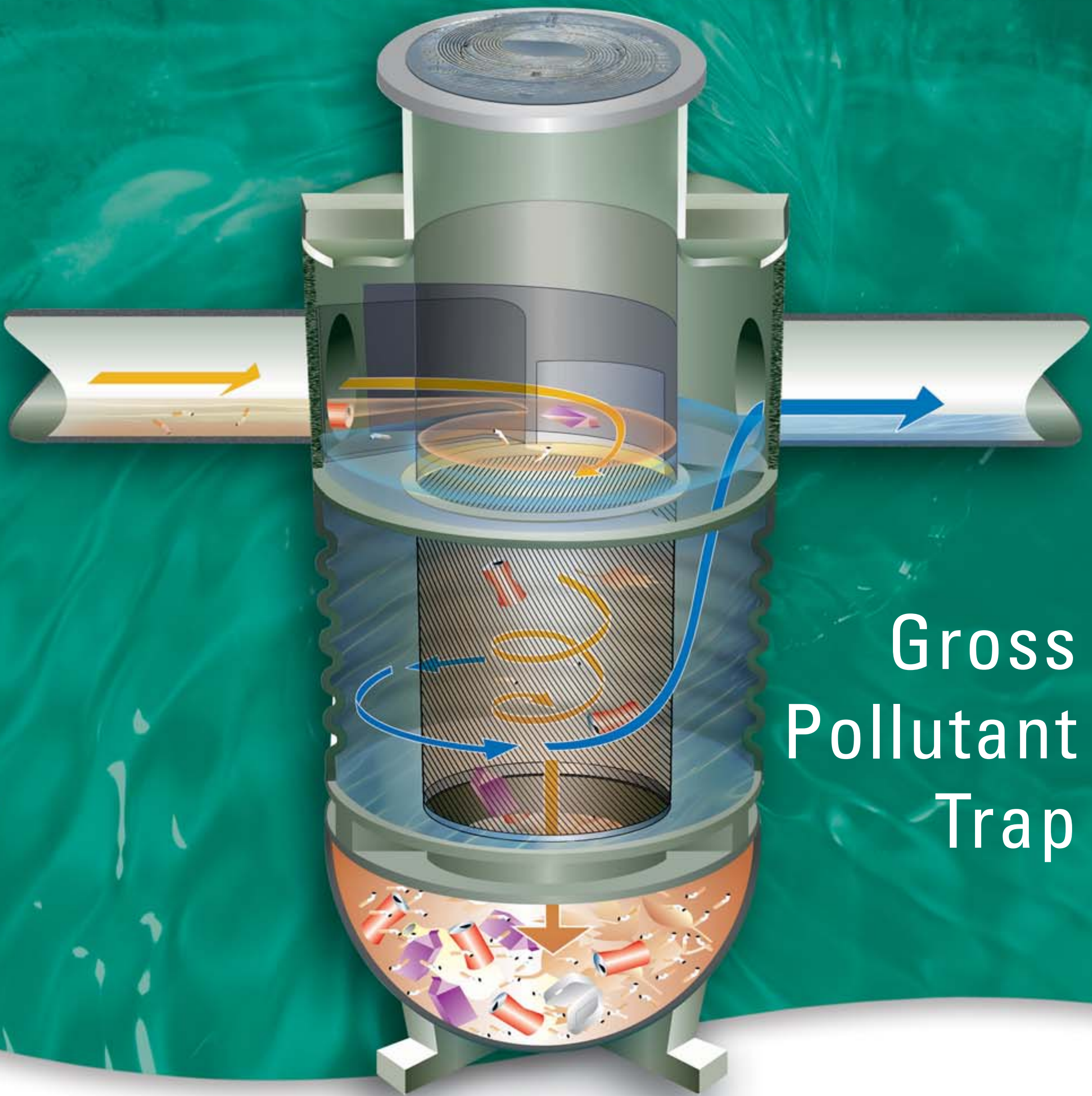
Rocla®

CDS® Unit 0506



Gross Pollutant Trap

WATER QUALITY

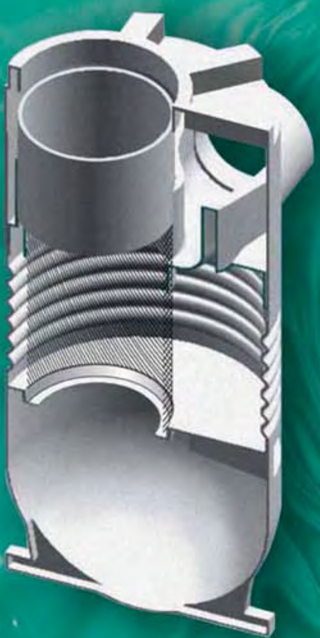
CDS® TECHNOLOGIES

Specifications

Storage	0.72 cubic metres
Weight	140 kilograms
Footprint	1050mm diameter
Material	High density polyethylene
Treatment	Self-cleaning screens, vortex and gravity
Screens	2.4mm stainless steel
Inlet Size	Up to 375mm diameter

Applications

- Small subdivisions
- Bus and train stations
- Pre-screening bio-retention systems
- Pre-screening construction wetlands
- Packaging warehouses
- Roadside drains
- Car parks



Rocla® Water Quality

CDS® 0506 Gross Pollutant Trap

Compact stormwater treatment

The PL0506 in-line CDS® Unit, known as the Nipper, is the smallest in the CDS® range of gross pollutant traps. It provides the fully proven performance of CDS® GPTs in a pint-sized polymer unit.

The Nipper is ideally suited for installation at the collection source in small catchment areas of less than a hectare and is designed to remove gross pollutants, organic waste, silt, sediment and oils.

Manufactured from strong, lightweight polymer material, the CDS® 0506 is delivered to site in one piece, making it easy to install and cost-effective.

CDS® 0506 Characteristics

Pipe Flows	Up to 152 L/s (max)
Gross Pollutant Removal	95% (>1mm)
Sediments Capture	>80% (>75µm)
TSS Removal	>70%
Total Phosphorous (TP) Removal	>30%
Hydrocarbon Capture	Removes majority of oils and grease
Free Oil Storage Capacity	150 litres

CDS® TECHNOLOGIES

Call Rocla on **131 004**

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Or visit our website
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Quality System
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SAI Global