

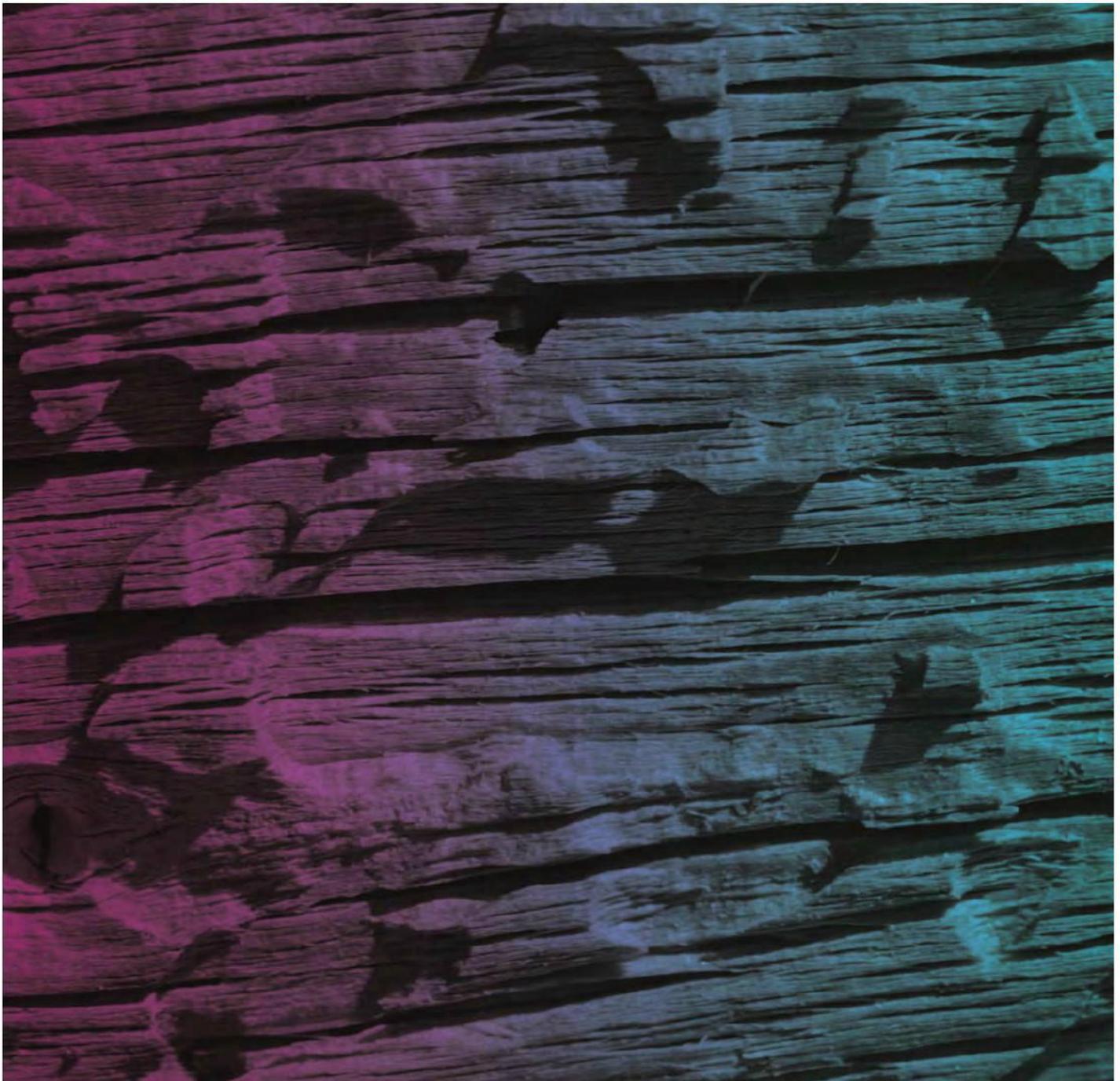
Appendix E

Noise and Vibration Impact Assessment

Appendix E Noise and Vibration Impact Assessment

Noise Impact Statement

Worth Recycling - St Marys Facility



Noise Impact Statement

Worth Recycling - St Marys Facility

Prepared for

Worth Recycling Pty Ltd

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Quality Information

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1.0 Introduction

1.1 Background

AECOM Australia Pty Ltd (AECOM) has been engaged by Worth Recycling Pty Ltd (Worth) to provide an environmental acoustic report for the proposed waste treatment plant at 42-46 Charles Street, St Marys, NSW. At present, Worth is operating a waste management facility at South Windsor. Worth is now seeking to relocate its solid waste operations from the South Windsor site to St Marys, which will enable an increased waste treatment capacity.

Director General's Assessment Requirements (DGRs) were issued for the project on the 12 February 2013 and required a noise assessment be undertaken, in accordance with relevant Environment Protection Authority (EPA) guidelines, to consider potential impacts on private receptors due to construction, operation and traffic noise.

This report will:

- Establish maximum noise limits applicable to the proposed construction activities, expected traffic generation and daily site operations;
- Assess noise from predicted construction and operational traffic flow generated by the site against existing traffic flow;
- Provide a computational noise model of the site;
- Assess the likely noise and vibration impact from construction activities on nearby sensitive receivers;
- Assess the likely noise impact from operational activities on nearby sensitive receivers;
- Provide recommendations to attenuate noise to satisfy the established noise limits.

This report has been prepared in accordance with the following guidelines and policies:

- Department of Environmental, Climate Change and Water (DECCW) NSW Interim Construction Noise Guideline (INCG)
- Department of Environmental, Climate Change and Water (DECCW) NSW Road Noise Policy (RNP)
- Environmental Protection Authority (EPA) NSW Industrial Noise Policy (INP)

The acoustic terminology used in this report is explained in Appendix A.

1.2 Site Description

The St Marys Facility is located at 42-46 Charles Street, St Marys, NSW as shown in Figure 1. The site is located within a large industrial zone called the Dunheved Industrial Precinct. Forrester Road, an arterial road, runs north-south to the east of the industrial zone.

The site would be equipped to process the following types of waste:

- Drills muds;
- Stormwater and canal dredgings;
- Restricted soils;
- Hazardous soils;
- Greases and Refinery sludges;
- Construction/demolition waste; and
- Oil filters and drums.

The site would also comprise of a workshop for repair and maintenance of site vehicles and facilities.

Site operations would typically commence at 5:00 am and finish at 10:00 pm on weekdays and operate between 8am and 1pm on weekends.

Trucks would regularly travel into the site delivering various waste types throughout the day and evening period. There would also be periods where trucks will remove treated waste from the site.

Front end loaders, forklifts and excavators would be utilised on site to move various materials and containers to various locations within the site for storage or processing purposes.

Much of existing building infrastructure at the site currently exists from the previous site operations. The site is bounded by a concrete barrier of varying heights. A site map has been included in Appendix B indicating the site barrier and site buildings.



Worth Recycling - St Marys
Site Location and Receivers

06 Apr 2013

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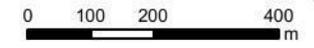


Fig. 1

2.0 Existing Acoustic Environment

2.1 Receivers

Various types of receivers exist within 1.5 km of the St Marys facility and these are shown on Figure 1. The St Marys site is located within the Dunheved Industrial Precinct and is surrounded by industrial receivers. The nearest residential receiver 199 Forrester Rd (R1 on Figure 1) is at an approximate distance of 865 m south-east of the facility. Residential zones also exist to the north-east, east and west of the site.

A golf course is located 600 m west of the facility. This is classified as an active recreational area in accordance with the INP. The potentially most-affected locations at the golf course, such as the golf house, nearby tee-off points and greens, were included as receiver locations. These points have been indicated as receivers "GF" on Figure 1. The nearest commercial facilities are St Marys Leagues Club and McDonalds, located on adjacent corners of Forrester Rd and Boronia St approximately 800 m from the Development site. The nearest school has been identified as Chiefly College (S1), located 1.15 km south east of the site.

A noise catchment area is a zone classified by receivers that have similar existing noise exposure. The receivers identified within this section are the nearest receivers of their type within their noise catchment area. Therefore these receivers have been chosen for assessment as they represent the receivers that will be the most noise affected for their receiver type within the noise catchment area.

2.2 Environmental Noise Monitoring

AECOM deployed a noise logger at a location nearby to the nearest residential receiver to continuously measure the existing noise levels in the environment. Monitoring occurred over the period of a week, starting Tuesday 12th March to Wednesday 20th March, 2013. The noise logger used was an ARL-215, serial no. 194464. It was calibrated before deployment and after retrieval with a drift in calibration not exceeding ± 0.5 dB. It was also within its current National Association of Testing Authorities, Australia (NATA) certified calibration period.

The logger was placed at the front yard of 144 Ayrell St, St Marys. This location was selected taking into consideration the nearest residential receiver locations, which were expected to be the most affected receivers, prior to undertaking the operational noise assessment. This location was chosen as it was not adjacent to Forrester Rd and hence had a reduced amount of road noise compared to residences located nearer to the road. All other receivers identified in Figure 1 are expected to have an equal or reduced level of traffic noise when taking into account the distance from main roads and shielding from buildings. As such, this monitoring location would result in more conservative criteria for noise emissions to residential receivers.

The logged data was processed into values useful for assessment purposes (refer to Table 1). The background noise level or rating background level (RBL) is representative of the lowest background sound level for any residential receiver considered within this assessment. The RBL, representing the day and evening assessment periods, is the median of the individual assessment background levels (ABL) determined over the entire monitoring duration. The ABLs are established by determining the lowest tenth-percentile level (L_{A90}) of the noise data acquired over each period of interest.

The logarithmic average of the values (L_{Aeq}) is taken to represent the average ambient noise for the day and evening periods for that location.

Table 1 Logger results – existing background (L_{A90}) and ambient noise levels (L_{Aeq})

Measurement Date	L_{A90} Background noise Levels, dB(A)			L_{Aeq} , Ambient Noise Levels, dB(A)		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Wed13, March	40	38	33	63	53	50
Thurs 14, March	41	36	33	58	53	49
Fri 15, March	40	36	31	55	54	51
Sat 16, March	39	36	N/A ⁴	55	52	N/A ⁴
Sun 17, March	41	38	34	55	52	48
Mon18, March	39	N/A ⁴	N/A ⁴	57	N/A ⁴	N/A ⁴
Tues 19, March	38	N/A ⁴	N/A ⁴	56	N/A ⁴	N/A ⁴
RBL/Log Average	40	36	33	58	53	49

Notes:

- 1) Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sunday and Public Holidays
- 2) Evening is defined as 6:00pm to 10:00pm, Monday to Sunday Public Holidays
- 3) Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays and Public Holidays
- 4) Measurement affected by adverse weather conditions

2.3 Attended Noise Measurements

The attended noise monitoring was conducted on Tuesday 19 March 2013 between the hours of 7:00 pm to 8:00 pm, to determine ambient noise characteristics and also gather spectral information of the noise levels. A 15 minute measurement was taken at the logger location.

The acoustic environment was predominantly composed of road noise from vehicles travelling along adjacent local roads and also from Forrester Road.

Table 2 presents spectra recorded during the attended measurement. These spectra were used in the assessment as representative of the background noise. The measurements were conducted during the evening period as defined by the INP (refer to notes provided under Table 1).

Table 2 Continuous equivalent noise levels (L_{Aeq}) in octave frequency bands

Time period	L_{eq} , continuous equivalent noise levels, dB									Overall L_{Aeq} , dB(A)
	Octave Band Centre Frequency, Hz									
	31.5	63	125	250	500	1000	2000	4000	8000	
Evening	53	57	53	50	45	47	41	36	31	50

3.0 Acoustic Criteria

The St Marys facility is located in the local government area of Penrith, NSW within the Dunheved Industrial Precinct. Industrial operations are required to comply with the noise requirements in accordance with guidelines provided by the EPA titled:

- Department of Environmental, Climate Change and Water (DECCW) NSW Road Noise Policy (RNP)
- Department of Environmental, Climate Change and Water (DECCW) NSW Interim Construction Noise Guideline (INCG)
- Environmental Protection Authority (EPA) NSW Industrial Noise Policy (INP)

3.1 Interim Construction Noise Guideline

The EPA's NSW Interim Construction Noise Guidelines (ICNG) (DECCW, 2009) are used to assess construction noise. This document was used as the basis for establishing construction noise management levels (NMLs) for the proposed development. Under the ICNG, a construction noise management plan is required to be compiled by the contractor, prior to construction commencing. Noise management levels must be set for the standard working hour periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours generally requires strong justification. Standard working hours are defined by the ICNG as being 7am to 6pm, Monday to Friday and 8am to 1pm on Saturdays. There are no standard working hours on Sunday or public holidays.

The noise management plan should detail the 'best practice' construction methods to be used, presenting a reasonable and feasible approach. The ICNG defines what is considered to be feasible and reasonable as follows:

Feasible

A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constructions such as safety and maintenance requirements.

Reasonable

Selecting reasonable measures from those that are feasible involves making a judgement to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.

The ICNG recommends that a quantitative assessment is carried out for all 'major construction projects that are typically subject to an EIA process. A quantitative assessment, based on a likely 'worst case' construction scenario has been carried out for this development.

Predicted noise levels at nearby noise sensitive receivers are compared to the levels provided in Section 4 of the ICNG. Where an exceedance of the NMLs is predicted the ICNG advises that the proponent should apply all feasible and reasonable work practices to minimise the noise impact.

Table 3 sets out the guidance from the ICNG for setting and applying NMLs for residential receivers.

The background noise levels measured at 144 Ayrell St are considered to be low in comparison to the other residences assessed within this report. Therefore, a conservative construction NML is generated for residential receivers within this assessment. Table 4 presents the NMLs applicable to residences in proximity of the development. Construction will occur within the recommended standard hours and as such only criteria for this period has been presented.

Table 3 Setting and applying construction noise limits at residences

Time of Day	NML, $L_{Aeq,15min}$, dB(A) ¹	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 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. <ul style="list-style-type: none"> Where the predicted or measured $L_{Aeq,15min}$ 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(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Notes:

- Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 4 Construction noise management levels – Residential receivers

Residential Receivers	Recommended Standard Hours RBL dB(A)	Recommended Standard Hours NML, L_{Aeq} dB(A)
	40	50

The proposed development will occur within close proximity to active recreational areas, industrial premises and commercial premises. A school receiver is located 1.2 km from the proposed construction site. NMLs for these sensitive receivers, as defined in the ICNG, are presented in Table 5.

Table 5 Noise at sensitive land uses (other than residences) using quantitative assessment

Land Use	NML, $L_{Aeq,15min}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Industrial premises	External noise level 75 dB(A)
Office, retail outlets	External noise level 70 dB(A)

3.2 Construction Vibration Criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. The EPA's *Assessing vibration: A Technical Guideline* (DEC, 2006) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

Vibration intensive activities such as the use of hydraulic hammers must be operated such as to minimise disturbance to the occupants of buildings and avoid the risk of damage to buildings and other structures.

The German Standard DIN 4150-Part 3 'Structural vibration in buildings – Effects on Structures' provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. If cosmetic damage is avoided then structural damage will not occur.

The EPA's publication *Assessing vibration: A Technical Guideline* (DEC, 2006) recommends safe working distances to minimise disturbance to occupants of nearby buildings and is based on *British Standard BS 6472 'Evaluation of human exposure to vibration in buildings'*.

Safe working distances for vibration inducing equipment are listed in Table 6.

Table 6 Recommended safe working distances for vibration intensive plant

Plant	Rating/Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Vibratory Roller	< 50 kN (Typically 1-2T)	5 m	15-20 m
	< 100 kN (Typically 2-4T)	6 m	20 m
	< 200 kN (Typically 4-6T)	12 m	40 m
	< 300 kN (Typically 7-13T)	15 m	100 m
	> 300 kN (Typically 13-18T)	20 m	100 m
Small Hydraulic Hammer	(300 kg – 5-12T excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12-18T excavator)	7 m	23 m
Large Hydraulic Hammer	(1,600 kg – 18-34T excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2–20 m	20 m
Pile Boring	≤ 800 mm	2 m	N/A
Jackhammer	Handheld	1 m nominal	Avoid contact with structure

3.3 Traffic Noise Criteria

The RNP outlines the assessment method to be used to assess the noise arising from traffic generated by the proposed development. The RNP guidelines are applicable for traffic movements generated as a result of the additional traffic generated during the operational phase of the Development. Criteria for various receivers are included in the RNP; however, industrial receivers do not require assessment in accordance with the RNP.

The main road providing access to the industrial zone where the proposed development is located is Links Rd. This road is classified as a local road. Movements along Links Rd will only affect industrial receivers and hence traffic flows on this road were not included in this road noise assessment. The main road, Forrester Rd which connects to Links Rd is an arterial road and will be the focal point of the road noise assessment within this report.

The relevant road traffic noise assessment criteria have been shown below in **Error! Reference source not found.**

Table 7 Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7 a.m.-10 p.m.)	Night (10 p.m. – 7 a.m.)
Arterial road	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments	LAeq(15 hour) 60 (external)	LAeq(9 hour) 55 (external)

Where the road noise level is found to be above the RNP criteria the relative increase criteria shall be applied. The relative increase criteria are applied as follows:

‘Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of the project by applying the relative increase criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

...

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.

Therefore the criteria for the road noise assessment is that, at a minimum, traffic arising from the proposed development should not lead to an increase in existing noise levels of more than 2 dB(A).

The EPA’s Interim Construction Noise Guideline (ICNG) does not provide direct reference to an appropriate criterion to assess the noise arising from construction traffic on public roads.

Given the relative short duration of most construction activities and taking into consideration the recently released EPA’s Road Noise Policy (RNP) which provides guidance when assessing relative increases in criteria, namely:

‘In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person’.

Thus, the criterion applied to traffic movements on public roads generated during the construction phase of the project is an increase in existing road traffic noise of no more than 2 dB(A).

3.4 Industrial Noise Policy

The INP provides guidance and recommendations on the assessment of noise impacts from industrial and commercial facilities throughout all periods of the day, evening and night. The assessment procedure for industrial noise sources has two components that must be satisfied:

Intrusiveness criteria

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. The industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in absence of the source by more than 5 dB. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

Amenity criteria

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use.

The amenity criteria as defined in the INP are shown in Table 8, for residential receivers in suburban areas, and for other various types of receivers.

Table 8 Recommended L_{Aeq} noise levels from industrial noise sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
School classroom - internal	All	Noisiest 1-hour period when in use	35	40
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

The residential receivers in this study are defined as 'Suburban' for the purposes of this noise assessment.

A summary of the applicable intrusive and amenity criteria for nearby residential receivers is given in Table 9. These criteria must be applied at the most affected boundary, if this is more than 30 m from the residence, at the most-affected point within 30 m of the residence. Residences within this assessment are classified as being located in a suburban area. The background noise level measured at 144 Ayrell St was used to form the criteria for all residential receivers within this assessment. This criteria is considered to be conservative, as this location is likely to have a low background noise level in comparison to other surrounding residences.

Active recreational areas should be assessed at the most-affected point within 50 m of the area boundary. School classrooms should be assessed as internal noise levels. The outdoor to indoor noise reduction is generally accepted as being 10 dB (A) with windows open and 20 dB (A) with windows closed.

Table 9 Summary of environmental noise criteria for residential receivers

Period	RBL (L_{A90})	Intrusive Criterion RBL + 5	Ambient (L_{Aeq})	Amenity Criteria	Final Environmental Criteria
Day	40	45	58	48	45
Evening	36	41	53	43	41
Night	33	38	49	39	38

4.0 Construction Noise Assessment

4.1 Construction Activities

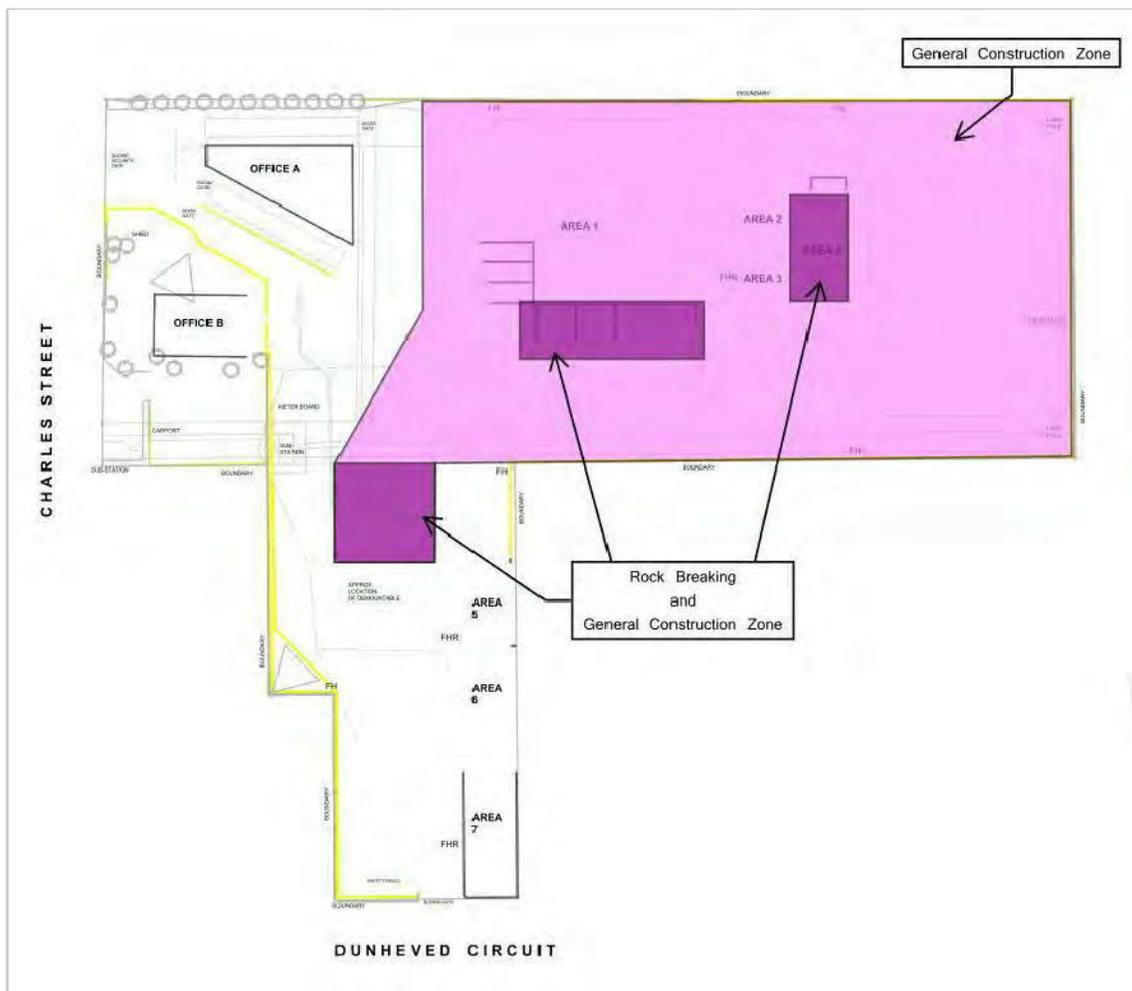
Construction activities have been separated into two work types:

- General construction works, which include use of all construction plant and equipment proposed, except for rock breaking hammers; and
- Rock breaking works.

A detailed construction plan will be prepared by Worth Recycling during detailed design of the project. This construction noise and vibration assessment has been undertaken based on a list of works planned to take place at the Development by Worth Recycling. This list of works has been included in Appendix F. For the purpose of undertaking the construction noise and vibration assessment, a number of conservative assumptions have been made regarding works scheduling and construction perimeters. These assumptions are outlined in the following section.

The assessment footprint of the proposed construction works is shown in Figure 2 and conservatively assumes that construction works will occur across most of the site.

Figure 2 Construction activities zoning schematic



4.2 Construction Noise Model

Modelling of the construction scenarios was performed using SoundPLAN 7.0. Neutral weather conditions were applied. The following conditions and assumptions were made when modelling the construction works:

- Two work packages were modelled:
 - General construction works, which includes all sources except for the hydraulic rock breaker; and
 - Excavator with a rock breaking hammer.

The works were assumed to occur within the footprints defined in Figure 2.

All buildings within the construction works footprint have been removed, providing a conservative assessment as it would be expected that the existing buildings would provide some level of noise attenuation during construction.

- The existing concrete perimeter fence would remain in place and would not change in height throughout the construction works; and
- All noise sources (i.e. all construction activities) would occur simultaneously. Although this is unlikely, it provides a more conservative prediction of noise levels during construction.

4.3 Construction Noise Sources

The construction works will require the use of a range of construction plant and equipment, which will generate a range of noise sources. Noise sources, the estimated quantity, their respective sound power levels and representative source heights are shown in Table 10. Sound power levels (SWL) were obtained from AECOM's noise source database and published datasets of the UK Department for Environmental, Food and Rural Affairs.

Table 10 Construction Noise Sources

Plant and Equipment (Noise Source)	Quantity	Representative	Unit SWL,	Total SWL,
		Source Height, m	dB	dB
100t Crane	1	3	100	100
20t Franna Crane	1	3	93	93
13t Excavator with hydraulic rock breaking hammer	1	0.5	112	112
Angle Grinders	2	3	108	111
20t Excavators	2	3	99	102
Scissor Lifts	2	3	100	103
Mobile Cranes	2	3	104	107
Hand Tools (Electrical/Mechanical)	3	3	94	99
Concrete Pumps and delivery trucks	1	3	106	106
Portable Compressor	3	0.5	109	114

4.4 Construction Noise Results

The results of the noise modelling at each sensitive receiver are presented in Table 11 and the noise contour maps of the construction noise model are provided in Figure 3. The two noise contours shown are the residential and industrial noise management levels for construction, 50 and 75 dB (A) respectively. By observing the 75 dB (A) contour, Figure 3 demonstrates that the NML for industrial premises is not exceeded for any industrial premises. The NML for the residential receiver is the most stringent of any assessed receivers. The 50 dB (A) noise contour is shown to be contained within Dunheved Industrial Precinct, where only industrial receivers are situated. Noise levels outside of this contour, further away from the noise source, will be lower than 50 dB (A). This indicates that all non-industrial receivers will be exposed to a noise level lower than the most stringent assessment criteria and will therefore comply with their respective noise management levels.

Table 11 Construction Noise Results

ID	Location	Receiver Type	NML, $L_{Aeq, 15min}$, dB(A)	Predicted Noise Level, $L_{Aeq, 15min}$, dB(A)	Compliance (Y/N)
Standard Working Hours					
R1	199 Forrester Rd	Residential	50	36	Y
R2	11 Townsend Cres	Residential	50	35	Y
R3	Eastern Residents	Residential	50	33	Y
R4	189 Boronia Rd	Residential	50	37	Y
R5	South West Residents	Residential	50	34	Y
S1	Chifley College	School classroom - internal	45	35 ¹ (25)	Y
C1	McDonalds, St Marys	Commercial	70	39	Y
C2	Leagues Club	Commercial	70	40	Y
GF1	Golf House	Active recreation	65	42	Y
GF2	Golf Course	Active recreation	65	42	Y
GF3	Golf Course	Active recreation	65	41	Y
GF5	Golf Course	Active recreation	65	40	Y
GF4	Golf Course	Active recreation	65	41	Y
I1	40A Charles St	Industrial	75	63	Y
I3	48 Charles St	Industrial	75	65	Y
I2	40B Charles St	Industrial	75	53	Y
I4	101-104 Dunheved Ct	Industrial	75	54	Y
I5	50 Charles St	Industrial	75	46	Y

Note:

- 1) The predicted noise level is an external noise level. The predicted internal noise level has been provided in brackets using the common assumption that an external façade with an open window typically provides 10 dB (A) attenuation.



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Construction Noise Assessment

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4.5 Construction Vibration Assessment

Table 10 provides a list of the equipment that may be used during the construction stage at the St Marys facility. This includes a 13t excavator with a hydraulic rock breaking hammer. Due to the vibration intensive nature of the rock breaker safe working distances relevant to vibration have been provided in Table 12.

For this development site, the nearest buildings with human occupants are adjacent to the St Marys facility. The closest building to any specified rock breaking works indicated in Figure 2 is 48 Charles St which is 12 metres from the works. At this distance the work will not cause cosmetic damage to neighbouring structures, however, may trigger human response to the occupants within those structures such as distraction, irritation or subsequently interfere with quiet activities. Measures to minimise the impacts of vibration on neighbouring industrial receptors are presented in Section 7.

Table 12 Relevant safe working distances for excavators with rock breaking hammer

Plant	Rating/Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Medium Hydraulic Hammer	(900 kg – 12-18T excavator)	7 m	23 m

5.0 Road Noise Assessment

An assessment of road traffic noise based on existing and predicted traffic flows due to the proposed development has been undertaken for both construction and operation. The roads included in the assessment were Forrester Rd (South of Links Rd), Forrester Rd (North of Links Rd) and Links Rd (refer to Figure 4). Light and heavy vehicle traffic flows have been predicted from 2013, when construction begins, to 2015 when the site is expected to be fully operational. Separate traffic flows were predicted for weekday and weekend periods.

Figure 4 Road points where existing and predicted traffic flows were assessed



Road traffic noise from increased traffic flows along Forrester Rd as a result of the Development has the potential to impact on residential and commercial receivers. Given all receivers on Links Road are industrial receivers and the RNP does not require impacts to be assessed for industrial receivers, Links Road was not included in the assessment of road traffic noise.

5.1 Operational Traffic Noise

By using predicted background traffic flows, traffic noise without the addition of traffic generated from the development has been calculated. Road noise levels were predicted for a receiver at a distance of 20 metres from the road. These predicted background traffic noise levels have been shown in .

Table 13 Background day and night road traffic noise levels, $L_{Aeq, (15 \text{ hour})}$ and $L_{Aeq, (9 \text{ hour})}$ dB(A) respectively, during years of operation

Stage	2015			
	Facility Fully Operational			
	Day		Night	
Time of day	Weekday	Weekend	Weekday	Weekend
Forrester Rd – South of Links	70	66	65	60
Forrester Rd – North of Links	68	65	62	59

The predicted background road traffic noise levels exceed their respective assessment criteria (being 60 dB (A) for day and 55 dB (A) for night) and thus the relative increase criteria would apply.

The potential increase in road traffic noise resulting from forecasted traffic increases during the operation of the Development was calculated as a logarithmic percentage above the existing traffic flow. It was found that traffic increases related to the operation of the proposed Development at the St Marys facility would not increase the L_{Aeq} noise level of any 1 hour period by more than 2 dB, in compliance with the RNP. Noise is expected to increase by less than 1 dB (A) in the most affected hour, from its predicted flow from the St Marys facility.

The full result tables are provided in Appendix G.

5.2 Construction Traffic Noise

The assessment of construction traffic noise predicted that during the construction period, a peak $L_{Aeq, 1hour}$ increase of 1.3 dB(A) will occur. This peak is expected to occur along the northern section of Forrester Road.

It has been predicted that noise due to construction traffic would not add to the current road traffic noise by more than 2 dB and therefore the Development will comply with the 2 dB relative increase criteria during the construction phase.

Full results tables for the construction phase have also been provided in Appendix G.

6.0 Operational Noise Assessment

6.1 Noise Model

The operational noise levels were predicted using an implementation of the CONCAWE algorithms in the SoundPLAN (V7.0) noise propagation software.

The noise model takes into account significant noise source sound level emissions and locations, screen effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions.

The noise model was based on ground topography, general plant site layouts and plant equipment sound power and pressure levels measured on site.

All residential receivers were modelled at a height of 1.5 m above ground level. Noise predictions were carried out at representative receivers located within proximity of 1 km from the proposed Development.

6.2 Modelled Site Operations

The proposed Development will typically operate 5 am to 10 pm Monday to Friday and 8 am to 1 pm on Saturdays. These periods of operation occur within the periods defined by the INP as daytime, evening and night periods.

The various types of wastes received at the St Marys facility are generally treated via one of three processes, designated below as processes A to C. Four other general operational processes form part of the site's routine and intermittent operations, designated as processes D to G. These noise generating processes are identified below:

- A) Drills Muds and Stormwater and Canal dredging
- B) Restricted and Hazardous Soils and Greases Refinery Sludges
- C) Construction Demolition Waste
- D) Waste Removal from Site
- E) Workshop Activities
- F) Wheel Washing Activities
- G) Oil Filter and Drum Storage

Provided in Appendix D are the significant noise activities within each process. Equipment locations, activity locations and vehicle movements around the site that were included in the noise model are also shown in Appendix D.

In order to provide a conservative assessment, the model assumed that all noise sources (i.e. all operational activities) would occur simultaneously. Although this is unlikely, it provides a more conservative prediction of noise levels during operation.

6.3 Modelled Plant and Equipment

Attended measurements were conducted by AECOM personnel at Worth's South Windsor site on the 12 March 2013. A series of sound pressure measurements were made to enable calculations of equipment and process sound powers.

For activities that were not occurring on the day, sound power levels were determined from published data by the UK Department for Environment, Food and Rural Affairs (DEFRA) "Update of noise database for prediction of noise on construction and open sites" noise database.

The sound power levels used in the noise model are shown in Table 14.

Table 14 Sound power levels for major equipment

Equipment/Activity	Sound Power Level, L_{Aeq} dB(A)
Measured	
Truck moving	94
Shaker	97
Decanter and pumps	86
Jet washing	105
Auger and mixer	95
Excavator emptying/sorting cans	101
Broadband reversing beeper	109
Externally Sourced	
Front end loader transporting material	124
Excavator scooping into designated storage areas	118
Angle grinder grinding steel	108

As further input for calculating noise levels, Worth Recycling has provided AECOM with the frequencies and durations of each activity or movement that is considered within this assessment. Using these parameters, the sound power levels of the equipment were normalised against the assessment period of 15 minutes (900 seconds).

Roller door openings for Area 1 (entry and exit) and Area 2 were included in the noise model as area sources. The activities/equipment within the respective areas are shown in Table 15. The sources were taken to be positioned at the centre of the spaces, with the resulting sound power levels also presented in Table 12.

Table 15 Calculated sound power levels for shed openings

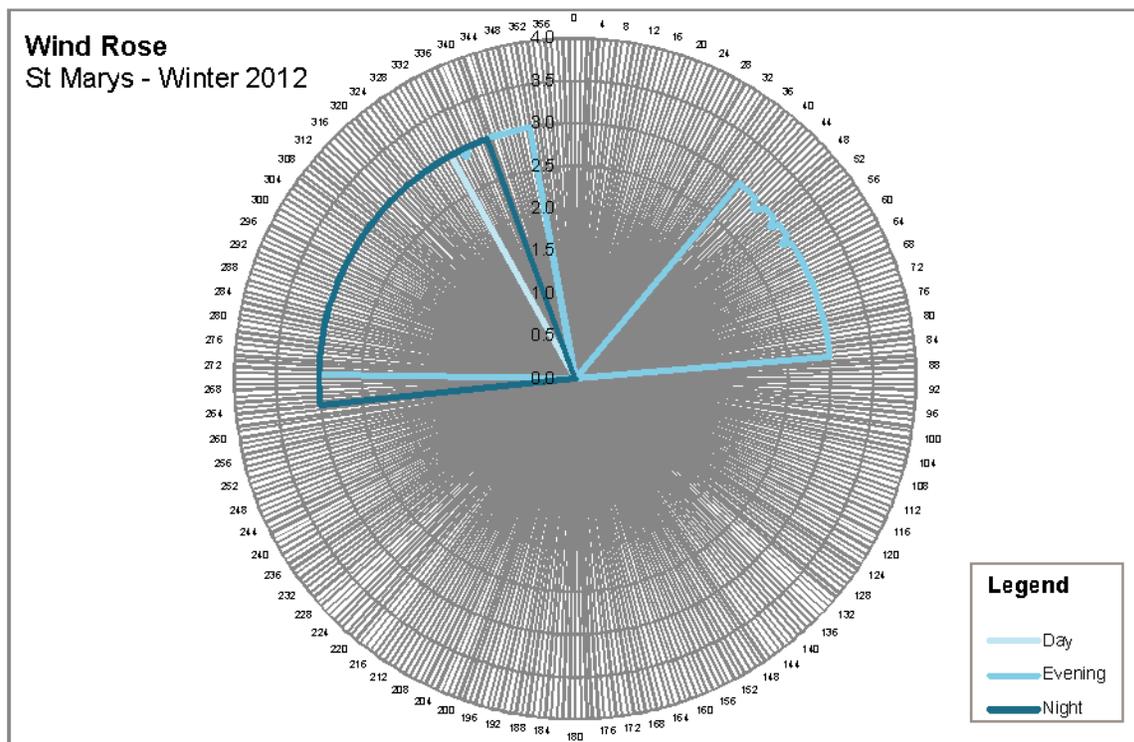
Opening	Equipment/Activities Contained	Sound Power Level, $L_{Aeq(15\text{ min})}$ dB(A)
Area 1 – Entry	- Broadband reversing beeper	111
Area 1 - Exit	- Excavator scooping into designated storage areas - Auger and mixer	109
Area 2	- Decanter and pumps - Shaker	99

The waste water treatment plant has not been included into the model, as sound data has not yet been attained from the manufacturer nor was the equipment active at the South Windsor facility for attended measurements to occur. In absence of the sound power spectrum, the maximum overall sound power level at which the selected waste water treatment plant may operate concurrently with all other proposed plant has been proposed, based on the modelling (refer to Section 7). Provided this maximum sound power level is achieved by the water treatment plant, changes to the predicted noise emission results would not be expected.

6.4 Meteorological Conditions

Worst case weather conditions have been assessed using weather data measured at the Environment Protection Authority Weather Station at St Marys over 3 months of winter in 2012. In accordance with the INP guidelines, wind has been assessed if there is a 30% or greater occurrence of wind speeds less than 3 m/s, source to receiver. The prevailing wind directions for wind speeds below 3 m/s are shown below in Figure 5. The wind direction indicated in Figure 5 which is most likely to affect nearby residential receivers considered within this assessment is 3 m/s east wind during the day, evening and night time period. The other wind directions indicated are unlikely to affect residential receivers. Day is defined as 7 am to 6 pm, evening is defined as 6 pm to 10 pm and night is defined as 10 pm to 7 am.

Figure 5 Wind directions for a 30% or greater occurrence of wind speeds below 3 m/s



6.5 Operational Noise Modelling Results

Based on the assumptions and modelling parameters as set out in the previous section, the operational noise levels were predicted at receiver locations indicated in Section 2.1 under neutral and worst case weather conditions. The noise modelling results have been shown against the night time criteria, which has the more stringent of the assessable periods. Noise contour plots for these scenarios are presented in Appendix H.

Table 16 Operational Noise Results

ID	Location	Type	Criteria, L _{Aeq} (15min), dB(A)	Predicted Noise Level L _{Aeq,15min} , dB(A)		Exceedance, dB(A)	
				Neutral wind	Worst case weather (3 m/s wind)	Neutral weather	Worst case weather (3 m/s wind)
Night Period							
I1	40A Charles St	Industrial	70	68	67	-	-
I3	48 Charles St	Industrial	70	64	63	-	-
I2	40B Charles St	Industrial	70	55	55	-	-
I4	101-104 Dunheved Ct	Industrial	70	49	49	-	-
I5	50 Charles St	Industrial	70	48	46	-	-
GF1	Golf House	Active recreation	55	42	35	-	-
GF2	Golf Course	Active recreation	55	41	34	-	-
GF3	Golf Course	Active recreation	55	41	33	-	-
GF5	Golf Course	Active recreation	55	40	33	-	-
GF4	Golf Course	Active recreation	55	40	32	-	-
C2	Leagues Club	Commercial	65	40	44	-	-
C1	McDonalds, St Marys	Commercial	65	37	41	-	-
R1	199 Forrester Rd	Residential	38	36	41	-	3
R4	189 Boronia Rd	Residential	38	36	41	-	3
R2	11 Townsend Cres	Residential	38	35	40	-	2
R3	Eastern Residents	Residential	38	33	38	-	-
R5	South West Residents	Residential	38	32	25	-	-
S1	Chifley College	School classroom - internal	Out of School Hours				
Evening Period							
I1	40A Charles St	Industrial	70	68	67	-	-
I3	48 Charles St	Industrial	70	64	63	-	-
I2	40B Charles St	Industrial	70	55	55	-	-
I4	101-104 Dunheved Ct	Industrial	70	49	49	-	-
I5	50 Charles St	Industrial	70	48	46	-	-
GF1	Golf House	Active recreation	55	42	35	-	-

ID	Location	Type	Criteria,		Predicted Noise		Exceedance, dB(A)		
			L _{Aeq} (15min), dB(A)		Level L _{Aeq,15min} , dB(A)				
GF2	Golf Course	Active recreation	55	41	34	-	-		
GF3	Golf Course	Active recreation	55	41	33	-	-		
GF5	Golf Course	Active recreation	55	40	33	-	-		
GF4	Golf Course	Active recreation	55	40	32	-	-		
C2	Leagues Club	Commercial	65	40	44	-	-		
C1	McDonalds, St Marys	Commercial	65	37	41	-	-		
R1	199 Forrester Rd	Residential	41	36	41	-	-		
R4	189 Boronia Rd	Residential	41	36	41	-	-		
R2	11 Townsend Cres	Residential	41	35	40	-	-		
R3	Eastern Residents	Residential	41	33	38	-	-		
R5	South West Residents	Residential	41	32	25	-	-		
S1	Chifley College	School classroom - internal	Out of School Hours						
Day Period									
I1	40A Charles St	Industrial	70	68	67	-	-		
I3	48 Charles St	Industrial	70	64	63	-	-		
I2	40B Charles St	Industrial	70	55	55	-	-		
I4	101-104 Dunheved Ct	Industrial	70	49	49	-	-		
I5	50 Charles St	Industrial	70	48	46	-	-		
GF1	Golf House	Active recreation	55	42	35	-	-		
GF2	Golf Course	Active recreation	55	41	34	-	-		
GF3	Golf Course	Active recreation	55	41	33	-	-		
GF5	Golf Course	Active recreation	55	40	33	-	-		
GF4	Golf Course	Active recreation	55	40	32	-	-		
C2	Leagues Club	Commercial	65	40	44	-	-		
C1	McDonalds, St Marys	Commercial	65	37	41	-	-		
R1	199 Forrester Rd	Residential	41	36	41	-	-		
R4	189 Boronia Rd	Residential	41	36	41	-	-		
R2	11 Townsend Cres	Residential	41	35	40	-	-		
R3	Eastern Residents	Residential	41	33	38	-	-		
S1	Chifley College	School classroom - internal	35	33 ¹ (23)	38 ¹ (28)	-	-		
R5	South West Residents	Residential	41	32	25	-	-		

Note:

- 2) The predicted noise level is an external noise level. The predicted internal noise level has been provided in brackets using the common assumption that an external façade with an open window typically provides 10 dB (A) attenuation.

Exceedances are predicted to occur at three residential receivers (R1, R4 and R2) to the east of the St Marys facility during the night time. No exceedances are predicted to occur during the day and evening times.

Inspection of the computational noise model indicates that the night time exceedances are due to the use of excavators. The excavator scooping material into designated storage areas has the second highest sound power level of any equipment or activity within Table 14. Recommendations have been provided in the following section to achieve compliance at the receiver locations where exceedances are predicted.

6.6 Car Park Noise Emissions

A simple calculation was performed to assess the potential noise impacts from car parking activities at the Site, on nearby sensitive receivers. The noise criteria which these noisy car park activities are assessed against are identical to those applied for the aforementioned site operations.

The sound power levels used for the activities are shown in Table 17. These levels have been sourced from AECOM's sound power database. Level spectrums have been provided in Appendix E.

Table 17 Car park activities sound power levels

Activity	Time weighting reduction, dB(A)	Sound Power Level, dB(A)	Resultant Sound Power Level, dB(A), $L_{Aeq, 15min}$
Door/boot slam	3	84	81
People talking	-	79	79
Car accelerating	-	93	93

The predicted noise levels from car parking activities are shown in Table 18. The calculations did not include attenuation that would be likely from perimeter barriers, ground and air absorption, buildings and topography, therefore the calculations are conservative and measured values are expected to be much less than the results shown below.

Table 18 Car park noise emission predicted noise levels

ID	Location	Type	Distance from car park, m	Criteria, $L_{Aeq, 15min}$, dB(A)	Predicted Noise Level $L_{Aeq, 15min}$, dB(A)	Exceedance, dB(A)
				Acceptable	Hemispherical Spreading	
I3	48 Charles St	Industrial	15	70	62	-
C2	Leagues Club	Commercial	880	65	26	-
R1	199 Forrester Rd	Residential	865	38	26	-
S1	Chifley College	School classroom - internal	1200	35	24	-
GF1	Golf House	Active recreation	570	55	30	-

The addition of these noise levels to the predicted operational noise levels shown in Table 16 will have no audible increases to the noise levels nor will they cause non-compliance against the INP criteria.

7.0 Mitigation and Management

7.1 Construction Vibration

The use of a 13T excavator with a hydraulic rock breaking hammer will be used during the construction phase. This selection of plant and the designated work area at which it will be utilised has the potential to trigger human response for occupants within neighbouring premises, 12 metres from the specified work area. To mitigate the effects of vibration on to neighbouring occupants, the following mitigation measures are recommended:

- 1) Source Controls
 - a) Use of less noise and vibration intensive equipment, for example, a smaller hydraulic hammer attached to an excavator with tonnage less than 12 tonne, which has a safe working distance for cosmetic damage (2m) and human response (7m) that is less than the distance between the nearest neighbouring and the work area.
 - b) Respite periods
- 2) Management controls
 - a) Inform neighbouring property owners prior to vibratory construction works commencing
 - b) Maintain a complaints register and provide prompt responses
 - c) Site planning and layout
 - d) Training of all site staff, including contractors, site managers, temporary equipment operators etc.
- 3) Path controls
 - a) Avoid vibration intensive works in a concentrated area and work over a large area to reduce maximum vibration dose values

7.2 Management of Operational Noise Exceedances

The modelling results presented in Section 6.5 show predicted exceedances of the operational noise criteria in the night time period at three residential receivers.

An investigation of the SoundPLAN model reveals that the dominant noise source causing exceedances of the noise criteria is the excavator scooping material into the designated storage areas and sorting oil drums and construction waste. To address exceedances that will potentially occur within the night-time period, it is recommended that the excavator is not used to handle oil drums and construction waste during the night-time period. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays and public holidays.

The predicted noise levels with the implementation of limiting operation of the excavator to daytime and evening periods (i.e. no operation of the excavator during the night time period) are shown in Table 19.

Table 19 Operational Noise with Shaker Barrier

ID	Location	Type	Criteria, L _{Aeq} (15min)	Predicted Noise Level L _{Aeq,15min} , dB(A)		Exceedance, L _{Aeq,15min} dB(A)	
			Acceptable	No Met	3 m/s wind	No Met	3 m/s wind
Night Period – Shaker Barrier and No Excavator							
R1	199 Forrester Rd	Residential	38	32	38	-	-
R4	189 Boronia Rd	Residential	38	30	36	-	-
R2	11 Townsend Cres	Residential	38	29	35	-	-

The results show that the night time residential criterion is satisfied at all receiver locations. Noise contours without the contribution from excavator works has been shown in Appendix H.

To align with the predicted noise levels the waste water treatment plant should have an overall sound power level no greater than 104 dB (A). This sound power level was determined through distance loss and the assumption that the noise source is positioned at a height that is lower than the barrier between the proposed plant location and the receiver locations. No noise shielding due to buildings was considered in this calculation.

7.3 General Noise Management and Mitigation Recommendations

In addition to the specific noise mitigation measures described above to comply with the INP criteria, reasonable and feasible mitigation and management measures should be considered to minimise unnecessary excessive noise. Examples of general measures to minimise noise include:

- Maximise the offset distance between noisy plant items and nearby noise sensitive receivers;
- Avoiding the coincidence of noisy plants working simultaneously close together and adjacent to sensitive receivers, where practicable;
- Where possible, equipment with directional noise emissions should be orientated away from sensitive receivers;
- Locate noisy plant away from potentially noise affected neighbours or behind barriers, such as sheds or walls;
- Maintenance work on equipment and plant with the potential to generate noise impacts should be carried out within daytime hours, where possible;
- Minimising consecutive works in the same locality, where practicable;
- Turn off plant when not in use;
- Examine, and implement where feasible and reasonable, alternative work practices which generate less noise – for example, use electric equipment instead of diesel or petrol powered equipment;
- Maintain and operate equipment in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse noise and vibration impacts;
- Ensure plant is regularly maintained, and repair or replace equipment that becomes noisy;
- Arrange the work site to minimise the use of movement alarms on vehicles and mobile plant.
- In the case that high impact noise activities or activities likely to generate noise with intermittent, impulsive, tonal or low-frequency characteristics are required, appropriate notification of neighbours prior to works commencing and respite periods should be implemented.
- Proactive driver/operator training and operational procedures to minimise the use of reversing alarms (taking into account WorkCover and occupational health and safety requirements).

8.0 Conclusion

The impact of the noise associated with the operation of the Worth Recycling's proposed St Marys Waste Treatment Facility has been assessed. The scope of the assessment included road noise, construction noise and vibration and operation noise generated by the development and operation of the site. A noise model was constructed using SoundPLAN v7.0 and equipment sound powers measured on site as input into the model.

8.1 Construction Noise and Vibration

Construction noise will comply with respective noise criteria at all receivers. However, the use of vibratory intensive equipment specified in the construction plant has the potential to cause human discomfort to occupants of neighbouring properties. Mitigation measures have been provided to avoid or control the effects of vibration from the construction activities and impacts on nearby receivers are not anticipated.

8.2 Road Noise

Noise generated from additional traffic by the development was assessed. The traffic flows considered within this assessment were light and heavy vehicles including staff vehicle movements, waste delivery trucks and construction vehicles. It was found that noise caused by these vehicles will not increase the $L_{Aeq, 1 \text{ hour}}$ road noise levels by more than 2 dB and hence will comply with the RNP and ECRTN.

8.3 Operational Noise

Site activities and equipment operating simultaneously were modelled to predict the noise levels at nearby receivers. Without noise mitigation measures, operational noise exceedances were predicted for residential receivers during the night time period. All exceedances were predicted to occur during worst-case weather conditions.

It is anticipated that by avoid the use of the excavator during night time hours, operational noise from the Development will not have unacceptable noise impacts on any receivers.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology used in this report.

<i>Sound power level (SWL)</i>	The total sound emitted by a source																						
<i>Sound pressure level (SPL)</i>	The amount of sound at a specified point																						
<i>Decibel [dB]</i>	The measurement unit of sound																						
<i>A Weighted decibels [dB(A)]</i>	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB (A).																						
<i>Decibel scale</i>	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: <table> <tr> <td>0dB(A)</td> <td>Threshold of human hearing</td> </tr> <tr> <td>30dB(A)</td> <td>A quiet country park</td> </tr> <tr> <td>40dB(A)</td> <td>Whisper in a library</td> </tr> <tr> <td>50dB(A)</td> <td>Open office space</td> </tr> <tr> <td>70dB(A)</td> <td>Inside a car on a freeway</td> </tr> <tr> <td>80dB(A)</td> <td>Outboard motor</td> </tr> <tr> <td>90dB(A)</td> <td>Heavy truck pass-by</td> </tr> <tr> <td>100dB(A)</td> <td>Jackhammer/Subway train</td> </tr> <tr> <td>110 dB(A)</td> <td>Rock Concert</td> </tr> <tr> <td>115dB(A)</td> <td>Limit of sound permitted in industry</td> </tr> <tr> <td>120dB(A)</td> <td>747 take off at 250 metres</td> </tr> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/Subway train	110 dB(A)	Rock Concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 take off at 250 metres
0dB(A)	Threshold of human hearing																						
30dB(A)	A quiet country park																						
40dB(A)	Whisper in a library																						
50dB(A)	Open office space																						
70dB(A)	Inside a car on a freeway																						
80dB(A)	Outboard motor																						
90dB(A)	Heavy truck pass-by																						
100dB(A)	Jackhammer/Subway train																						
110 dB(A)	Rock Concert																						
115dB(A)	Limit of sound permitted in industry																						
120dB(A)	747 take off at 250 metres																						
<i>Frequency [f]</i>	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
<i>Equivalent continuous sound level [L_{eq}]</i>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
L_{max}	The maximum sound pressure level measured over the measurement period																						
L_{min}	The minimum sound pressure level measured over the measurement period																						
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10} .																						
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90} .																						

<i>Ambient noise</i>	The all-encompassing noise at a point composed of sound from all sources near and far.
<i>Background noise</i>	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
<i>Traffic noise</i>	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
<i>Day</i>	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
<i>Evening</i>	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
<i>Night</i>	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
<i>Assessment background level [ABL]</i>	The overall background level for each day, evening and night period for each day of the noise monitoring.
<i>Rating background level [RBL]</i>	The overall background level for each day, evening and night period for the entire length of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 "Acoustics – Glossary of terms and related symbols", the EPA's NSW Industrial Noise Policy and the EPA's Road Noise Policy.

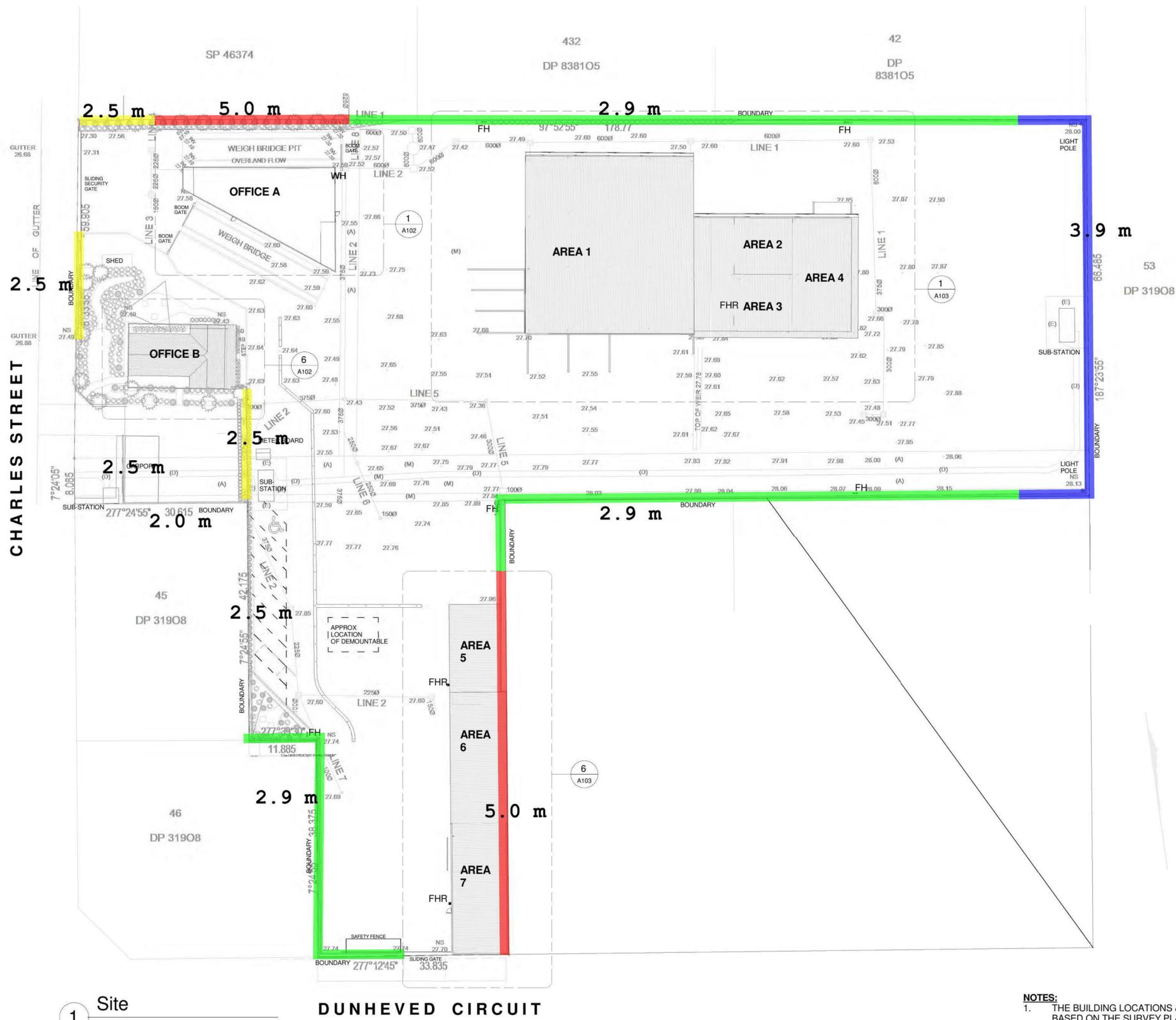
Appendix B

Site Layout

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2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION.
3. ALL DIMENSIONS, AS SHOWN ON DRAWINGS, SHALL BE CHECKED AND VERIFIED BY THE BUILDER BEFORE ANY CONSTRUCTION OR FABRICATION TO BE COMMENCED.
4. ANY PROPOSED AMENDMENTS OR VARIATIONS TO THE ORIGINAL DRAWINGS SHALL BE DISCUSSED AND APPROVED BY THE ARCHITECT.
5. ALL STRUCTURAL ELEMENTS SHALL BE DESIGNED AND CERTIFIED BY THE STRUCTURAL ENGINEER.
6. DO NOT KEEP SUPERSEDED DRAWINGS ON SITE.



1 Site
1 : 400

NOTES:

1. THE BUILDING LOCATIONS & DIMENSIONS & THE BOUNDARIES ARE BASED ON THE SURVEY PLAN PREPARED BY FREEBURN SURVEYING REF: 33362 DATED 23/10/12
2. THE LANDSCAPE PLAN IS BASED ON THE CAD PLANS PROVIDED BY MONACO DESIGNS. THIS PLAN HAS BEEN MODIFIED TO FIT THE SURVEY. THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
3. INTERNAL BUILDING WALLS AND DETAILS ARE BASED ON THE CAD PLANS PROVIDED BY WORTH RECYCLING AND HAVE BEEN MODIFIED TO FIT THE SURVEY. THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.

LEGEND

MR	COLORBOND METAL ROOF
MC	COLORBOND METAL WALL
CL	CLADDING
FH	FIRE HYDRANT
FHR	FIRE HOSE REEL
CRP	CEMENT RENDER & PAINT
PMP	PREFINISHED METAL PANEL
COR	CORRUGATED ZINCALUME
TR	TILED ROOF
CP	CONCRETE PANEL
CB	CONCRETE BLOCK
WH	WATER HEATER



Consultant Address	Consultant Address
Phone	Phone
Fax	Fax
e-mail	e-mail

No. Description Date

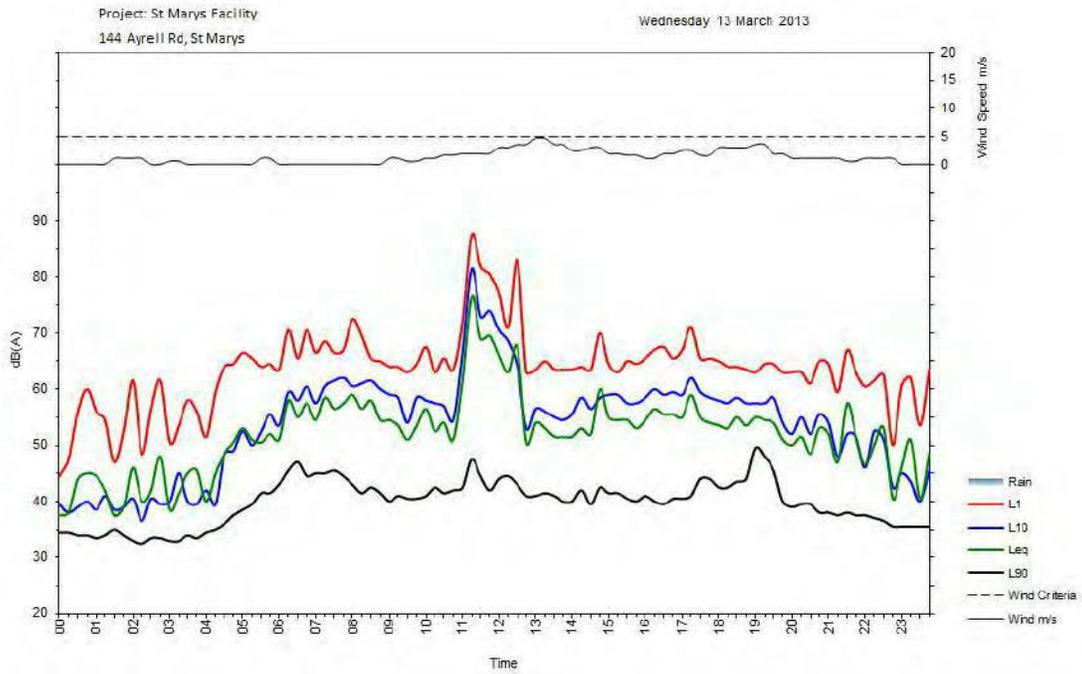
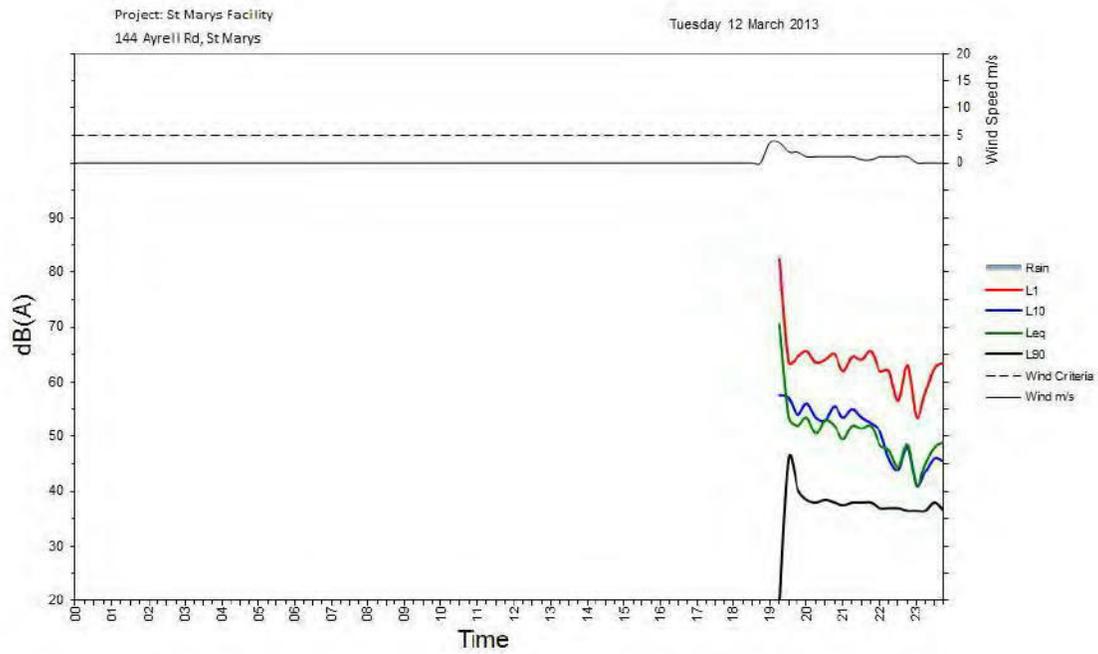
Architect **C.K. ARCHITECTS**
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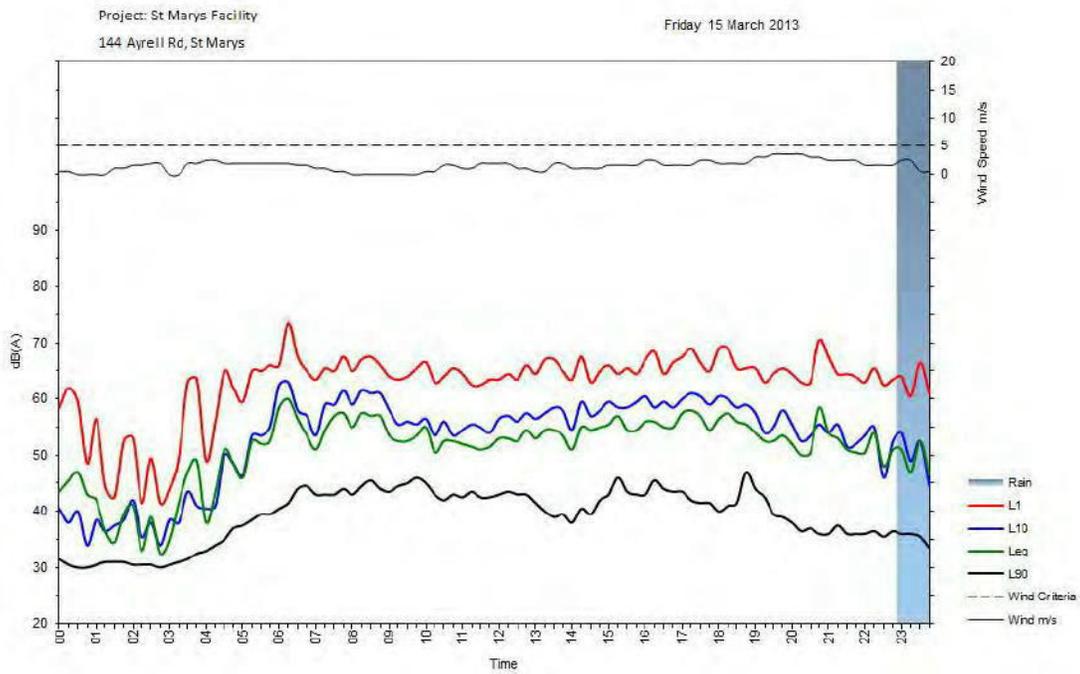
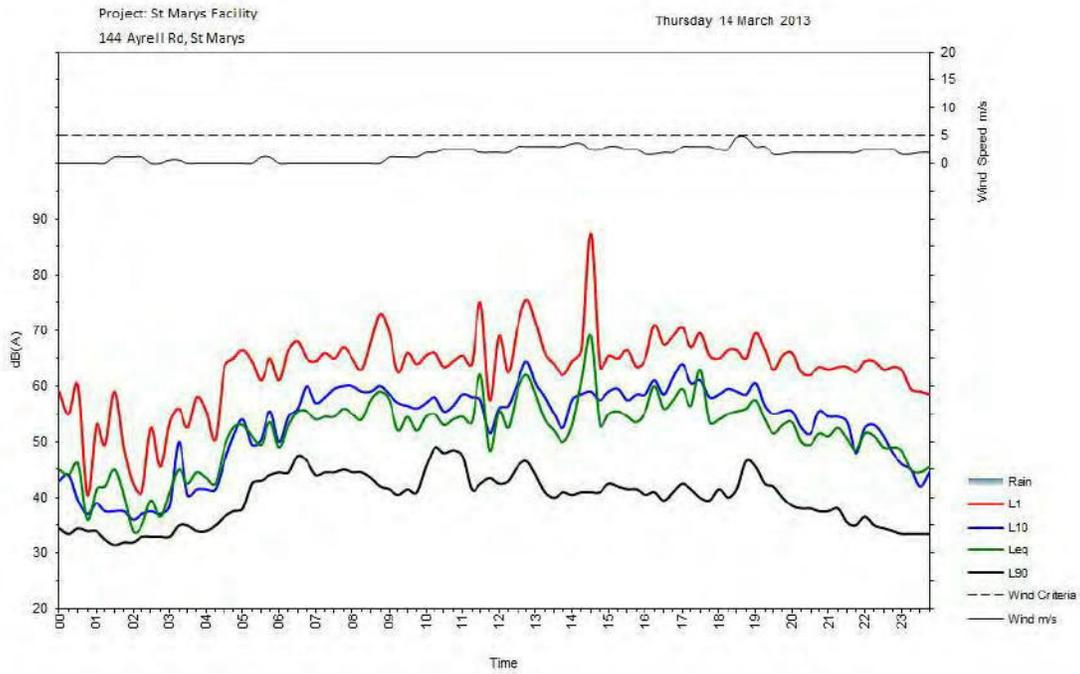
Client	WORTH RECYCLING
Project Name	42-46 CHARLES ST. ST. MARYS NSW
Drawing Title	SITE PLAN
Project Status	AS BUILT
Project number	WR0113
Date	Issue Date
Drawn by	Author
Revision	Scale As indicated @A3
	A101

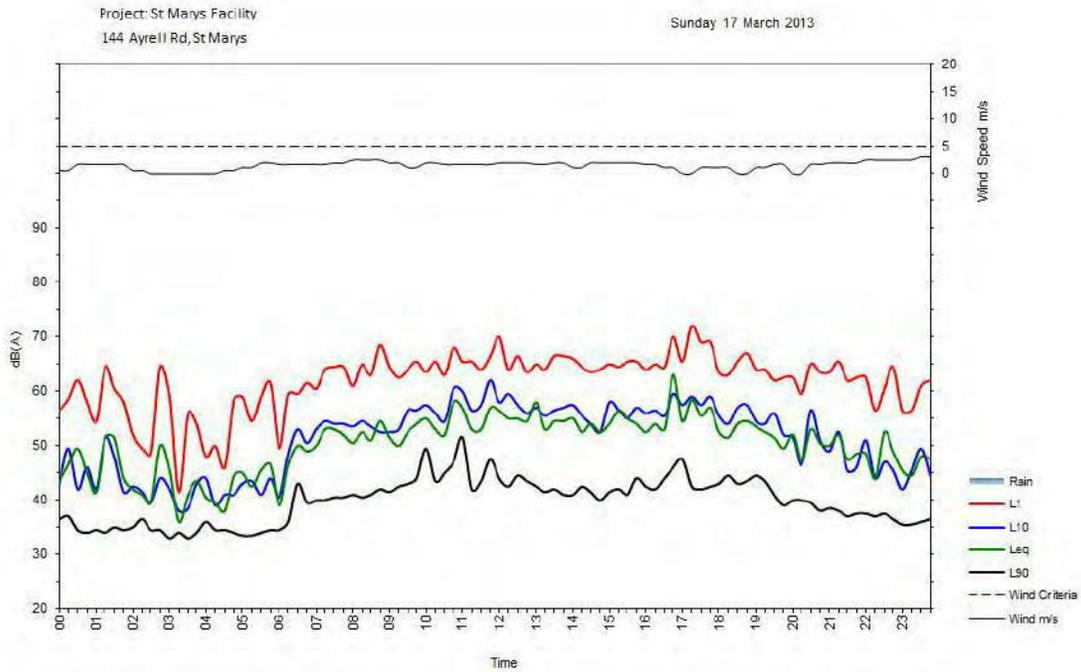
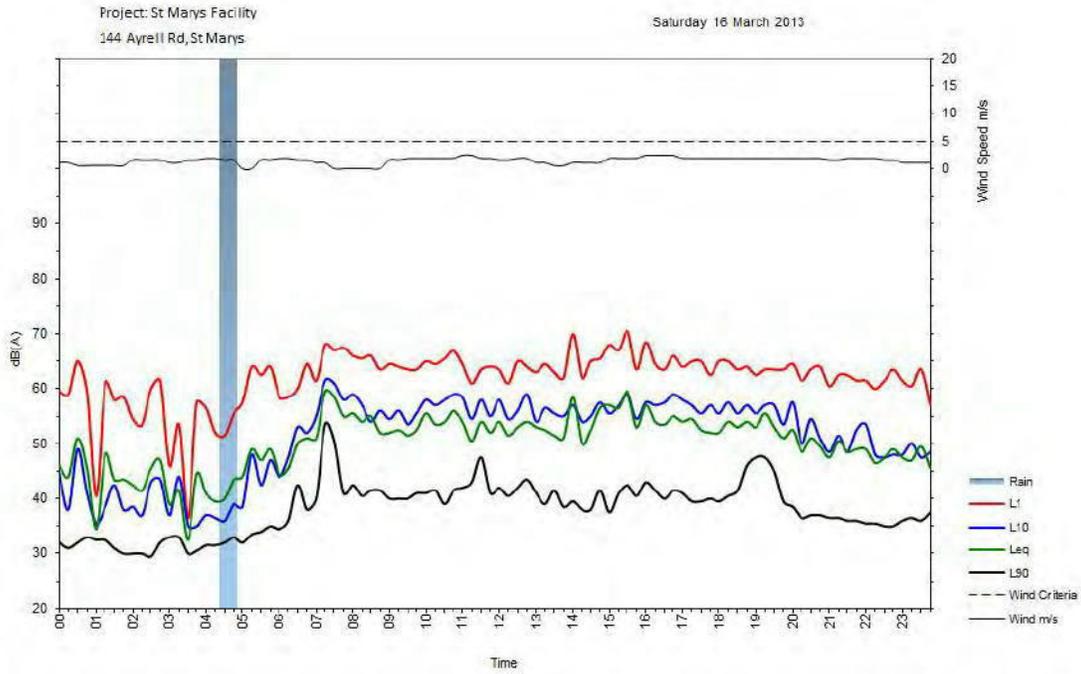
Appendix C

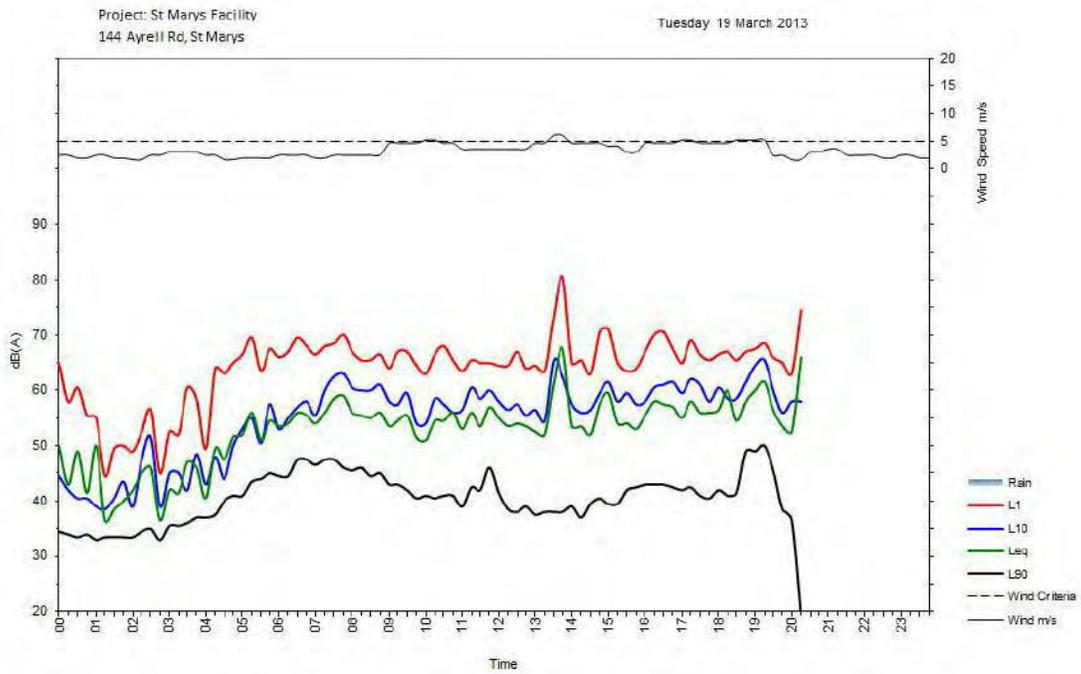
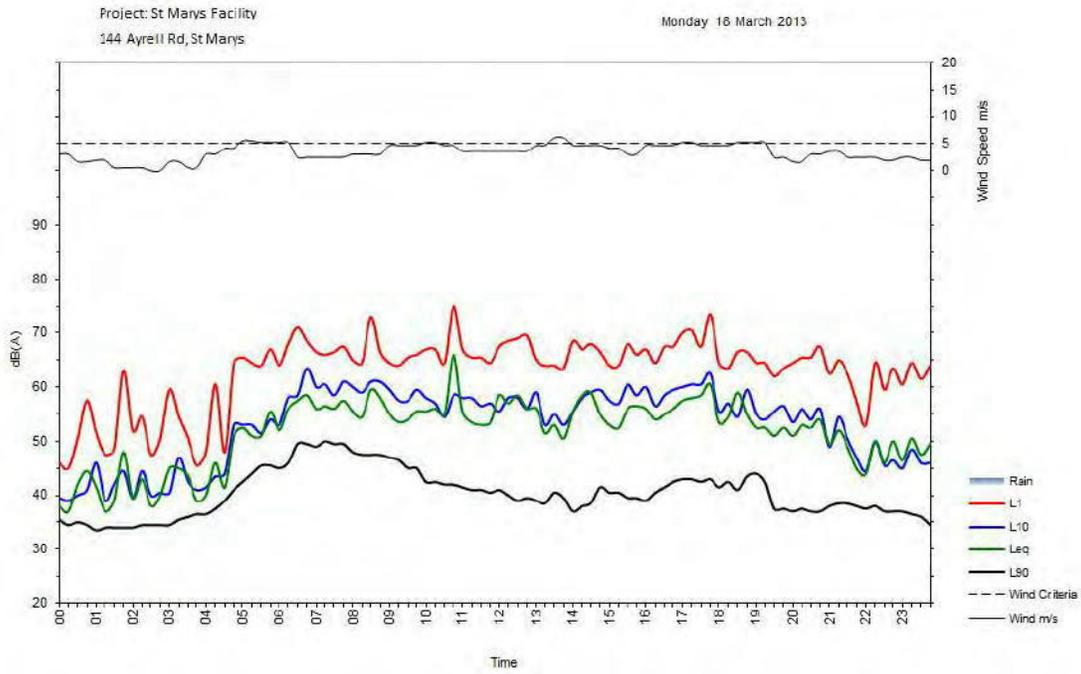
Noise Logging Summary

Appendix C Noise Logging Summary









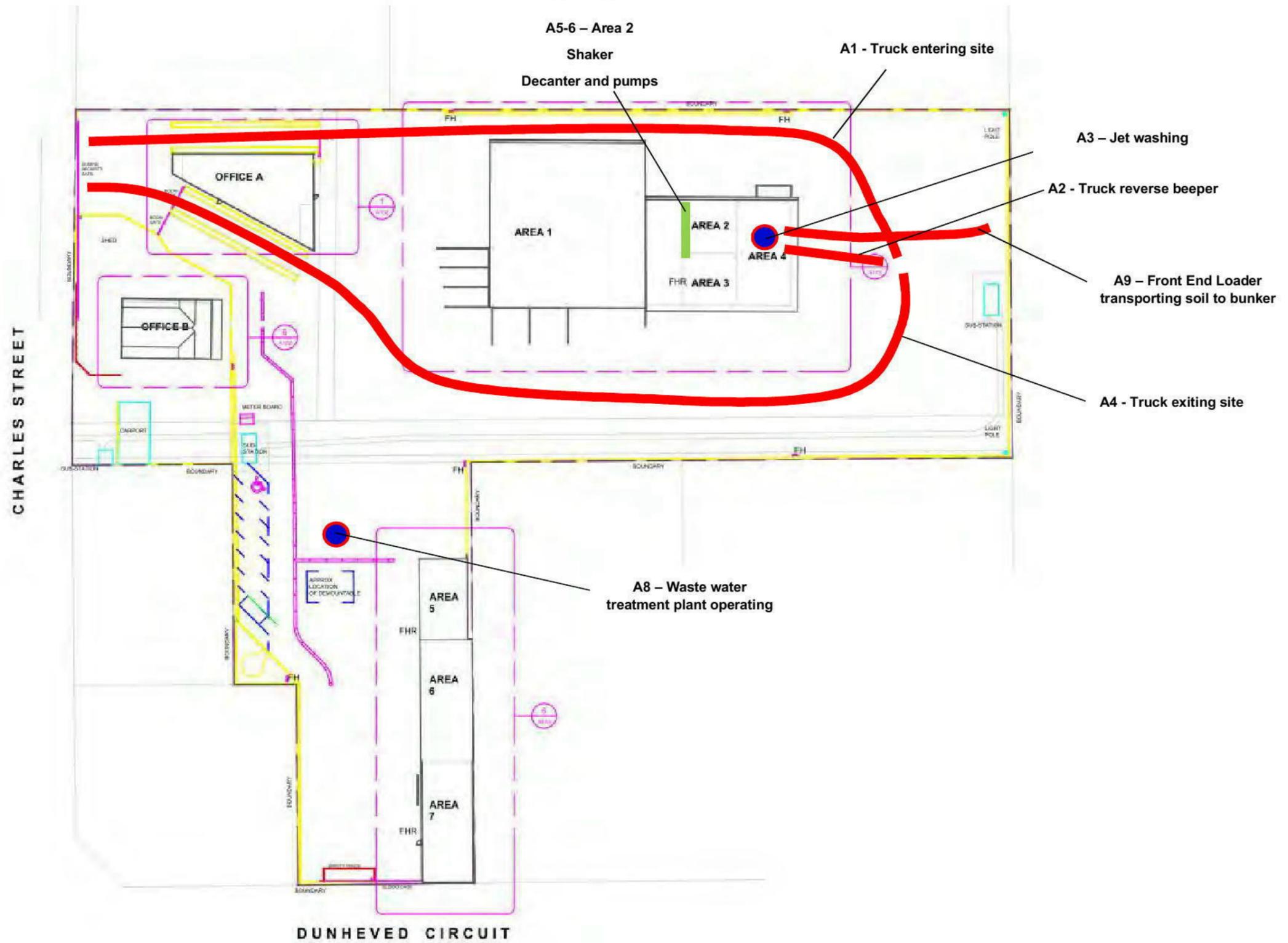
Appendix D

Operational Activities

Appendix D Operational Activities

Waste Stream	Process	Task	Activity Descriptions	Duration (seconds) limited to 15 min	Frequency per 15 min	Location / Zone of use (vehicles)
Drill Muds Stormwater and canal dredging	A	1	- Truck movement into site (Tanker)	60	1	Entrance → Area 4
		2	- Truck reverse (beeper) to dump contaminated mud/liquid waste into pit	15	1	Area 4
		3	- Washing Truck Vessel	120	1	Area 4
		4	- Truck movement out of the site	60	1	Area 4 → Exit
		5	- Pumps + Shaker (Mud)	900	1	Area 4
		6	- Pumps + Decanter (Mud)	900	1	Area 2
		7	- Pumps (Stormwater & Canal dredgings)	300	1	Area 2
		8	- Waste water treatment plant to process waste water and store into tanks	900	1	South East of Area 1
		9	- Front End Loader to move soil (from stormwater and canal dredgings waste stream) to external storage bunker until offsite removal	600	1	Area 4 → External bunker storage area (eastern boundary)
Restricted Soils Hazardous Soils Greases Refinery Sludges	B	1	- Truck movement into site	60	1	Entrance → Area 1
		2	- Truck reverse (beeper) to dump contaminated soil into pit	15	1	Area 1
		3	- Truck movement out of the site	60	1	Area 1 → Exit
		4	- Excavator to scoop up solids to place into designated storage areas	30	20	Area 1
		5	- Auger to move product through to immobilisation station	90	5	Area 1
		6	- Mixer to apply concrete mix to product to immobilise the contaminated waste	90	5	Area 1
		7	- Waste water transferred to storage tanks for treatment offsite	300	1	South-west of Area 1
		8	- Front End Loader to relocate immobilised waste to external bunker (located at western wall of Area 1) for storage prior to offsite removal	120	5	West of Area 1
Construction/demolition waste	C	1	- Truck delivery of waste containers	600	1	Entrance → External bunker storage area (eastern boundary)
		2	- Truck exiting site	60	1	External bunker storage area → Exit
		3	- Excavator (tracks) movement to and around construction/demolition waste area to relocate waste into Area 1 for sorting/segregating	120	2	Bunded storage area → Area 1 (and back)
		4	- Excavator to pick up and drop waste containers	180	2	Bunded storage area
		5	- Excavator to move waste containers	60	1	Bunded storage area
Waste removal from site	D	1	- Trucks to remove immobilised waste, drill muds and soil from stormwater/canal dredgings and demolition/construction material (assisted by excavator)	600	1	Various
		2	- Trucks (tanker) to remove contaminated waste water from tanks	600	1	Tanks adjacent to Area 1 (ASS), Tanks adjacent to Water Treatment Plant (south-west)
		3	- Trucks to remove crushed drums (assisted by excavator) or crushed filters (in skip bin)	600	1	Bunded storage area (adjacent to Area 1) → Exit
		4	- Trucks to remove other waste streams (i.e. plastics)	600	1	Various
Workshop Activities	E	1	- Noisiest workshop activities specified by Worth Recycling e.g. Grinding, Welding or Cutting	120	5	Area 6 and 7
Wheel washing activities	F	1	- Wheels of trucks are washed	120	2	Area 5
Oil filters and drum storage	G	1	- Trucks delivery of drums and oil	600	1	Bunded storage area (adjacent to Area 1)
		2	- Trucks exiting the site	60	1	Bunded storage area (adjacent to Area 1)
		3	- Crushing of oil filters or drums using hydraulic machine (drums assisted by forklift)	180	5	Bunded storage area (adjacent to Area 1)

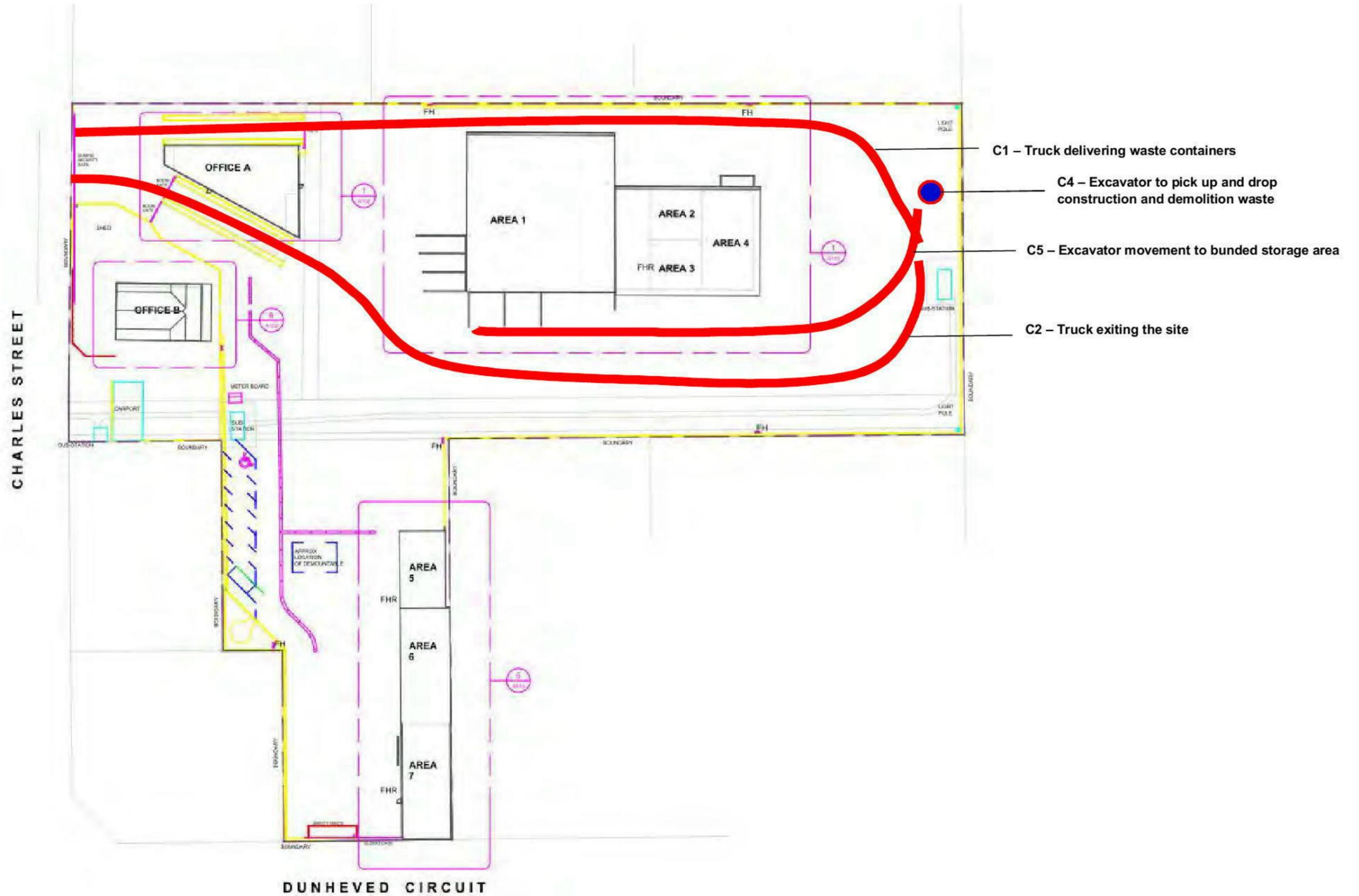
Process A – Drill Muds, Stormwater and Canal Dredgings



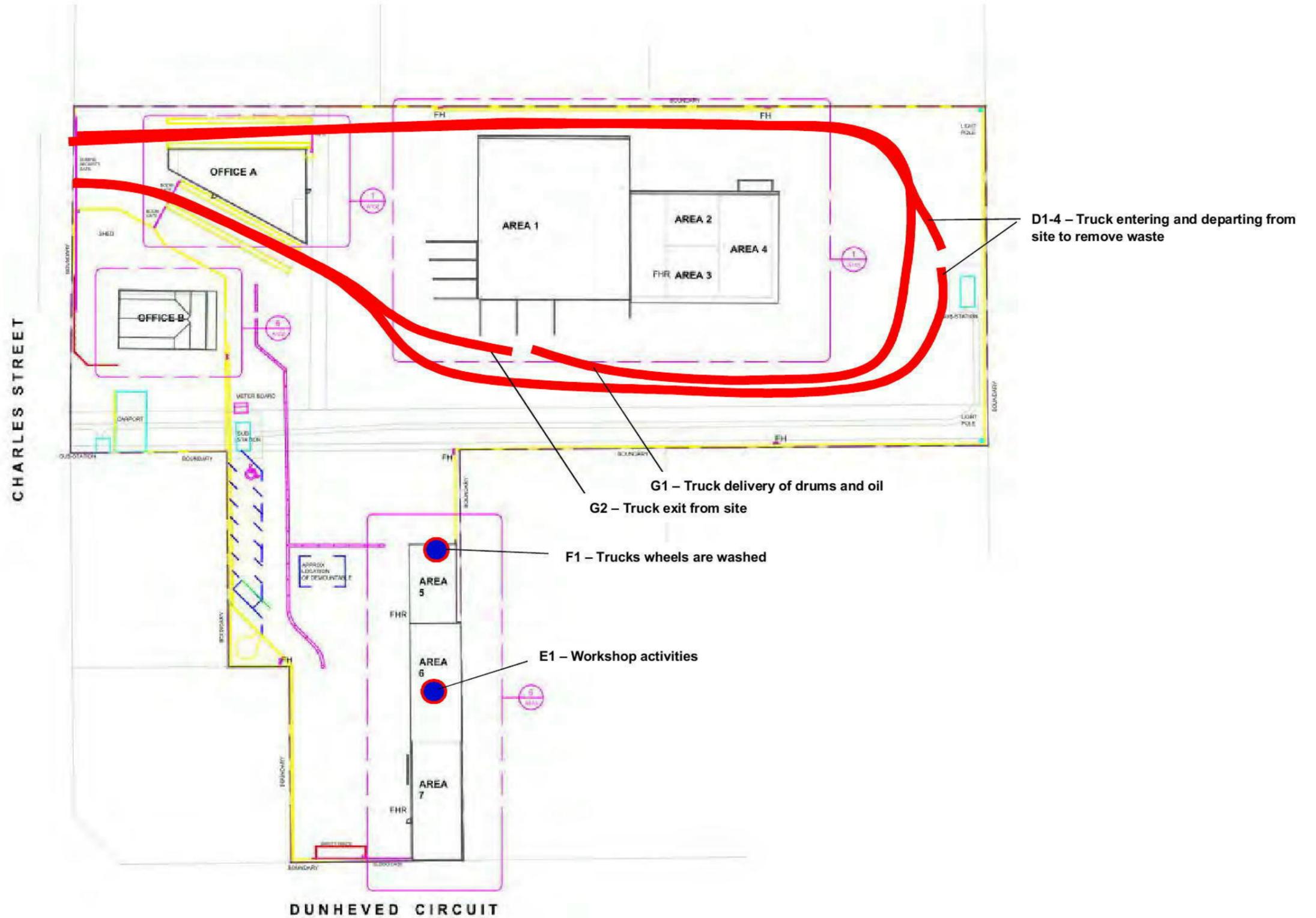
Process B – Restricted and Hazardous Soils, Greases and Refinery Sludges



Process C – Construction and Demolition Waste



Process D, E, F and G – Waste Removal from Site, Workshop Activities, Wheel Washing and Oil Drum Storage



Appendix E

Modelled Sound Power Spectrums

Appendix E Sound Power Levels

Figure 6 Sound Power Levels for Activities and Equipment used in noise modelling and calculations within this report

Equipment	Sound Power Level, L_{eq} dB								Overall, L_{Aeq} dB(A)
	Octave Frequency Band Centre (Hz)								
	63	125	250	500	1000	2000	4000	8000	
Truck moving	94	92	87	91	93	91	88	94	94
Shaker	102	99	101	95	87	89	73	102	97
Decanter and pumps	85	84	82	86	79	78	76	85	86
Jet washing	105	99	99	101	100	99	96	105	105
Auger and mixer	102	98	93	92	90	88	84	102	95
Excavator emptying/sorting cans	98	100	101	99	95	94	88	98	101
Broadband reversing beeper	100	90	85	88	105	105	95	100	109
Front end loader transporting material	111	117	120	118	99	97	92	111	124
Excavator scooping into designated storage areas	109	107	107	111	112	109	104	109	118
Angle grinder grinding steel	85	79	80	88	98	105	101	85	108
Door/boot slamming	71	76	76	83	78	76	72	-	84
People talking	68	72	72	75	74	72	73	-	79
Car accelerating	68	72	75	83	91	84	82	-	93

Appendix F

Construction Activities

Appendix F Construction Activities

Area 1:

- Civil works would involve construction of bunding and drainage for bunkers
- Back wall would be removed and part of the eastern wall (approximately 4-5m from the northern corner)
- External bays (concrete and foundations, with steel enforcements) and roofing would be constructed. Roofing would be canvas material (curtain/synthetic) over bunkers which would be mounted on a frame which is water resistant.
- Building cladding would be constructed with roller doors for the drum / oil storage area
- Exterior materials would include a concrete panel at base of building, with Colorbond metal wall cladding above and Colorbond metal roof.

Areas 2, 3 and 4:

- Exterior materials would include a concrete panel at base of building, with Colorbond metal wall cladding above.
- Construction of two pits in Area 4 – will require removal of concrete and excavation of soil, concrete pour to form the pits
- Area 2, construction of catch drain along southern extent of Area 2.
- Installation of plant in Area 2,3, and 4 (Mud plant and stormwater/canal dredgings)
- Height of building would not change.
- Height of the tanks would be 7m (delivered, installed with necessary foundations)

Areas 5, 6 and 7:

- No modifications
- Height of building would not change as a result of the project.

Office A and B:

- No modifications to buildings.

External bunkers (western boundary):

- Would comprise concrete and foundations, with steel enforcements.

Hoppers:

- Approximately 3m x 3m x 6m.
- Would be installed using crane of at least 100 tonnes. Would take approximately half a day.

Laboratory:

- Portable building.

Water Treatment Plant:

- Containerised Reverse Osmosis Plant delivery and installation, installation of tanks (foundations)

Appendix G

Predicted Road Noise Increase

Appendix G Predicted Road Noise Increase

Table 20 Noise Increase on Forrester Rd (South)

Period	Weekdays									Weekends								
	2013 - Construction begins			2014 - Construction ends			2015 – First year of full operation			2013 - Construction begins			2014 - Construction ends			2015 – First year of full operation		
	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase
0000-0100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0100-0200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0200-0300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0300-0400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0400-0500	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0500-0600	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0600-0700	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09
0700-0800	0.02	0.13	0.15	0.02	0.13	0.15	0.01	0.07	0.08	0.08	0.63	0.71	0.08	0.62	0.69	0.07	0.00	0.07
0800-0900	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.39
0900-1000	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33
1000-1100	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.32
1100-1200	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20
1200-1300	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.08	0.02	0.41	0.42	0.02	0.40	0.41	0.00	0.26	0.26
1300-1400	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.29
1400-1500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04
1500-1600	0.01	0.12	0.13	0.01	0.12	0.13	0.01	0.07	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1600-1700	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1700-1800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1800-1900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1900-2000	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000-2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2100-2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2200-2300	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2300-2400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period of Maximum L_{Aeq, 1hr} Noise Increase	0.02	0.13	0.15	0.02	0.13	0.15	0.00	0.12	0.12	0.08	0.63	0.71	0.08	0.62	0.69	0.00	0.39	0.39

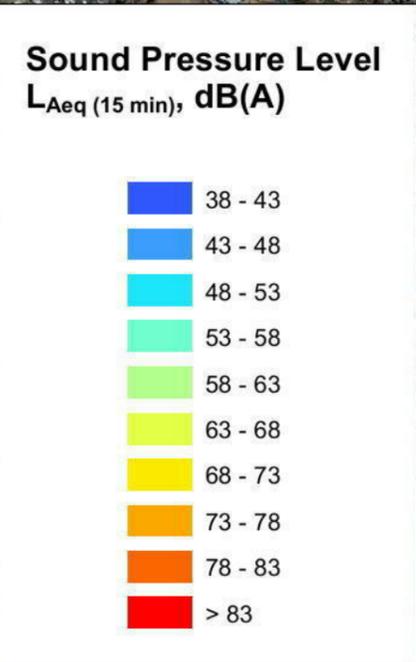
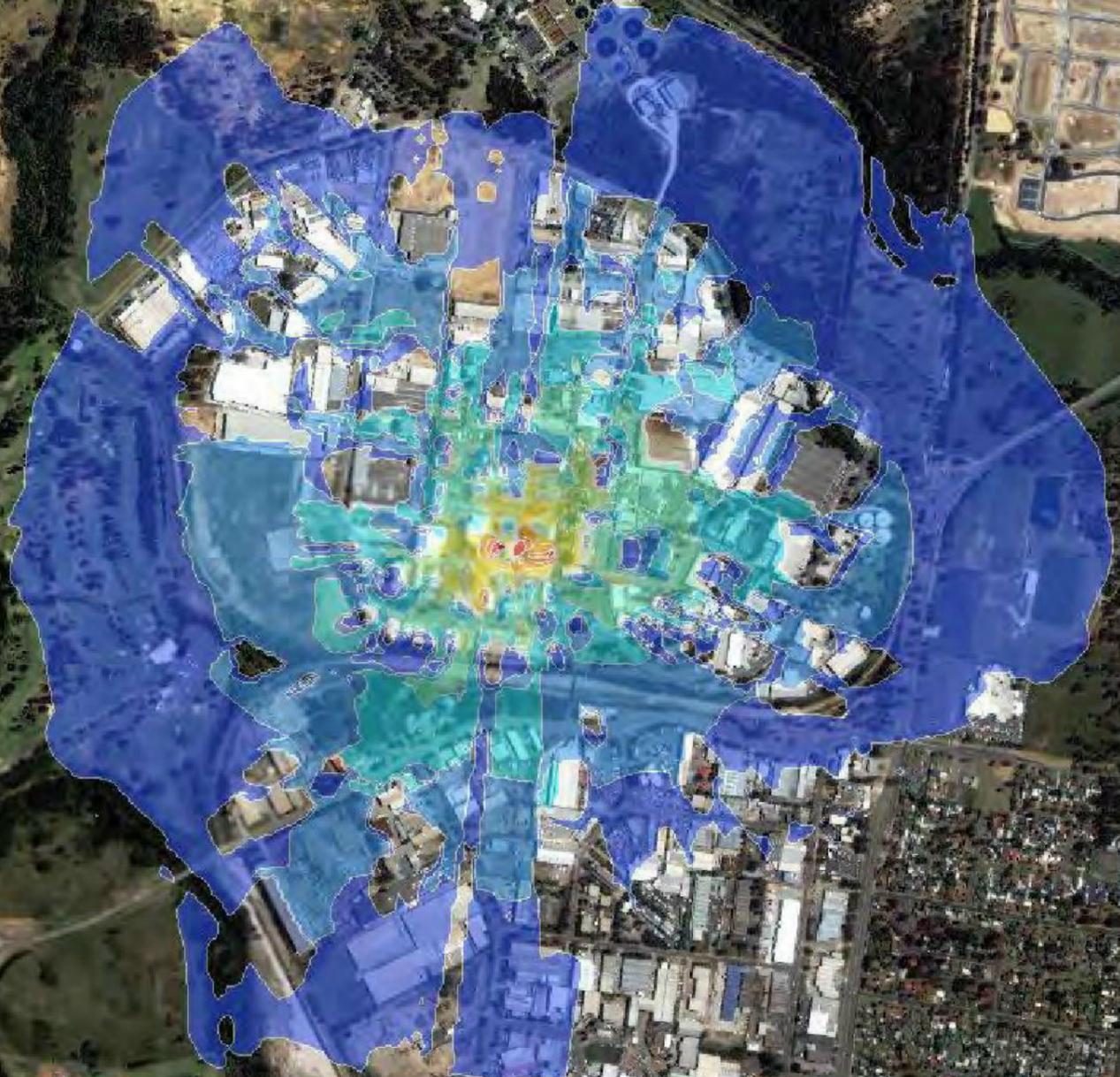
Table 21 Noise increase on Forrester Road (North)

Period	Weekdays									Weekends								
	2013 - Construction begins			2014 - Construction ends			2015 – First year of full operation			2013 - Construction begins			2014 - Construction ends			2015 – First year of full operation		
	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase	Light	Heavy	Total Noise Increase
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0100-0200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0200-0300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0300-0400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0400-0500	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0500-0600	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0600-0700	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.20	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.14
0700-0800	0.03	0.21	0.24	0.03	0.21	0.24	0.02	0.14	0.16	0.14	1.16	1.31	0.14	1.14	1.28	0.14	0.00	0.14
0800-0900	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.79
0900-1000	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.69	0.70
1000-1100	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.75
1100-1200	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.60
1200-1300	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.15	0.05	1.05	1.10	0.05	1.02	1.07	0.00	0.71	0.71
1300-1400	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.76
1400-1500	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.16	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.11
1500-1600	0.03	0.25	0.28	0.02	0.25	0.27	0.02	0.17	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1600-1700	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.22	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1700-1800	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.32	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1800-1900	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1900-2000	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000-2100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2100-2200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2200-2300	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2300-2400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period of Maximum L_{Aeq, 1hr} Noise Increase	0.03	0.25	0.28	0.02	0.25	0.27	0.01	0.32	0.33	0.14	1.16	1.31	0.14	1.14	1.28	0.00	0.79	0.79

Appendix H

Noise Contours

Appendix H Noise Contours



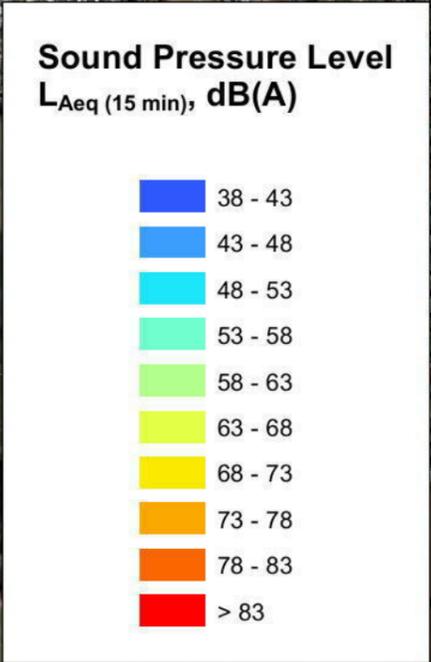
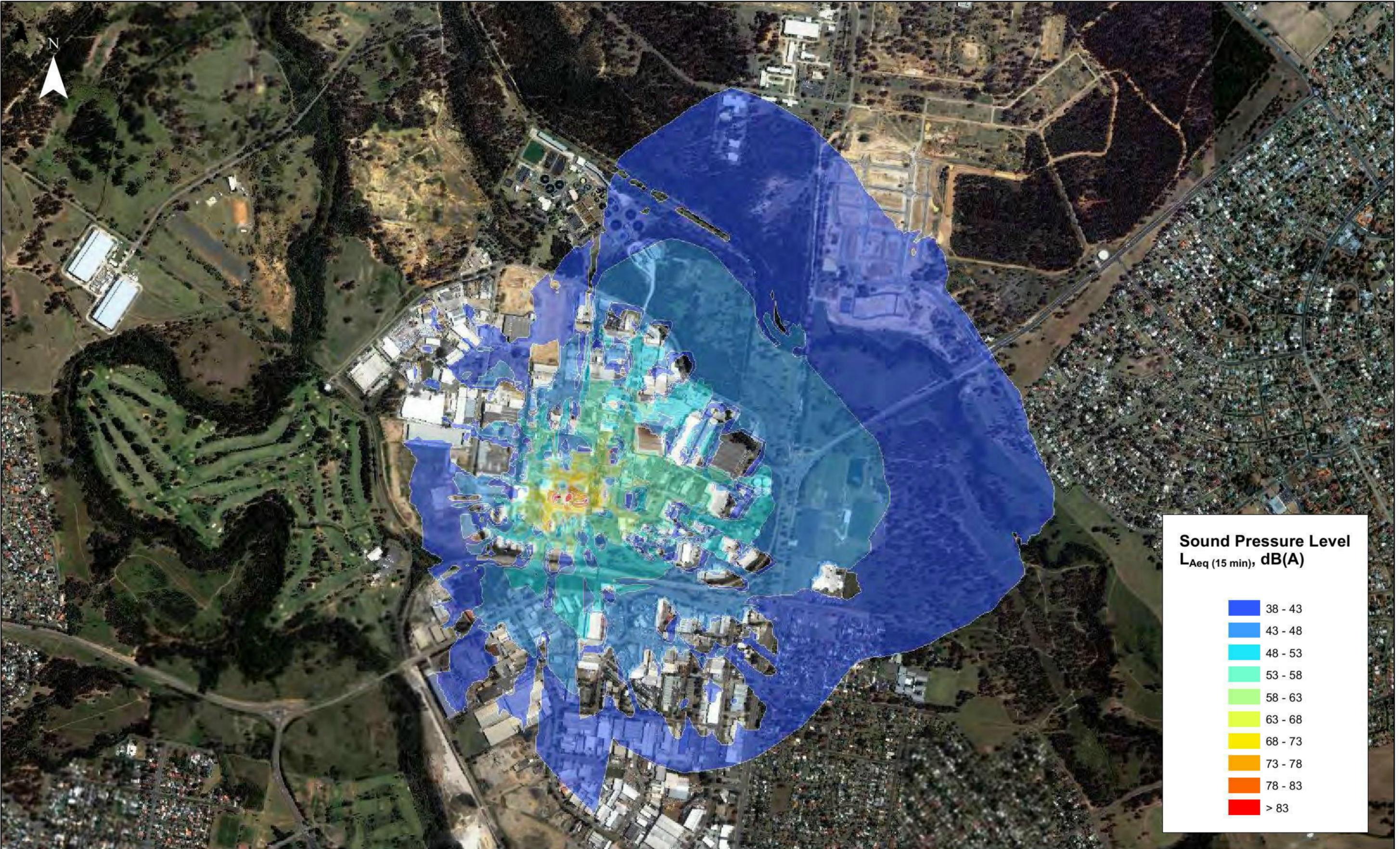
Worth Recycling - St Marys Facility
Neutral Weather Conditions - Base Situation

18 Apr 2013
60283208

Source: ESRI Imagery



Fig **A**



Worth Recycling - St Marys Facility
Adverse Weather Conditions - Base Situation

18 Apr 2013
60283208

Source: ESRI Imagery



Fig **B**



Sound Pressure Level
L_{Aeq} (15 min), dB(A)

- 38 - 43
- 43 - 48
- 48 - 53
- 53 - 58
- 58 - 63
- 63 - 68
- 68 - 73
- 73 - 78
- 78 - 83
- > 83

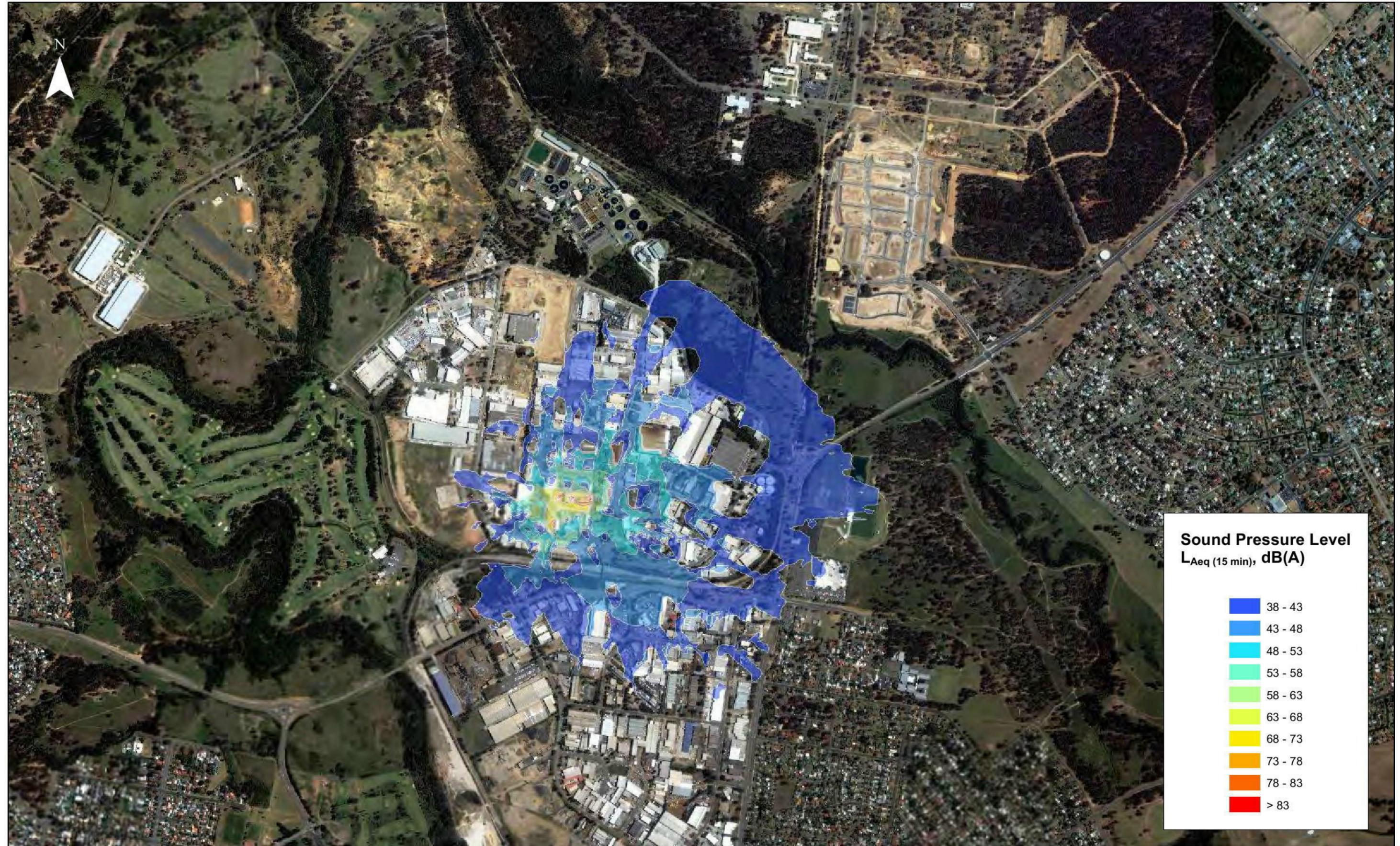
Worth Recycling - St Marys Facility
Neutral Weather Conditions - Night Noise Control

18 Apr 2013
60283208

Source: ESRI Imagery



Fig. **C**



Worth Recycling - St Marys Facility
Adverse Weather Conditions - Night Noise Control

18 Apr 2013
60283208

Source: ESRI Imagery

0 100 200 400
m

Fig **D**