Appendix D – Odour impact assessment

Modification to the Picton Water Recycling Plant

Section 75W modification application

Odour impact assessment

November 2014

This report was prepared for Sydney Water by ENSure

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Appendix A – ETC odour testing report

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Glossary and abbreviations

Term	Definition
DEC	Department of Environment and Conservation
Secretary's environmental assessment requirements	Outlines the requirements for an environmental impact assessment in accordance with the EP&A Act
DoP	Department of Planning
ENSure	ENSure is a GHD and Jacobs Joint Venture
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environmental Protection Authority
IDAL	Intermittently decanted aerated lagoon
OER	Odour emission rate
OU	Odour units - the number of odour units is the concentration of a sample divided by the odour threshold or the number of dilutions required for the sample to reach the threshold. This threshold is the numerical value equivalent to when 50% of a testing panel correctly detect an odour.
katabatic drainage	Means air drainage that typically occurs at night time, where rapidly cooling air near the ground becomes denser, than the overlaying air. Where the local terrain slopes, this increase in density results in the drainage of the underlying cooled air down the slope. As a result, katabatic drainage has a tendency to follow natural drainage lines.
proposal	The construction and operation of the proposed modifications to the Picton WRP.
proposal site	The immediate location of the proposal, which is the area that has the potential to be directly disturbed by construction and operation.
WRP	Water recycling plant.

1. Introduction

1.1 Overview

Sydney Water is proposing to amplify the Picton Water Recycling Plant (the Picton WRP) to respond to existing and future needs.

The construction and operation of the works required to amplify the Picton WRP requires approval from the NSW Minister for Planning under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), in the form of a modification of the existing approval for the Picton Sewerage Scheme.

This report has been prepared by ENSure as part of the environmental assessment of the proposal. The environmental assessment has been prepared to accompany the modification application and has been prepared in accordance with the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the 'Secretary's environmental assessment requirements').

1.2 The proposal

The proposal would involve constructing and operating the following facilities to increase the capacity of the Picton WRP:

- two additional intermittently decanted aerated lagoons (IDALs)
- new inlet works and associated components to distribute flows to the existing and proposed IDALs
- two additional sludge lagoons
- a chemical dosing unit (CDU) for pH correction
- a pipeline (about 275 metres long) to deliver chemicals from the CDU to the western dam
- various ancillary works.

1.3 Scope and limitations

This report provides an assessment the potential odour impacts of the proposal during construction and changes to operation. The assessment has been undertaken in accordance with the requirements of:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005).
- draft NSW Best Practice Odour Guideline Sewerage systems including sewage treatment plants, water recycling facilities, sewage reticulation systems and sewer mining (DoP, 2010).
- The Secretary's environmental assessment requirements, which specify:

  '…include an assessment of the odour impacts associated with construction and changes to operation respectively. The odour analysis shall be undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005) and draft NSW Best Practice Odour Guideline Sewerage systems including sewage treatment plants, water recycling facilities, sewage reticulation systems and sewer mining (DoP 2010).'

To address the above requirements, the assessment involved the following tasks:

- A site visit was undertaken to develop an understanding of the existing WRP processes and potential odour sources, and to review odour complaint history. The site visit was also used to gain an appreciation of the potential receivers and surrounding terrain.
- Odour emission testing was undertaken at Picton WRP of the sludge lagoons, mixing of the sludge lagoons and effluent disposal.
- A meteorological data file was synthesised using weather data recorded from the closest monitoring point (at Tahmoor) to gain an understanding of the local wind climate and use as a model input for conducting atmospheric dispersion modelling.
- An odour emissions inventory was derived using:
  - measurements of significant odour sources onsite
  - source emission rate measurements from the emissions inventories held by Sydney Water and GHD.
- A level two odour modelling assessment was undertaken of the potential operational odour impacts using the NSW Environmental Protection Authority's (EPA) approved regulatory model AUSPLUME to predict the potential for odour impacts at the nearest residences (defined in Section 2.2). A level two assessment is a refined dispersion modelling technique using site specific input data.
- The potential impacts of the proposal were considered against relevant odour criteria.
- A qualitative assessment of the potential odour impacts of construction was undertaken.
- The results of the assessment were summarised in this report.

2. Proposal site and sensitive receivers

2.1 Location

The proposal site for the purposes of the assessment is shown in Figure 1 and is described below. Picton WRP is located approximately 1.5 km south of Picton, and is accessed via Remembrance Driveway. Picton Farm surrounds the WRP, and is located south of Stonequarry Creek and west of the Nepean River.

The concept plan for the proposal is shown at Figure 2.

2.2 Sensitive receivers

Sensitive receivers include locations where people are likely to work or reside - these may include dwellings, schools, hospitals, offices or public recreational areas. Figure 1 shows that the nearest sensitive receivers to the proposal site are houses along Remembrance Driveway to the west.

The following residences surrounding the WRP were identified for the purposes of the odour impact assessment:

- 2260 Remembrance Driveway - located 450 m from the WRP site boundary
- 2290 Remembrance Driveway (Lot 29 DP 734568) - located 320 m from the WRP site boundary
- 2290 Remembrance Driveway (Lot 30 DP 734568) - located 370 m from the WRP site boundary
- 2300 Remembrance Driveway - located 320 m from the WRP site boundary
- 2310 Remembrance Driveway - located 460 m from the WRP site boundary
- 2326 Remembrance Driveway - located 530 m from the WRP site boundary
- 2330 Remembrance Driveway – located 610 m from the WRP site boundary
- 2360 Remembrance Driveway- located 660 m from the WRP site boundary
- 2245 Remembrance Driveway (Lot 2 DP1042285) - located 570 m from the WRP site boundary.

The nearest sensitive receiver to the proposal site is located at 2300 Remembrance Driveway, about 320 m from the WRP site boundary.

2.3 Operation of the existing Picton Sewerage Scheme

The Picton Sewerage Scheme collects wastewater from the villages of Picton, Tahmoor, Thirlmere, Bargo and Buxton and transfers it to the Picton WRP for treatment.

The WRP receives pumped flows from two wastewater pumping stations. The wastewater flows through the inlet works, which consist of a step screen, flow measurement flume, flow distribution channel and odour control system.

Screened wastewater then flows from the flow distribution channel to the two IDALs. Excess sludge is transferred to the sludge lagoons. There are currently two sludge lagoons, each with a volume of 2,600 m^2 and each giving an area of 1,500 m^2.

Decanted effluent from the IDAL tanks flows to the equalisation basin. A portion of the secondary effluent is pumped to the Western Dam via tertiary filters and then to the ultra-violet (UV) disinfection system. The remaining effluent flows to the Eastern Dam.

Most of the treated effluent produced by the WRP is used for irrigation at Picton Farm. Liquid biosolids from the sludge lagoons at the WRP are applied onto the land to increase soil fertility, with application typically occurring two to three times a year. This process takes approximately one week and involves pumping the liquid biosolids directly into trucks. Liquid biosolids is then applied at Picton Farm by direct injection beneath the surface of the grass crop.

2.4 The proposal

A summary of the key features of the proposal that are relevant to the odour assessment is provided below. The proposal layout is shown in Figure 2.

2.4.1 Inlet works (including odour control system)

The new inlet works would comprise fine screening (band screens) and grit removal. The screens and grit removal systems would be installed in channels and include penstocks and stopboards for isolation for maintenance. A bypass channel with a manually-raked bar screen would be provided for emergency overflow during high flow events. Screenings wash presses and a grit classifier would process grit and screenings, disposing these into a common collection bin. All channels, screens and the grit chamber would be covered and connected to a new odour control system.

Screened and degritted raw wastewater would flow from the inlet works to a flow distribution structure, which would distribute flow between the four intermittently decanted aeration lagoons (IDALs) – two existing and two new. The distribution structure would also be covered and connected to the new odour control system.

The new odour control system would be located adjacent to the inlet works. Air extracted from the inlet works process units and the flow distribution structure would be treated through the biotrickling filter. Future allowance would also be made to extract air from the selector zones in the new IDALs using the same filter.

2.4.2 New IDALs 3 and 4

The flow would be evenly split between the four IDALs. The new IDALs 3 and 4 would also contain selector zones and Return Activated Sludge (RAS) pumps to help improve sludge settleability and nitrogen removal performance. The four IDALs would operate using the same cycle arrangement and timing, being aeration, settle and decant phases, which would be staggered to avoid simultaneous decanting and aeration (between a pair of tanks). During the settle phase, mixed liquor would settle to the bottom of the tank, and during decant phase the secondary treated effluent would be decanted from the top of the tank, and diverted to the Equalisation Basin, or directly to the Eastern Dam. Waste Activated Sludge (WAS) pumps for the new IDALs 3 and 4 would deliver waste sludge from the process to the sludge lagoons.

2.4.3 New diffused aeration blowers

The existing IDALs 1 and 2 utilise surface aeration. The new IDALs 3 and 4 would utilise diffused bubble aeration, and air would be delivered by blowers located in a new building adjacent to the new IDALs.

2.4.4 New CDU and pipeline

A CDU would be provided at the WRP to control the pH of the effluent stored in the Western Dam prior to discharge to Stonequarry Creek as precautionary discharges. The CDU would be

housed in a building designed to accommodate a chemical storage tank and its bund, dosing equipment, and electrical and telemetry controls. The CDU would be located adjacent to the existing alum storage area within the WRP site. Either hydrochloric or citric acid would be used.

The chemical injection point would be located at the precautionary discharge pumps, adjacent to the Western Dam.

A chemical dosing pipeline (about 275 metres long) would be constructed between the CDU and the injection point. The pipeline would be a pipe-in-pipe sleeved arrangement with leak detection system.

A new chemical delivery bay would be provided at the WRP.

Bunds would be provided at not less than 110% of the chemical storage tank sizes in accordance with relevant Australian Standards.

2.4.5 Alum system modifications and renewal

Phosphorus removal at the WRP is currently achieved by alum dosing, via two dosing points. These dosing point locations would be modified to suit the installation of the new IDALs. One dosing point would be upstream of the IDALs in the channel prior to the flow distribution structure, and the other would be in the effluent pit (EP2) upstream of the Equalisation Basin.

2.4.6 New sludge lagoons.

Sludge (mixed liquor / WAS) from the IDALs would be diverted to four sludge lagoons for stabilisation and storage. Two new lagoons are provided as part of this proposal. A new supernatant pipework interconnection between all four lagoons would also allow series operation. New pipework would also drain the supernatant back to the new inlet works.

Biosolids (stabilised sludge) would be carted from site by a vacuum truck, and then applied to the Picton Farm as a liquid as per the current operation practice. A dewatering hardstand area is therefore not required.

280,000

281,000

6,214,000

6,213,000

6,212,000

PICTON ROAD

STAFF ROAD

REMEMBRANCE DRIVEWAY

REMEMBRANCE DRIVEWAY

NEPEAN RIVER

LEGEND

- Odour Sensitive Receiver
- Picton Farm Boundary
- Proposal site

Paper Size A3

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

ENSure

Sydney Water
Picton wastewater flows

Job Number 21-2284914
Revision A
Date 17 Nov 2014

Site location

Figure 1

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z026_Picton_Farm_Nosie_WRF_Odour_assessment_Location_map.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung

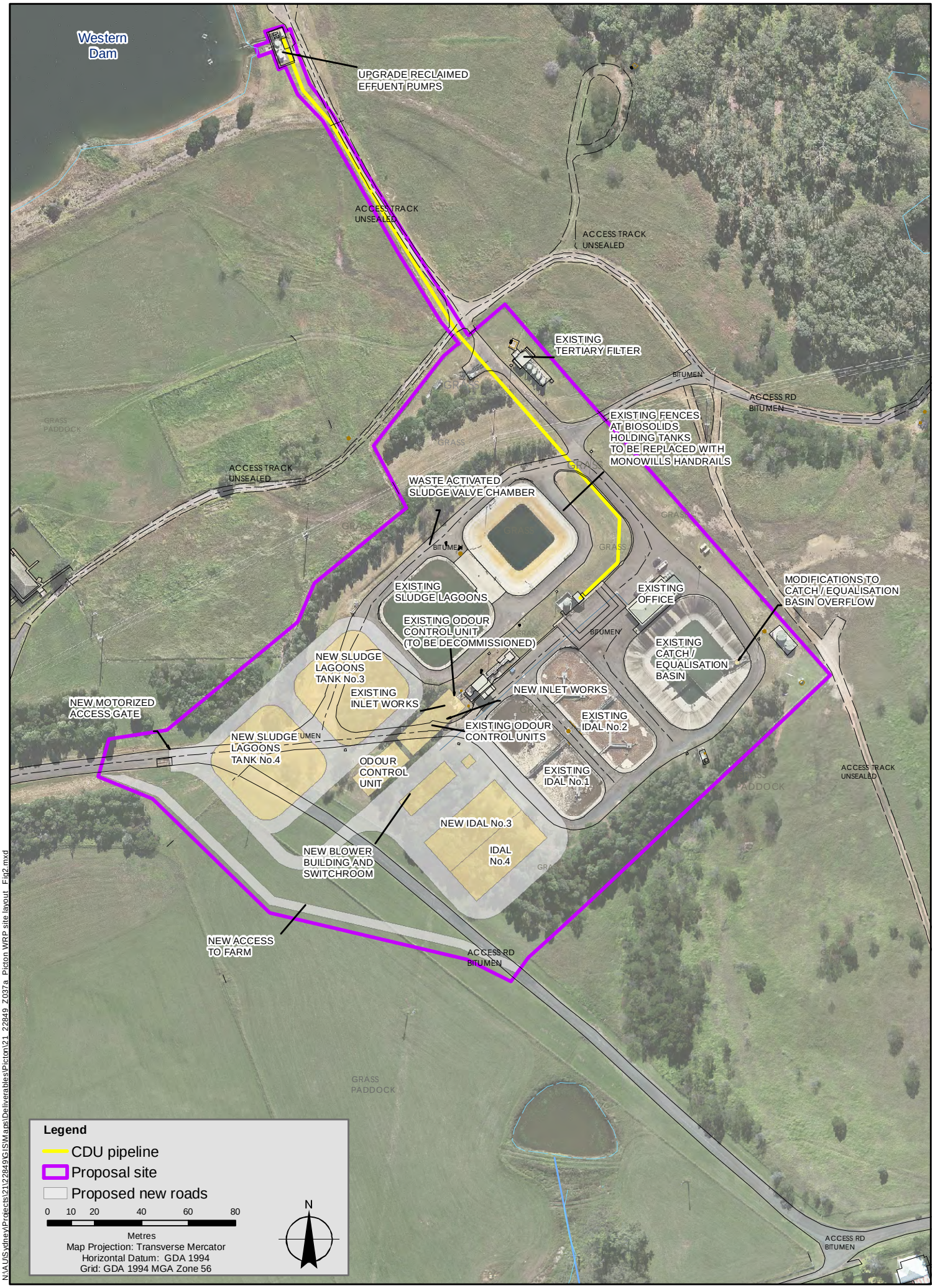


Figure 2
Picton WRP site layout

2.5 Odour Assessment in NSW

2.5.1 Legislation

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes, amongst other things, the procedures for issuing licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an environmental protection licence (EPL) and comply with the conditions of that licence. Sydney Water holds an EPL for the Picton Sewage Treatment System, which includes the operation of the Picton WRP (EPL No. 10555). In relation to odour, the EPL requires that (condition O1.3) 'The licensee must not cause or permit the emission of any offensive odour from the premises. This condition does not apply if the only person(s) affected by the odour were person(s) engaged in the management or operation of the premises.'

The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act).

The POEO Act includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

2.5.2 Guidelines

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (DEC, 2005) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

The draft *NSW Best Practice Odour Guideline Sewerage systems including sewage treatment plants, water recycling facilities, sewage reticulation systems and sewer mining* (the 'draft Best Practice Guidelines') (DoP 2010) provides recommended odour design criteria for new, existing and expanding sewage treatment plants.

2.5.3 Odour assessment criteria

Approved Methods

The Approved Methods defines odour assessment criteria and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are the:

- **F**requency of the exposure
- **I**ntensity of the odour
- **D**uration of the odour episodes
- **O**ffensiveness of the odour
- **L**ocation of the source.

These factors are often referred to as the FIDOL factors.

The odour assessment criteria is defined to take account of two of these factors (**F** is set at 99th percentile; **I** is set at from 2 to 7 OU). The choice of assessment criteria has also been made to be dependent on the population of the affected area, and to some extent it could be said that

population is a surrogate for location – so that the **L** factor has also been considered. The relationship between the criteria odour level **C** to affected population **P** is given below:

$$C = [\log P\text{-}4.5] \div \text{-}0.6 \qquad \text{equation 1}$$

Table 1 lists the values of C for various values of affected populations as obtained using equation 1.

Table 1 Odour criteria for the assessment of odour (DEC, 2005)

Population of affected community	Odour performance criteria (nose response odour certainty units at 99th percentile[1])
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2

Note 1: This is a prediction of the odour level that may occur 1% of the time, or one hour in one hundred. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised.

The criteria assumes that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be encountered. The criteria of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally 1 second. The choice of the short averaging time recognises that the human nose has a response time of less than 1 second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the Ausplume dispersion model (used in this assessment) cannot predict concentrations for a 1 second average, a ratio between the 1 second peak concentration and 60 minute average concentration has been applied. This is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (that is, near or far-field), and values are tabulated in the Approved Methods.

Draft Best Practice Guidelines

For expanding sewage treatment plants, the draft Best Practice Guidelines recommends adoption of the same specific odour criteria for a new plant. For a new plant 'the odour design criteria to be adopted … is the achievement of a 2 OU odour assessment criteria at the boundary of the Industrial Zone or the Rural or SP2 lot(s)...'

2.6 Proposal specific odour assessment criteria

The proposal site is located on and is surrounded by rural zoned land. Residential areas associated with the townships of Picton and Tahmoor are located approximately 1 km away.

As noted in Section 2.2, scattered rural residential dwellings are located in the vicinity of the proposal site on Remembrance Driveway. Given the low density of surrounding receivers, compliance with the 5 OU assessment criteria was adopted and assessed in accordance with the Approved Methods.

As the proposal is located in a rural zone, achievement of the 2 OU assessment criteria at the boundary of the rural lot (that is, the boundary of Picton Farm) was also considered, as recommended by the draft Best Practice Guidelines. It is noted that this is a very stringent requirement. The Approved Methods recommend that this assessment criteria only be adopted for urban areas with a population equal or greater than 2000 people.

3. Existing environment

3.1 Existing air quality (odour)

The WRP is the main source of odour in the local area. Sydney Water prepared an Odour Emission Study of the Picton WRP in 2001. The study concluded that during normal operations the WRP would not cause odour annoyance in the local area. The odour dispersion modelling undertaken for this assessment found that the 2 OU odour contour was fully contained within the site boundary. As a result, it was not expected that existing odour emissions would impact on nearby sensitive receivers.

A summary of the odour complaints over the past four years (provided by Sydney Water) is presented in Table 2. No further information was provided about the complaints but the attributed cause of the odour complaints suggest that better sludge management may reduce odour impacts from the site.

Table 2 Odour complaint history

Year	Number of complaints	Attributed cause
2010-2011	1	Ageing of the sludge lagoon
2011-2012	2	Ageing of the sludge lagoon IDAL removed from service for maintenance
2012-2013	0	N/A
2013-2014	1	Poor performance of the odour control unit

3.2 Meteorology

Hourly meteorological data was obtained from an Automatic Weather Station (AWS) located at the Tahmoor Colliery, less than 6 km from the Picton WRP. The AWS was located at 34^{o} 15' 06" S, 150^{o} 34' 37" E. This data ranged from June 2006 to July 2007. Both Tahmoor Colliery and the proposal site would expect similar drainage due to their close proximity, the hills to west and the Nepean River running to the northeast.

Atmospheric stability categories were derived using the Solar Radiation Delta-T (SRDT), as detailed in the US EPA *Meteorological Monitoring Guidance for Regulatory Modeling Applications*. The SRDT method uses surface layer wind speeds in combination with measurements of total solar radiation during the day and low-level vertical temperature differences during the night.

A default mixing height of 5,000 m was adopted for all hours, as this parameter will not affect the dispersion of emissions from sources close to the ground. The minimum wind speed was also set to 0.5 m/s for use in dispersion modelling to remove calm winds as per US EPA recommendations.

Figures indicating the distribution of recorded wind speed and wind direction, and distribution of derived atmospheric stability categories follow, and each are addressed individually.

With reference to the distribution of wind speed classes (refer Figure 3), the most common frequencies fall between 0.5 and 3.0 m/s. Quite low wind speeds are observed, with very few wind speeds being above 5 m/s and an overall average wind speed of 2 m/s.

Figure 4 contains a wind rose that illustrates the distributions of wind speeds and wind direction at the location of the Tahmoor Colliery. On an annual basis the prevailing winds are from the southwest with winds also from the north, northeast and southeast. Higher speed winds are

associated with westerly and southerly directions with speeds up to eight m/s; such speeds are not reached from other directions. The highest frequencies of light winds also occur from the southwest, with very little occurrence in other directions.

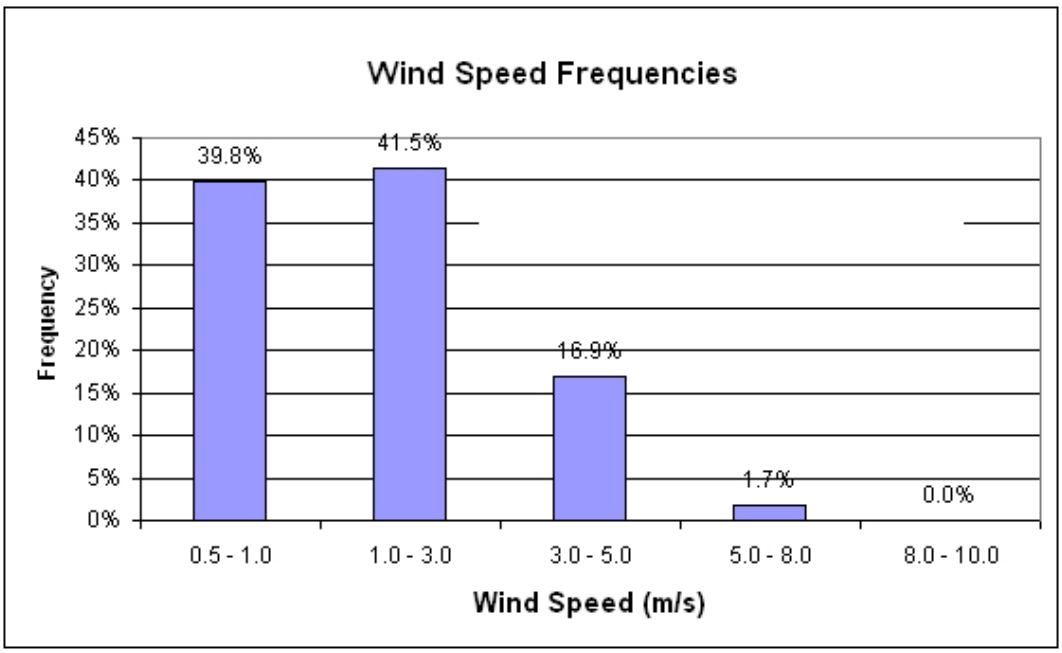


Figure 3 Wind speed frequencies for synthesised met file

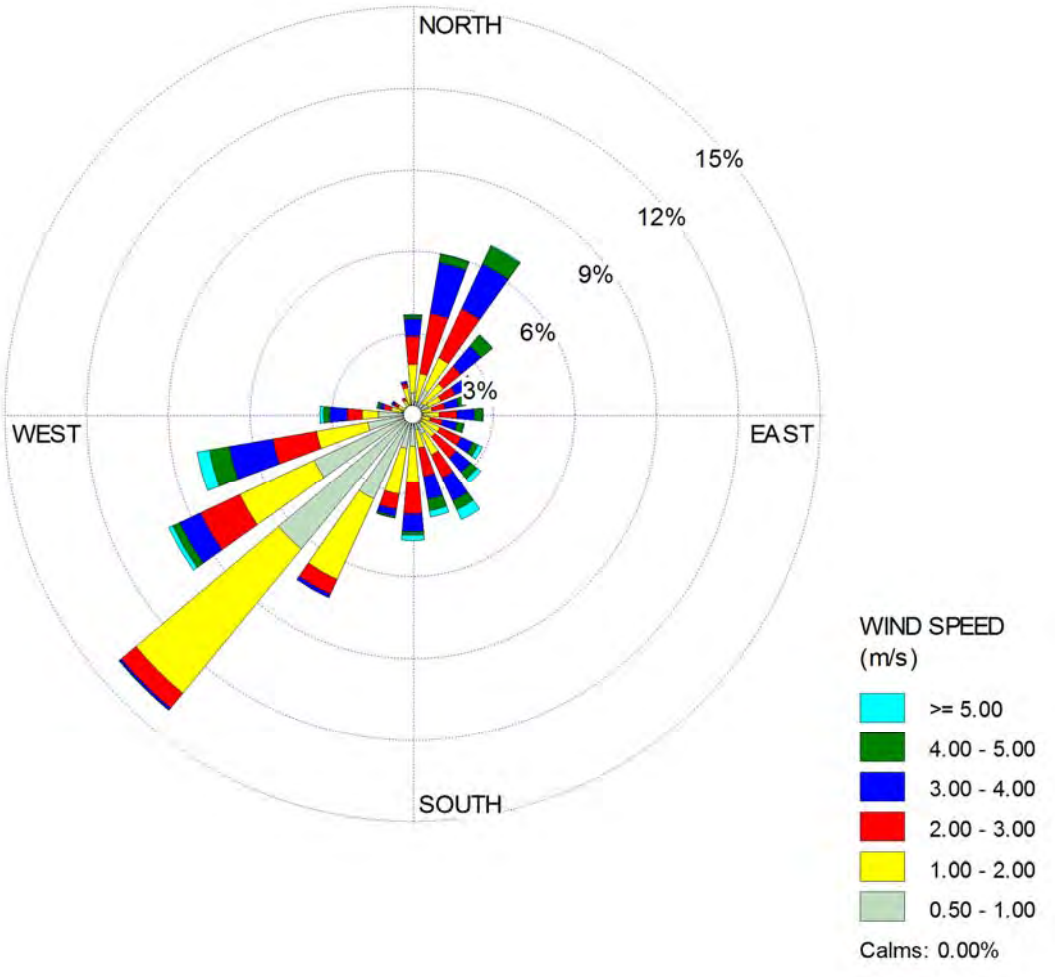


Figure 4 Synthesised annual wind rose 2006/2007 – Tahmoor Colliery

A categorised measure of atmospheric stability is also output from the model. These can be broadly defined as per Table 3.

Table 3 Atmospheric stability classes

Stability class	Description
A	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.
B	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.
C	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.
D	Neutral atmospheric conditions occurring during the day or night with stronger winds, or during periods of total cloud cover, or twilight.
E	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds.
F	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.

Figure 5 shows the stability category distribution from the synthesised meteorological data. High proportions of neutral and moderately stable (D and F) categories are noted.

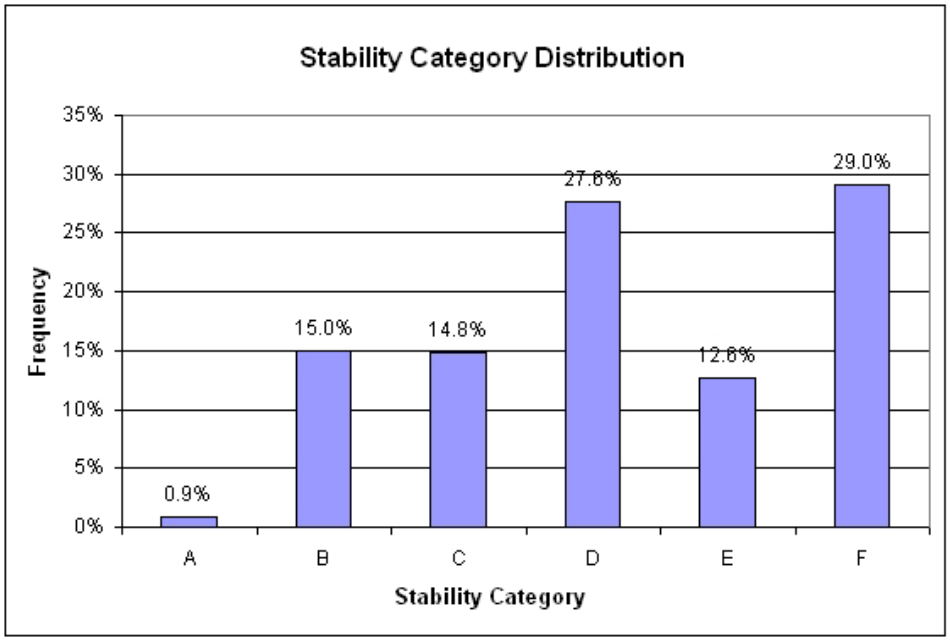


Figure 5 Stability category distribution for synthesised Met file

Figure 6 contains a stability rose that illustrates the directional distribution of the predicted atmospheric stability. This figure indicates that stable flows are predominantly coming from the southwest, which is consistent with expected drainage flows from the hills in this direction.

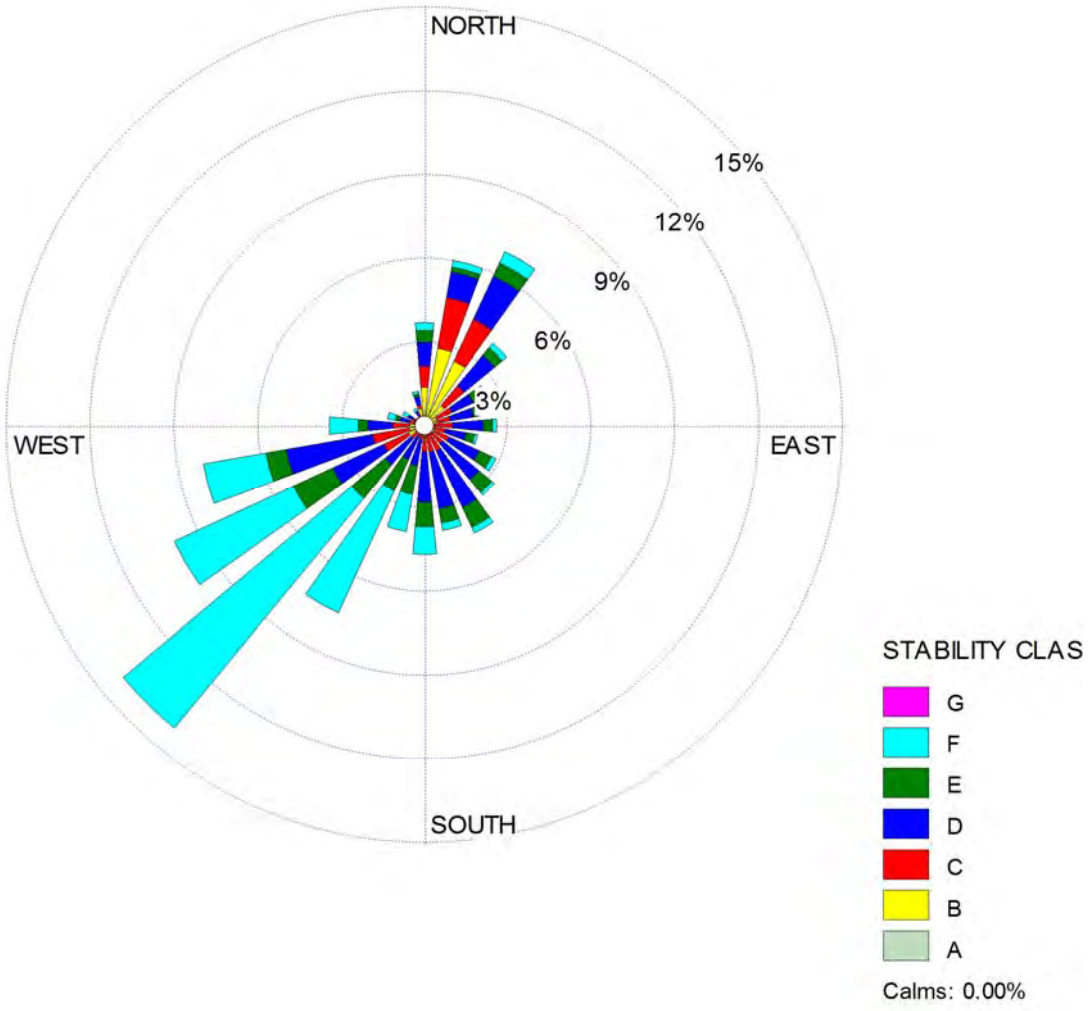


Figure 6 Synthesised Annual Stability Rose 2006/2007 – Tahmoor Colliery

4. Odour emissions

4.1 Overview

Odour sampling was undertaken by Emissions Testing Consultants (ETC) on 13 May 2014 and analysed by The Odour Unit as part of this assessment. The odour testing report is provided in Appendix A. Odour sampling was conducted on the existing sludge lagoons, including during de-sludging and mixing. Odour samples were also undertaken at Picton Farm during application of biosolids via direct injection.

Additionally, Sydney Water has undertaken odour monitoring at the site in 2005 and 2006, although monitoring was not conducted for all sources. As a result, odour emission rate data for some processes was sourced from the Sydney Water Odour Emission Database 2010. This data is assumed to be representative of WRP operations under normal conditions.

The report *Picton WRP Upgrade and Amplification – Stage 2 Concept Design Report* (ENSure, October 2014) indicates that the potential significant sources of odour associated with the amplified WRP would be the:

- inlet works
- IDAL reactors (and selector zones)
- sludge lagoons
- de-sludging activities (a temporary and occasional activity).

Other sources of odour have been assumed not to contribute significantly to the overall site odour emissions. Biosolids from the sludge lagoons is pumped directly into a truck and there are no sludge/biosolids stockpiles onsite. This liquid biosolids is then applied to Picton Farm by direct injection beneath the surface of the grass crop. Observations and odour sampling undertaken at Picton Farm during direct injections showed that odour emissions are not significant and comparable to ambient odour from a grassed area.

The assessment has not considered the potential impacts of equipment failures (such as biofilter failing to operate correctly), which may have the potential to temporarily increase odour impacts.

4.2 Odour emission source characteristics

Where an odour release is from an extended liquid surface (such as the IDALs/sludge lagoons) the source is modelled as an area source, and the odour emission rate (OER) is specified as the specific odour emission rate (SOER, or OER/m^2) multiplied by the source area.

The proposed inlet works would be enclosed and odours would be collected and treated in an odour control system (biofilter) prior to being released into the environment via a stack. The specification of the biofilter is not yet known and therefore a conservative odour emission rate of 500 OU per second has been assumed as per the recent assessment for the proposed Bargo Water Recycling Plant (ENSure, 2013). The odour emission rates and stack properties for the Picton WRP are assumed to be similar. A stack with a height of 5 m, tip diameter of 0.15 m and velocity of 8.8 m/s has been used in this assessment.

Sludge lagoons would have different SOERs based on the timing sequence and how they are managed. The two available SOER measurements from Picton are assumed to represent an average fluctuation across all four lagoons. Two lagoons have been modelled using the highest measured value and two lagoons with the lowest.

As incoming wastewater flows increase to the WRP, it is likely that de-sludging would occur once every six months for each lagoon, or once every two to four months in total. Only one lagoon would be de-sludged at any one time, and this would take up to one week. Biosolids would be pumped directly into a truck during the daytime period, meaning that there would not be any sludge/biosolids stockpiles onsite.

The de-sludging data has been calculated using odour measurements down-wind and up-wind of the sludge lagoon during mixing. This was observed to be the significant source of odour during the de-sludging activity. Mixing involves pumping sludge through a hose in one corner of the tank in order to circulate the sludge. Odour from this was found to be localised to the corner where this was occurring, with a definite odour plume distinguishable just downwind.

The predicted emissions from all significant odour sources in the existing Picton WRP are summarised in Table 4. The existing inlet works and odour control system have been identified to be ineffective in controlling concentrations of odour. No odour sampling has been undertaken of the inlet works therefore the assumed odour emission rate of 500 OU may be low and the existing odour impacts may be underestimated.

The emissions from all significant odour sources at the amplified WRP are summarised in Table 5. It can be seen that, during normal operations (that is, without de-sludging), there is an expected increase in the total plant OER from 1659 OU m^3/s to 2,731 OU m^3/s, which represents an increase of approximately 65%.

De-sludging activities at the modified WRP would result in an approximate 85% increase in the OER (refer Table 5) compared to normal operations.

Peak odour concentration factors have been applied to the OERs below as described in the Approved Methods prior to Ausplume modelling.

Table 4 Odour Emission Rate data used for the existing WRP

Facility	Data source	Height (m)	Area (m^2)	SOER OU ($m^3/s/m^2$)	OER (OU m^3/s)	% Plant OER
Inlet stack biofilter	Bargo WRP	5	-	-	77.8	4.7
IDAL tank 1 (aerating)	Picton WRP	Ground level	1350	0.72	972	70
IDAL tank 2 (settling)	Picton WRP	Ground level	1350	0.14	189	
Sludge lagoon 1	Picton WRP[1]	Ground level	1500	0.1	150	25.3
Sludge lagoon 2	Picton WRP[1]	Ground level	1500	0.18	270	
All	-	-	-	-	1659	100

Note 1: data obtained by ETC on 13 May 2014

Table 5 Odour emission rate data used for the proposal

Facility	Data source	Height (m)	Area (m^2)	SOER OU ($m^3/s/m^2$)	OER OU (m^3/s)	% Plant OER (with de-sludging)
Inlet stack biofilter	Bargo WRP	5 m	-	-	77.8	1.5
IDAL tank 1 (aerating)	Picton WRP	Ground level	1350	0.72	972	35.6
IDAL tank 2 (decanting)	Picton WRP	Ground level	1350	0.2	270	
IDAL tank 3	Picton	Ground	600	0.72	432	

Facility	Data source	Height (m)	Area (m^2)	SOER OU ($m^3/s/m^2$)	OER OU (m^3/s)	% Plant OER (with de-sludging)
(aerating)	WRP	level				
IDAL tank 4 (decanting)	Picton WRP	Ground level	600	0.2	12	
Selector zone 1	Quakers Hill STP	Ground level	20	0.48	9.6	0.4
Selector zone 2	Quakers Hill STP	Ground level	20	0.48	9.6	
Sludge lagoon 1	Picton WRP[1]	Ground level	1500	0.1	150	16.7
Sludge lagoon 2	Picton WRP[1]	Ground level	1500	0.18	270	
Sludge lagoon 3	Picton WRP[1]	Ground level	1500	0.1	150	
Sludge lagoon 4	Picton WRP[1]	Ground level	1500	0.18	270	
De-sludging (day time only)	Picton WRP[1]	Ground level	50.3	46	2312.2	45.8
All (without de-sludging)	-	-	-	-	2731	54.2
All (with de-sludging)	-	-	-	-	5043.2	100

Note 1: data obtained by ETC on 13 May 2014

5. Odour impact assessment

5.1 Construction odour

Construction odour was not modelled in this assessment as the existing WRP would remain operational during construction and there would be no additional sources of odour. There may however be various activities that could result in isolated odour events including the following:

- decommissioning the existing inlet works
- cleaning of any existing infrastructure such as IDAL tanks and sludge lagoons
- issues from commissioning new infrastructure including inlet works, IDAL tanks and sludge lagoons.

The potential for significant odour impacts during construction are not considered to be high and mitigation measures are outlined in Section 6.1.

5.2 Operational odour

Dispersion modelling was undertaken to predict the maximum ground level odour concentrations resulting from odour emissions as a result of normal operations of the existing and amplified WRP. The objective of the modelling was to generate predicted peak 99th percentile one second averaged ground level odour contours and compare these to the two and 5 OU contours to assess the potential impacts of the project.

5.2.1 The model

Dispersion modelling was undertaken using Ausplume version 6.0. Ausplume is a Gaussian plume dispersion model developed by the Victorian EPA to assess the impact of airborne pollutants. Ausplume predicts downwind concentrations for the model inputs representative of pollutant emissions at a given physical site under a range of hourly varying meteorological conditions over a period of a year or more. Features of the model include: building downwash (the effect of buildings in causing a plume to be dragged down to ground level where it can impact an area); area, line and volume sources; plume rise as a function of downwind distance; and terrain adjustment.

5.2.2 Model configuration

Ausplume was configured to model the proposal using the measured OERs and relevant physical building characteristics.

Key components of the model configuration are summarised below:

- 12 month meteorological dataset
- a 5 km x 5 km square receptor grid, centred over the Picton WRP, using a grid resolution of 50 m
- an averaging period of one hour
- given that the region is relatively flat and the model domain of interest is confined to the near-field (e.g. site boundary and nearest receptors), the effects of terrain on dispersion were considered negligible and were not included in this assessment
- horizontal dispersion was parameterised according to equations for the Pasquill-Gifford curves
- a surface roughness height of 0.4 m was used, rolling rural

- emission rates from area sources were modelled (assumed to be 24 hours/day, 365 days/year for all sources).

Further details about the model configuration are given in the Ausplume input text file shown in Appendix B.

5.3 Predicted peak odour impact of existing Picton WRP

Figure 7 shows the predicted odour impact from the existing Picton WRP operating in normal conditions, expressed as a peak concentration (that is, approximately one second average) 99th percentile using measured OERs as given in Section 4. Both the 5 OU (DEC, 2005) and the 2 OU (DoP, 2010) criteria have been plotted. A detailed example text output from the model run is supplied in Appendix B.

The results indicate that the 2 and 5 OU contour extends predominantly to the northeast of the site, consistent with the calm stable winds from the southwest (refer to Section 3.2). The contours are totally contained within the site and the irrigation area to the east.

5.4 Predicted peak odour impact of the proposal

Output from the Ausplume model is presented in Figure 8 and Figure 9 as contours of predicted odour levels at the 99th percentile odour levels for all sources during normal operations, and for normal operations with de-sludging. An explanation of the results is provided in the following sections.

5.4.1 Normal operations

Figure 8 shows the predicted odour impact from normal operation of the amplified Picton WRP and does not include the sludge lagoon de-sludging odour source. The impact is expressed as a peak concentration (that is, approximately one second average) 99th percentile using measured OERs as given in Section 4. Both the 5 OU and the 2 OU contours have been plotted.

The 2 and 5 OU contours are completely contained within Picton Farm. The 2 OU contour extends predominantly to the northeast of the site, consistent with the calm stable winds from the southwest as seen in Section 3.2. No sensitive receivers are located within the 2 and 5 OU contours and therefore odour impacts during normal operation are unlikely.

The predicted odour level at all residential dwellings is below 2 OU. Under normal operating conditions this is not expected to be noticeable at the nearest receivers.

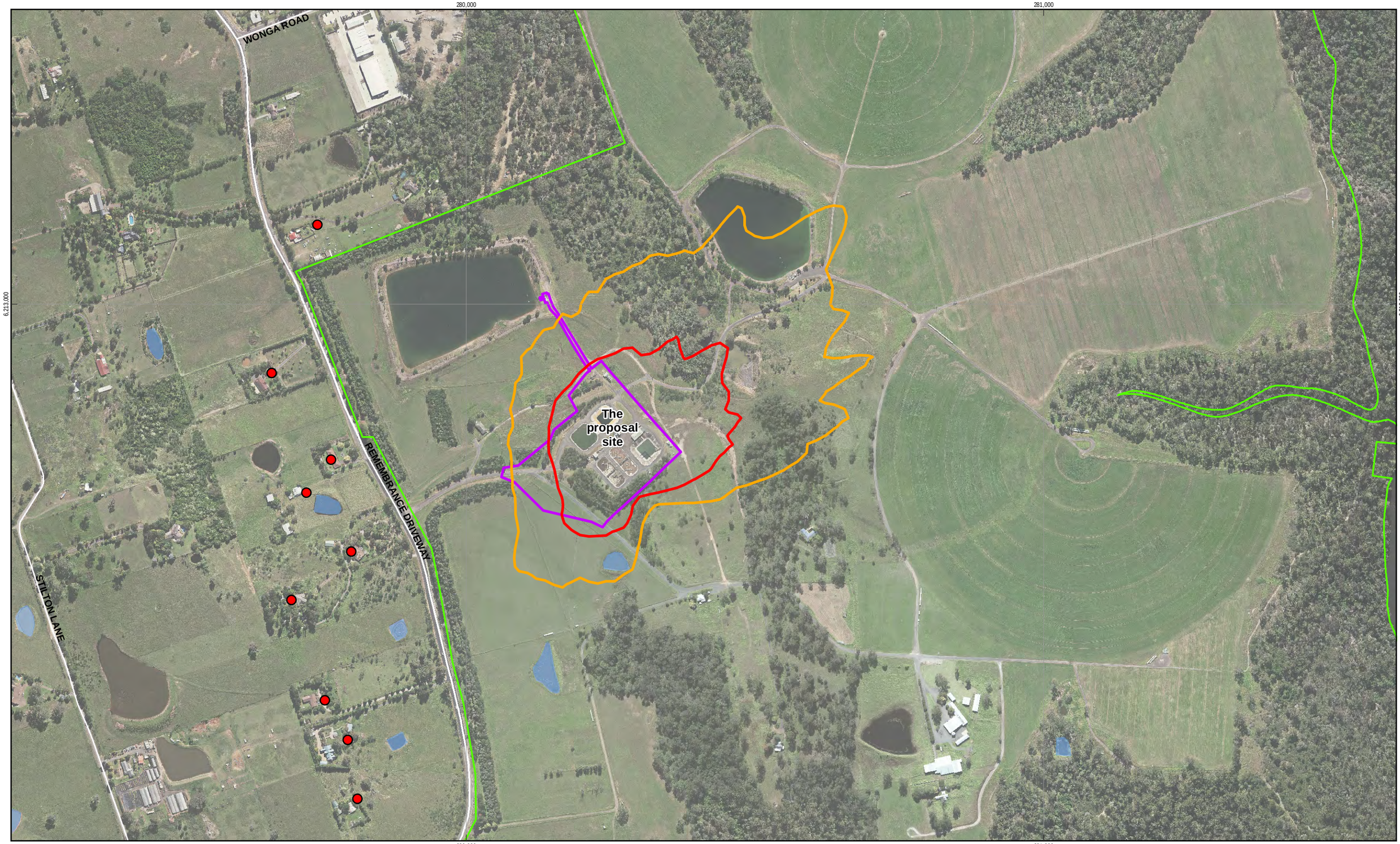
5.4.2 Operations with de-sludging

It is assumed that de-sludging would need to take place every two to four months, depending on wastewater flows to the WRP. It is assumed that, to minimise the potential for odour impacts, de-sludging would commence at 8 am and continue for up to approximately 10 hours per day. A modelling scenario was undertaken of the amplified WRP (as modified by the proposal) with de-sludging occurring. Figure 9 shows the predicted odour impacts, expressed as a peak concentration (that is, approximately one second average) 99th percentile using measured OERs as given in Table 5. The 5 OU and the 2 OU criteria have been plotted.

The results indicate that the 5 OU contour is completely contained within the site. The 2 OU contour is contained within the site boundary and road reserve. No sensitive receivers are located within the 2 or 5 OU contours and therefore odour impacts during de-sludging activities are unlikely.

It is noted that de-sludging is an occasional and temporary activity, with a typical duration of seven days. It may not occur during the worst case meteorological conditions that assist dispersion.

The modelling shows that the peak value for the 100 worst cases all occurred during the night time ‘sleep period’ when no impact would be registered by those sleeping. Therefore it is expected that the daytime odour impact of the proposal would be minimal.



Paper Size A3

0 50 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Odour sensitive receivers
- Proposal site
- Picton Farm Boundary

Predicted peak odour levels

- 2OU
- 5OU

Sydney Water
Picton wastewater flows

Predicted peak odour levels (99th percentile) – existing operations

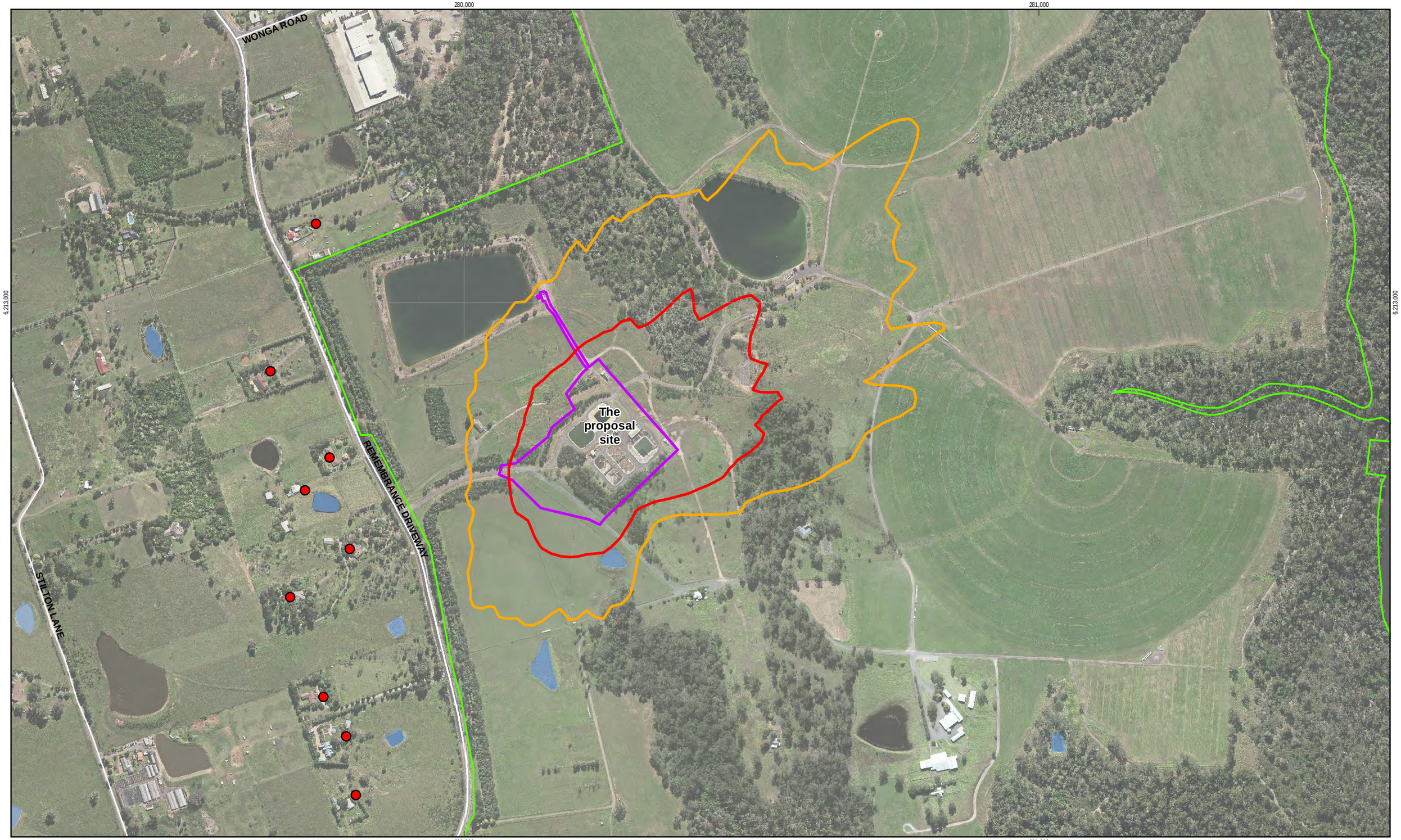
Job Number	21-2284914
Revision	B
Date	14 Nov 2014

Figure 7

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z034_Predicted_peak_odour_levels_Existing.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung



Paper Size A3

0 50 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Odour sensitive receivers
- Proposal site
- Picton Farm Boundary

Predicted peak odour levels

- 2OU
- 5OU

Sydney Water
Picton wastewater flows

Predicted peak odour levels
(99th percentile) – amplified Picton WRP
normal operations

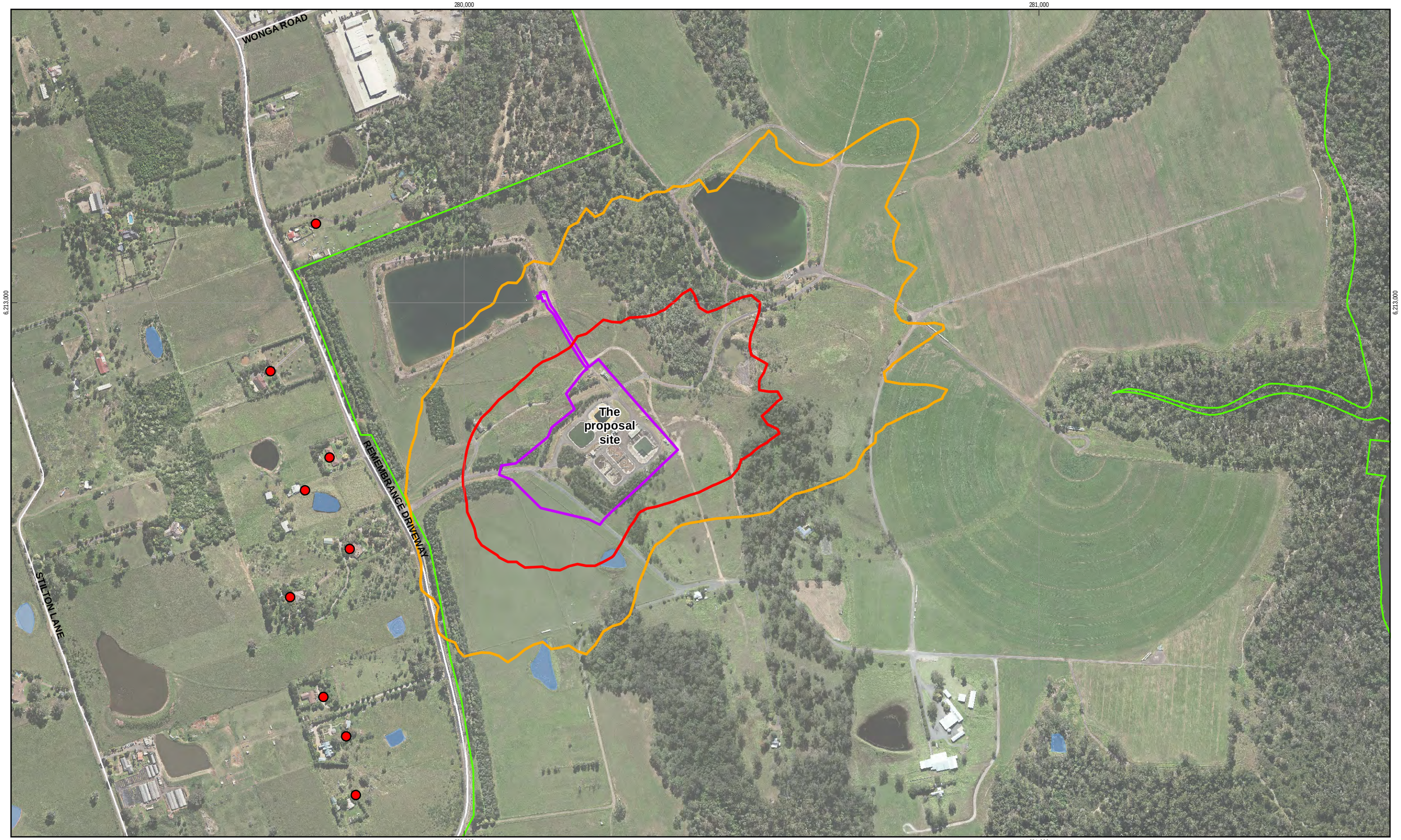
Job Number	21-2284914
Revision	B
Date	14 Nov 2014

Figure 8

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z035_Predicted_peak_odour_levels_Normal.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung



Paper Size A3

0 50 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Odour sensitive receivers
- Proposal site
- Picton Farm Boundary

Predicted peak odour levels

- 2OU
- 5OU

Sydney Water
Picton wastewater flows

Predicted peak odour levels
(99th percentile) – amplified Picton WRP with de-sludging

Job Number	21-2284914
Revision	B
Date	14 Nov 2014

Figure 9

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z046_Predicted_peak_odour_levels_99pc_DeSludging_Miligation_Fig11.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung

6. Mitigation

6.1 Construction odour

The following measures would be implemented during construction and commissioning:

- Odour management procedures would be included in the CEMP to specify the measures that would be implemented during construction to minimise the potential for isolated odour events during decommissioning, cleaning and commissioning.
- Any odour complaints would be managed in accordance with Sydney Water's Customer Complaint Procedure.

6.2 Operational odour

The results show that the proposed limitations to the hours when de-sludging can be undertaken would be an effective tool to minimise the potential for off-site odour impacts. Mixing of the sludge lagoon was shown to be the most significant odour emission onsite. Worst case meteorological conditions for odour dispersion generally occur in the night time and early morning period. Limiting the mixing to occur outside of this time can reduce the potential for odour impact. The potential for impacts could be further reduced if mixing of the sludge lagoon did not occur when winds blow in the direction of worst impact odour dispersion, that is, from the northeast.

The following measures would be implemented during operation:

- Any odour complaints would be managed in accordance with Sydney Water's Customer Complaint Procedure and the *Pollution Incident Response Management Plan for Picton Water Recycling Plant* (May 2014).
- Wherever practicable, de-sludging would be limited to the day time after 8 am, and would be avoided during worst case meteorological conditions (winds from the northeast), and conducted in the shortest timeframe possible.
- During commissioning, odour monitoring would be undertaken to monitor compliance with the odour assessment criteria.

Other options to further minimise the potential for operational odours include ensuring the clean state of inlet channels, and avoiding any stockpiling of sludge or other residuals at the site (from screening or from de-sludging operations).

7. Conclusion

Operational odour assessment criteria were established for the proposal in accordance with relevant guidelines. In accordance with the Approved Methods, an odour assessment criteria of 5 OU was adopted for the proposal. As the proposal site and surrounds are located in a rural zone, achievement of the 2 OU odour assessment criteria at the Picton Farm boundary was also considered, as recommended by the draft Best Practice Guidelines.

It is unlikely that construction of the proposal would result in the potential for off-site odour impacts.

The proposal would incorporate measures to manage the potential for odour impacts, including a new odour control system and limiting the time period for de-sludging.

The potential operational impacts of the proposal were modelled. The results indicate that no sensitive receivers are located within the 5 OU and 2 OU contours. Therefore odour impacts on sensitive receivers are not anticipated.

The proposal would be acceptable from an odour perspective based on the assumptions in this report.

Management measures are presented to further minimise and manage the potential for off-site odour impacts.

8. References

Department of Planning, 2010, *Draft NSW Best Practice Odour Guideline – Sewerage Systems including sewage treatment plants, water recycling facilities, sewage reticulation systems and sewer mining*

Department of Environment and Conservation, 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, August

ENSure, 2013. Bargo Water Recycling Plant Odour Modelling and Assessment

Sydney Water Odour Emission Database 2010

GHD, 2013, *Detailed Planning for Picton Sewerage Scheme Amplification Options Report and Augmentation Plan*

GHD, 2013, *Preliminary odour impact assessment – upgraded Nowra and Bomaderry WWTPs*

Appendices

Appendix A – ETC odour testing report

emissiontestingconsultants
Environmental Partners

VIC
Unit 2, 160 New Street,
Ringwood, VIC 3134

QLD
Unit 7, 10 Fortune Street,
Geebung QLD 4034

NSW
Unit 1, 19 Ralph Black Drive
Wollongong, NSW 2500

WA
Unit 3, 4 Monash Gate,
Jandakot, WA 6164

Freecall 1300 782 007
www.emission.com.au
ABN 74 474 273 172

GHD Services Pty Ltd
380 Lonsdale Street
Melbourne VIC 3000

Odour Testing – May 2014
Picton Waste Water Treatment Plant, NSW

Dear Mr Evan Smith,

Tests were performed 13 May 2014 to determine odour emissions to air from various locations at the Picton Waste Water Treatment Plant, NSW, operated by Sydney Water.

EXECUTIVE SUMMARY 2
RESULTS 3
Biosolids Holding Tank 2 3
Biosolids Holding Tank 1 4
Farm (During Liquid Biosolids Injection) 5
Farm (Background) 6
Biosolids Holding Tank 1 (Upwind and Downwind) 7
PLANT OPERATING CONDITIONS 9
TEST METHODS 10
APPENDIX 1 – ODOUR RESULTS FROM THE ODOUR UNIT PTY LTD 11
DEFINITIONS 12

Yours faithfully
Emission Testing Consultants

Aaron Davis BSc, LLB (Hons)
State Manager

ad@emission.com.au

EXECUTIVE SUMMARY

Emission Testing Consultants (ETC) was engaged by GHD Services Pty Ltd to perform odour sampling at various locations throughout Picton Waste Water Treatment Plant, operated by Sydney Water;

- *Biosolids Holding Tank 2 (Isolation Flux Chamber)*
- *Biosolids Holding Tank 1 (Isolation Flux Chamber)*
- *Farm during Liquid Biosolids Injection (Isolation Flux Chamber)*
- *Farm Background (Isolation Flux Chamber)*
- *Biosolids Holding Tank 1 during homogenisation (Upwind and Downwind)*

Odour analysis was performed by The Odour Unit Pty Ltd on the same day as sampling by ETC.

The methodologies chosen by ETC are those recommended by NSW EPA *Approved Methods for Sampling and Analysis of Air Pollutants in NSW*. There were no technical issues in terms of sampling on the days of testing. Plant operating conditions have been noted in the report.

RESULTS

Biosolids Holding Tank 2

13 May 2014

Location	140171 Biosolids Holding Tank 2
Date tested	13/05/2014
Location Description	WWTP Holding Tank
Surface Description	Light brown/green turbid water
Area Classification	Rural
Sampling Method	Isolation Flux
Equilibration time, hrs	858 - 922
Sample ID	5
Dilution ratio	1
Sampling time, hrs	922 - 934
Odour concentration, ou	**170**
Odour flux rate, ou/m²/min	**6.1**
Sweep Rate, L/min	4.73
Penetration Depth, mm	10
Static Pressure, Pa	1
Ambient temperature (°C)	17

Biosolids Holding Tank 1

13 May 2014

Location	Biosolids Holding Tank 1
140171	
Date tested	13/05/2014
Location Description	WWTP Holding Tank
Surface Description	Light brown turbid water
Area Classification	Rural
Sampling Method	Isolation Flux
Equilibration time, hrs	950 - 1014
Sample ID	27
Dilution ratio	1
Sampling time, hrs	1014 - 1027
Odour concentration, ou	**300**
Odour flux rate, ou/m²/min	**11**
Sweep Rate, L/min	4.67
Penetration Depth, mm	10
Static Pressure, Pa	1
Ambient temperature (°C)	18

Farm (During Liquid Biosolids Injection)

13 May 2014



Location	140171 Farm (During Liquid Biosolids Injection)
Date tested	13/05/2014
Location Description	Farm (Injection location)
Surface Description	Uneven (ploughed) lightly grassed earth, damp
Area Classification	Rural
Sampling Method	Isolation Flux
Equilibration time, hrs	1119 - 1143
Sample ID	33
Dilution ratio	1
Sampling time, hrs	1143 - 1154
Odour concentration, ou	**170**
Odour flux rate, ou/m²/min	**5.9**
Sweep Rate, L/min	4.59
Penetration Depth, mm	10
Static Pressure, Pa	1
Ambient temperature (°C)	20

Farm (Background)

13 May 2014

Location 140171	Farm (Background)
Date tested	13/05/2014
Location Description	Farm (Non-Injection location)
Surface Description	Flat unploughed lightly grassed earth, dry
Area Classification	Rural
Sampling Method	Isolation Flux
Equilibration time, hrs	1206 - 1230
Sample ID	38
Dilution ratio	1
Sampling time, hrs	1230 - 1242
Odour concentration, ou	**240**
Odour flux rate, ou/m²/min	**8.5**
Sweep Rate, L/min	4.67
Penetration Depth, mm	10
Static Pressure, Pa	1
Ambient temperature (°C)	21

Biosolids Holding Tank 1 (Upwind and Downwind)

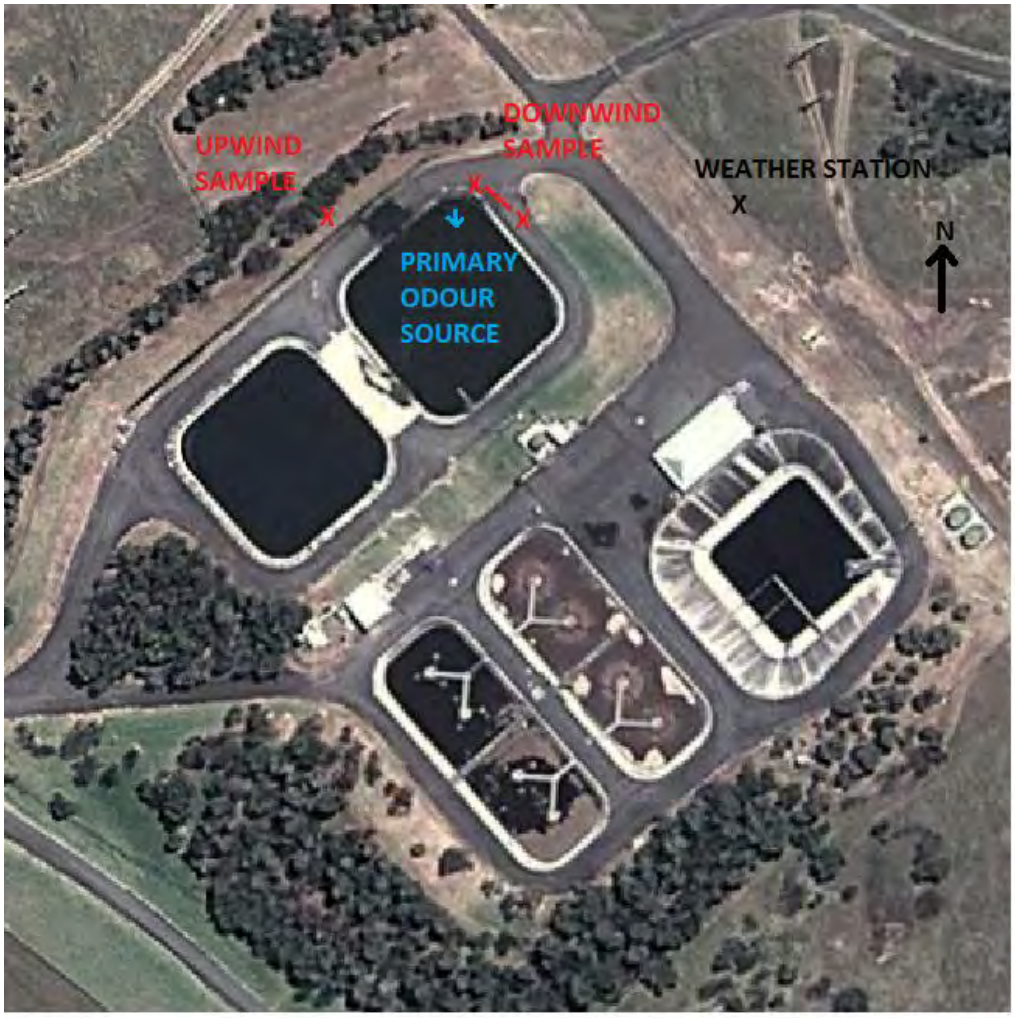
13 May 2014

Description

Odour sampling was conducted upwind and downwind from Biosolids Holding Tank 1 whilst undergoing homogenisation (recirculation) of leachate. The upwind sample was taken approximately 20m from the disturbed surface of the Holding Tank, which was identified as the primary odour source. The downwind sample was taken within an arc approximately 10m in length, located approximately 10m from the primary odour source.

Weather data was obtained from a portable station installed to the east of the Holding Tank, and was logged at 5 minute intervals for the duration of the sampling period, and is set out below.

Sampling Location (Biosolids Holding Tank 1)



Photographs

Weather Station installed to east of odour source

Looking east (downwind) across odour source

Looking west (upwind) across odour source

Weather Data

Time	Outdoor humidity (%)	Temperature (degC)	Wind average (km/h)	Wind gusts (km/h)	Wind direction	Relative pressure (hPa)
13/05/2014 13:14	54	21	1.1	3.6	NW	1012.6
13/05/2014 13:19	56	20.6	1.1	3.6	W	1012.8
13/05/2014 13:24	56	20.7	2.5	3.6	W	1012.7
13/05/2014 13:29	55	20.7	1.1	3.6	W	1012.7

Results

Site	Sample ID	Sampling Time	Odour Concentration (ou)	Approx distance to odour source (m)	Wind direction	Average wind speed (km/h)
Upwind	58	1315-1330	215	20	WNW	1.5
Downwind	67	1315-1330	362	10	WNW	1.5

PLANT OPERATING CONDITIONS

Plant operating conditions were supplied by Sydney Water and GHD personnel and were considered to be representative of normal operating conditions for the duration of the sampling programme.

TEST METHODS

The following methods are accredited with the National Association of Testing Authorities (NATA) and are approved for the sampling and analysis of gases unless otherwise stated. Specific details of the methods are available on request.

All sampling and analysis conducted in accordance with test methods (TM) prescribed for the purposes of the New South Wales Protection of the Environment Operations (Clean Air) Regulation 2002, or other approved methods (OM) unless otherwise stated.

All parameters are reported adjusted to wet NTP conditions unless otherwise stated.

Parameter	Sampling			Analysis			
	NATA	NSW TM Method	Sampling Method	NATA	Analytical Laboratory	Analytical Method	Analytical Laboratory Report Number(s)
Temperature	Yes	TM-2	USEPA 2	Yes	Emission Testing Consultants	NA	140171r
Odour	Yes	OM-7	AS4323.3	Yes	The Odour Unit Pty Ltd	AS4323.3	N1886R.03
Odour isolation flux sampling	Yes	OM-8	ETC 130	Yes			N1886R.03

APPENDIX 1 – ODOUR RESULTS FROM THE ODOUR UNIT PTY LTD

Odour Sample Measurement Results
Panel Roster Number: SYD20140513_040

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
#38 Farm Background	SC14290	13/05/2014 1242 hrs	13/05/2014 1606 hrs	4	8	-	-	235	235	N/A
#58 Up Wind	SC14291	13/05/2014 1330 hrs	13/05/2014 1641 hrs	4	8	-	-	215	215	N/A
#33 Farm Injection	SC14292	13/05/2014 1154 hrs	13/05/2014 1703 hrs	4	8	-	-	166	166	N/A
#5 Biosolids Holding Tank 2	SC14293	13/05/2014 0934 hrs	13/05/2014 1741 hrs	4	8	-	-	166	166	N/A
#27 Biosolids Holding Tank 1	SC14294	13/05/2014 1027 hrs	13/05/2014 1802 hrs	4	8	-	-	304	304	N/A
#67 Downwind	SC14295	13/05/2014 1330 hrs	13/05/2014 1825 hrs	4	8	-	-	362	362	N/A

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:
1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd. have performed the dilution of samples.

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20140513_040	50,000	$20 \leq \chi \leq 80$	724	69	Yes

Comments — Odour Character:
SC14290 Musty, sewage, stale water.
SC14291 Musty, stale water.
SC14292 Musty, stale water.
SC14293 Sewage, musty.
SC14294 Sewage, stale water.
SC14295 Sewage, stale water.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

Note: This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd. Any attachments to this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.

Note: Isolation flux odour concentrations have been rounded to 2 significant figures due to precision and confidence limits within the sampling methodology.

DEFINITIONS

The following symbols and abbreviations are used in test reports:

Concentration	Mass of analyte per cubic metre expressed at NTP dry conditions (ng, µg or mg/m^3).
Flow rate at wet NTP conditions	Volume of gas flow per unit time expressed at 0°C, an absolute pressure of 101.325 kPa and discharge moisture content (m^3/min).
Mass rate	Mass of analyte per unit time (µg, mg or g/min).
NA	Not applicable.
NTP	Normal temperature and pressure. Gas volumes and concentrations are expressed on a dry **(wet in the case of odour only)** basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Odour concentration	Number of odour units (ou).
Odour flux rate	Odour emission rate per unit surface area per unit time (ou/m^2/min).
Odour mass rate	Odour emission rate per unit time (ou/min).
Odour unit	One odour unit (ou) is that concentration of odorant(s) at standard concentrations that elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
Velocity	Gas velocity expressed at discharge temperature, pressure and moisture content (m/s)
>	Greater than.
<	Less than the minimum limit of detection using the specified method.
~	Approximately.

Template version 200613

Appendix B – AUSPLUME output file

1 _____

Picton

_____

Concentration or deposition Concentration

Emission rate units OUV/second

Concentration units Odour_Units

Units conversion factor 1.00E+00

Constant background concentration 0.00E+00

Terrain effects None

Smooth stability class changes? No

Other stability class adjustments ("urban modes") None

Ignore building wake effects? No

Decay coefficient (unless overridden by met. file) 0.000

Anemometer height 10 m

Roughness height at the wind vane site 0.300 m

Use the convective PDF algorithm? No

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford

Vertical dispersion curves for sources <100m high Pasquill-Gifford

Horizontal dispersion curves for sources >100m high Pasquill-Gifford

Vertical dispersion curves for sources >100m high Pasquill-Gifford

Enhance horizontal plume spreads for buoyancy? Yes

Enhance vertical plume spreads for buoyancy? Yes

Adjust horizontal P-G formulae for roughness height? Yes

Adjust vertical P-G formulae for roughness height? Yes

Roughness height 0.400m

Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes

Stack-tip downwash included? Yes

Building downwash algorithm: PRIME method.

Entrainment coeff. for neutral & stable lapse rates 0.60,0.60

Partial penetration of elevated inversions? No

Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients

given by the hourly met. file, a value from the following table

(in K/m) is used:

Wind Speed	Stability Class					
Category	A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES

1 hour

1 _____

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SOURCE CHARACTERISTICS

STACK SOURCE: BIOF

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
280203	6212730	0m	5m	0.15m	40C	8.8m/s

No building wake effects.

(Constant) emission rate = 1.79E+02 OUV/second

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: BHT01

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280238	6212775	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280238	6212775	2	280266	6212800
3	280240	6212828	4	280210	6212802

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01
Stability B:	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01
Stability C:	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01
Stability D:	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01	2.34E-01
Stability E:	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01
Stability F:	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: BHT02

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280204	6212743	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280204	6212743	2	280232	6212768
3	280206	6212797	4	280176	6212770

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01
Stability B:	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01
Stability C:	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01
Stability D:	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01	4.22E-01
Stability E:	3.48E-01	3.48E-01	3.48E-01	3.48E-01	3.48E-01	3.48E-01
Stability F:	3.48E-01	3.48E-01	3.48E-01	3.48E-01	3.48E-01	3.48E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: BHT03

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280131	6212679	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280131	6212679	2	280160	6212706
3	280134	6212734	4	280105	6212708

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8

Stability A: 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01

Stability B: 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01

Stability C: 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01

Stability D: 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01 2.34E-01

Stability E: 1.93E-01 1.93E-01 1.93E-01 1.93E-01 1.93E-01 1.93E-01

Stability F: 1.93E-01 1.93E-01 1.93E-01 1.93E-01 1.93E-01 1.93E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: BHT04

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280167	6212711	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280167	6212711	2	280195	6212737
3	280169	6212766	4	280140	6212740

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01

Stability B: 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01

Stability C: 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01

Stability D: 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01 4.22E-01

Stability E: 3.48E-01 3.48E-01 3.48E-01 3.48E-01 3.48E-01 3.48E-01

Stability F: 3.48E-01 3.48E-01 3.48E-01 3.48E-01 3.48E-01 3.48E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IDAL01

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height

280221 6212722 0m 4 0m 0m

Integrated Polygon Area Source Vertice Locations (in metres)

No. X Y No. X Y

1 280221 6212722 2 280238 6212738

3 280279 6212695 4 280262 6212680

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability B: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability C: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability D: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability E: 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00

Stability F: 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IDAL02

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height

280243 6212742 0m 4 0m 0m

Integrated Polygon Area Source Vertice Locations (in metres)

No. X Y No. X Y

1 280243 6212742 2 280260 6212758

3 280301 6212714 4 280284 6212700

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01

Stability B: 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01

Stability C: 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01

Stability D: 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01 4.60E-01

Stability E: 3.80E-01 3.80E-01 3.80E-01 3.80E-01 3.80E-01 3.80E-01

Stability F: 3.80E-01 3.80E-01 3.80E-01 3.80E-01 3.80E-01 3.80E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IDAL03

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280202	6212675	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280202	6212675	2	280213	6212664
3	280239	6212687	4	280229	6212699

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability B: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability C: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability D: 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00 1.66E+00

Stability E: 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00

Stability F: 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00 1.37E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: EQUAL

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280280	6212751	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280280	6212751	2	280314	6212785
3	280338	6212749	4	280312	6212714

(Constant) emission rate = 1.00E-06 OUV/second per square metre

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: INLETW

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280238	6212775	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280238	6212775	2	280266	6212800
3	280240	6212828	4	280210	6212802

(Constant) emission rate = 1.00E-05 OUV/second per square metre

No gravitational settling or scavenging.

INTEGRATED CIRCULAR AREA SOURCE: SLUDGE

X0(m)	Y0(m)	Ground El	Radius	No. Vertices	Ver. spread	Height
280112	6212708	0m	4m	20	0m	0m

Emission rates by hour of day in OUV/second per square metre:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 2.20E+02	8 2.20E+02
9 2.20E+02	10 2.20E+02	11 2.20E+02	12 2.20E+02
13 2.20E+02	14 2.20E+02	15 2.20E+02	16 2.20E+02
17 2.20E+02	18 0.00E+00	19 0.00E+00	20 0.00E+00
21 0.00E+00	22 0.00E+00	23 0.00E+00	24 0.00E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IDAL04

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280213	6212663	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280213	6212663	2	280224	6212652
3	280250	6212676	4	280239	6212687

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01
Stability B:	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01
Stability C:	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01
Stability D:	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01
Stability E:	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01
Stability F:	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: SEL1

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280229	6212699	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280229	6212699	2	280230	6212700
3	280241	6212688	4	280240	6212687

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability B: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability C: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability D: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability E: 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01

Stability F: 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: SEL2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
280240	6212687	0m	4	0m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	280240	6212687	2	280241	6212688
3	280251	6212677	4	280250	6212676

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s): < 1.5 1.5_ 3.1 3.1_ 5.1 5.1_ 8.2 8.2_10.8 >10.8

Stability A: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability B: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability C: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability D: 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00 1.10E+00

Stability E: 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01

Stability F: 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01 9.12E-01

No gravitational settling or scavenging.

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RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):

279636.m 279651.m 279666.m 279681.m 279696.m 279711.m 279726.m

279741.m 279756.m 279771.m 279786.m 279801.m 279816.m 279831.m

279846.m 279861.m 279876.m 279891.m 279906.m 279921.m 279936.m

279951.m 279966.m 279981.m 279996.m 280011.m 280026.m 280041.m

280056.m 280071.m 280086.m 280101.m 280116.m 280131.m 280146.m

280161.m 280176.m 280191.m 280206.m 280221.m 280236.m 280251.m

280266.m 280281.m 280296.m 280311.m 280326.m 280341.m 280356.m

280371.m 280386.m 280401.m 280416.m 280431.m 280446.m 280461.m

280476.m 280491.m 280506.m 280521.m 280536.m 280551.m 280566.m

280581.m 280596.m 280611.m 280626.m 280641.m 280656.m 280671.m

280686.m 280701.m 280716.m 280731.m 280746.m 280761.m 280776.m

280791.m 280806.m 280821.m 280836.m 280851.m 280866.m 280881.m

280896.m 280911.m 280926.m 280941.m 280956.m 280971.m 280986.m

281001.m 281016.m 281031.m 281046.m 281061.m 281076.m 281091.m

281106.m 281121.m 281136.m

and these y-values (or northings):

6211939.m 6211954.m 6211969.m 6211984.m 6211999.m 6212014.m 6212029.m

6212044.m 6212059.m 6212074.m 6212089.m 6212104.m 6212119.m 6212134.m

6212149.m 6212164.m 6212179.m 6212194.m 6212209.m 6212224.m 6212239.m

6212254.m 6212269.m 6212284.m 6212299.m 6212314.m 6212329.m 6212344.m

6212359.m 6212374.m 6212389.m 6212404.m 6212419.m 6212434.m 6212449.m

6212464.m 6212479.m 6212494.m 6212509.m 6212524.m 6212539.m 6212554.m

6212569.m 6212584.m 6212599.m 6212614.m 6212629.m 6212644.m 6212659.m

6212674.m 6212689.m 6212704.m 6212719.m 6212734.m 6212749.m 6212764.m

6212779.m 6212794.m 6212809.m 6212824.m 6212839.m 6212854.m 6212869.m

6212884.m 6212899.m 6212914.m 6212929.m 6212944.m 6212959.m 6212974.m

6212989.m 6213004.m 6213019.m 6213034.m 6213049.m 6213064.m 6213079.m

6213094.m 6213109.m 6213124.m 6213139.m 6213154.m 6213169.m 6213184.m

6213199.m 6213214.m 6213229.m 6213244.m 6213259.m 6213274.m 6213289.m

6213304.m 6213319.m 6213334.m 6213349.m 6213364.m 6213379.m 6213394.m

6213409.m 6213424.m 6213439.m

METEOROLOGICAL DATA : Tahmoor 2006 to 2007

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1 Peak values for the 100 worst cases (in Odour_Units)

Averaging time = 1 hour

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	7.33E+03	07,16/05/07	(280116, 6212704, 0.0)
2	5.56E+03	07,09/05/07	(280116, 6212704, 0.0)
3	5.56E+03	07,21/05/07	(280116, 6212704, 0.0)
4	4.07E+03	08,03/08/06	(280116, 6212704, 0.0)
5	4.07E+03	17,19/04/07	(280116, 6212704, 0.0)
6	4.01E+03	08,30/04/07	(280116, 6212704, 0.0)
7	4.01E+03	08,25/06/07	(280116, 6212704, 0.0)
8	3.82E+03	07,24/01/07	(280116, 6212704, 0.0)
9	3.82E+03	07,03/04/07	(280116, 6212704, 0.0)
10	3.82E+03	09,13/05/07	(280116, 6212704, 0.0)
11	3.82E+03	08,15/05/07	(280116, 6212704, 0.0)
12	3.82E+03	15,06/06/07	(280116, 6212704, 0.0)
13	3.62E+03	08,01/06/07	(280116, 6212704, 0.0)
14	3.62E+03	10,01/06/07	(280116, 6212704, 0.0)
15	3.32E+03	07,01/05/07	(280116, 6212704, 0.0)
16	3.32E+03	07,04/06/07	(280116, 6212704, 0.0)
17	2.90E+03	10,22/04/07	(280116, 6212704, 0.0)

18	2.90E+03	08,26/05/07	(280116, 6212704,	0.0)
19	2.90E+03	09,27/05/07	(280116, 6212704,	0.0)
20	2.90E+03	17,01/06/07	(280116, 6212704,	0.0)
21	2.74E+03	17,28/05/07	(280116, 6212704,	0.0)
22	2.73E+03	08,09/08/06	(280116, 6212704,	0.0)
23	2.53E+03	07,19/09/06	(280116, 6212704,	0.0)
24	2.53E+03	07,19/04/07	(280116, 6212704,	0.0)
25	2.42E+03	07,03/06/07	(280101, 6212704,	0.0)
26	2.27E+03	17,03/05/07	(280116, 6212704,	0.0)
27	2.01E+03	07,10/03/07	(280116, 6212704,	0.0)
28	2.01E+03	07,23/03/07	(280116, 6212704,	0.0)
29	2.01E+03	08,26/03/07	(280116, 6212704,	0.0)
30	2.01E+03	17,21/05/07	(280116, 6212704,	0.0)
31	1.98E+03	11,27/06/07	(280116, 6212704,	0.0)
32	1.97E+03	08,20/05/07	(280116, 6212704,	0.0)
33	1.88E+03	07,09/08/06	(280116, 6212704,	0.0)
34	1.82E+03	07,25/11/06	(280116, 6212704,	0.0)
35	1.79E+03	07,11/05/07	(280116, 6212719,	0.0)
36	1.75E+03	07,26/05/07	(280101, 6212704,	0.0)
37	1.75E+03	07,27/05/07	(280101, 6212704,	0.0)
38	1.70E+03	13,06/06/07	(280116, 6212704,	0.0)
39	1.69E+03	07,18/03/07	(280116, 6212704,	0.0)
40	1.69E+03	15,19/03/07	(280116, 6212704,	0.0)
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43	1.62E+03	08,11/02/07	(280116, 6212704,	0.0)
44	1.58E+03	08,31/07/06	(280116, 6212704,	0.0)
45	1.56E+03	07,14/08/06	(280101, 6212689,	0.0)
46	1.56E+03	07,15/08/06	(280101, 6212689,	0.0)
47	1.56E+03	07,08/05/07	(280101, 6212689,	0.0)
48	1.55E+03	07,23/06/07	(280131, 6212719,	0.0)
49	1.54E+03	07,22/12/06	(280116, 6212704,	0.0)
50	1.53E+03	09,31/05/07	(280116, 6212704,	0.0)
51	1.52E+03	07,10/08/06	(280116, 6212719,	0.0)
52	1.51E+03	16,03/06/07	(280116, 6212704,	0.0)
53	1.50E+03	12,27/06/07	(280116, 6212704,	0.0)

54	1.49E+03	08,22/02/07	(280116, 6212704,	0.0)
55	1.49E+03	08,08/03/07	(280116, 6212704,	0.0)
56	1.43E+03	12,28/04/07	(280116, 6212704,	0.0)
57	1.42E+03	15,20/10/06	(280116, 6212704,	0.0)
58	1.41E+03	08,18/09/06	(280116, 6212704,	0.0)
59	1.41E+03	09,21/04/07	(280116, 6212704,	0.0)
60	1.41E+03	07,24/12/06	(280116, 6212719,	0.0)
61	1.41E+03	17,29/03/07	(280116, 6212719,	0.0)
62	1.41E+03	09,16/05/07	(280116, 6212719,	0.0)
63	1.41E+03	07,05/09/06	(280101, 6212704,	0.0)
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76	1.28E+03	07,30/01/07	(280116, 6212704,	0.0)
77	1.28E+03	08,20/03/07	(280116, 6212704,	0.0)
78	1.27E+03	16,20/10/06	(280116, 6212704,	0.0)
79	1.26E+03	17,27/06/07	(280116, 6212704,	0.0)
80	1.24E+03	10,24/12/06	(280116, 6212704,	0.0)
81	1.22E+03	10,28/07/06	(280116, 6212704,	0.0)
82	1.22E+03	09,27/03/07	(280116, 6212704,	0.0)
83	1.19E+03	08,12/11/06	(280116, 6212704,	0.0)
84	1.18E+03	08,16/05/07	(280116, 6212719,	0.0)
85	1.17E+03	08,24/03/07	(280116, 6212704,	0.0)
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87	1.16E+03	08,10/02/07	(280116, 6212704,	0.0)
88	1.16E+03	07,14/03/07	(280116, 6212704,	0.0)
89	1.16E+03	08,16/03/07	(280116, 6212704,	0.0)

90	1.16E+03	07,28/03/07	(280116, 6212704, 0.0)
91	1.16E+03	09,29/03/07	(280116, 6212704, 0.0)
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93	1.16E+03	10,28/04/07	(280116, 6212704, 0.0)
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95	1.16E+03	07,22/09/06	(280101, 6212704, 0.0)
96	1.15E+03	09,28/07/06	(280116, 6212719, 0.0)
97	1.15E+03	08,14/08/06	(280116, 6212719, 0.0)
98	1.15E+03	07,27/11/06	(280116, 6212719, 0.0)
99	1.15E+03	11,19/03/07	(280116, 6212719, 0.0)
100	1.15E+03	10,11/02/07	(280116, 6212704, 0.0)

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Document Status

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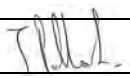
C	E Smith	T Pollock		A Raleigh		28/01/14
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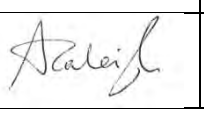
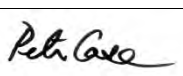
1	E Smith	A Raleigh		P Carson		20/11/2014

Appendix E – Noise and vibration assessment

Modification to the Picton Water Recycling Plant

Section 75W modification application

Noise and vibration assessment

November 2014

This report was prepared for Sydney Water by **ENSure**

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Appendices

Appendix A - Noise monitoring charts

Glossary and abbreviations

Term	Definition
EPA	Environmental Protection Authority
Ambient	The all-encompassing noise level in an environment
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
determining authority	Defined by Section 110 of the *Environmental Planning and Assessment Act 1979* as 'a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out.'
Secretary's environmental assessment requirements	Outlines the requirements for an environmental impact assessment in accordance with the EP&A Act.
ENSure	ENSure is a GHD and Jacobs Joint Venture.
ICNG	*Interim Construction Noise Guideline* (DECC, 2009).
INP	*Industrial Noise Policy* (EPA, 2000).
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
noise sensitive receiver	An area or place potentially affected by noise which includes: • a residential dwelling • an educational institution, library, childcare centre or kindergarten • a hospital, surgery or other medical institution • an active (e.g. sports field, golf course) or passive (e.g. national park) recreational area • commercial or industrial premises • a place of worship.
PPV	Peak particle velocity is the maximum vector sum of three orthogonal time-synchronized velocity components regardless of whether these component maxima occurred simultaneously.
proposal	The construction and operation of the proposed modifications to the Picton WRP.
proposal site	The immediate location of the proposal, which is the area that has the potential to be directly disturbed by construction and operation.
rating background level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
RNP	*Road Noise Policy* (DECCW, 2011).
scheme	The Picton Sewerage Scheme.

Term	Definition
Rw	Weighted Sound Reduction Index which provides a single-number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies
study area	Land in the vicinity of, and including, the proposal site. The 'study area' is the wider area surrounding the proposal site.
VDV	Vibration dose value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).
WRP	Water recycling plant

1. Introduction

1.1 Overview

Sydney Water is proposing to amplify the Picton Water Recycling Plant (the Picton WRP) to respond to existing and future needs.

The construction and operation of the works required to amplify the Picton WRP requires approval from the NSW Minister for Planning under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), in the form of a modification of the existing approval for the Picton Sewerage Scheme.

This report has been prepared by ENSure as part of the environmental assessment of the proposal. The environmental assessment has been prepared to accompany the modification application and has been prepared in accordance with the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the 'Secretary's environmental assessment requirements').

1.2 The proposal

The proposal would involve constructing and operating the following facilities to increase the capacity of the Picton WRP:

- two additional intermittently decanted aeration lagoons (IDALs)
- new inlet works and associated components to distribute flows to the existing and proposed IDALs
- two additional sludge lagoons
- a chemical dosing unit (CDU) for pH correction
- a pipeline (about 275 metres long) to deliver chemicals from the CDU to the western dam
- various ancillary works.

The concept design for the proposal incorporates features to minimise the potential for off-site noise and vibration impacts. These features are described in 4.3.1.

The proposal site is shown in Figure 1.

1.3 Scope of this assessment

The noise assessment has been prepared to address the Secretary's environmental assessment requirements for the proposal. The Secretary's environmental assessment requirements relating to noise and vibration are as follows:

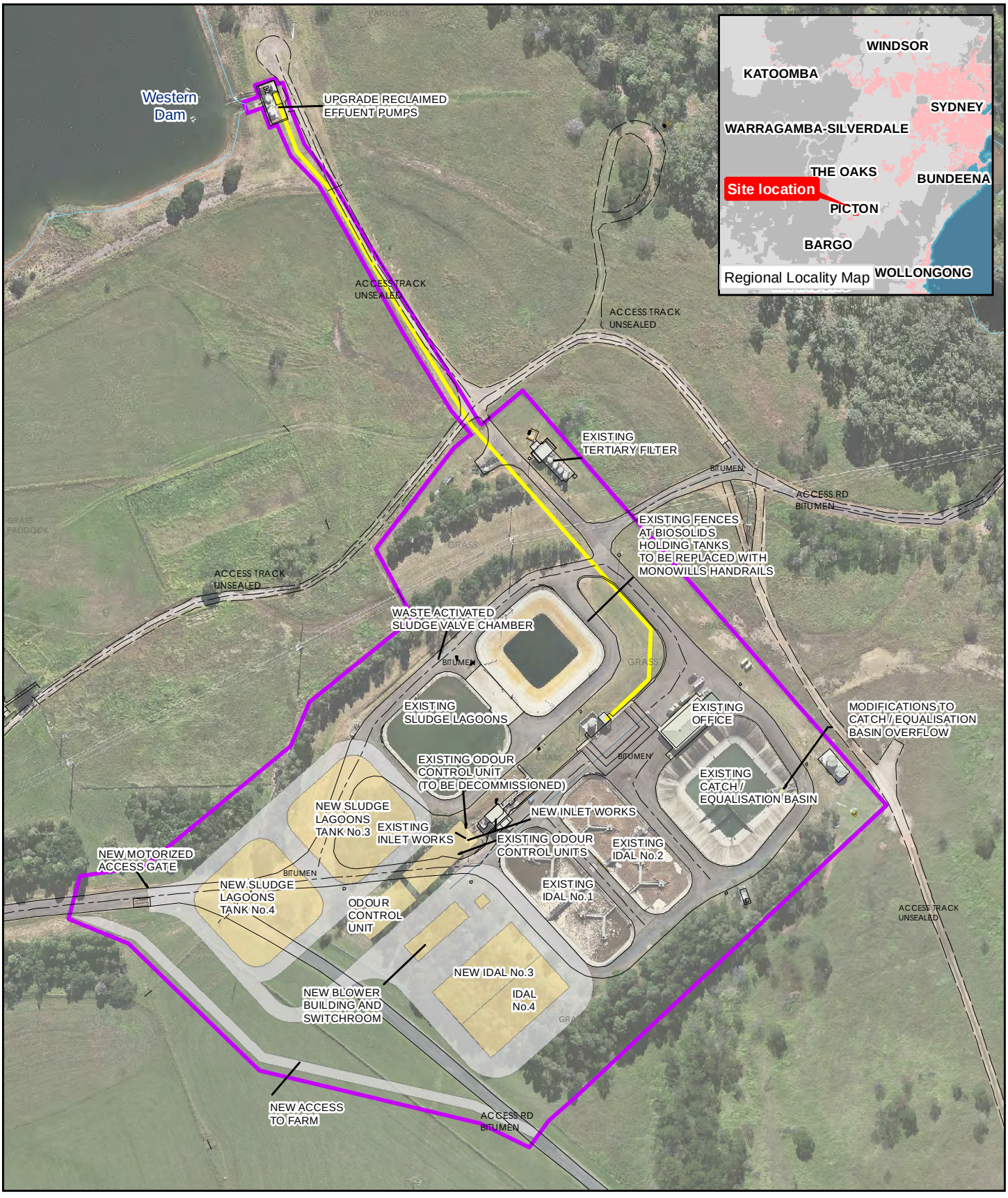
> *'Noise and Vibration – include an assessment of noise and vibration impacts during construction and operation and in a cumulative context with existing development. The assessment must consider the following guidelines, as relevant: Interim Construction Noise Guidelines (DECC, 2009) and Road Noise Policy (DECCW, 2011), Industrial Noise Policy (EPA, 2000).'*

To address the Secretary's environmental assessment requirements, the scope of works to assess the potential noise and vibration impacts associated with the proposal includes:

- quantifying the existing ambient and background noise environment in the vicinity of the proposal using the results of noise monitoring

- establishing construction noise and vibration management levels and assessing the construction noise and vibration impacts associated with the proposal in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC July 2009) and *Assessing vibration: a technical guideline* (DEC, 2006) at potentially impacted receivers.
- establishing the *Industrial Noise policy* (INP) (EPA 2000) proposal specific operational noise levels at potentially impacted receivers and assessing the operational noise impacts
- assessing the potential effectiveness of the proposed noise mitigation features included in the concept design
- assessing any road traffic noise impacts considering the *Road Noise Policy* (RNP) (DECCW, 2012)
- identifying exceedances and providing mitigation measures to manage noise and vibration impacts associated with the proposal.

A glossary of acoustic terms can be found at the beginning of the report.



LEGEND

- CDU pipeline
- Proposal site
- Proposed new roads

Paper Size A4

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Sydney Water
Picton wastewater flows

Job Number 21-2284914
Revision A
Date 14 Nov 2014

Proposal site

Figure 1

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z056_Noise_Proposed_site_Picton WRP site layout _Fig1.mxd

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung

2. Existing environment

2.1 Sensitive receivers and land uses

Noise sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Sensitive noise and vibration receivers could include:

- residences
- educational institutions when in use
- hospitals and medical facilities
- places of worship when in use
- passive and active recreational areas such as parks, sporting fields and golf courses
- commercial or industrial premises.

The following residences surrounding the WRP were identified for the purposes of the noise assessment:

- 2260 Remembrance Driveway 450 m from the WRP site boundary
- 2290 Remembrance Driveway (Lot 29 DP 734568) 320 m from the WRP site boundary
- 2290 Remembrance Driveway (Lot 30 DP 734568) 370 m from the WRP site boundary
- 2300 Remembrance Driveway 320 m from the WRP site boundary
- 2310 Remembrance Driveway 460 m from the WRP site boundary
- 2326 Remembrance Driveway 530 m from the WRP site boundary
- 2330 Remembrance Driveway 610 m from the WRP site boundary
- 2360 Remembrance Driveway 660 m from the WRP site boundary
- 2245 Remembrance Driveway (Lot 2 DP1042285) 570 m from the WRP site boundary.

The nearest sensitive receiver to the proposal site is located at 2300 Remembrance Driveway, about 320 m from the WRP site boundary.

2.2 Existing noise environment

2.2.1 Existing operation of the Picton WRP

The Picton Sewerage Scheme collects wastewater from the villages of Picton, Tahmoor, Thirlmere, Bargo and Buxton and transfers it to the Picton WRP for treatment.

The WRP receives pumped flows from two wastewater pumping stations. The wastewater flows through the inlet works, distribution channel and then to the two IDALs. Excess sludge is transferred to the two sludge lagoons.

Decanted effluent from the IDAL tanks flows to the equalisation basin. A portion of the secondary effluent is pumped to the Western Dam via tertiary filters and then to the ultra-violet (UV) disinfection system. The remaining effluent flows to the Eastern Dam.

The dominant existing operational noise source on site is the surface aeration equipment within the existing IDAL tanks (IDAL 1 and IDAL 2).

2.2.2 Noise monitoring methodology

Noise monitoring was undertaken at two locations to assess the background and ambient noise levels in the study area for the proposal. Noise monitoring locations are shown in Figure 2. Location 1 provides a good representation of the existing background and ambient noise levels in a rural environment without noise contributions from the existing WRP, other industrial noise sources or road traffic noise. This location has been used to establish rating background noise levels for the project. Location 2 includes noise from the existing WRP and has been used for operational noise model verification.

All noise monitoring activities were undertaken and processed in accordance with the INP. All noise loggers were programmed to accumulate L_{A90}, $L_{A10\ and}$ L_{Aeq} noise descriptors continuously over sampling periods of 15 minutes for the entire monitoring period with a 'Fast' time weighting. The noise loggers were calibrated before and after each measurement period and were found to be within the acceptable tolerance of ± 0.5 dB(A).

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 m/s, or when rainfall occurred. Meteorological data was sourced from the Bureau of Meteorology's Picton Airport automatic weather station.

Table 2-1 provides details of the noise loggers used. Noise level charts of the noise monitoring results are shown in Appendix A.

Table 2-1 Noise monitoring equipment details

Location ID	Location	Measurement period	Equipment details
L1	1285 Menangle Park Road	Thursday 28/11/13 to Thursday 05/12/13	Bruel and Kjaer 2250L SN: 2731849
L2	Picton WRP	Thursday 28/11/13 to Thursday 05/12/13	Svantek SV979 SN: 2722377

2.2.3 Noise monitoring results

A summary of the calculated rating background level (RBL) $L_{A90(period)}$ and ambient $L_{Aeq(period)}$ noise monitoring results is shown in Table 2-2 for each background noise monitoring location. The study area has typical ambient noise levels, consistent with the surrounding land and low density residential development.

Table 2-2 Noise monitoring results, dB(A)

ID	Location	Rating background level, RBL $L_{A90(period)}$			Ambient noise levels, $L_{Aeq(period)}$		
		Day	Evening	Night	Day	Evening	Night
L1	1285 Menangle Park Road	35	33	32	54	47	46
L2	Picton WRP	42	39	36	52	54	47

Paper Size A3

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Noise monitoring locations
- Picton Farm WRP Boundary

GHD ENSure

Sydney Water
Picton wastewater flows

Job Number	21-2284914
Revision	C
Date	14 Nov 2014

Noise monitoring locations — Figure 2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung

3. Assessment levels

The noise and vibration assessment levels during operation and construction are presented in the following section. A summary of the noise assessment levels relevant to this proposal are provided in Section 3.4.

3.1 Construction noise assessment levels

3.1.1 Construction noise management levels

The ICNG guideline recommends standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays. The ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming that all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant or structures that police or other authorities determine to require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours.

Table 3-1 and Table 3-2 detail the ICNG construction noise management levels at sensitive land uses and residences, respectively.

Table 3-1 Construction noise management levels at sensitive land uses

Land use	Management level, $L_{Aeq(15min)}$ (when in use)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	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)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Industrial premises	External noise level 75 dB(A)
Offices and retail outlets	External noise level 70 dB(A)

Table 3-2 Construction noise management levels at residences

Time of day	Management level $L_{Aeq(15min)}$	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 Rating background level plus 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. 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. 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 • 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 Rating background level plus 5 dB(A)	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(A) above the noise affected level, the proponent should negotiate with the community.

3.1.1 Sleep disturbance during construction

The ICNG states that where construction works are planned to extend over more than two consecutive nights, the analysis should include maximum noise levels and the extent and number of times the maximum exceeds the rating background levels.

The ICNG also refers to the *Environmental Criteria for Road Traffic Noise* (EPA, 1999) for more guidance on sleep disturbance from maximum noise level events. This guideline has since been superseded by the RNP. Both guidelines provide a discussion on research into the effects of maximum noise events on sleep disturbance. The results of this research is aimed at limiting the level of sleep disturbance due to environmental noise and concludes that the L_{Amax} or $L_{A1(1min)}$ level of any noise should not exceed the ambient $L_{A90(15min)}$ noise level by more than 15 dB(A). This guideline takes into account the emergence of noise events, but does not directly limit the number of such events or their highest level, which are also found to affect sleep disturbance.

The RNP provides further guidance, which indicates that:

- maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- one or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

For sleep disturbance, the assessment point is inside the residence's bedroom and an open window is generally considered to provide a 10 dB(A) reduction in noise levels from outside the dwelling to inside the dwelling.

3.1.2 Traffic noise during construction

The RNP provides traffic noise target levels for residential receivers in the vicinity of existing roads (Table 3-3). These levels are applied to construction works to identify potential construction traffic impacts and the potential for reasonable and feasible mitigation measures.

The application notes[1] for the RNP state that:

> *'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 as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

If road traffic noise increases from the construction work is within 2 dB(A) of current levels then the objectives of the RNP are met and no specific mitigation measures are required.

[1] http://www.environment.nsw.gov.au/noise/roadnoiseappnotes.htm 12 December 2012

Table 3-3 Construction traffic noise target levels, $L_{Aeq(period)}$, dB(A)

Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$
School classrooms	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (When in use)	-
Places of worship	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)
Open space (active use)	External noise level 60 $L_{Aeq(15hr)}$ dB(A) (when in use)	-
Open space (passive use)	External noise level 55 $L_{Aeq(15hr)}$ dB(A) (when in use)	-

3.2 Construction vibration assessment levels

3.2.1 Human comfort

Vibration has been assessed using *Assessing Vibration: a technical guideline* (DEC February 2006). *British Standard (BS) 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* which is recognised by the guideline as the preferred standard for assessing 'human comfort'.

Typically, construction activities generate ground vibration of an intermittent nature. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table 3-4 for sensitive receivers.

Whilst the assessment of response to vibration in *BS 6472-1:1992* is based on vibration dose value and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak value, since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration,* as shown below in Table 3-5.

Table 3-4 Human comfort intermittent vibration limits (BS 6472-1992)

Receiver type	Period[1]	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day	0.2	0.4
	Night	0.13	0.26
Educational institutes	When in use	0.4	0.8

Note 1: Day is between 7 am and 10 pm and night is between 10 pm and 7 am

Table 3-5 Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

3.2.2 Structural damage

Currently, there is no Australian Standard that sets vibration levels for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures* (refer to Table 3-6).

Table 3-6 Guideline values for short term vibration on structures

Type of structure	Guideline values for velocity, (mm/s)		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]
Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example heritage listed buildings).	3	3 to 8	8 to 10

Note 1: At frequencies above 100 Hz the values given in this column may be used as minimum values.

3.3 Operational noise assessment levels

The INP provides guidance on the assessment of operational noise impacts. The guidelines include both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver. The INP also provides guidance on sleep disturbance impacts.

The INP provides planning levels that are not mandatory limits required by legislation however used to assist the determining authority to assess operational noise impacts. Where noise assessment levels are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. Feasible and reasonable noise mitigation measures should consider the economic, social and environmental costs and benefits of the development against the noise impacts.

The intrusive noise criteria controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity criteria limits the total level of extraneous noise for all receiver types. Both sets of criteria are calculated and, in the case of continuous noise sources, the lower of the two in each time period normally apply. For noise sources with intermittent characteristics both noise criteria should be assessed independently.

3.3.1 Intrusive criteria

The intrusive criteria are determined by a 5 dB(A) addition to the measured (or adopted) background level with a minimum of 35 dB(A). The INP recommends that the intrusive criteria for the evening period should not exceed the daytime period and the night-time period should not exceed the evening period. The intrusive criteria are only applicable to residential receivers.

3.3.2 Amenity criteria

The amenity criteria are determined based on the overall acoustic characteristics of the receiver area, the receiver type and the existing level of industrial noise.

Residential receiver areas are characterised into ‘urban’, ‘suburban’, ‘rural’ or other categories based on land uses, the existing level of noise from industry, commerce, and road traffic.

Amenity criteria are also provided for other sensitive land uses such as schools, hospitals, places of worship and recreational areas.

The amenity criteria aim to limit continual increases in noise levels from industrial noise sources and apply to all industrial noise sources at the receiver location, rather than just the noise source from the proposed development. To prevent cumulative noise level increases above the amenity criteria, the INP provides adjustments to the amenity criteria to set a target level for the proposed development. The applicable adjustment is scaled as per INP Table 2.2 and is based on the existing level of industrial noise at the receiver location. The INP amenity criteria are provided in Table 3-7.

Table 3-7 INP amenity criteria

Type of receiver	Noise amenity area	Time of day	Recommended $L_{Aeq(period)}$ noise level	
			Acceptable	Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban / industrial interface	Day	65	70
		Evening	55	60
		Night	50	55
School classroom	All	When in use (highest 1 hour period)	35 (internal)	40 (internal)
Hospital ward	All	When in use (highest 1 hour period)	35 (internal) 50 (external)	40 (internal) 55 (external)
Place of worship	All	When in use	40 (internal)	45 (internal)
Passive recreation	All	When in use	50	55
Active recreation	All	When in use	55	60
Commercial	All	When in use	65	70
Industrial	All	When in use	70	75

3.3.3 Meteorological conditions

Noise propagation can be enhanced by wind conditions and temperature inversions. The INP states:

> *'Where inversion conditions are predicted for at least 30% (or approximately 2 nights per week) of the total night time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment.*
>
> *Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 per cent of the time or more in any assessment period (day, evening, night) in any season.'*

Therefore noise enhancing meteorological conditions should be included in the assessment unless it can be shown that they do not occur for 30% of the time during any seasonal period.

3.3.4 Modifying factor adjustments

The INP requires that modifying factor adjustments are added to the measured or predicted noise levels if the noise sources contain tonal, low frequency, intermittent or impulsive characteristics, which have the potential to increase annoyance. The modifying factor adjustments are summarised in Table 3-8.

Table 3-8 Industrial Noise Policy modifying factor adjustments

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: ◗ 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz ◗ 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive ◗ 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dB(A)[2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more.	5 dB(A)[2]
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dB(A).	5 dB(A)
Impulsive noise	A-weighted fast response and impulse response	If the difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB.	Apply the difference in measured noise levels as the correction up to a maximum of 5 dB(A)

Note 1: Where two or more modifying factors are present the maximum correction is limited to 10 dB(A).

Note 2: Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

3.4 Summary of noise assessment levels

3.4.1 Construction noise

The construction noise assessment levels for the proposed construction activities during recommended standard hours and outside of the recommended standard hours are provided in Table 3-8 and Table 3-9 are based on Table 3-2 and the RNP guidance on sleep disturbance.

Table 3-9 Summary of construction noise assessment levels, dB(A)

Receiver area	Construction noise management level, $L_{Aeq(15min)}$					Sleep disturbance criteria[1] L_{Amax}
	During standard recommended hours		Outside of standard recommended hours			
	7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday, no work on Sunday or public holidays		**Day** *7 am to 8 am and 1 pm to 6 pm Saturday, 8 am to 6 pm Sunday & Public Holidays*	**Evening** *6 pm to 10 pm Monday to Sunday & Public Holidays*	**Night** *10 pm to 7 am, Monday to Saturday; 10 pm to 8 am Sunday & Public Holidays*	**Night** *10 pm to 7 am, Monday to Saturday; 10 pm to 8 am Sunday & Public Holidays*
	Noise affected	**Highly noise affected**				
Rural residential receivers surrounding the WRP	45	75	40	38	37	50 (internal)

Note 1: Sleep disturbance criteria based on RNP guidance.

3.4.2 Operational noise assessment levels

The proposal specific noise levels based on the INP and measured background noise levels are shown in Table 3-10 which apply cumulatively to existing and proposed operations. However the current Picton Sewage Treatment System Environmental Protection License 10555 noise limits are as follows:

> *'L6.1 Noise from the premises must not exceed:*
>
> *a) an $L_{A10(15min)}$ noise emission criterion of 45 dB(A) (7 am to 6 pm); and*
>
> *b) at all other times, an $L_{A10(15min)}$ noise emission criterion of 35 dB(A).'*

The compliance location:

> *'L6.2 Noise from the premises is to be measured at the nearest residence to determine compliance with this condition.'*

It is recommended that the existing EPL noise limit of 35 dB(A) for the evening and night time period be used as the proposal specific noise level with the $L_{Aeq(15min)}$ noise descriptor.

Table 3-10 Proposal specific noise levels during operation

Receiver area	Time period	Amenity criteria[1] $L_{Aeq(period)}$	RBL $L_{A90(15min)}$	Intrusive criteria $L_{Aeq(15min)}$	Proposal specific noise levels
Rural / suburban residential receivers	Day	50	35	40	**40 $L_{Aeq(15min)}$**
	Evening	45	33	38	**35 $L_{Aeq(15min)}$**[2]
	Night	40	32	37	**35 $L_{Aeq(15min)}$**[2]

Note 1: With consideration to the INP 'noise amenity area' classification, the residential receivers surrounding the sites have been classified as 'rural.

Note 2: Based on existing EPL noise limit level with a LAeq(15min) descriptor.

4. Assessment of impacts

4.1 Construction noise

4.1.1 Construction activities and noise sources

Typical construction equipment associated with the WRP are detailed in Table 4-1 along with their expected noise levels.

Noise levels of construction equipment have been obtained from Australian Standard, *AS 2436 – 2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites*, British Standards *BS5228-2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise* and other available data.

Table 4-1 Construction activities, equipment and noise levels

Construction equipment	SWL (dB(A))	Modelled source height (m)	Source
Crane	104	2 m	AS2436 Table A1
Excavator	107	2 m	BS5228 Table C4-17
Grader	110	2 m	AS 2436 Table A1
Concrete saw	117	Ground	AS 2436 Table A1
Vibratory roller	108	2 m	AS 2436 Table A1
Backhoe	104	2 m	AS 2436 Table A1
Hand tools	102	2 m	AS 2436 Table A1
Jack hammer	121	Ground	AS 2436 Table A1
Light vehicle	106	2 m	AS 2436 Table A1
Concrete pump truck	108	2 m	AS 2436 Table A1
Welding equipment	105	2 m	AS 2436 Table A1
Air compressor	101	2 m	AS 2436 Table A1
Generator	99	2 m	AS 2436 Table A1
Water truck	107	2 m	AS 2436 Table A1
Road sweeper	104	2 m	BS5228 Table C4-90
Truck	107	2 m	AS 2436 Table A1

4.1.2 Modelling methodology

The potential noise impacts on the surrounding sensitive receivers have been predicted. Noise modelling was undertaken using CadnaA v4.3 which calculates environmental noise propagation according to *ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors.*

The following assumptions and calculation parameters were used in the noise model:

- land was modelled assuming a mixture of moderate to soft ground with a ground absorption coefficient of 0.75 to represent grass
- the noise model was used to predict noise levels during a typical worst case 15 minute period of operation where the noisiest item of equipment is running at full power
- atmospheric absorption was based on an average temperature of 10 °C and an average humidity of 70%
- the algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation.

4.1.3 Predicted construction noise levels

Predicted construction noise levels are provided in Table 4-2 which identify the predicted noise levels at varying distances from each construction activity. The red bold text identifies distances from activities where the highly noise affected construction noise management levels are potentially exceeded.

Predicted receiver distances to meet the construction noise management levels are provided in Table 4-3 for each construction activity.

Table 4-2 Construction equipment noise levels at distance, dB(A)

Equipment	SWL	Approximate construction noise levels at distance from source						
		10 m	25 m	50 m	100 m	200 m	400 m	800 m
Crane	104	74	65	58	51	45	39	33
Excavator	107	**77**	68	61	54	48	42	36
Tractor	107	**77**	68	61	54	48	42	36
Grader	110	**80**	71	64	57	51	45	39
Concrete saw	117	**86**	**76**	68	60	53	47	40
Vibratory roller	108	**78**	69	62	55	49	43	37
Backhoe	104	74	65	58	51	45	39	33
Hand tools	102	72	63	56	49	43	37	31
Jack hammer	121	**90**	**80**	72	64	57	51	44
Light vehicle	106	**76**	67	60	53	47	41	35
Concrete pump truck	108	**78**	69	62	55	49	43	37
Welding equipment	105	75	66	59	52	46	40	34
Air compressor	101	71	62	55	48	42	36	30
Generator	99	69	60	53	46	40	34	28
Water truck	107	**77**	68	61	54	48	42	36

Equipment	SWL	Approximate construction noise levels at distance from source						
		10 m	25 m	50 m	100 m	200 m	400 m	800 m
Road sweeper	104	74	65	58	51	45	39	33
Truck	107	**77**	68	61	54	48	42	36

Note 1: **Bolded red** results indicate exceedance of highly noise affected construction noise management level.

Table 4-3 Receiver distances to meet construction noise management levels

Equipment	Distances for exceedance of the noise affected level (m) of 45 dB(A)	Highly noise affected distances (m)
Crane	200	<10
Excavator (8 Tonne)	280	10 to 15
Tractor	280	10 to 15
Grader	390	15 to 20
Concrete saw	450	25 to 30
Vibratory roller	320	10 to 15
Backhoe	200	<10
Hand tools	160	<10
Jack hammer	690	35
Light vehicle	250	10 to 15
Concrete truck and pump	320	10 to 15
Welding equipment	230	10
Air compressor	140	<10
Generator	110	<10
Water truck	280	10 to 15
Road sweeper	200	<10
Truck	280	10 to 15

4.1.4 Assessment of construction noise impacts

WRP construction activities during recommended standard construction hours are predicted to exceed the noise affected construction noise management levels at distances of up to 690 m from the WRP site and would be dependent on the equipment used.

The residences surrounding the WRP are located around 300 m from the proposal site, therefore there is the potential that the construction noise management levels would be exceeded.

In these circumstances noise mitigation measures detailed in Section 5.1 would be implemented where feasible and reasonable. All potentially impacted residents would be informed of the nature of the works, expected noise levels, duration of works and a method of contacting Sydney Water to raise noise complaints.

The highly noise affected construction noise management level is not anticipated to be exceeded.

4.1.5 Out of hours work and sleep disturbance

Some aspects of the works may be required outside the standard hours. For example, a 12 hour shutdown would be required for the cutover of the rising mains. This needs to occur during a low flow period (typically between 10 pm and 6 am). This work would require the following:

- cutting of existing pipework
- installation of new pipework (welding / installation of couplings and new pipework)
- backfilling of new pipework installation.

The types of equipment that would be involved in the work area:

- excavators / backhoes (during most of the period of work)
- pipe cutting equipment (short duration)
- welding equipment (short duration).

During out of hours work noise levels are predicted to range from 40 to 45 dB(A) at the nearest residential receivers. Residential receivers within 800 m of the works may experience noise that exceeds the out of hours construction noise management level of 37 dB(A). The sleep disturbance criteria of 50 dB(A) L_{Amax} (internal) is not predicted to be exceeded.

Where exceedances are identified, reasonable and feasible construction noise mitigation measures would be implemented, which would minimise noise impacts at potentially affected receivers. Measures are provided in Section 5 to manage the potential impacts of out of hours work.

4.1.6 Construction traffic impacts

The application notes[2] for the *Road Noise Policy* state that:

> *'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 as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

This is also considered to apply to traffic noise generated during construction. Therefore, if the increase in road traffic noise as a result of construction traffic is within 2 dB(A) of existing noise levels, the objectives of the *Road Noise Policy* would be achieved. It is noted that a doubling in traffic corresponds to an increase in noise levels of about 3 dB(A). As a result, a significant increase in traffic volumes would need to occur to result in increase of 2 dB(A).

Construction would generate heavy vehicle movements associated with the transportation of construction machinery, equipment and materials to the site. Light vehicle movements would be associated with employees and smaller deliveries. It is estimated that up to about 10 heavy vehicles per day would access the proposal site during construction. This equates to a maximum increase of approximately two truck movements per hour (or one movement each way) on the local road network.

The existing traffic volumes on Remembrance Drive are provided by the *Picton to Cobbitty Tanker Route Tankering Traffic Study* (AAJV, August 2014). The annual average daily traffic volume along Remembrance Driveway is 10,707 with 870 heavy vehicle movements per day.

An additional two truck movements per hour as a result of the proposal would be a negligible increase compared with the existing traffic volumes. Therefore traffic noise level increases

[2] http://www.environment.nsw.gov.au/noise/roadnoiseappnotes.htm 12 December 2012

would not be significant, and no construction traffic noise impacts are anticipated at any sensitive receiver. The project would be acceptable from a construction traffic perspective.

4.2 Construction vibration

Energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the:

- efficiency of the energy transfer mechanism of the equipment (i.e impulsive; reciprocating, rolling or rotating equipment)
- frequency content
- impact medium stiffness
- type of wave (surface or body)
- ground type and topography.

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. The *Environmental Noise Management Manual* (RTA, 2001) provides typical construction equipment ground vibration levels at 10 metres. The rate of vibration attenuation can be calculated from the following regression analysis formula:

- $V = D^{-n}$, *where*
- V = Peak Particle Velocity
- D = Distance
- n = attenuation exponent. The value of n generally lies between 0.8 and 1.6 with a relatively common value of 1.0

The predicted ground vibrations at various distances are shown in Table 4-4 for typical equipment that may be used, based on data from the *Environmental Noise Management Manual* (RTA, 2001).

Table 4-4 Typical vibration levels at distances (mm/s Peak)

Plant item	Distance from source			
	10 m	20 m	50 m	100 m
Roller (15 tonne)	7 to 8	3.8	1.5	0.8
Dozer	2.5 to 4	1.6	0.7	0.3
Backhoe	1.0	0.5	0.2	0.1

The nearest residential receivers are located over 320 m from the site. The construction activities to be undertaken onsite would not generate significant levels of vibration to impact these residential receivers. Therefore, no human comfort vibration impacts are predicted at any sensitive receiver outside of the proposal site. It is also unlikely that the proposed construction equipment would cause structural damage on the site.

4.3 Operational noise

4.3.1 The proposal - noise generating equipment

As noted in Section 2.2.1, the dominant existing operational noise source on site is the surface aeration equipment within the existing IDAL tanks (IDAL 1 and IDAL 2). Noise measurements were undertaken on the site to determine the existing surface aerator sound power levels.

ENSure has prepared a concept design for the proposal. Detailed information on the proposed design is provided in the report *Picton WRP Upgrade and Amplification – Stage 2 Concept Design Report* (ENSure, October 2014). The design incorporates features to minimise the potential for off-site noise and vibration impacts. The key features of the design relevant to the noise and vibration assessment, including the proposed mitigation features, are described below.

As part of a separate project, the existing surface aerators will be upsized in December 2014 from 22 kW to 37 kW. A typical 37 kW electric motor has a sound power level of 80 dB(A) which is more than 10 dB(A) below the measured splash noise level from the aerators and therefore would not significantly contribute to the overall noise emission levels of the surface aerators. As such the noise from surface aerators should not significantly increase with an upsized electric motor. The existing surface aerator noise source sound power level is shown in Table 4-5.

The proposed IDAL tanks (IDAL 3 and IDAL 4) would use diffused bubble aeration rather than surface aeration. Diffused bubble aeration does not produce significant noise levels and has not been included in the assessment. Diffused bubble aeration is delivered to the proposed IDAL tanks by blowers located in an adjacent new building. Up to two blowers would be operational inside the blower room at any given time when the WRP operates at a 4 ML/day capacity.

The preliminary equipment selection is an Atlas-Copco ZS55P 55 kW positive displacement screw compressor with a variable speed drive (VSD). Manufacturer supplied noise data for the screw compressor and VSD states that the sound pressure level at the workstation will be 80 dB(A) and 74 dB(A) for the VSD drive in free field. The blower and VSD sound power levels are shown in Table 4-5.

The blower building design would include the following treatments which have been incorporated into the assessment:

- acoustic absorption panels with an NRC rating of greater than or equal to 0.8 would be installed on 50% of the wall surface area
- acoustic rated louvres would be installed with a minimum insertion loss of 30 dB in the 500 Hz 1/1 octave frequency band
- acoustic rated doors and seals would be installed with a minimum weighted sound reduction index (Rw) of 30
- all aeration pipework would be acoustically lagged with a material which provides a minimum weighted sound reduction index (Rw) of 30.

In addition to the aerators and blowers, several pumps would operate on the site where required. The noise source levels from the pumps would be more than 10 dB(A) below the aerator noise levels and would not contribute to the overall noise source levels from the site. Therefore pump noise has not been included in the predictive modelling. However pump selection during detailed design should ensure the pump sound power levels are below 90 dB(A) or, if not feasible, design pump enclosures to comply with the proposal specific noise levels.

Site measurements indicated that no tonal, low frequency, intermittent or impulsive characteristics are associated with the aerators. The blower noise source would be housed in an enclosure. Therefore the INP modifying factor adjustments have not been applied.

The proposed site layout is shown in Figure 3 and Figure 4.

Table 4-5 Equipment sound power level, dB(A)

Item	Total	Frequency (Hz)								
		31.5	63	125	250	500	1000	2000	4000	8000
Surface aerator	108	56	78	91	97	100	103	103	100	94
Blower	91	-	37	79	79	85	88	84	78	-
VSD	85	-	-	86	83	85	74	77	77	-

Note: '-' indicates data not supplied by the manufacture

4.3.2 Modelling methodology

To assess compliance with the proposal specific noise levels, noise predictions were undertaken. CadnaA v4.3 noise modelling software was used to predict the operational noise in accordance with the *ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors'* algorithm. Ground absorption, reflection, terrain and relevant shielding objects are taken into account in the calculations.

The following assumptions and calculation parameters were used in the noise model:

- land surrounding the WRP site was modelled assuming a mixture of moderate to soft ground with a ground absorption coefficient of 0.75 to represent grassy land
- the WRP site was modelled assuming a mixture of moderate to hard ground with a ground absorption coefficient of 0.25 to represent gravel
- the existing noise model was verified against noise measurements undertaken next to the aerators and on the site boundary
- atmospheric absorption was based on an average temperature of 10 °C and an average humidity of 70%
- the algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation
- One existing surface aerator is in operation at all times and the closest aerator to residences has been used for worst-case predictions. Two blowers are operating in the blower building.

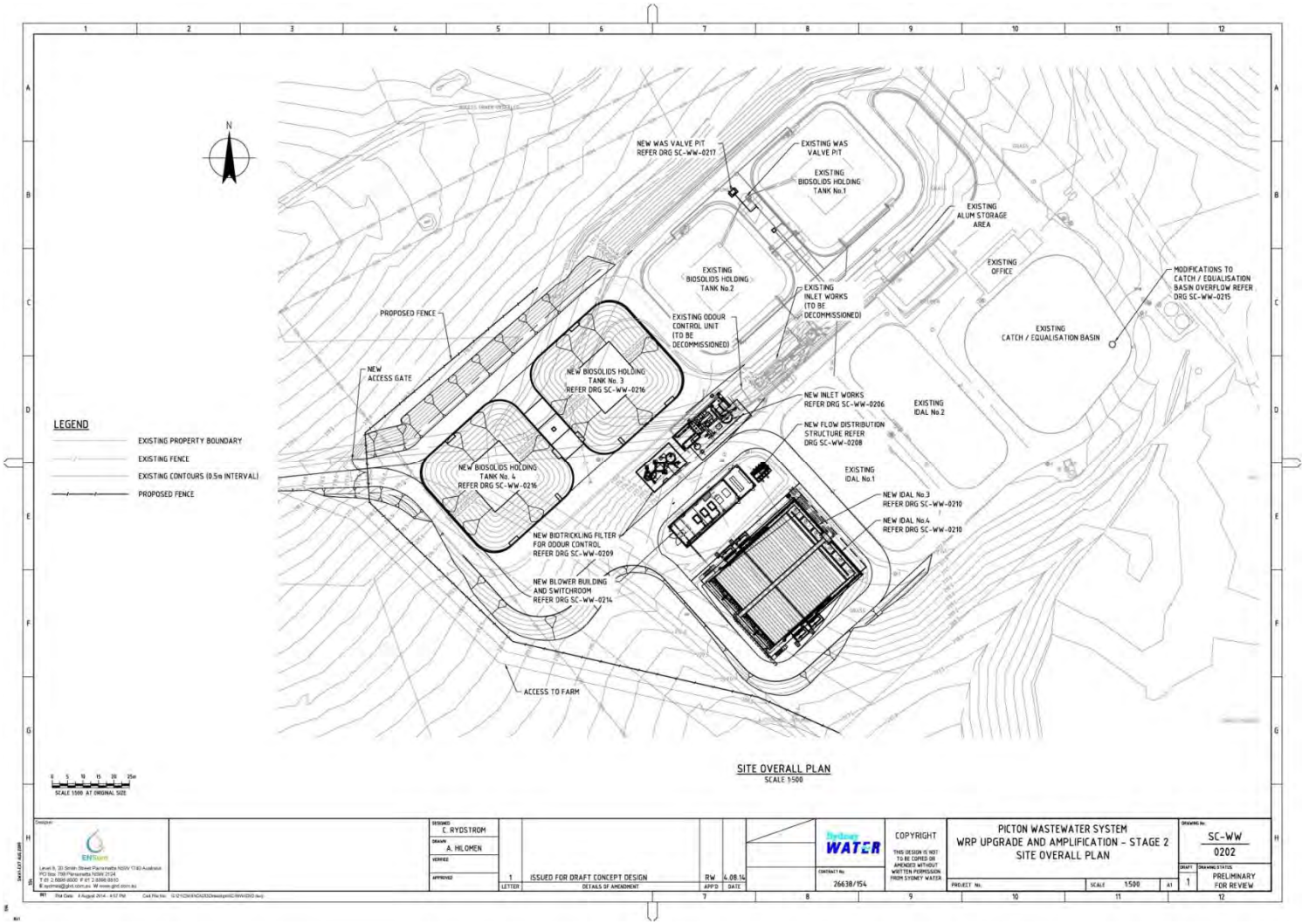


Figure 3 Proposed site layout (WRP area)

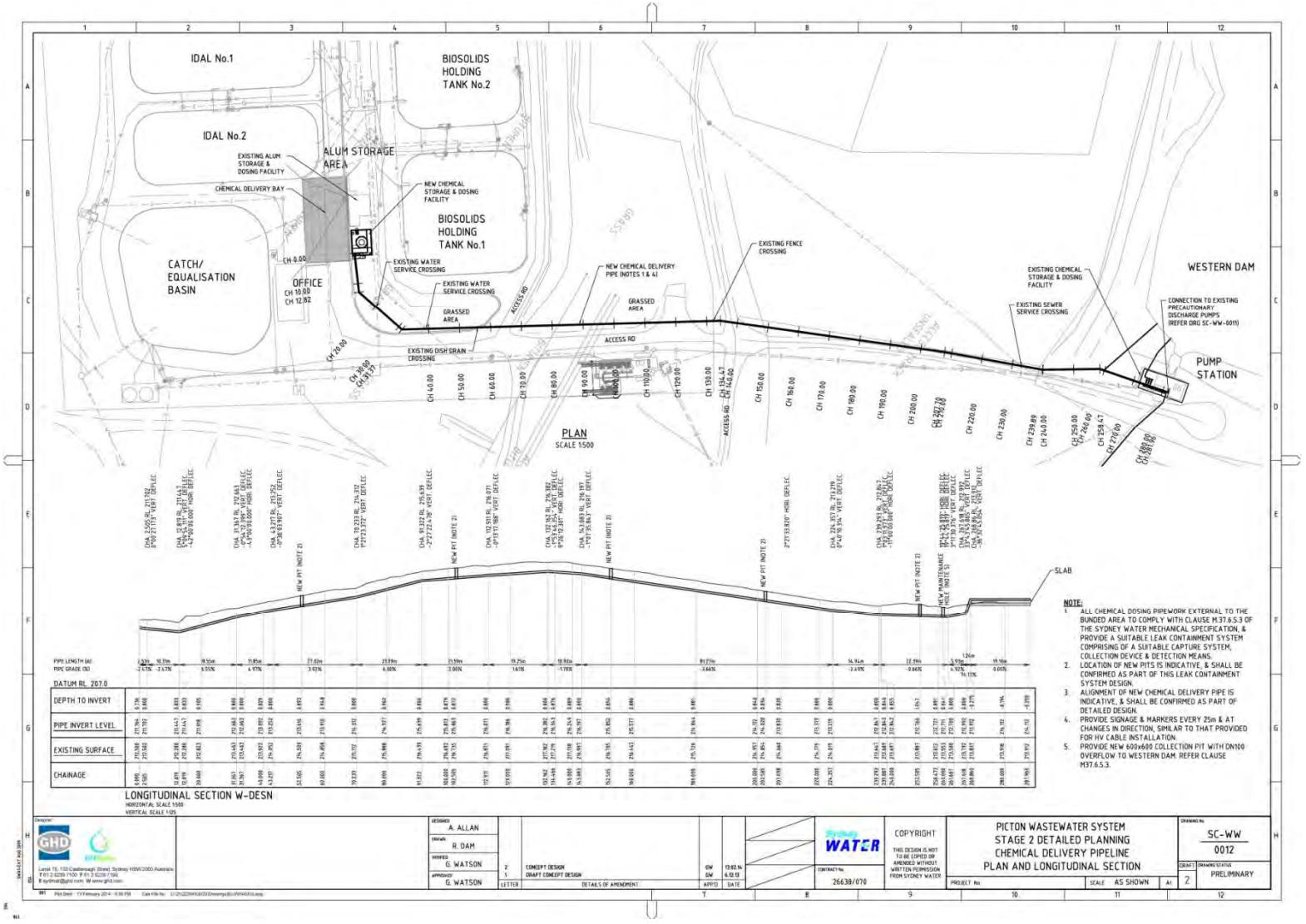


Figure 4 Proposed site layout (delivery pipework to western dam)

4.3.3 Predicted operational noise levels

The predicted noise levels are shown in Table 4-6 for the existing facility and proposed operations.

Noise contour plots for the existing and proposed scenarios are shown in Figure 5 and Figure 6 respectively.

Table 4-6 Predicted operational noise levels, dB(A)

Residential receiver	Proposal specific noise levels $L_{Aeq(15min)}$	Existing	Proposed design
2260 Remembrance Driveway	35	33	33
2290 Remembrance Driveway (Lot 29 DP 734568)		35	34
2290 Remembrance Driveway (Lot 30 DP 734568)		34	34
2300 Remembrance Driveway		35	35
2310 Remembrance Driveway		32	32
2326 Remembrance Driveway		31	31
2330 Remembrance Driveway		31	31
2360 Remembrance Driveway		30	30
2245 Remembrance Driveway (Lot 2 DP 1042285)		31	29

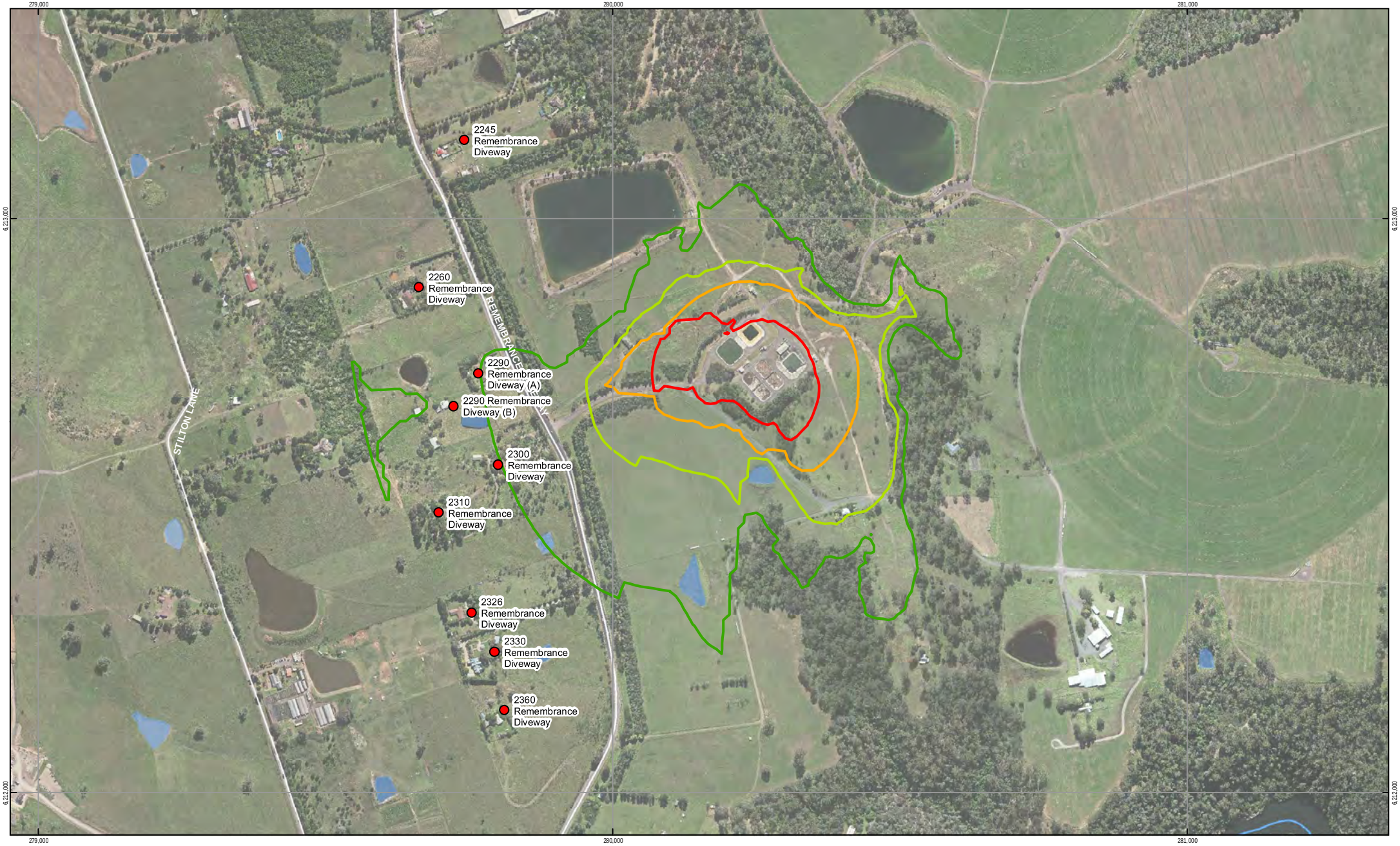
4.4 Operational noise impacts

The noise levels from the blower building do not significantly increase noise emissions from the site and the blower building shields some of the receivers to the west of the site which provides a slight reduction in noise levels. The modelling predicts that the proposal specific noise levels would not be exceeded. Sleep disturbance impacts are not expected at any residential receivers as the noise levels are continuous in nature and well below the sleep disturbance criteria.

During detailed design, blower building design and pump selection would ensure operating noise levels meet the proposal specific noise levels at the nearest residence. During commissioning of the proposal, noise monitoring would be conducted to assess performance against the proposal specific noise levels. Although unlikely, should this monitoring identify any exceedance, mitigation measures would be considered to reduce received noise levels to acceptable levels. General operational mitigation measures are provided in Section 5.2.

4.5 Operational vibration

No significant operational vibration sources are associated with the proposal therefore no operational vibration impacts at sensitive receivers are anticipated.



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Legend

- Noise sensitive receivers

Noise level contours, dB(A)

- 35
- 40
- 45
- 50

Sydney Water
Picton wastewater flows

Job Number	21-2284914
Revision	B
Date	14 Nov 2014

Noise level contours – existing operations, dB(A)

Figure 5

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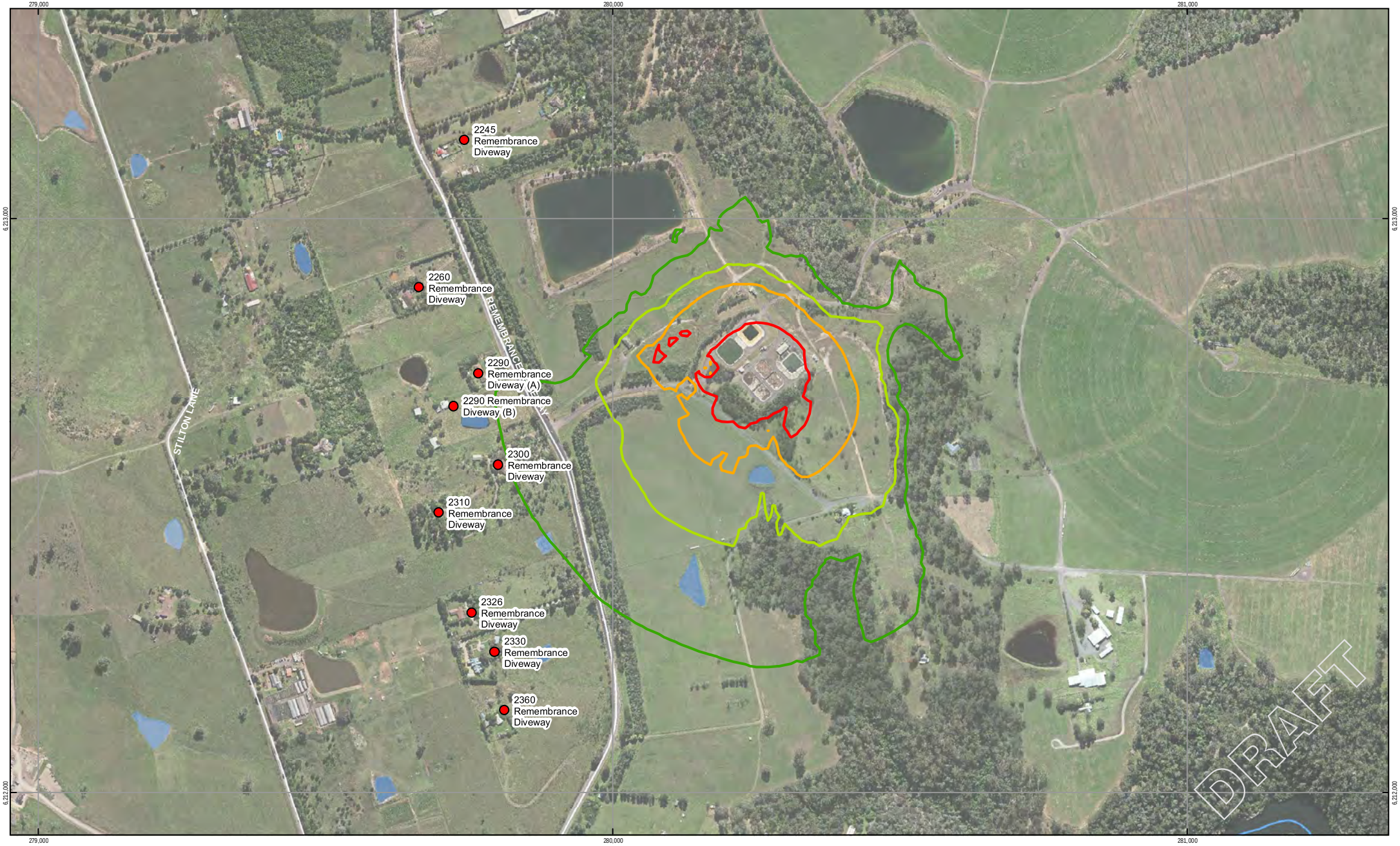
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung



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Legend

- Noise sensitive receivers

Noise level contours, dB(A)

- 35
- 40
- 45
- 50

Sydney Water
Picton wastewater flows

Noise level contours – proposed operations, dB(A)

Job Number	21-2284914
Revision	B
Date	14 Nov 2014

Figure 6

N:\AU\Sydney\Projects\21\22849\GIS\Maps\Deliverables\Picton\21_22849_Z059_Noise contours_Proposed.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2012; Geoscience Australia: 250k Data - Jan 2012; NSW Department of Primary Industry - Jan 2012; Sydney Water Imagery Jan 2013. Created by: qjchung

5. Mitigation measures

5.1 Construction noise mitigation measures

5.1.1 Standard mitigation measures

There is the potential that construction activities could exceed the construction noise management levels for the proposal. The measures provided below would be implemented to minimise potential construction noise and vibration impacts.

Construction noise mitigation measures
All feasible and reasonable noise mitigation measures would be implemented during construction in accordance with *AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites* and the *Interim Construction Noise Guideline* (DECC, 2009).
Works would be conducted in accordance with the Sydney Water Noise Management Procedure (SWEMS0056) and Noise Management Code of Behaviour (SWEMS0056.01).
Site inductions Inductions for the work crew would include the specific noise issues and mitigation measures required for the site. The induction would include: • all relevant project specific and standard noise mitigation measures • relevant licence and approval conditions • permissible hours of work • location of nearest sensitive receivers • construction employee parking areas • designated loading/ unloading areas and procedures • site opening/closing times (including deliveries) • behavioural practices including: – avoiding the use of outdoor radios when working outside the recommended standard hours – avoiding shouting and slamming doors – where practical, operating machines at low speed or power and switching off when not being used rather than left idling for prolonged periods – minimising reversing – avoiding dropping materials from height and avoiding metal to metal contact on material.
Property owners/occupiers would be informed in advance of construction, and a contact phone number for any complaints or concerns would be provided.
A community information telephone line would be established and maintained during construction. Any complaints would be managed in accordance with Sydney Water's Customer Complaint Procedure.
The use of truck engine brakes would be minimised when trucks enter or leave the proposal site.
Vibration levels would not exceed those recommended in the standard, DIN 4150-3 1999: Structural Vibration – Part 3: Effects of vibration on structures. Construction activities would be conducted in accordance with the limits of German Standard DIN 4150: Part 3 – 1999-02 – Effects of Vibration on Structures.

Construction noise mitigation measures
Out of hours work Where out of hours work is required: • the contractor's environmental representative would assess the need for additional mitigation measures such as noise monitoring, noise barriers, and notification of affected landholders • where possible, activities likely to generate the highest levels of noise would be scheduled to occur at the beginning of the shift (prior to 10pm) to minimise the potential for sleep disturbance • all workers would be briefed on the need to minimise noise as a result of their activities.

5.2 Operational mitigation measures

Operational noise levels are anticipated to comply with the proposal specific noise levels if the following mitigation measures are implemented.

Operational noise mitigation measures
During commissioning, a single period of noise monitoring would be undertaken to assess performance against the proposal specific operational noise levels and EPL noise limits.
Noise and vibration complaints would be managed in accordance with Sydney Water's Customer Complaint Procedure.

6. Conclusion

It is predicted that, during recommended standard construction hours for some activities, noise generated by construction of the proposal would have the potential to exceed the noise affected construction noise management level at residential receivers. For out of hours work, noise levels are likely to range from 40 to 45 dB(A) at the nearest residential receivers. Residential receivers within 800 m of the works may experience noise that exceeds the out of hours construction noise management level of 37 dB(A). The sleep disturbance criteria is not anticipated to be exceeded. Where exceedances are identified, reasonable and feasible construction noise mitigation measures would be implemented, which would minimise noise impacts at potentially affected receivers.

The proposed construction works would not be sufficient to generate human comfort vibration impact at any sensitive receiver outside of the proposal site. It is also unlikely that the proposed construction equipment would cause structural damage on the site.

During operation, there would be a slight improvement in noise levels compared to the existing situation. The blower building would shield some of the receivers to the west of the site, which would provide a slight reduction in noise levels.

The predicted operational noise levels indicate that the proposal specific noise levels would not be exceeded. During detailed design, the design of the blower building and equipment selection would ensure that the operating noise levels would meet the proposal specific noise levels.

During commissioning of the project, noise monitoring would be conducted at the WRP site to assess performance against the proposal specific operational noise levels and EPL noise limits.

The proposal would be acceptable from an acoustic perspective, assuming the recommended mitigation measures are implemented.

7. References

Assessing Vibration a Technical Guideline, Department of Environment and Conservation, February 2006

Code of practice for noise and vibration control on construction and open sites, BS 5228-1, British Standards, 2009

Environmental Criteria for Road Traffic Noise, Environmental Protection Authority, 1999)

Environmental Noise Management Manual (RTA, 2001)

Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), BS 6472 – 1992, British Standards, 1992

Guide to noise and vibration control on construction, demolition and maintenance sites, *AS 2436 - 2010,* Australian Standards, 2010

Industrial Noise Policy, Environmental Protection Authority, January 2000

Interim Construction Noise Guideline, Department of Environment and Climate Change, July 2009

ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors, International Organization for Standardization, 1996

Picton to Cobbitty Tanker Route Tankering Traffic Study (AAJV, August 2014)

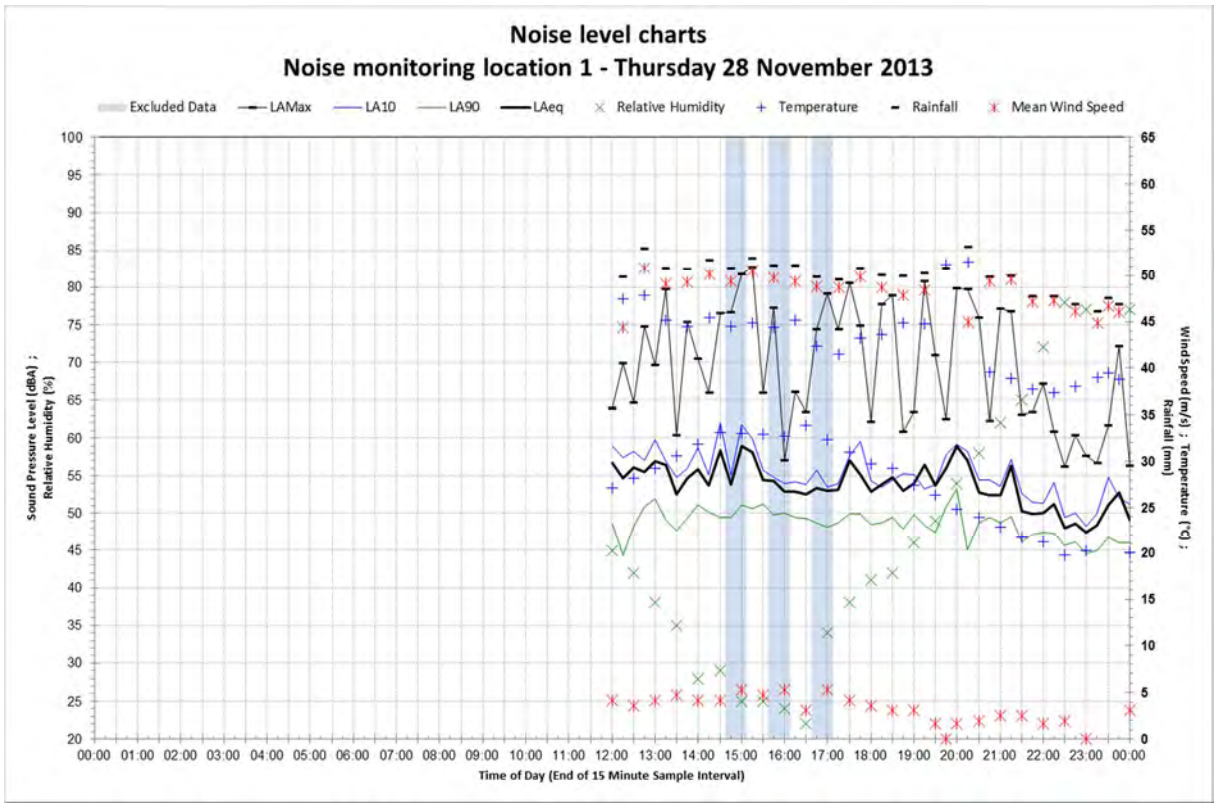
Picton Sewerage Treatment System Environmental Protection License 10555

Road Noise Policy, Office of Environment and Heritage, March 2011

Structural Vibration Part 3: Effects of vibration on structures, *DIN 4150-3 -1999,* German Standards, 1999

Appendix A - Noise monitoring charts

Appendices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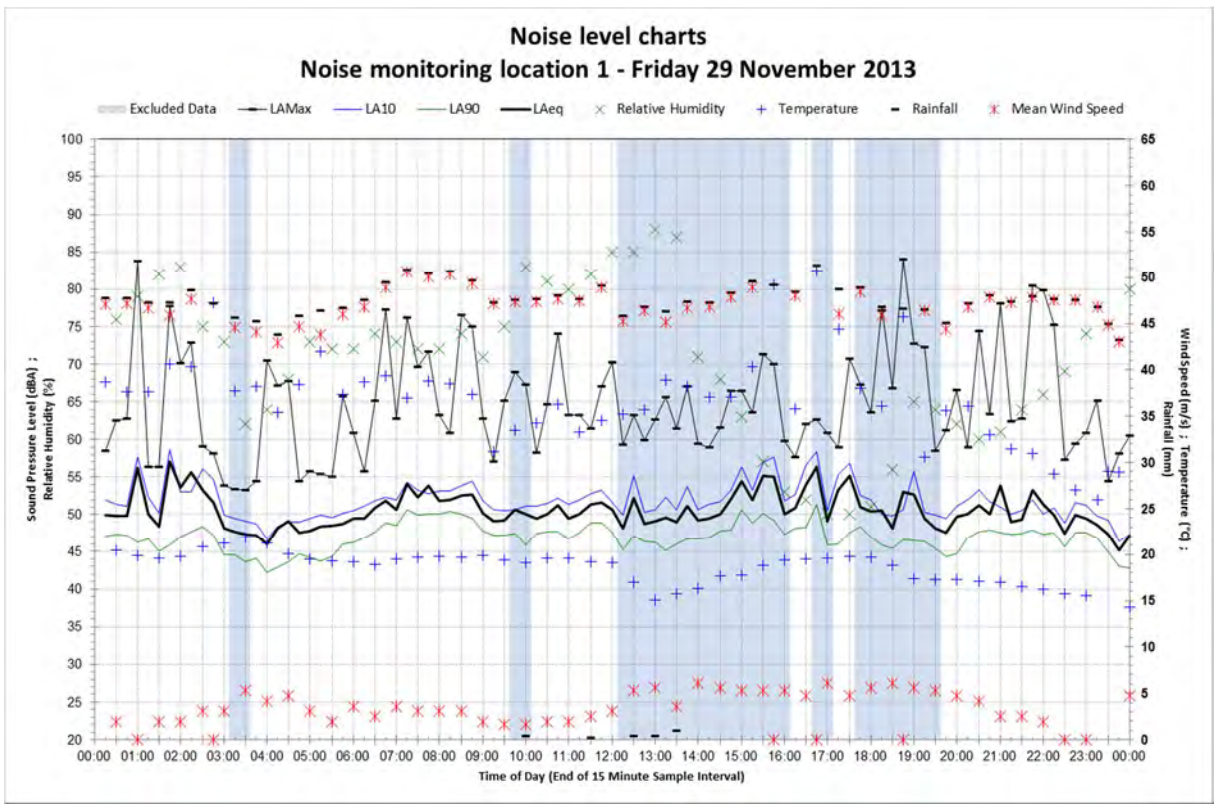
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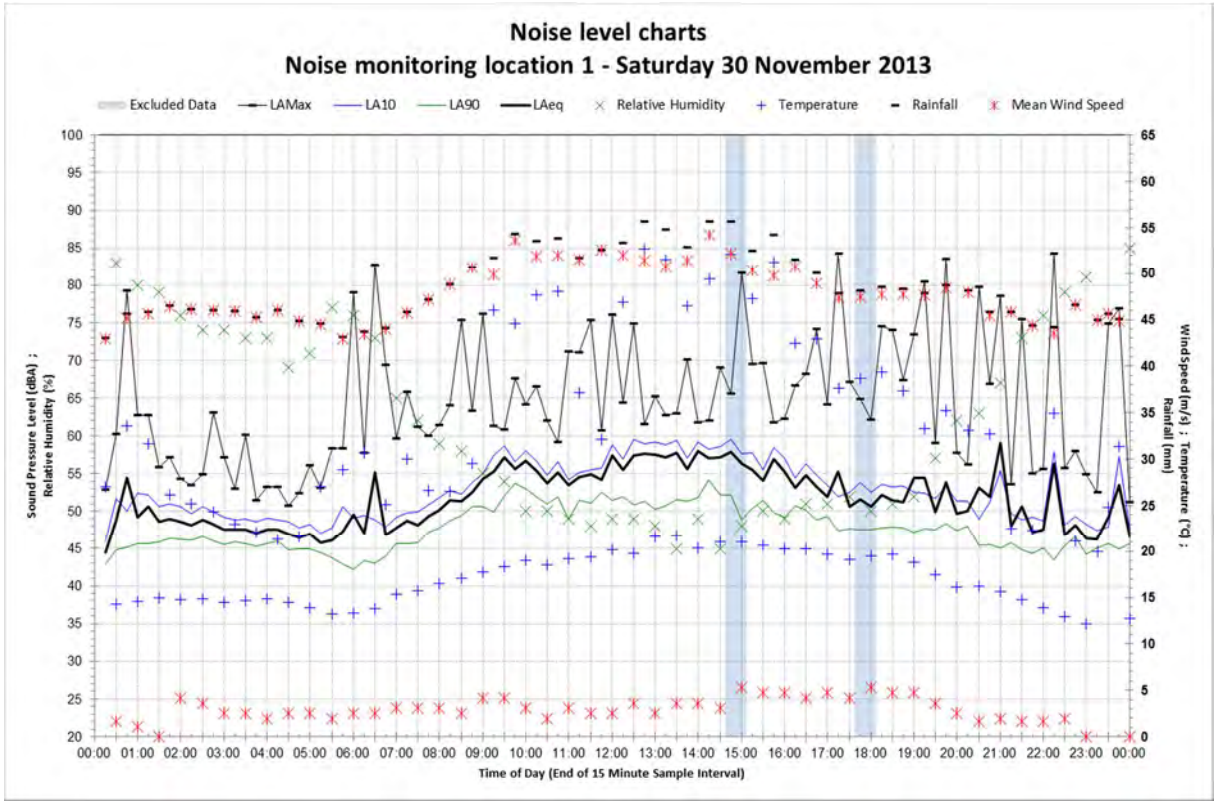
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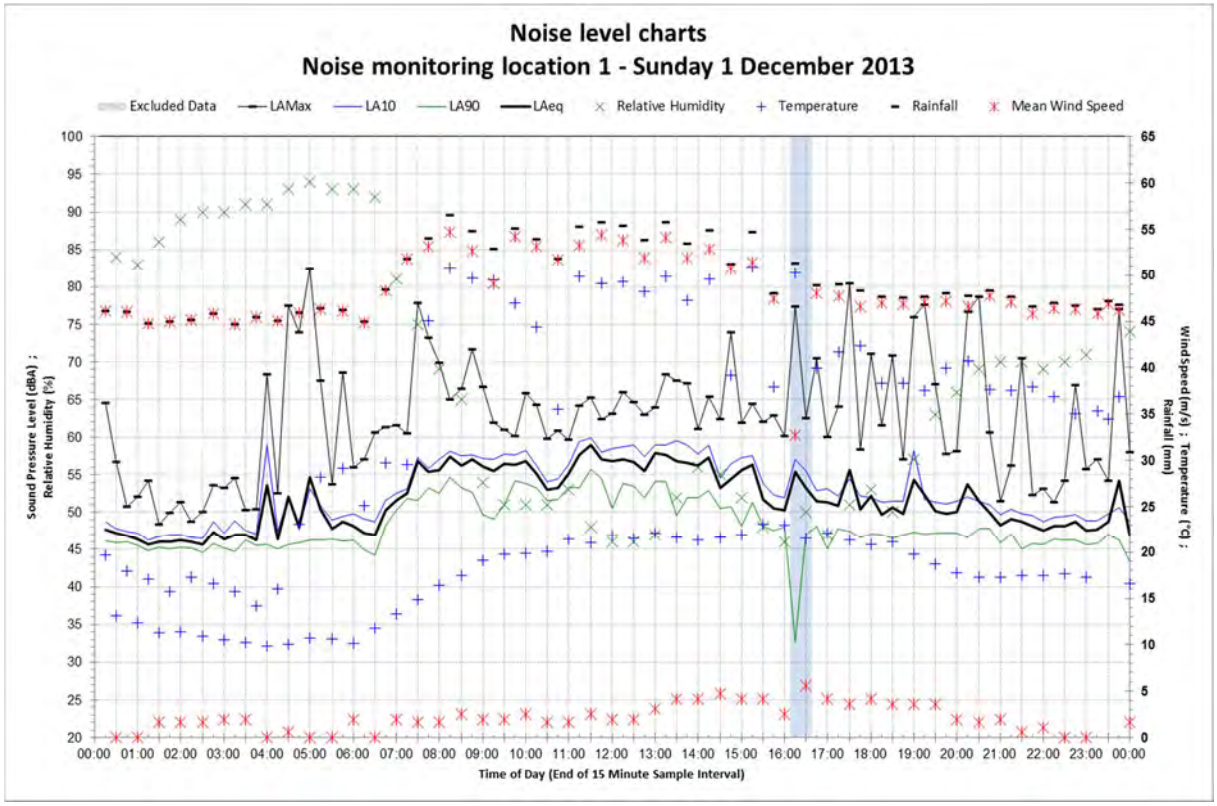
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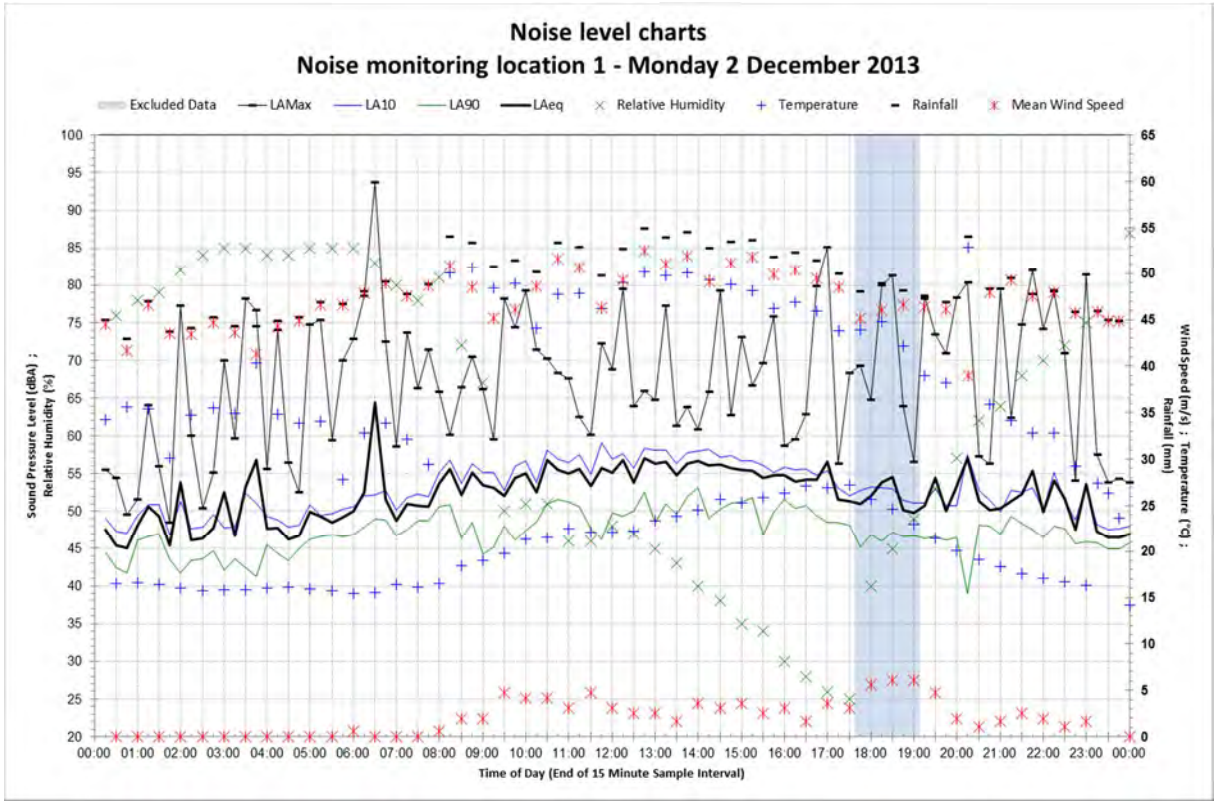
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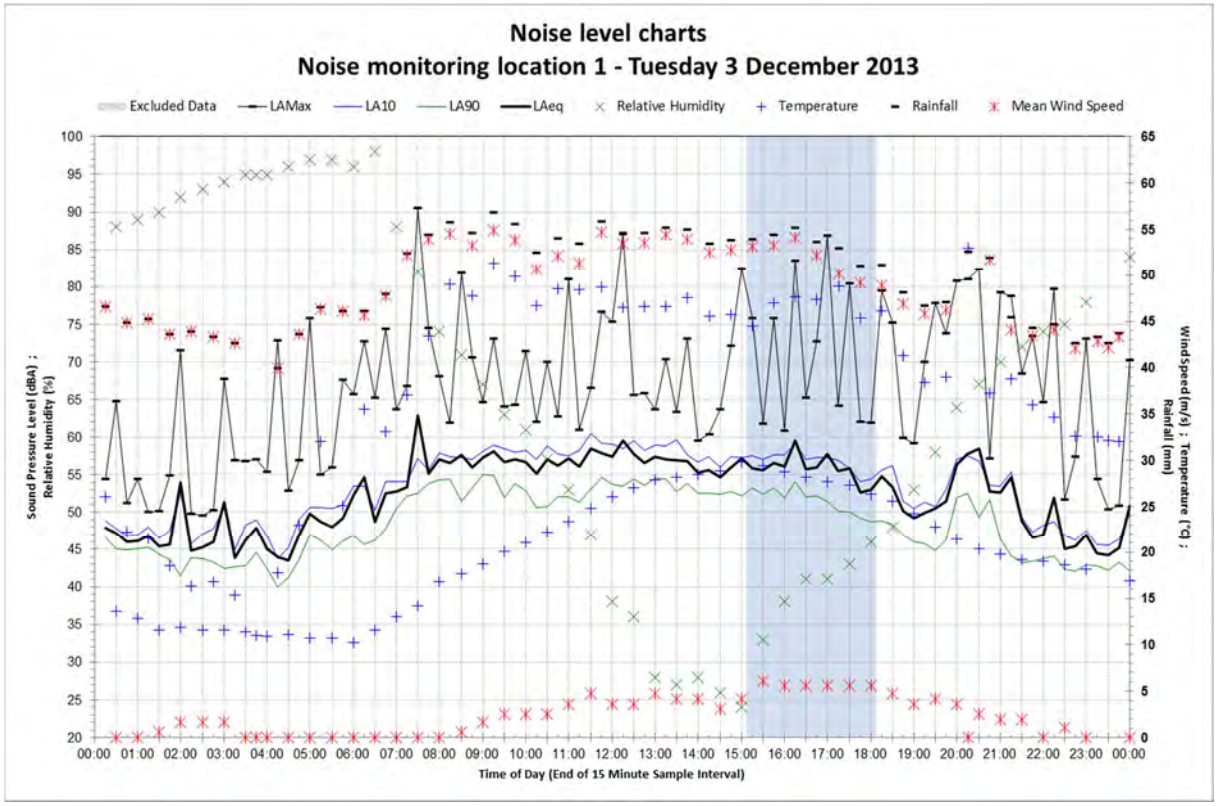
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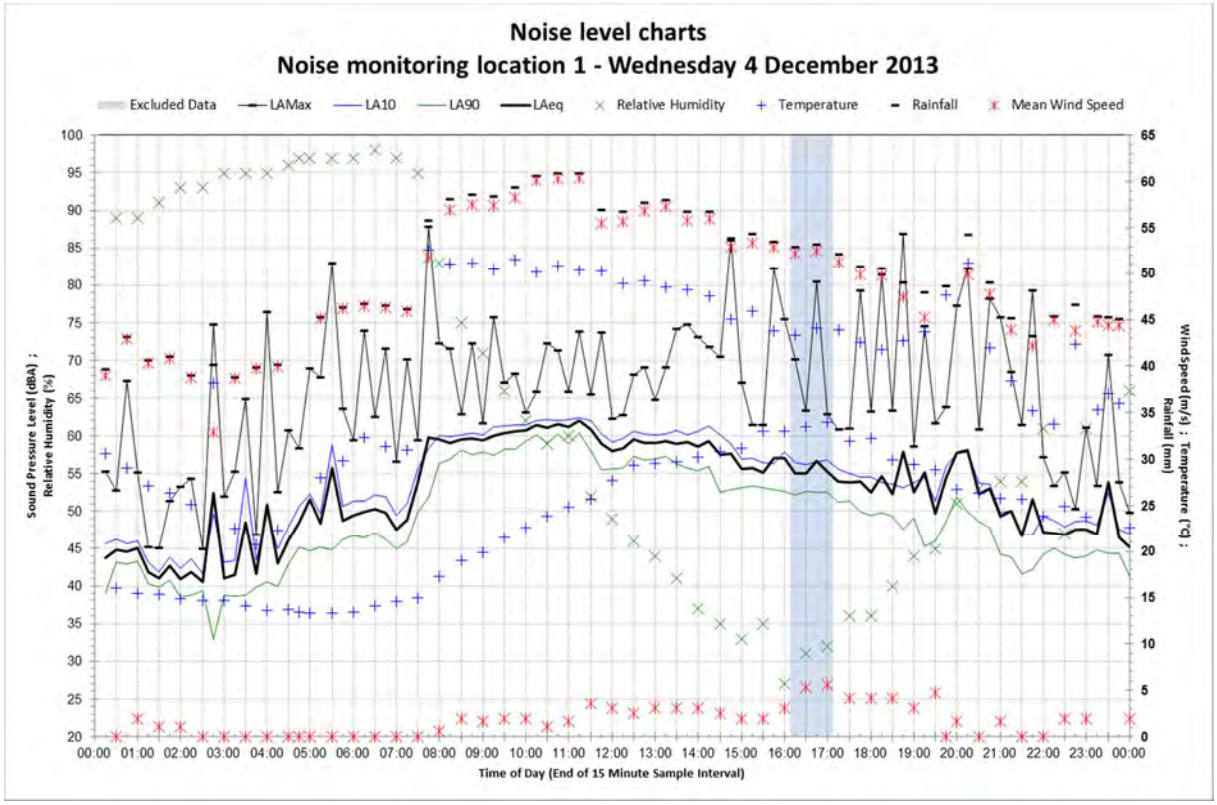
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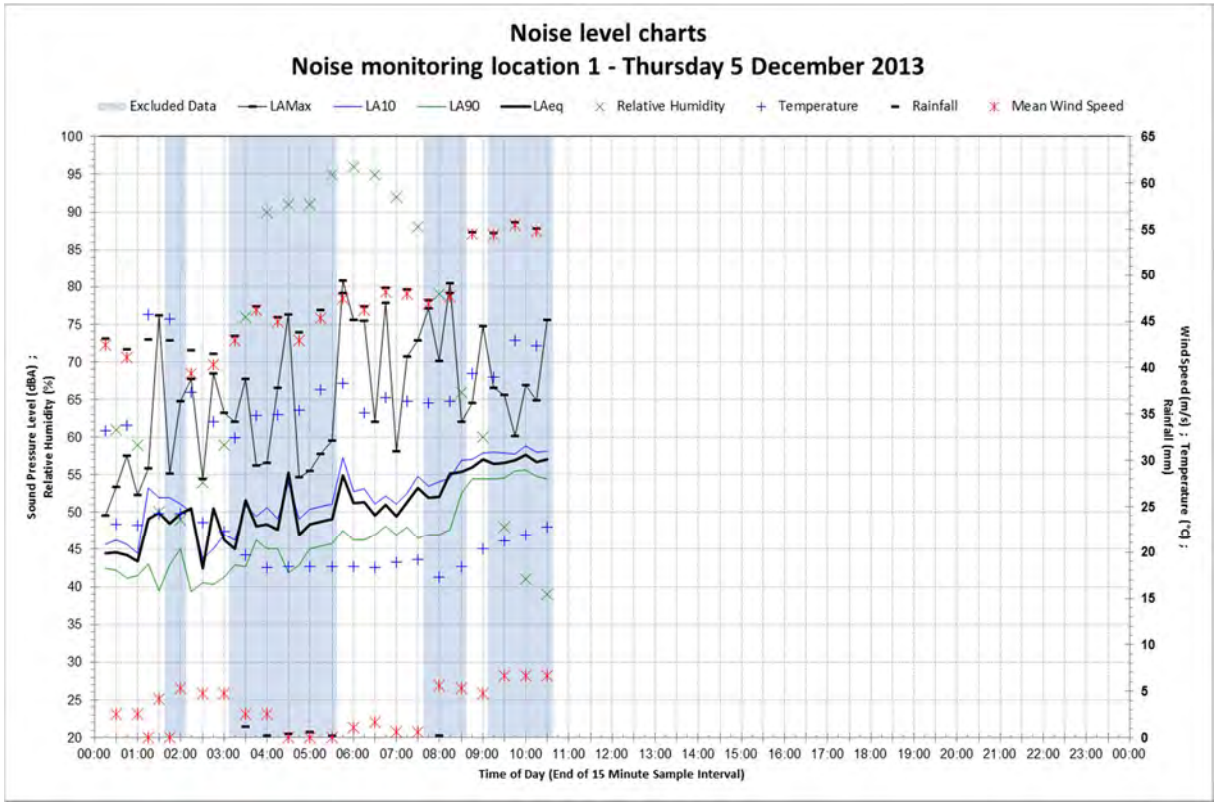
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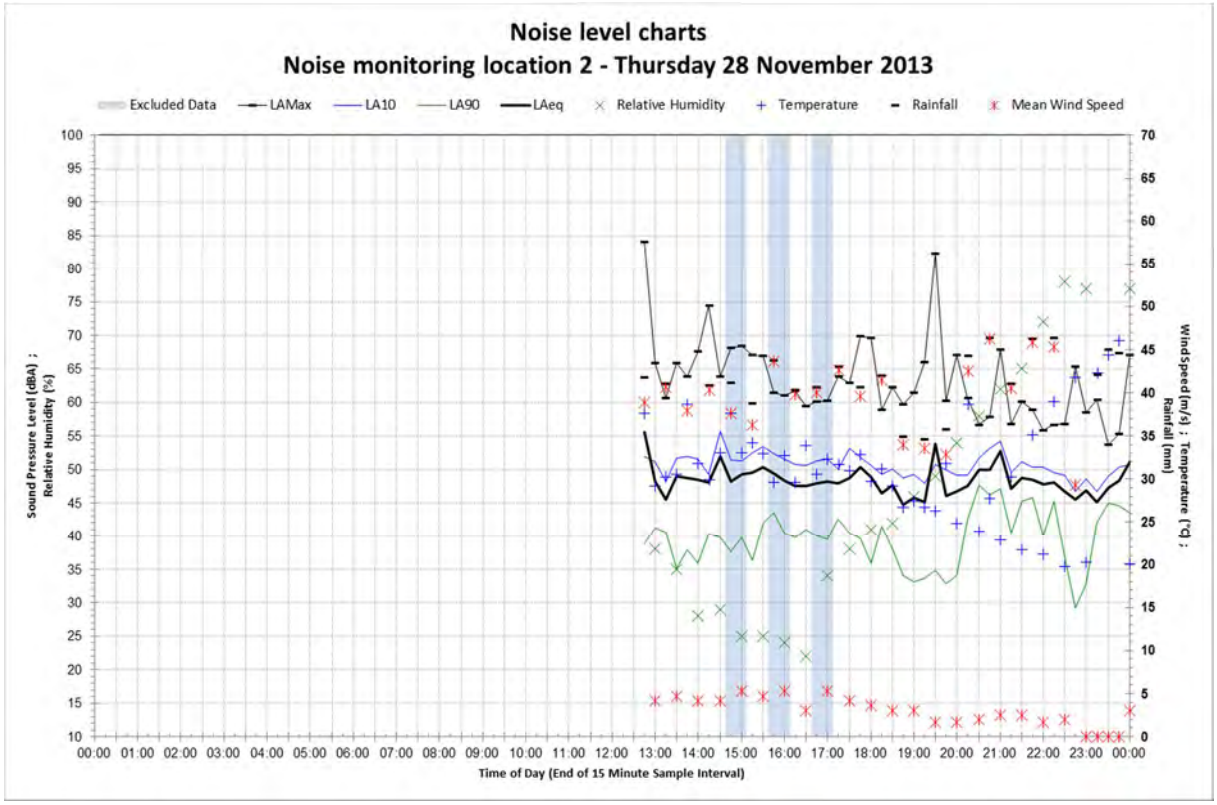
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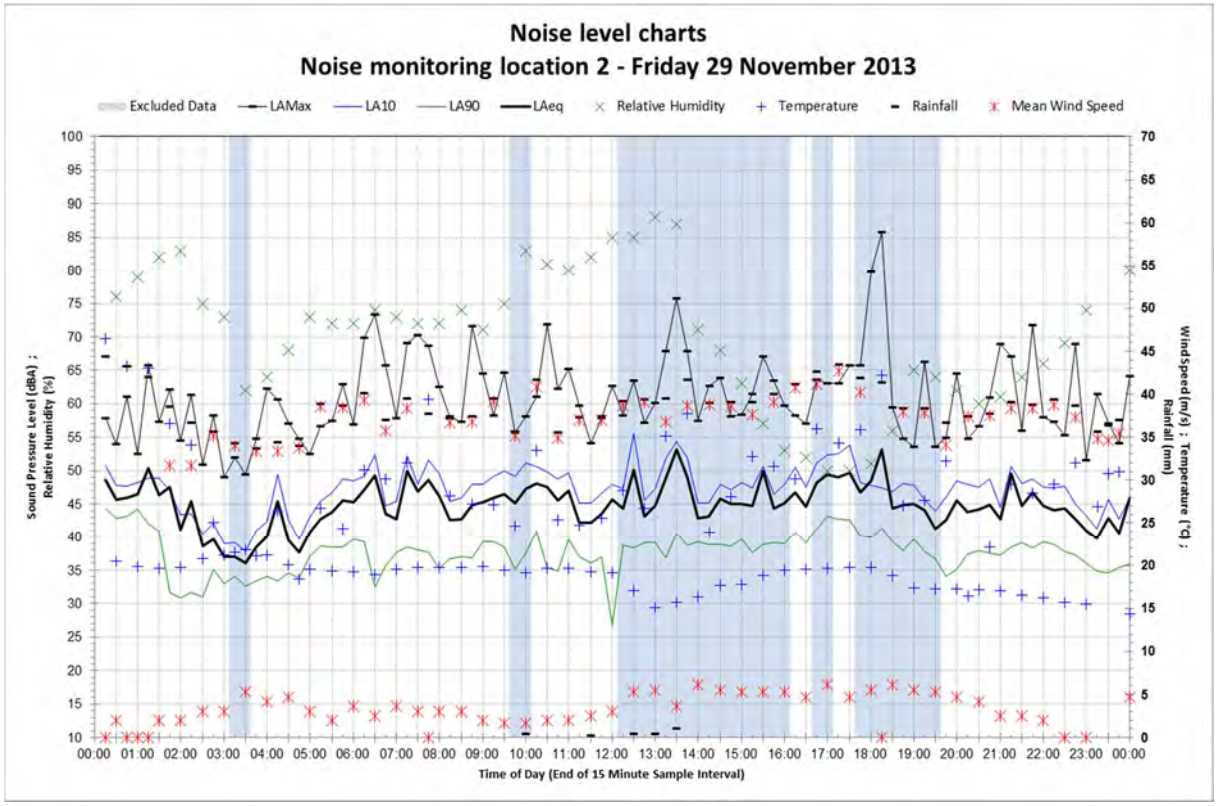
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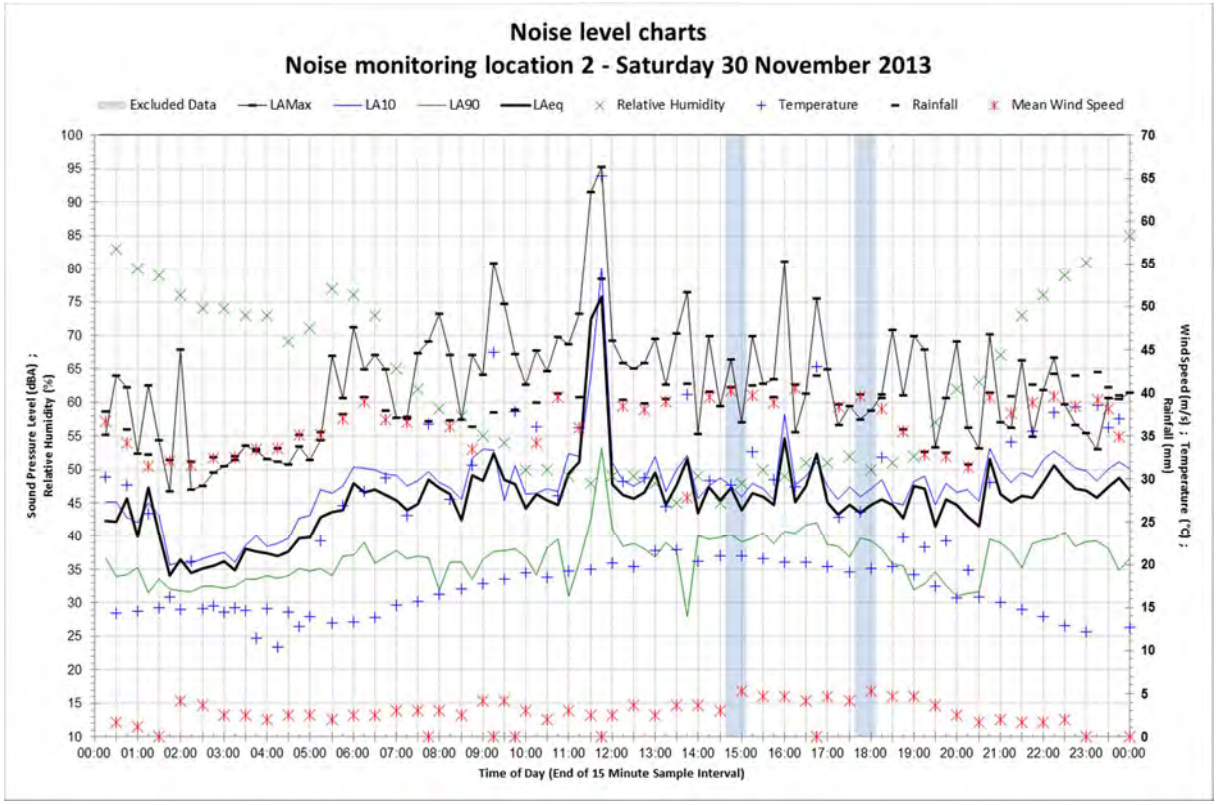
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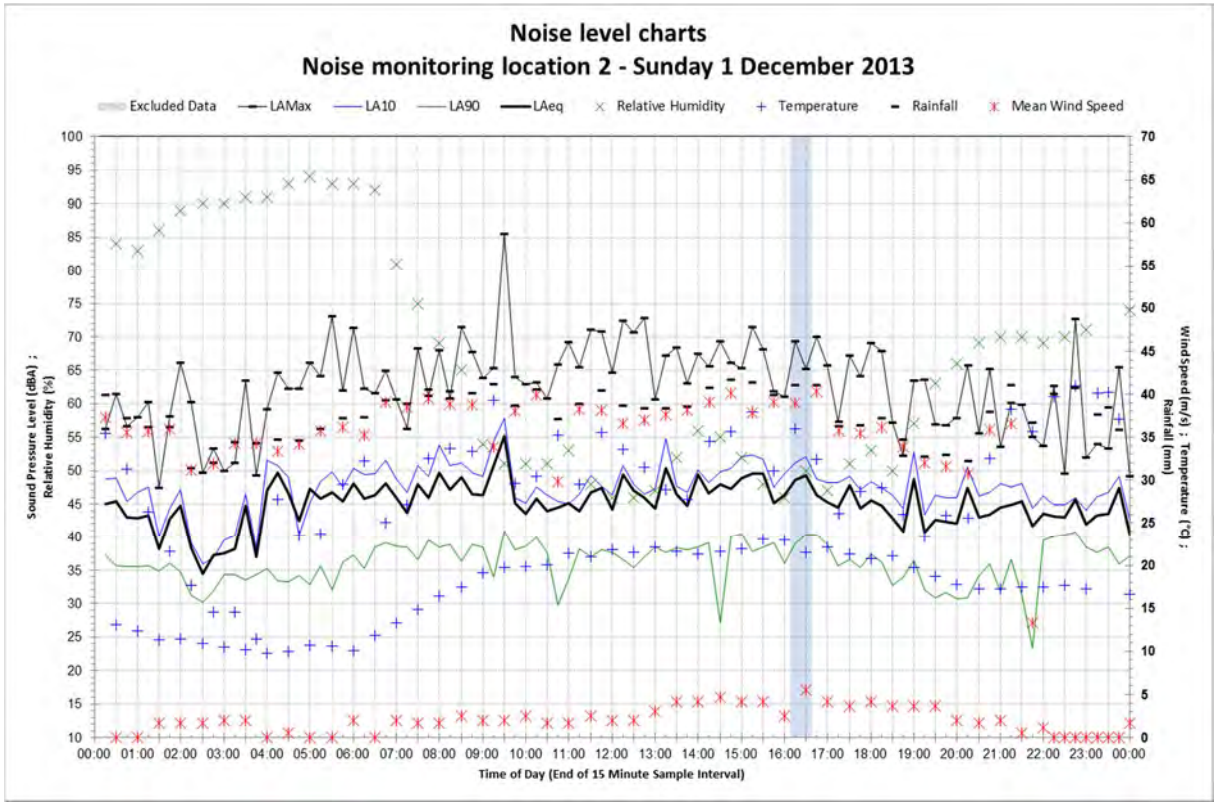
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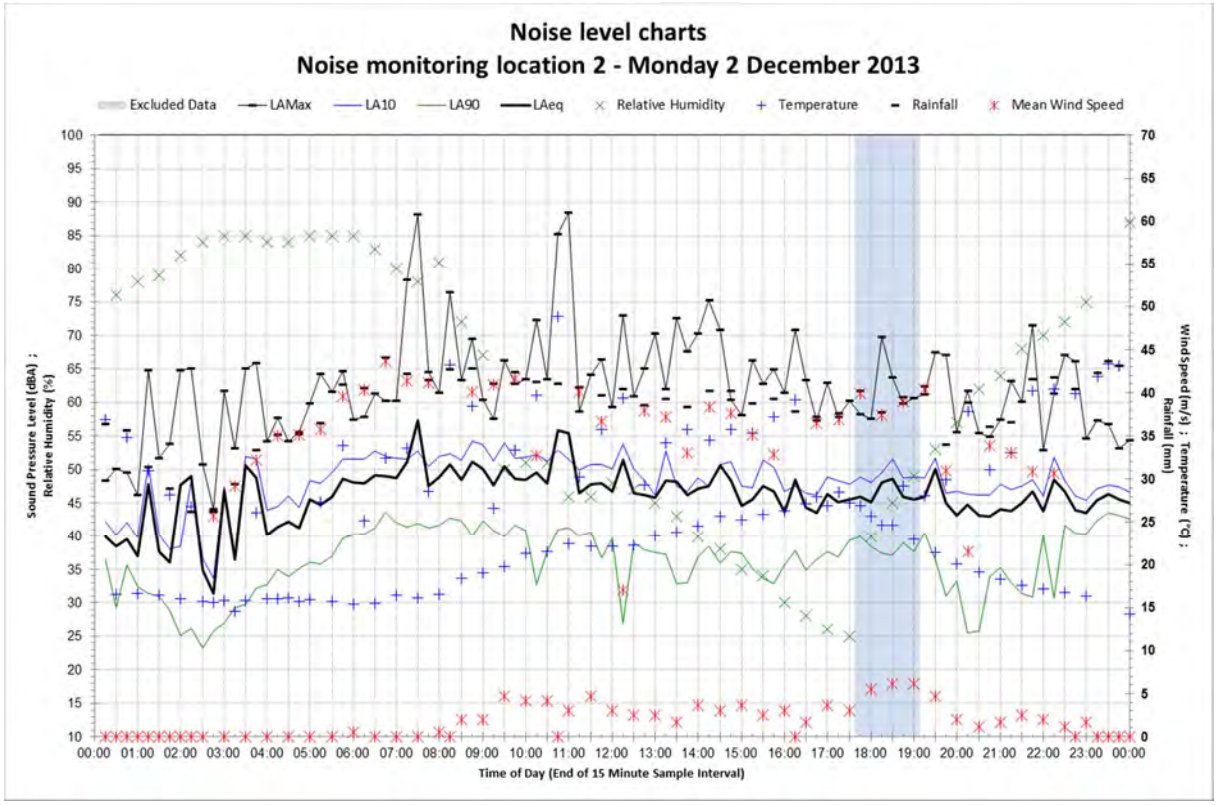
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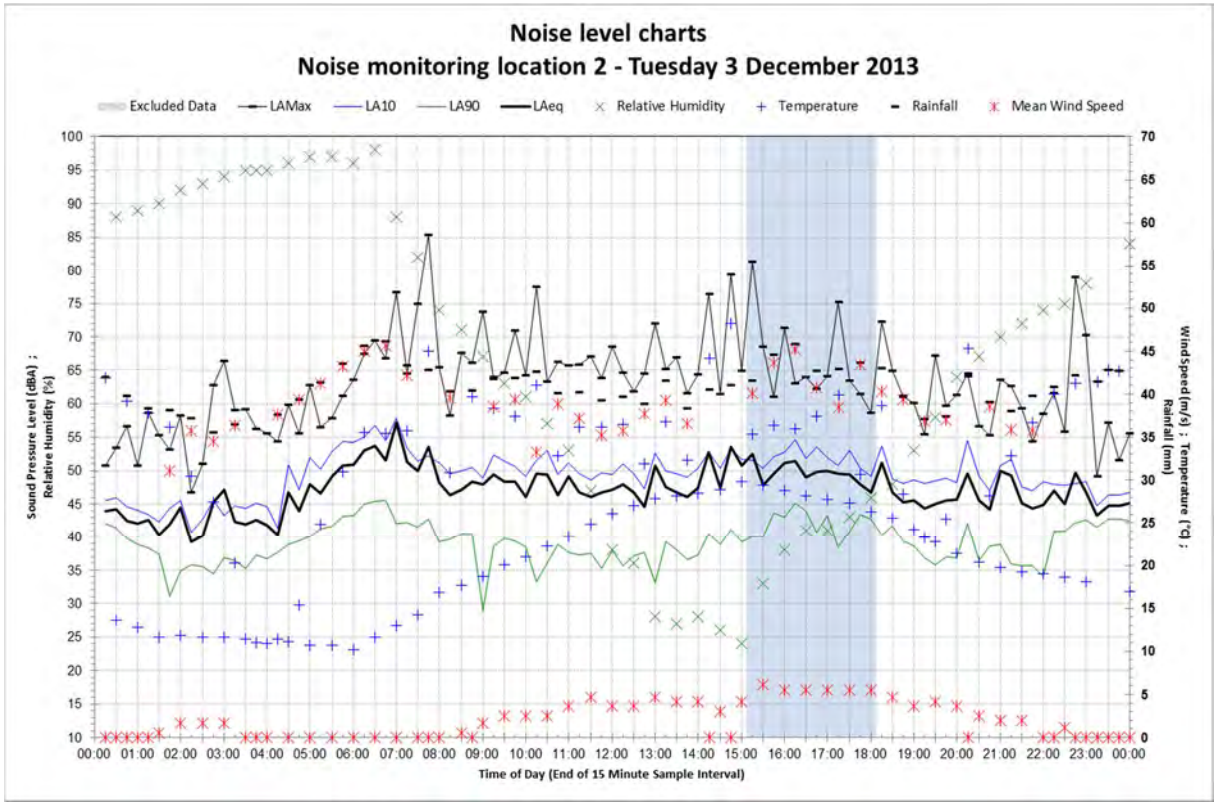
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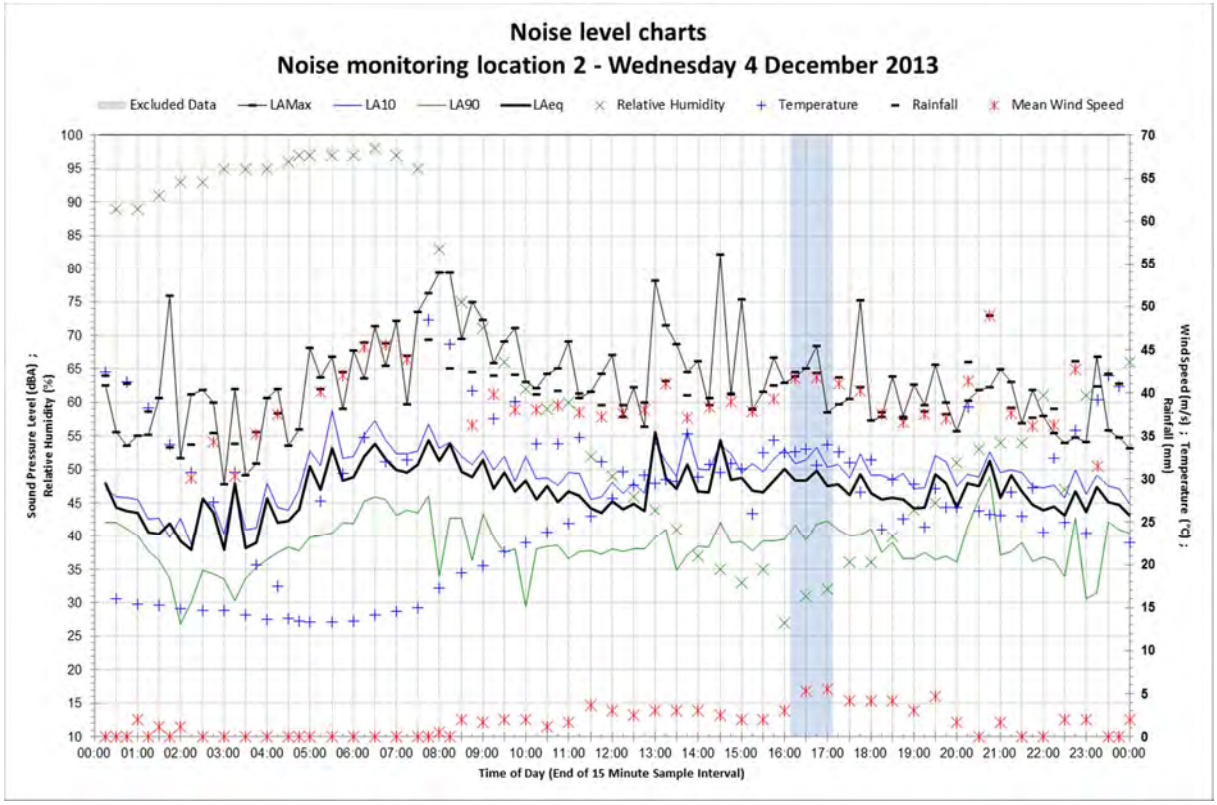
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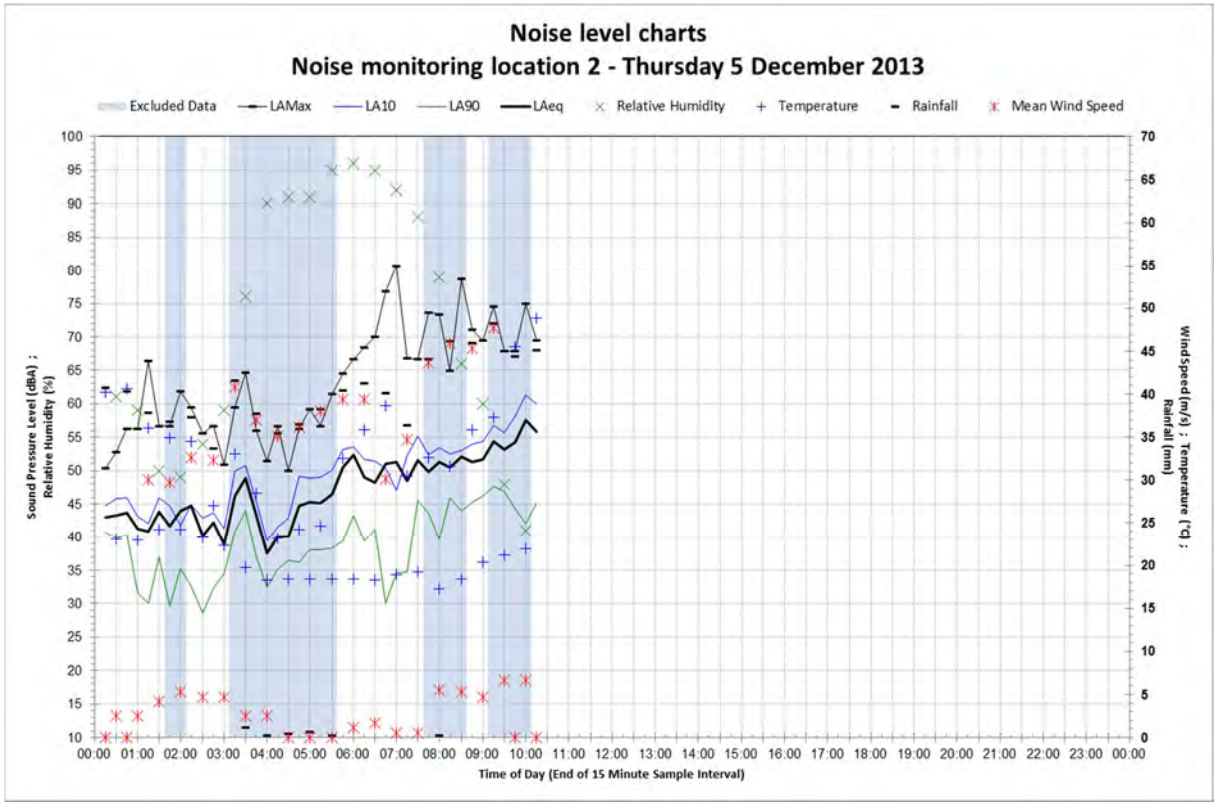
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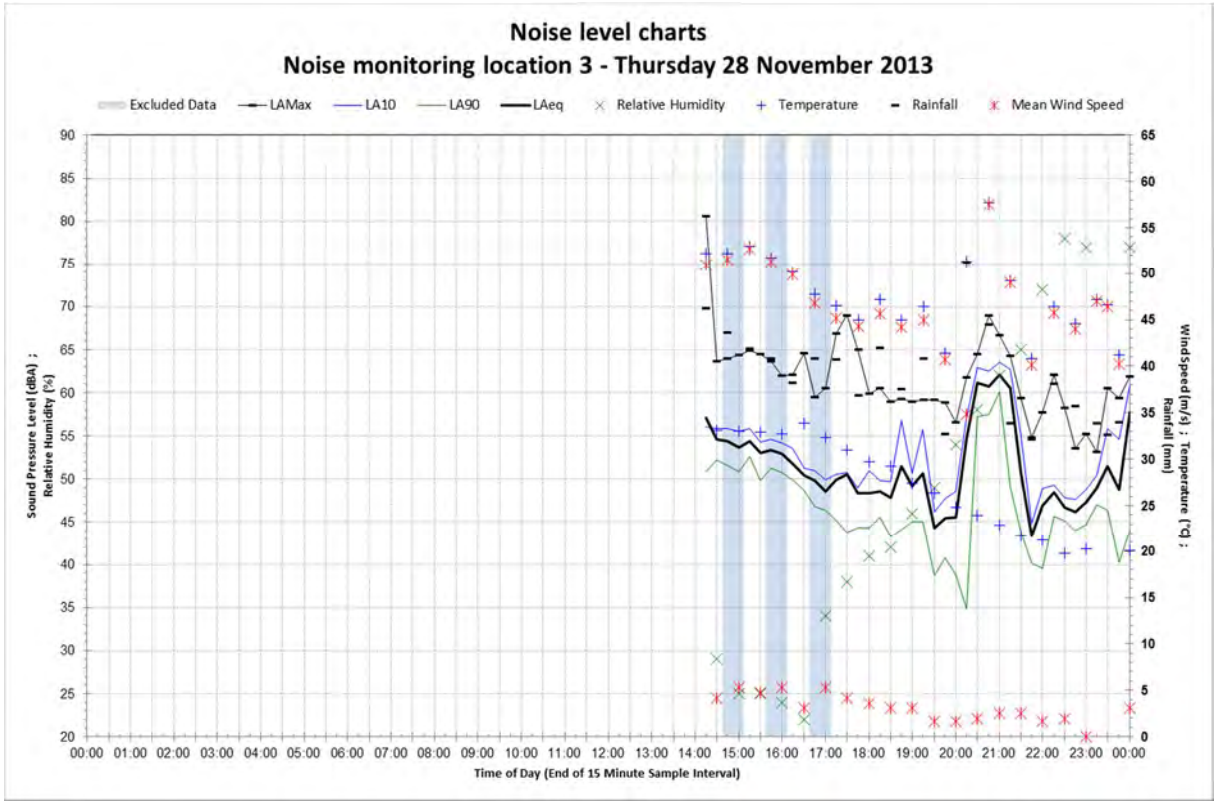
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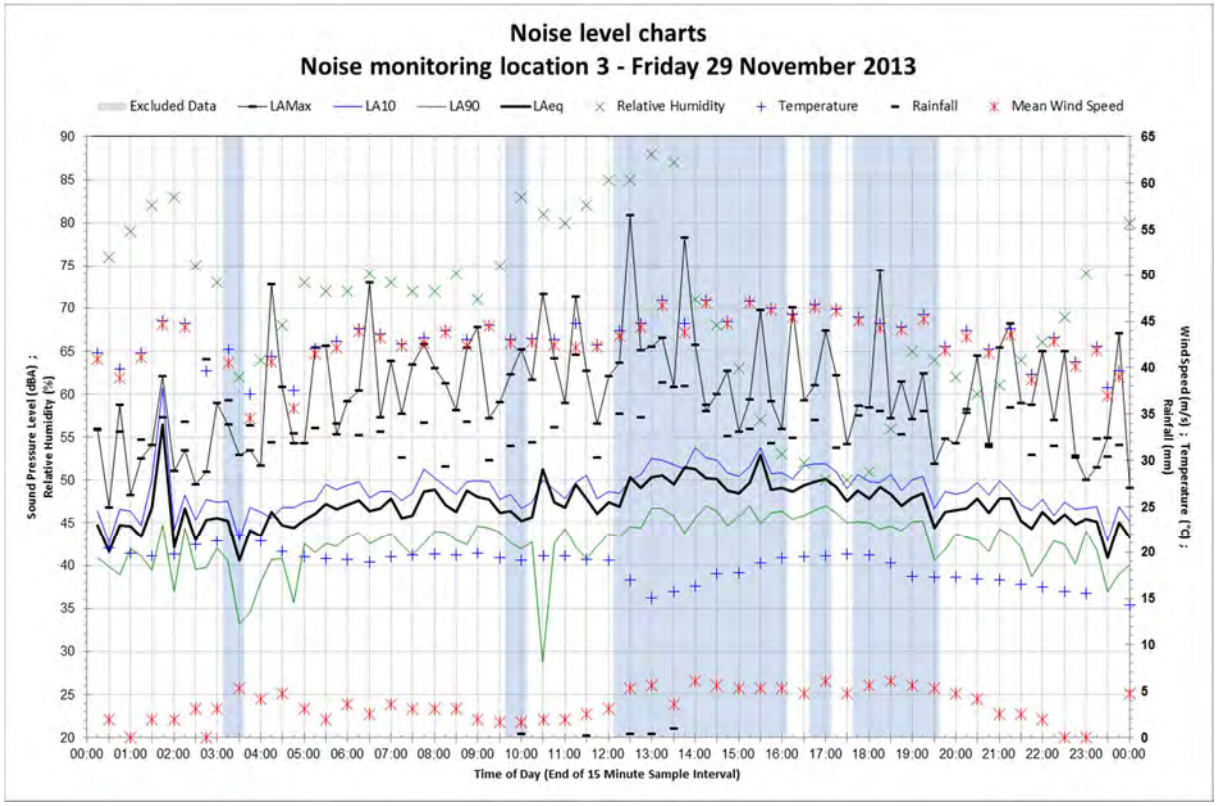
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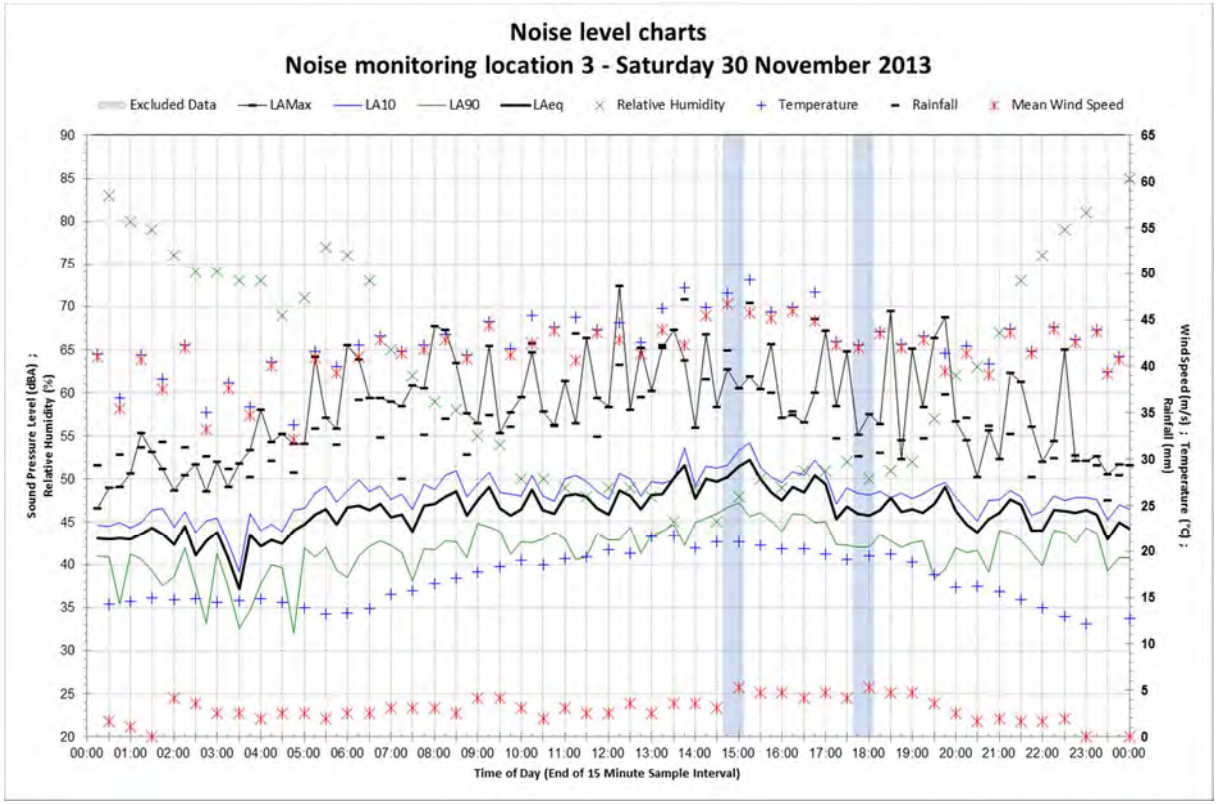
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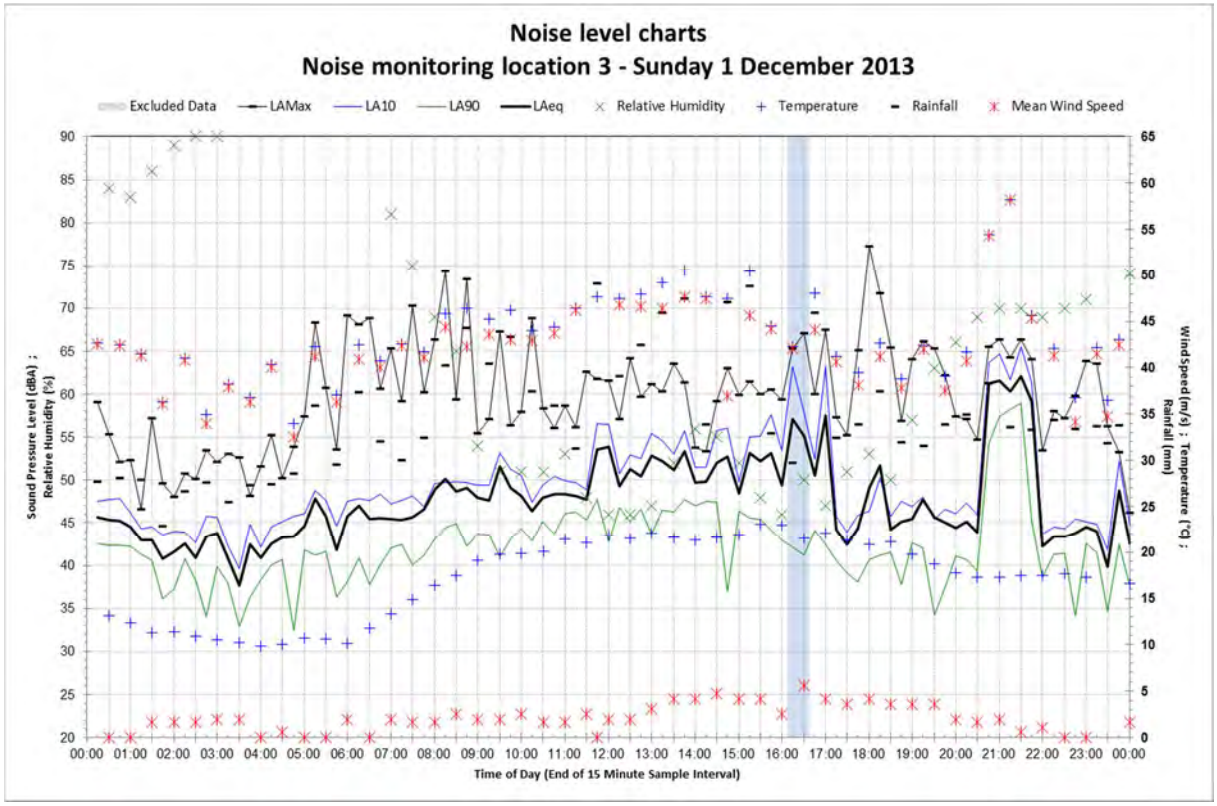
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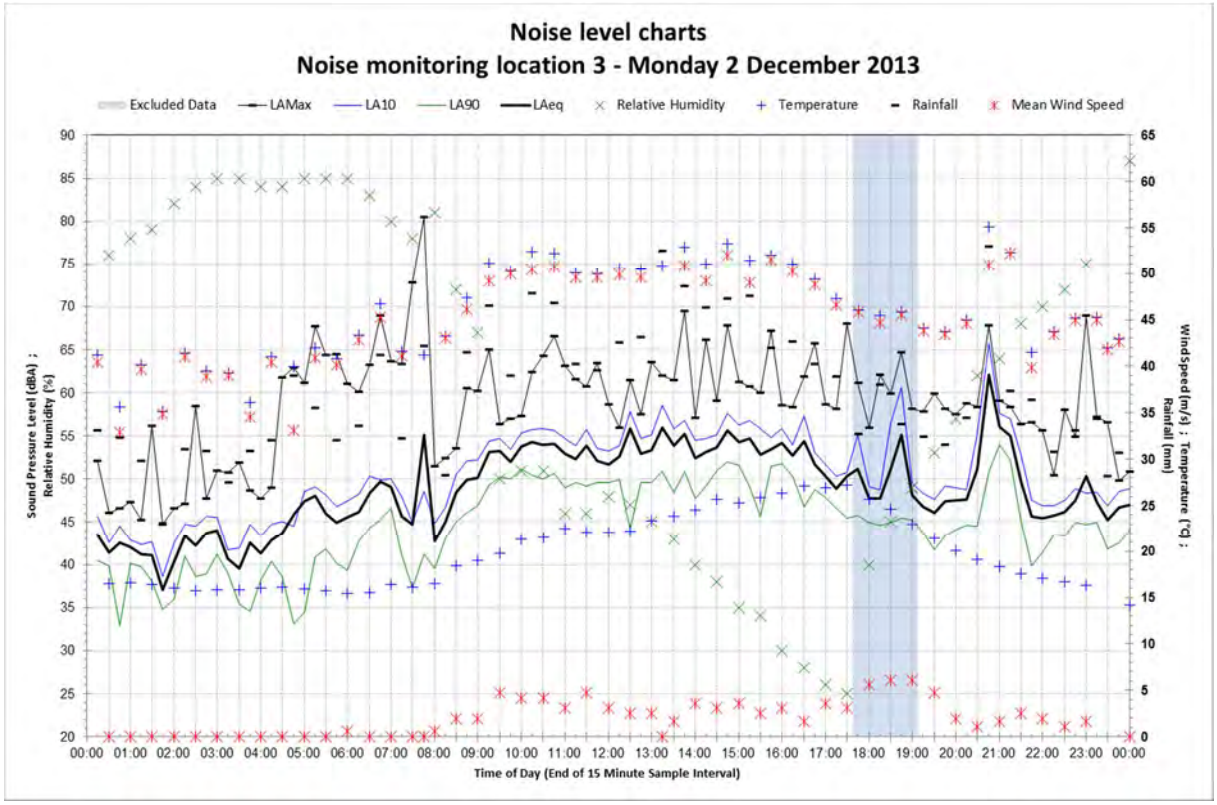
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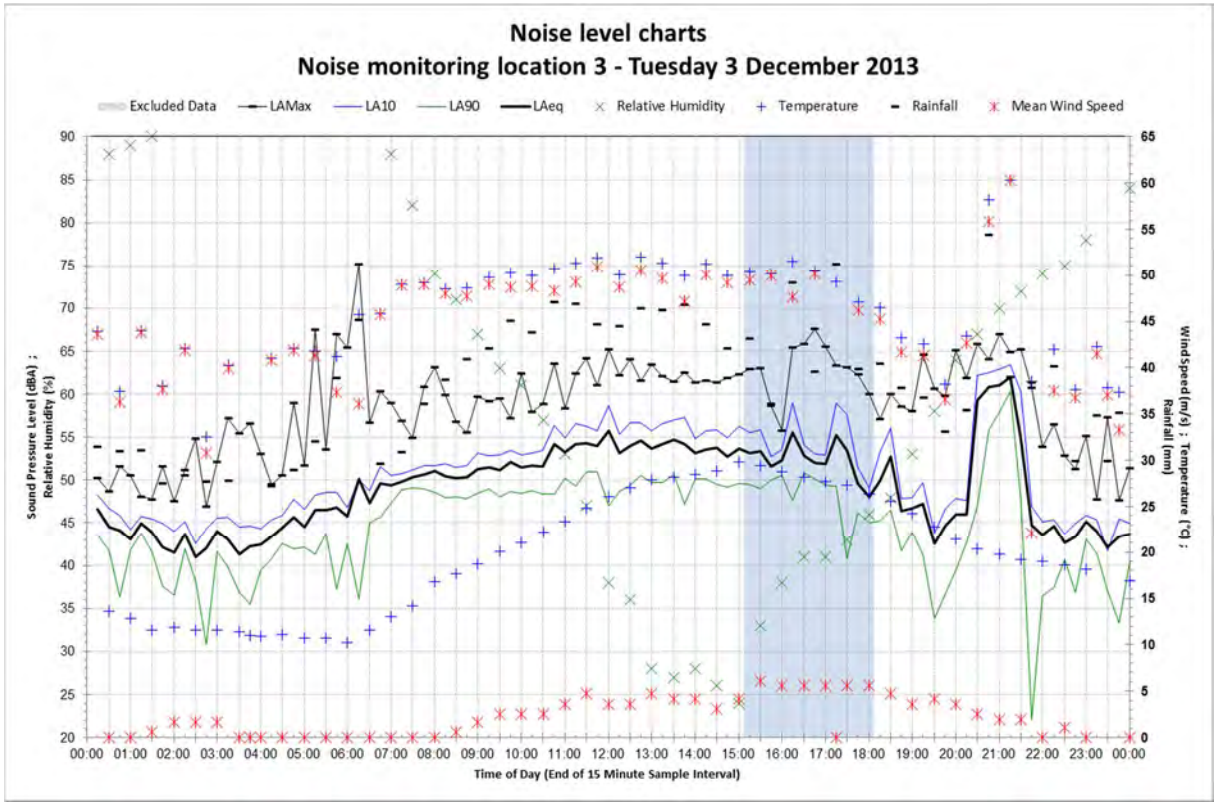
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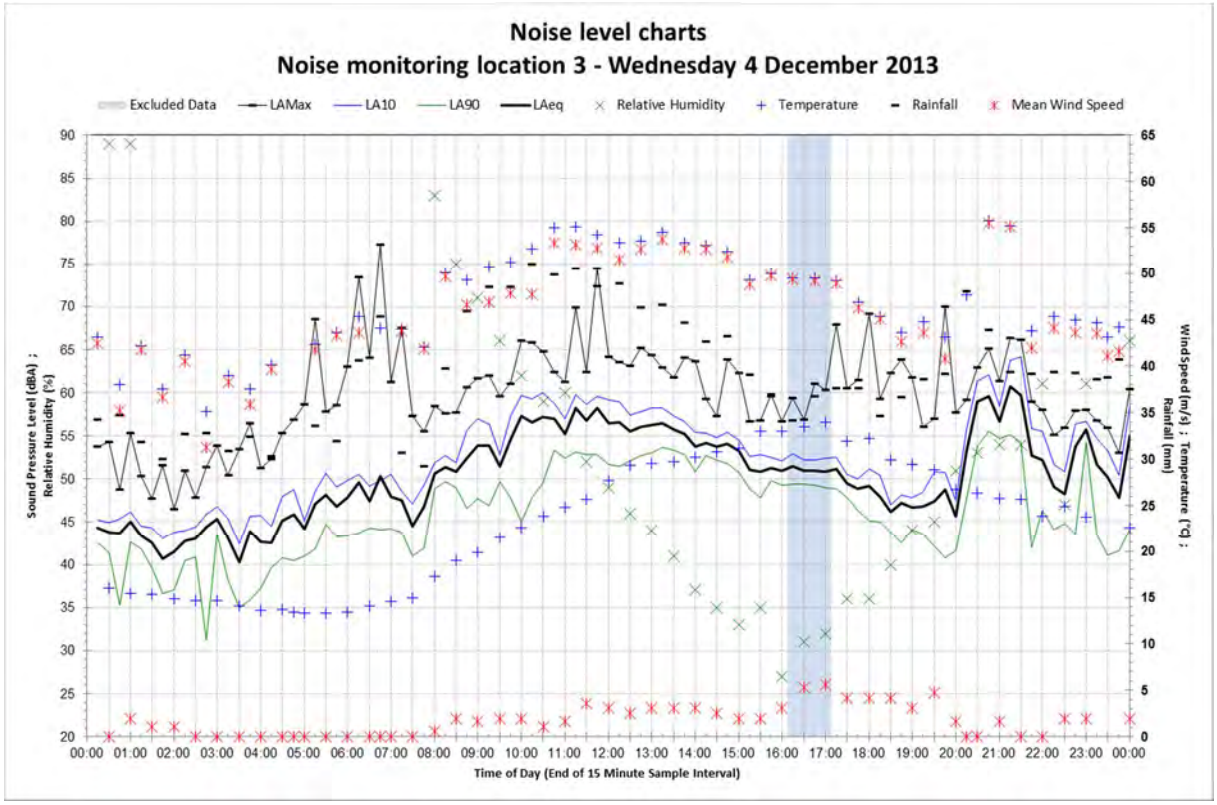
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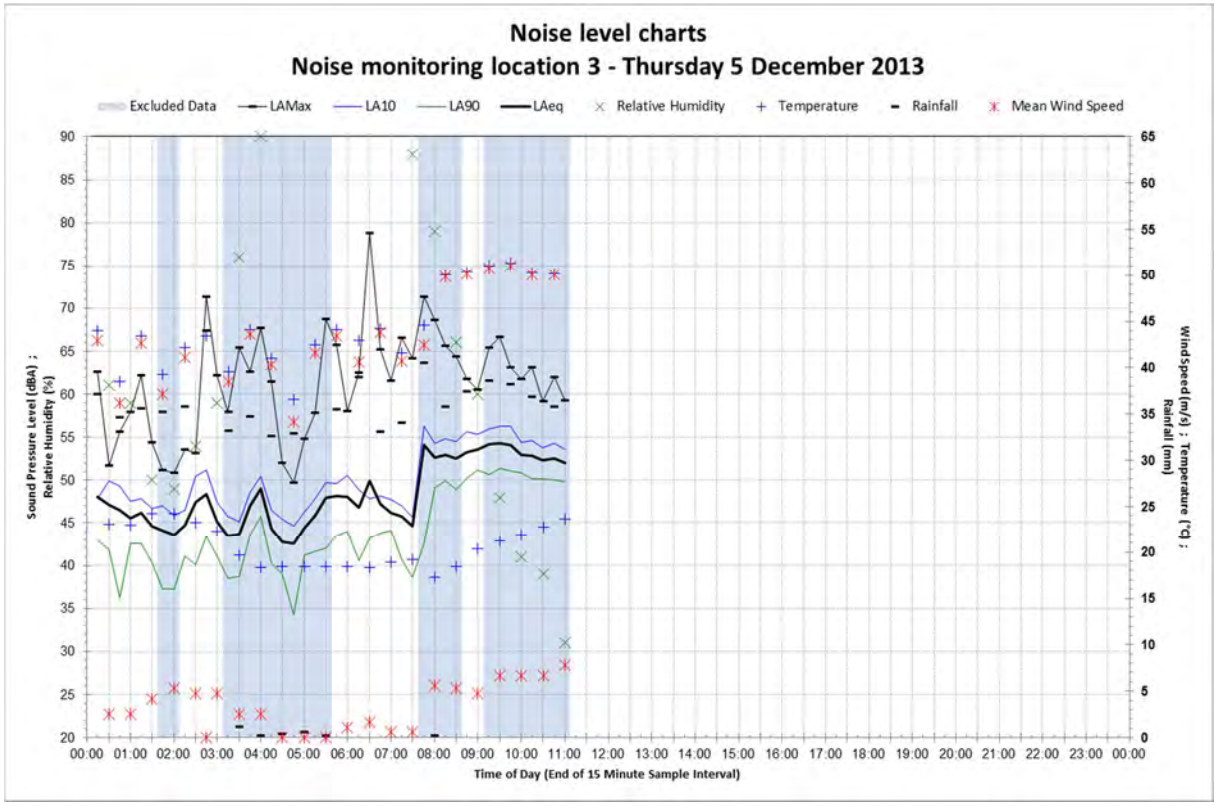
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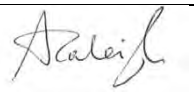
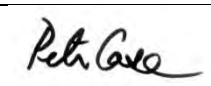
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	E Milton	A Raleigh		P Carson		21/11/14

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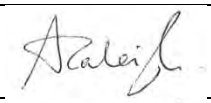
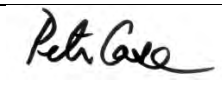
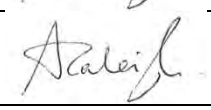
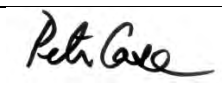
Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	A Raleigh	P Carson		P Carson		21/10/14
B	A Raleigh	P Carson		P Carson		31/10/14
1	A Raleigh	P Carson		P Carson		17/11/2014
2	A Raleigh	P Carson		P Carson		21/11/2014

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