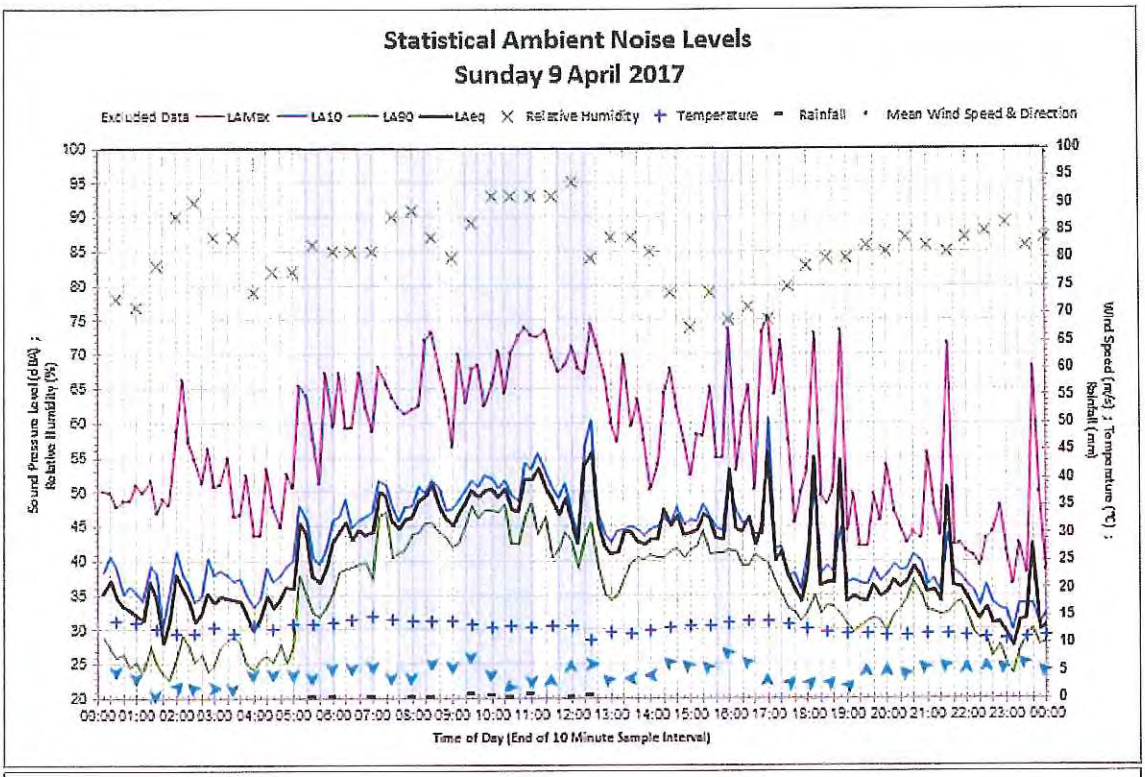
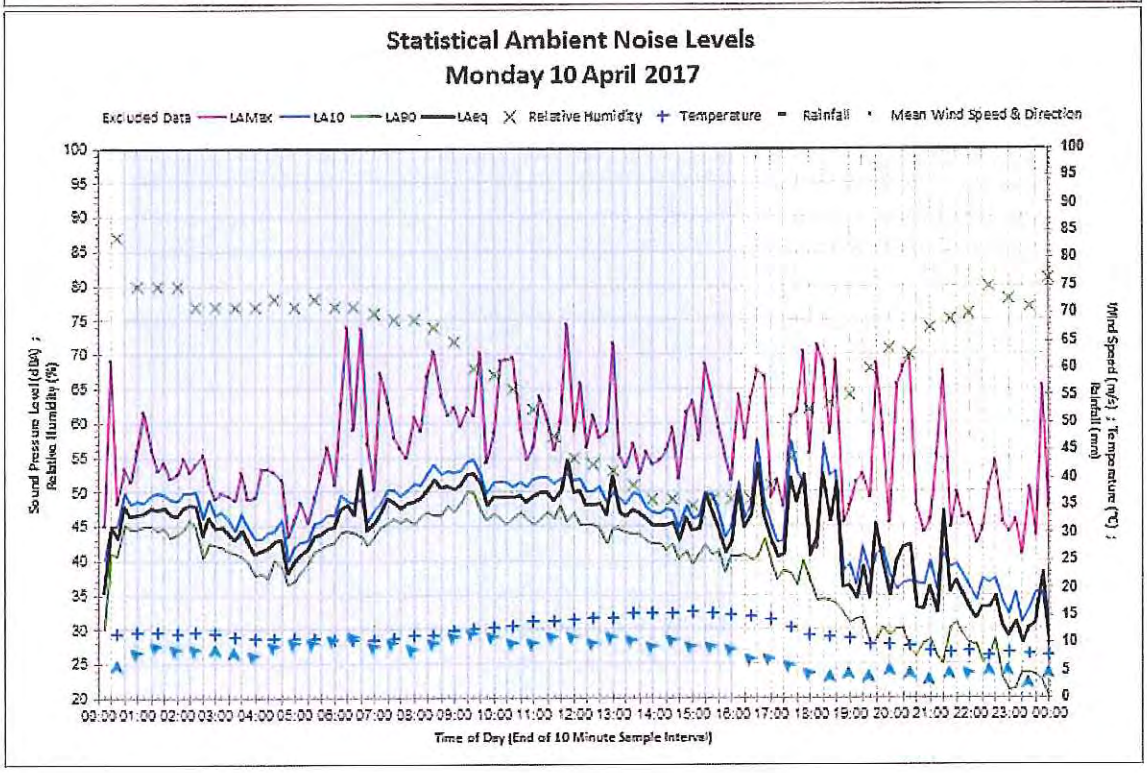
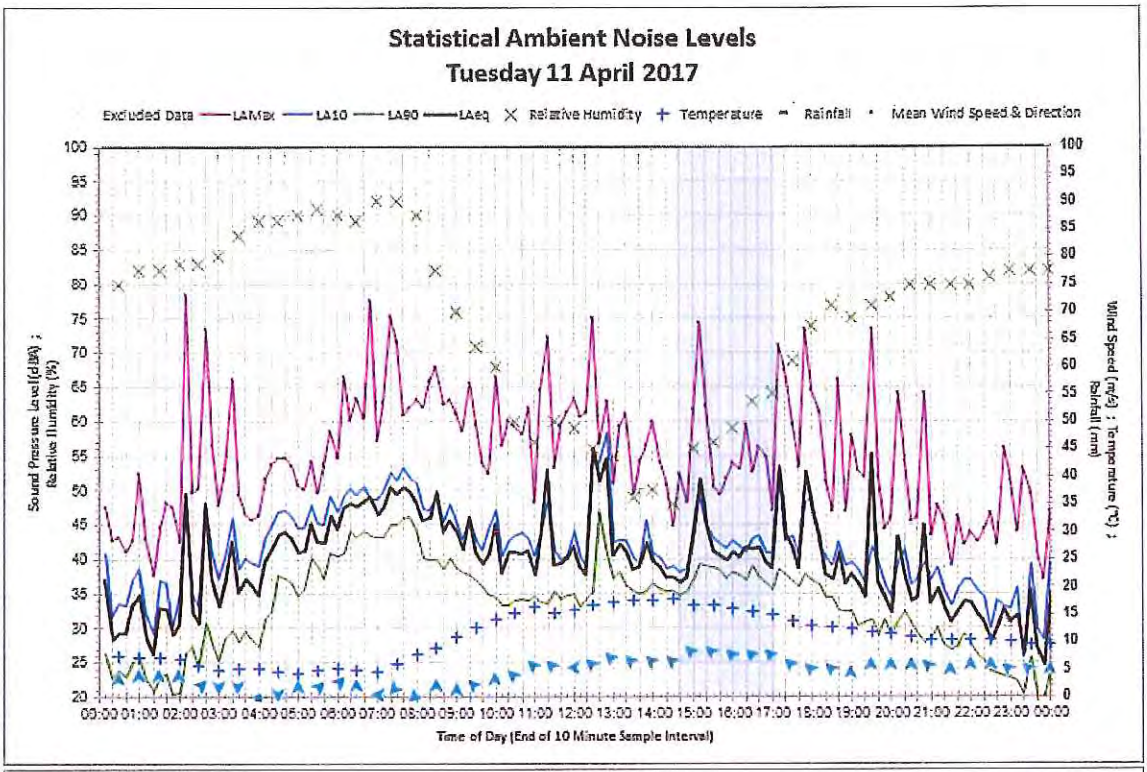
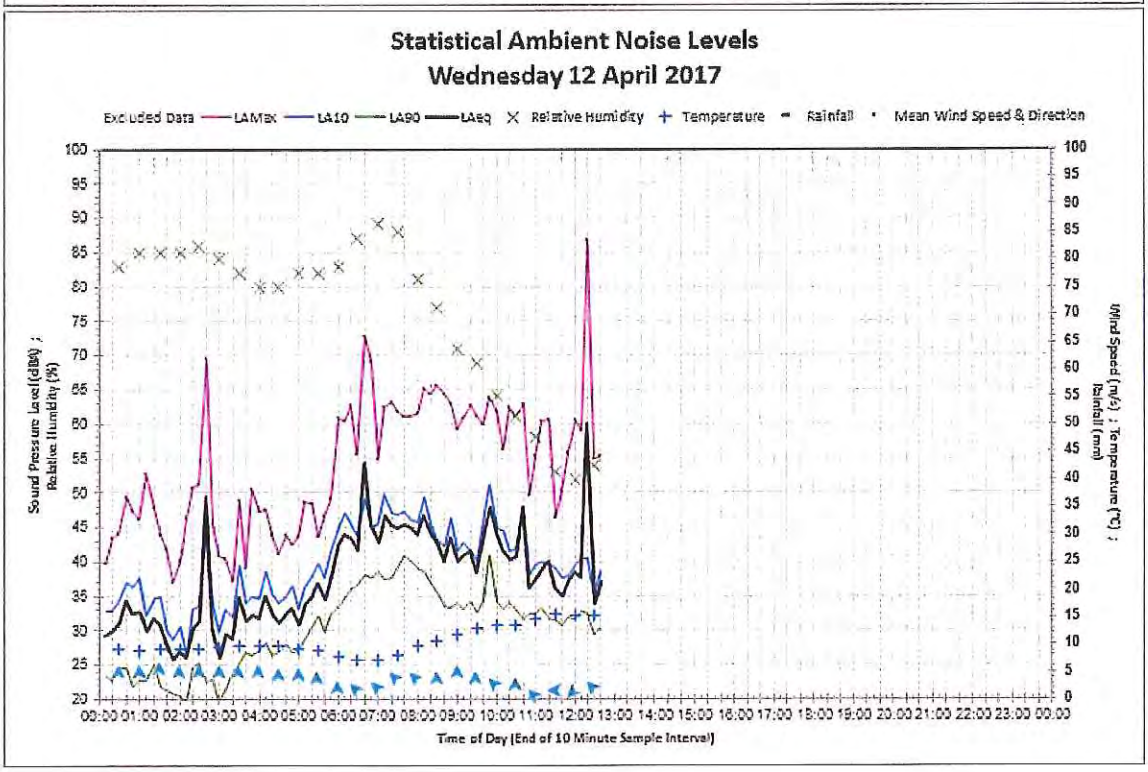

Statistical Ambient Noise Levels
Sunday 9 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 10 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 11 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 12 April 2017
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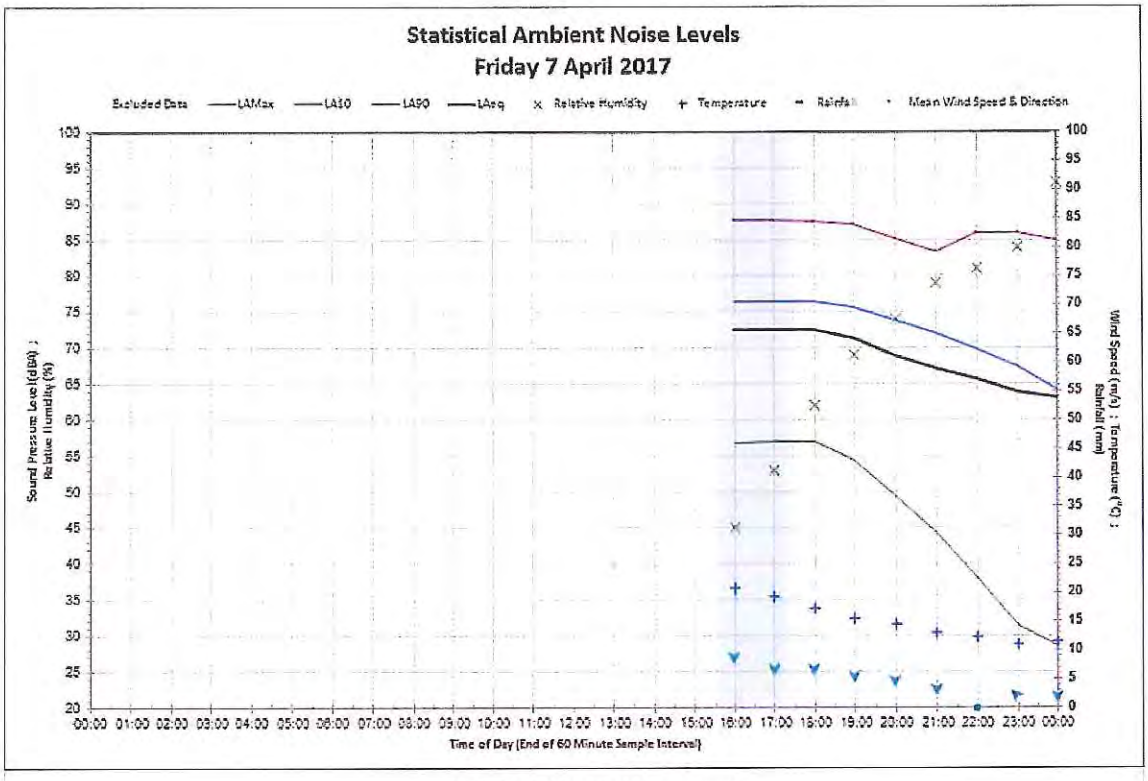
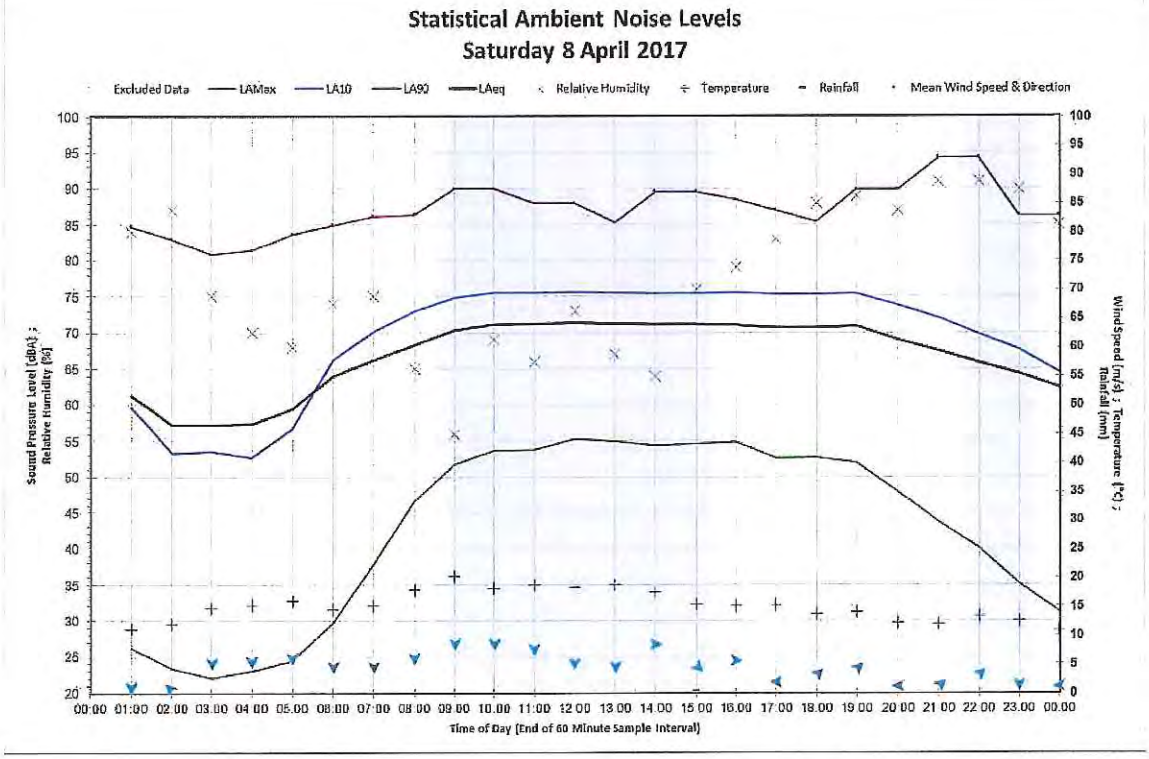
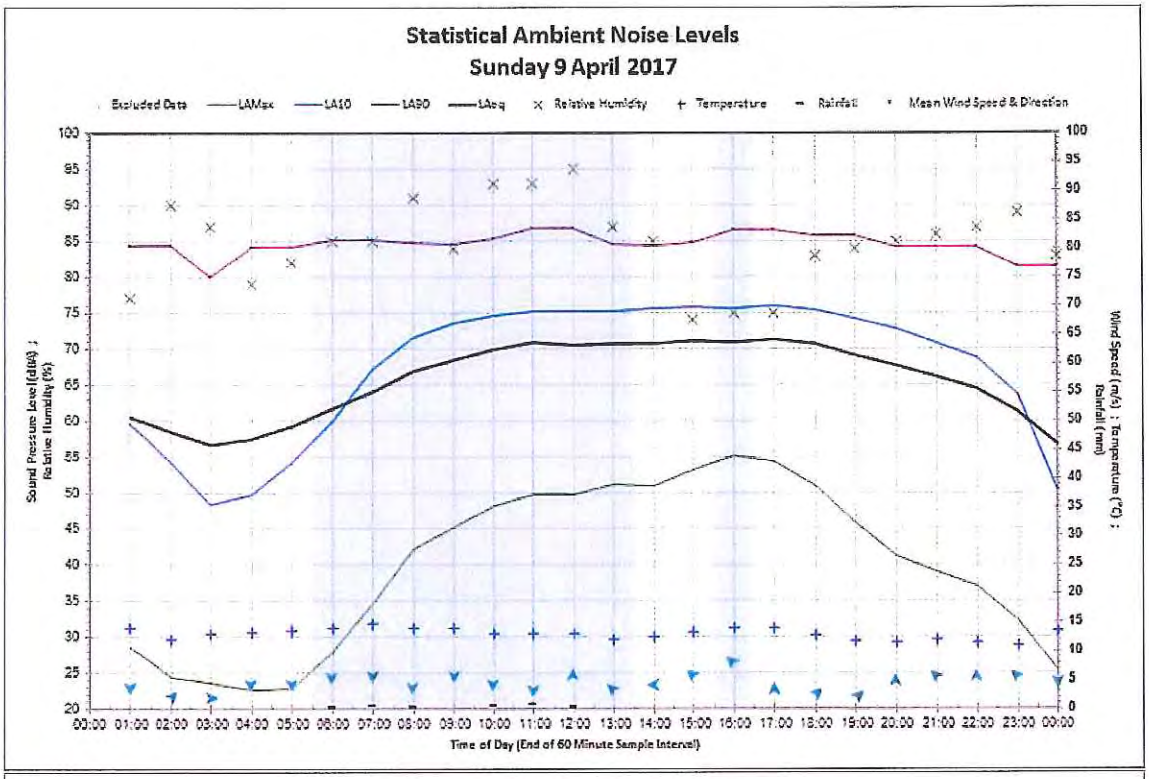
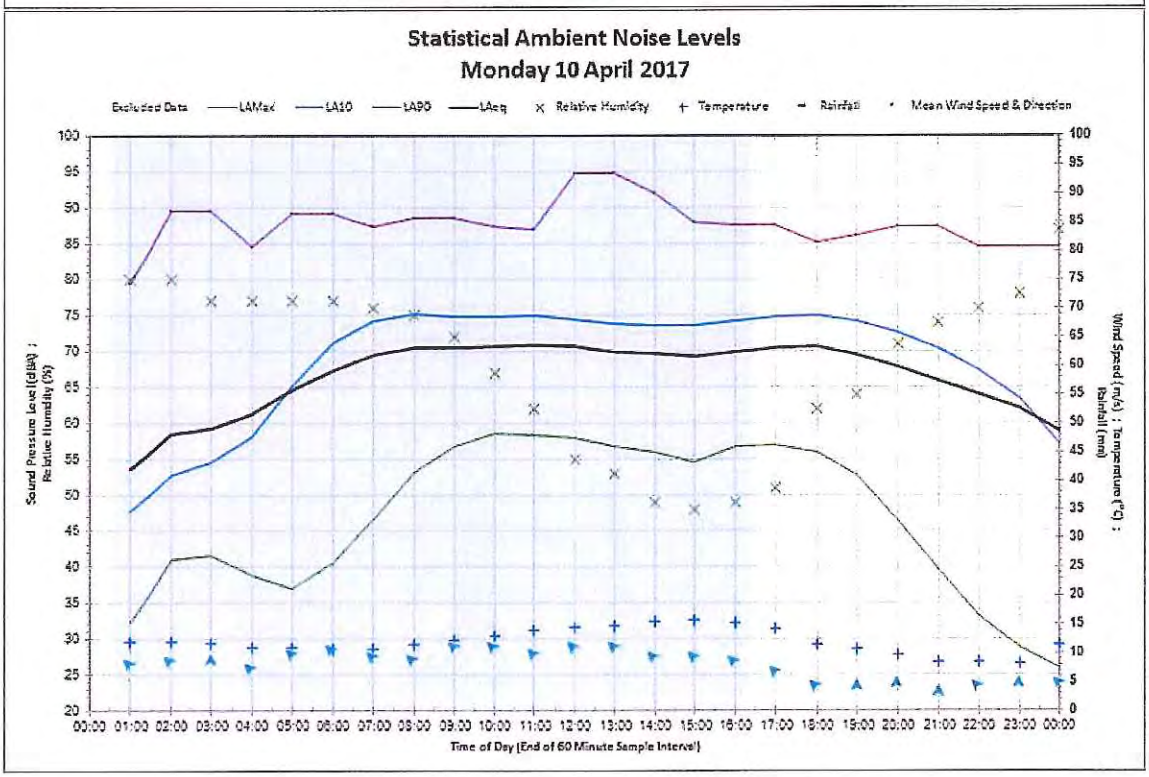
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)

Logger L03- 39 Illawara Rd






Statistical Ambient Noise Levels
Sunday 9 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dB(A)) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 10 April 2017
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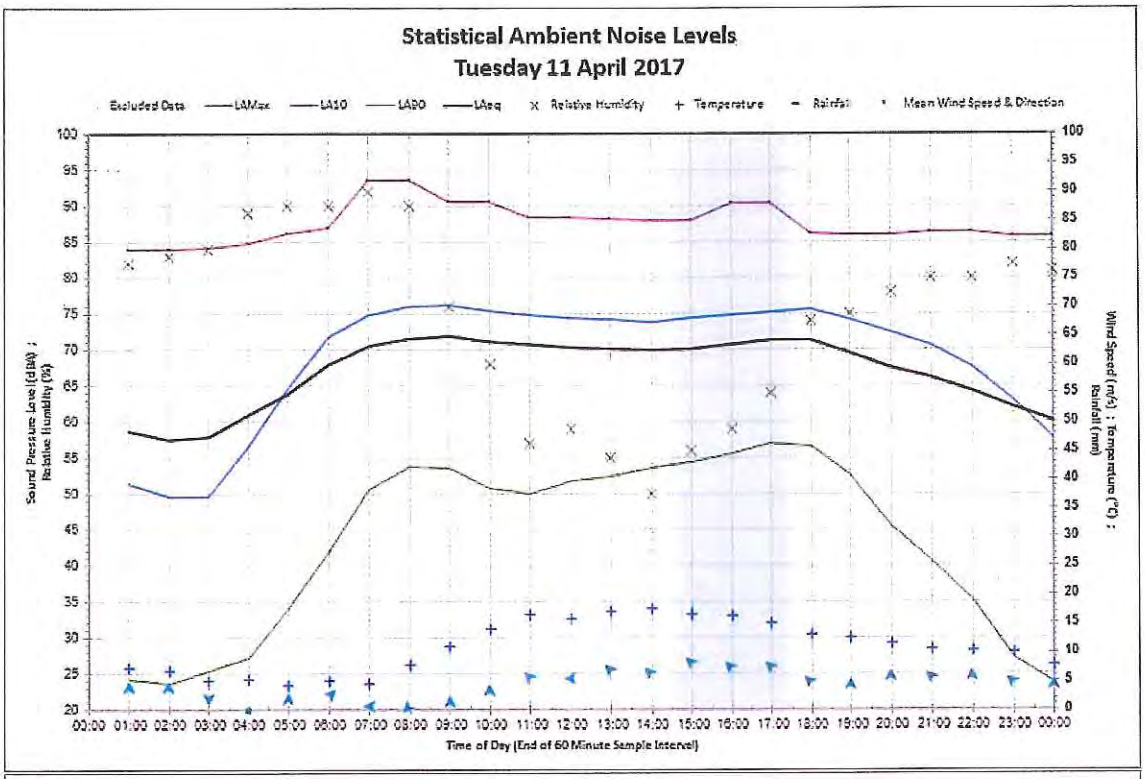
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dB(A)) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 11 April 2017
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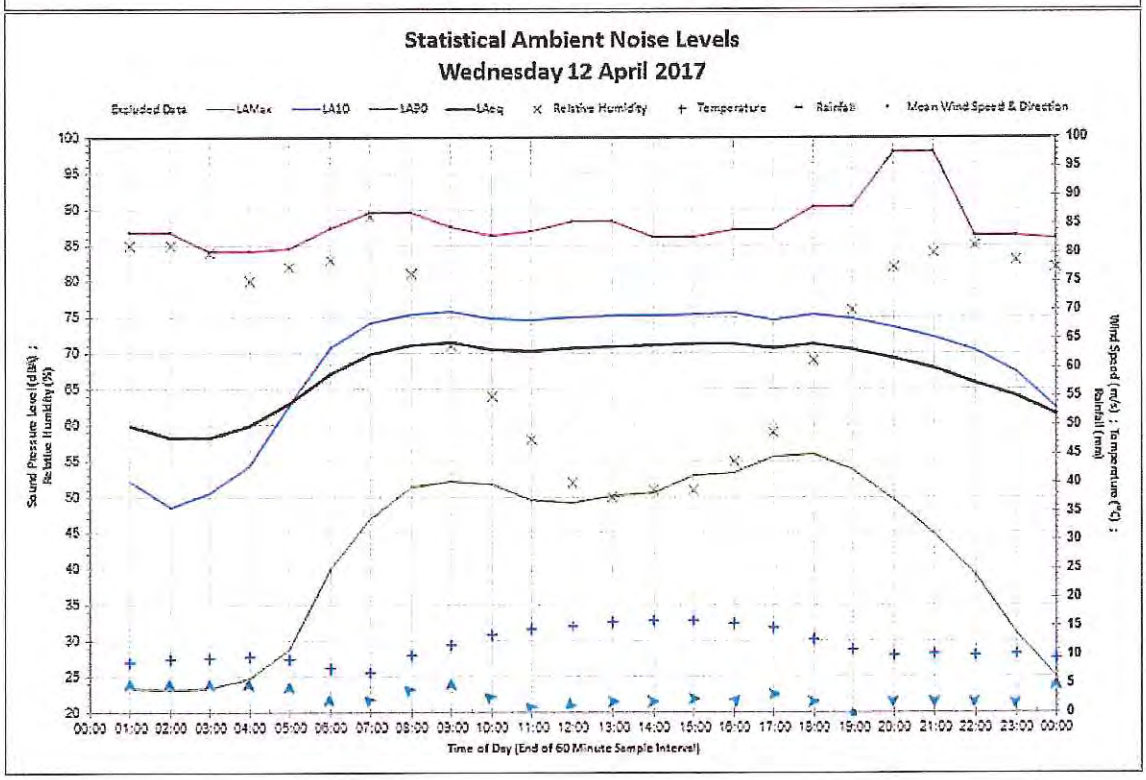
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 12 April 2017
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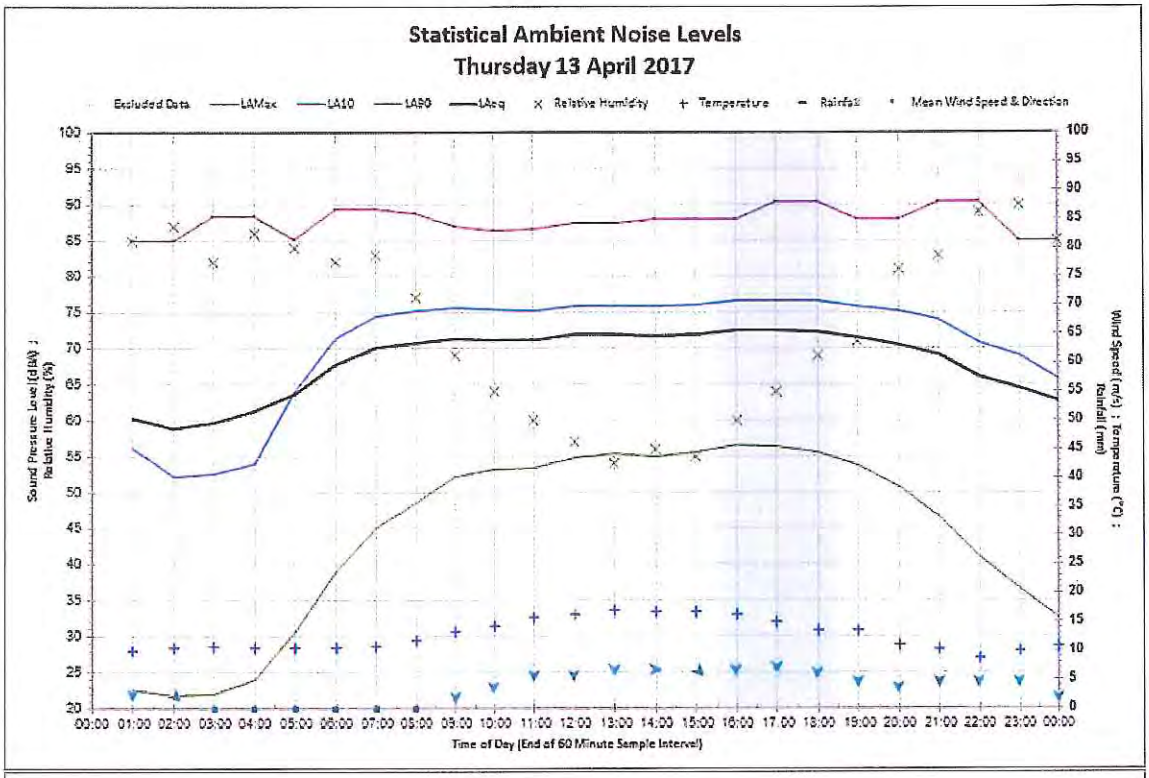
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 13 April 2017
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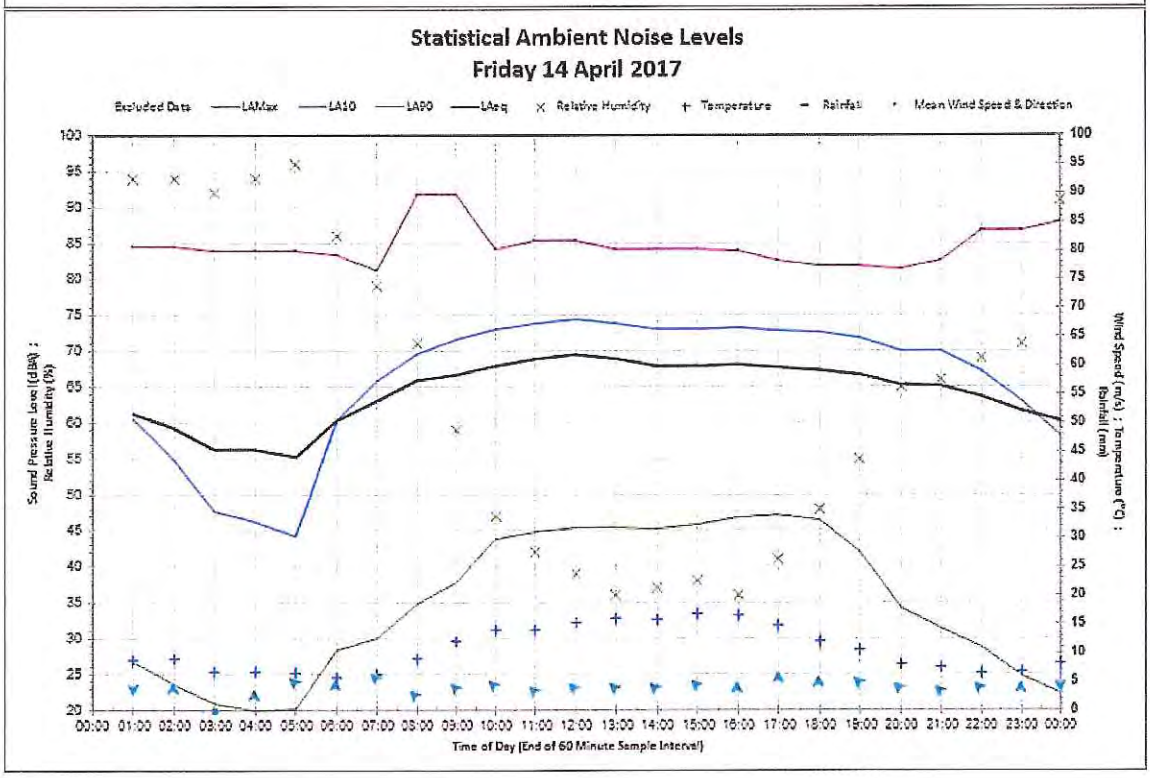
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 14 April 2017
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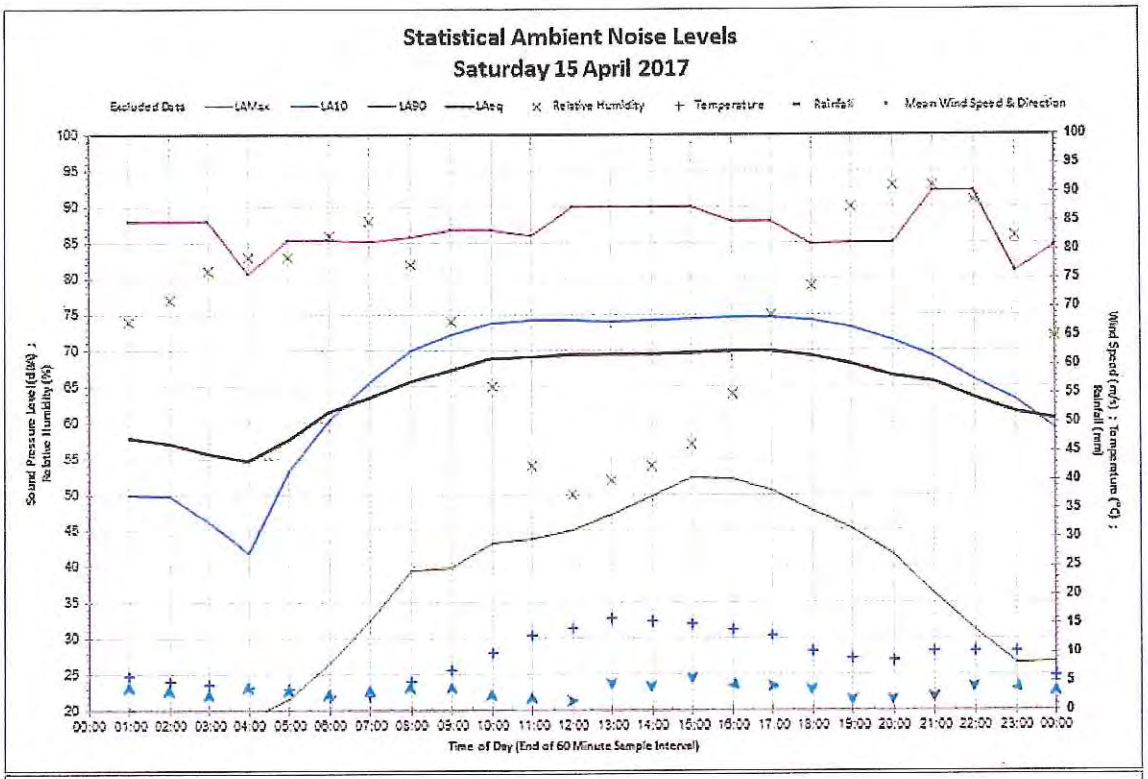
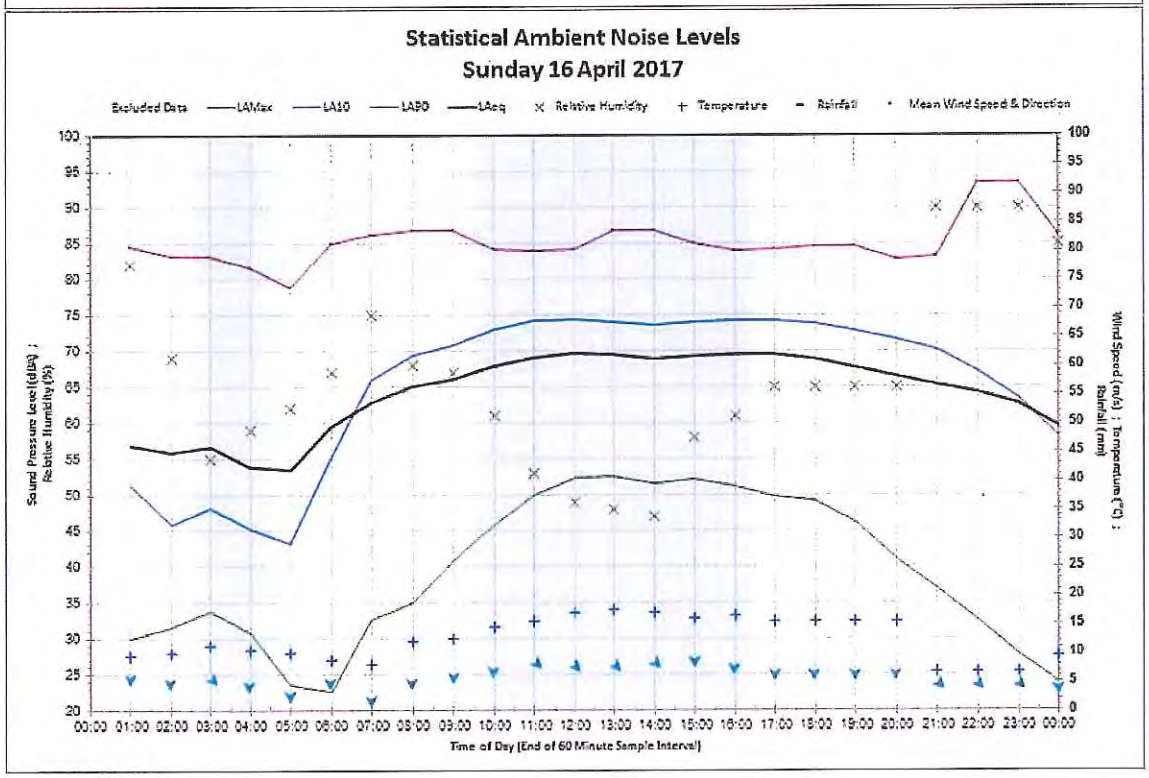
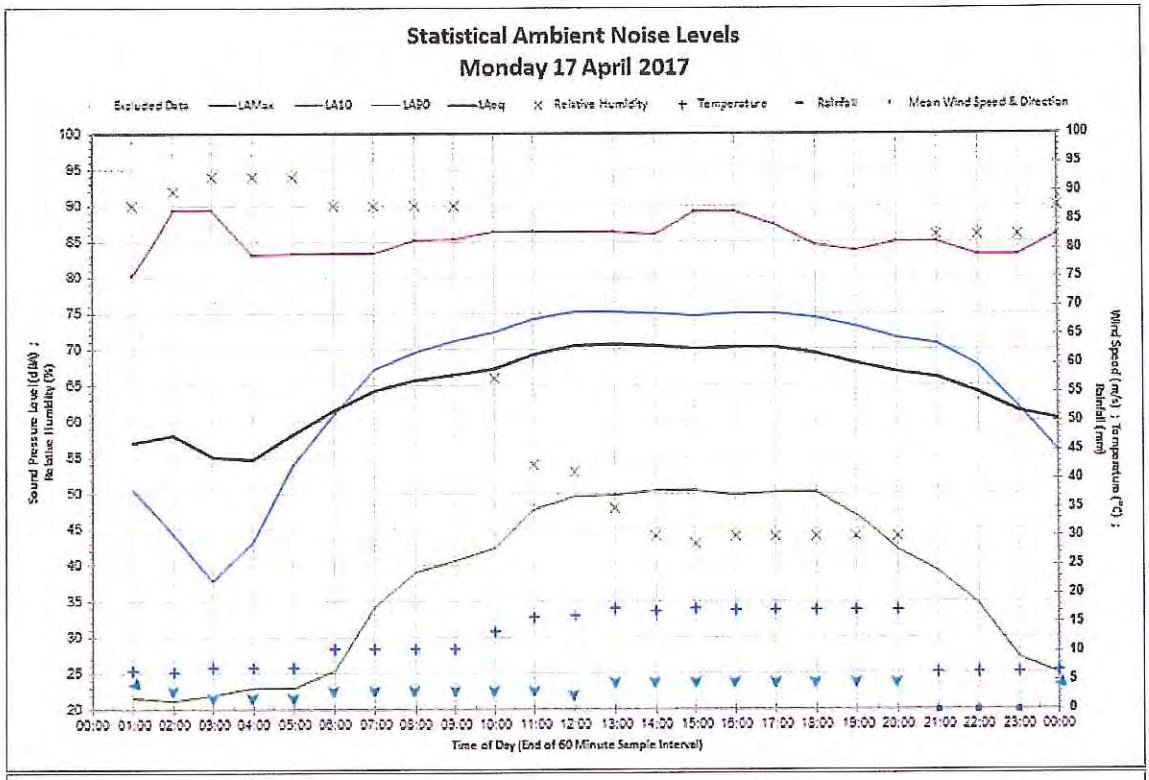
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 15 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 16 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 17 April 2017
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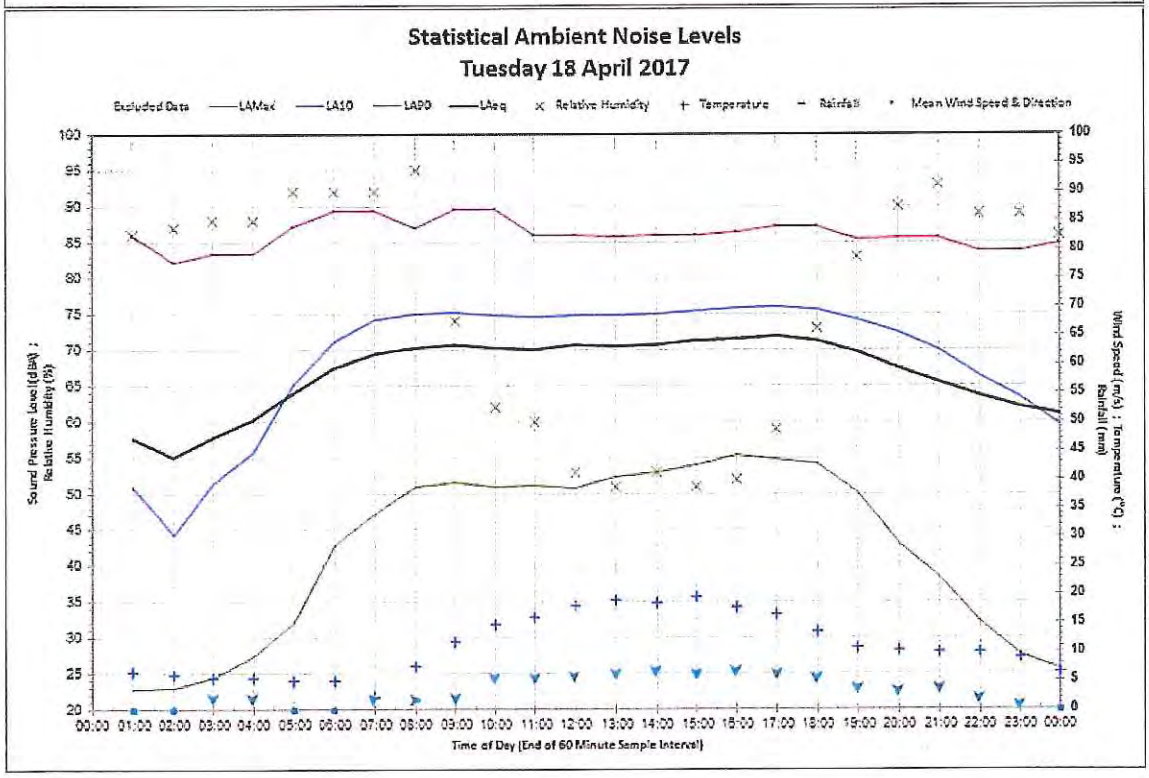
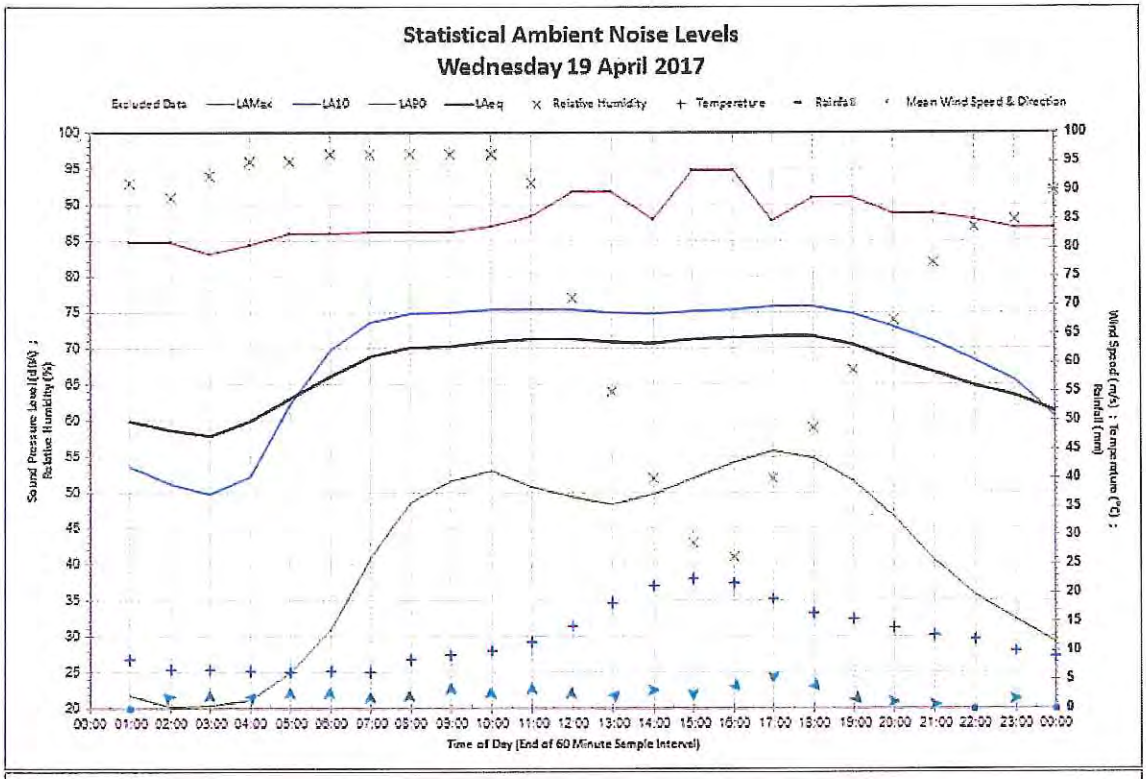
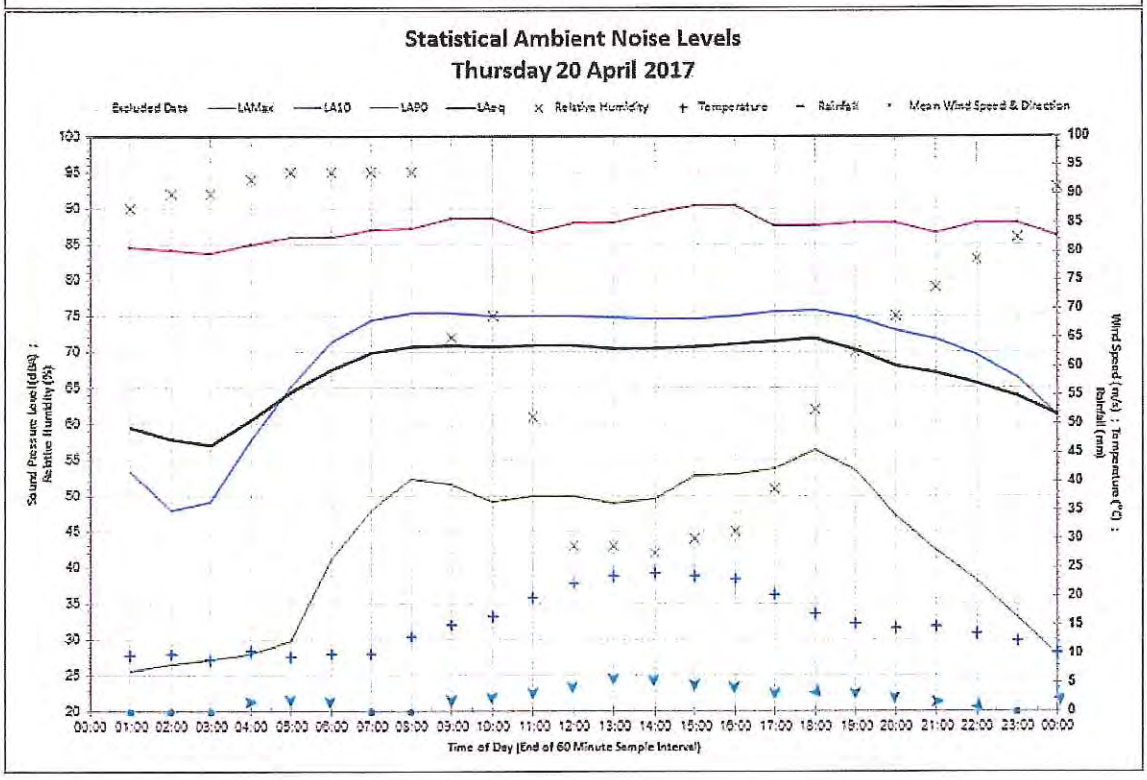
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 18 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 19 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 20 April 2017
Excluded Data
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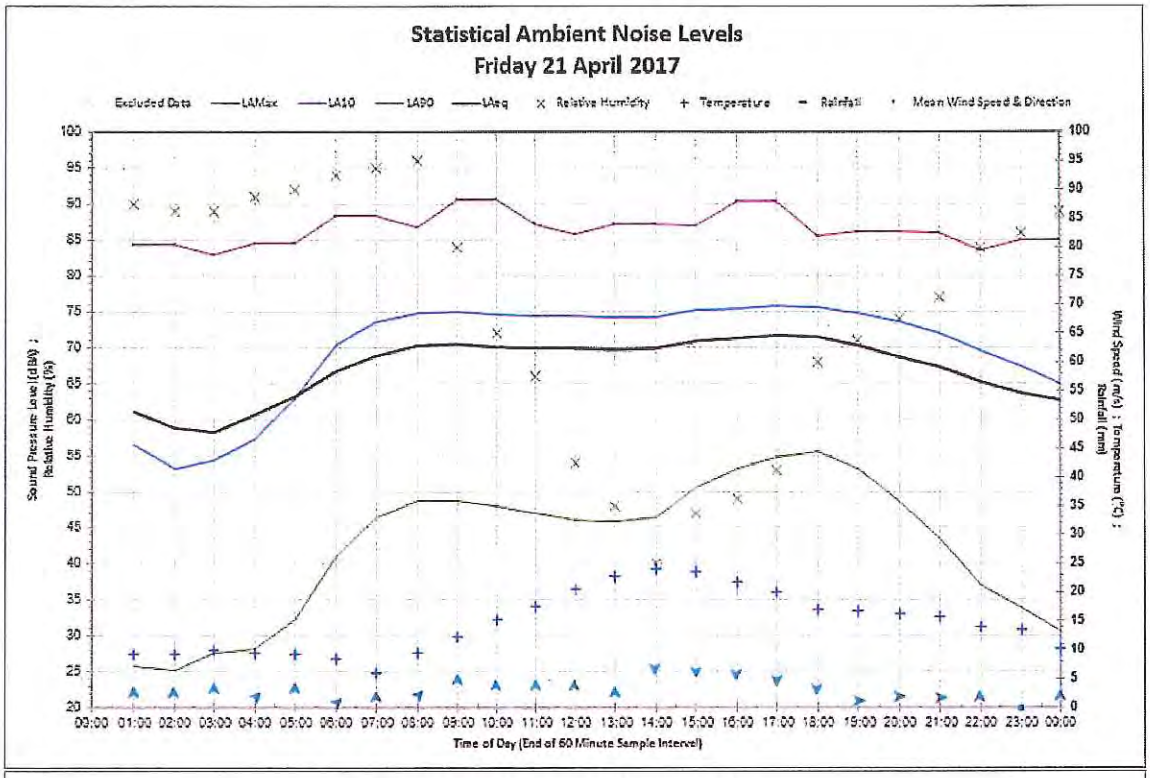
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 21 April 2017
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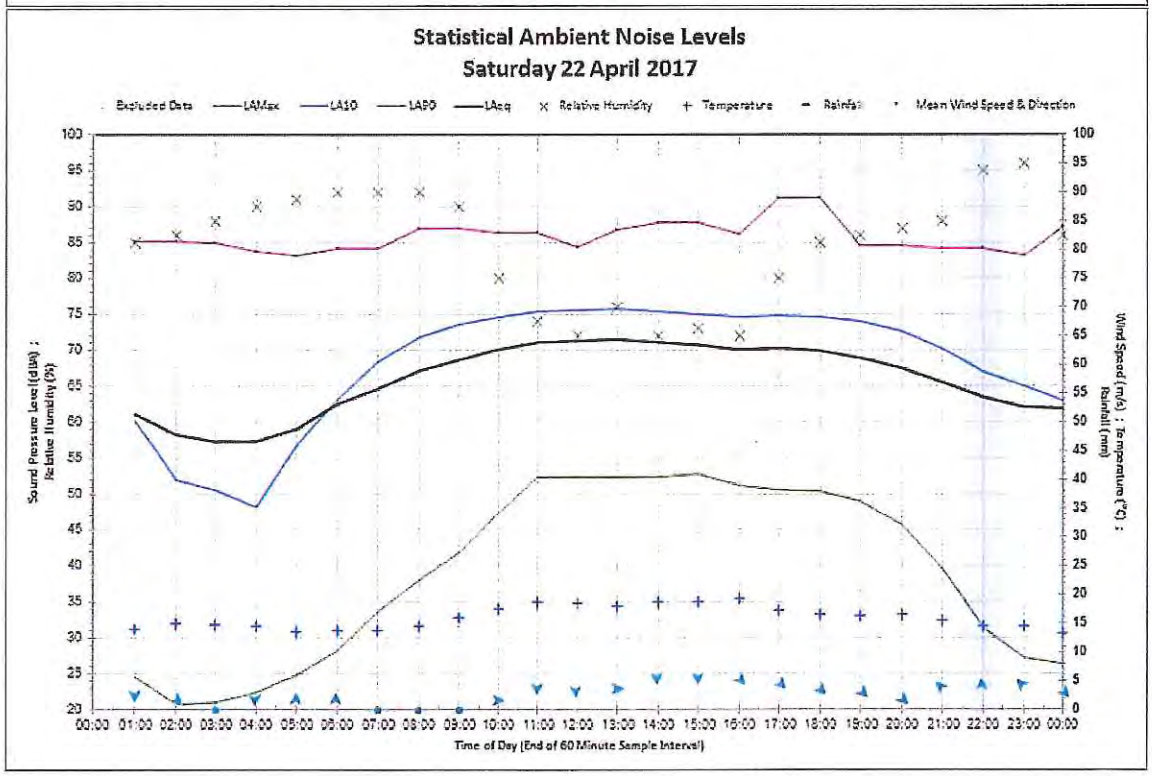
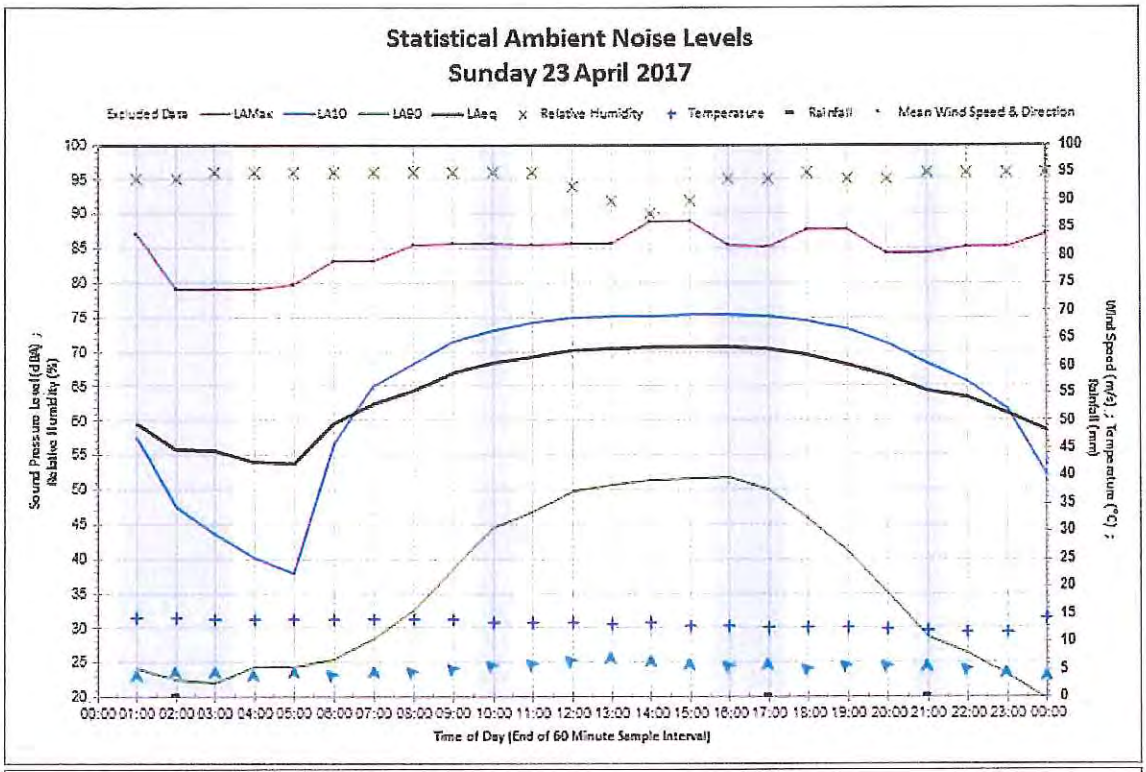
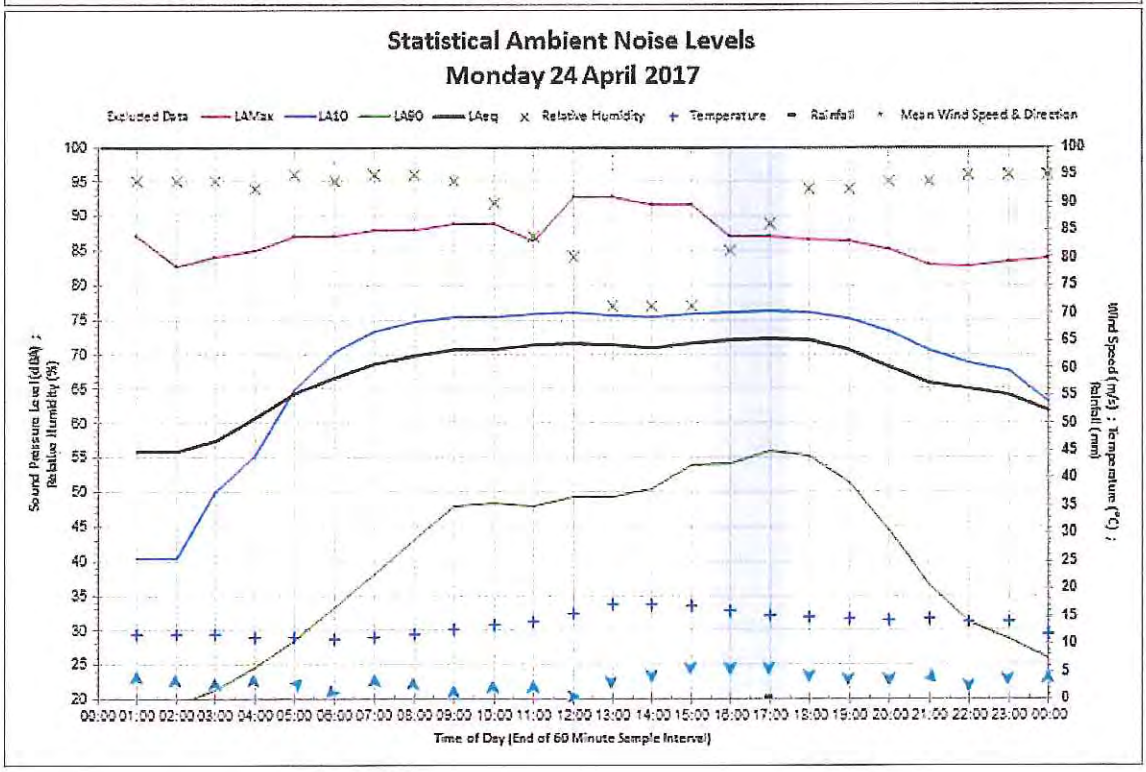
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 22 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 23 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 24 April 2017
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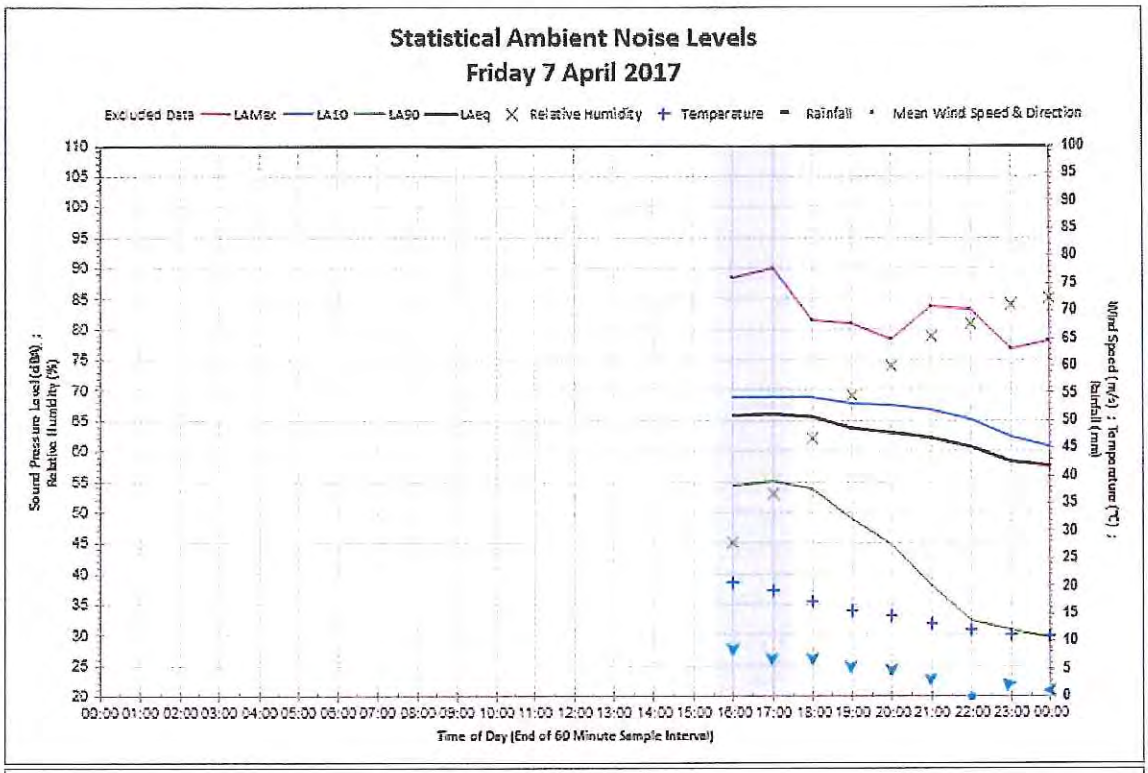
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

Logger L04


Statistical Ambient Noise Levels
Friday 7 April 2017
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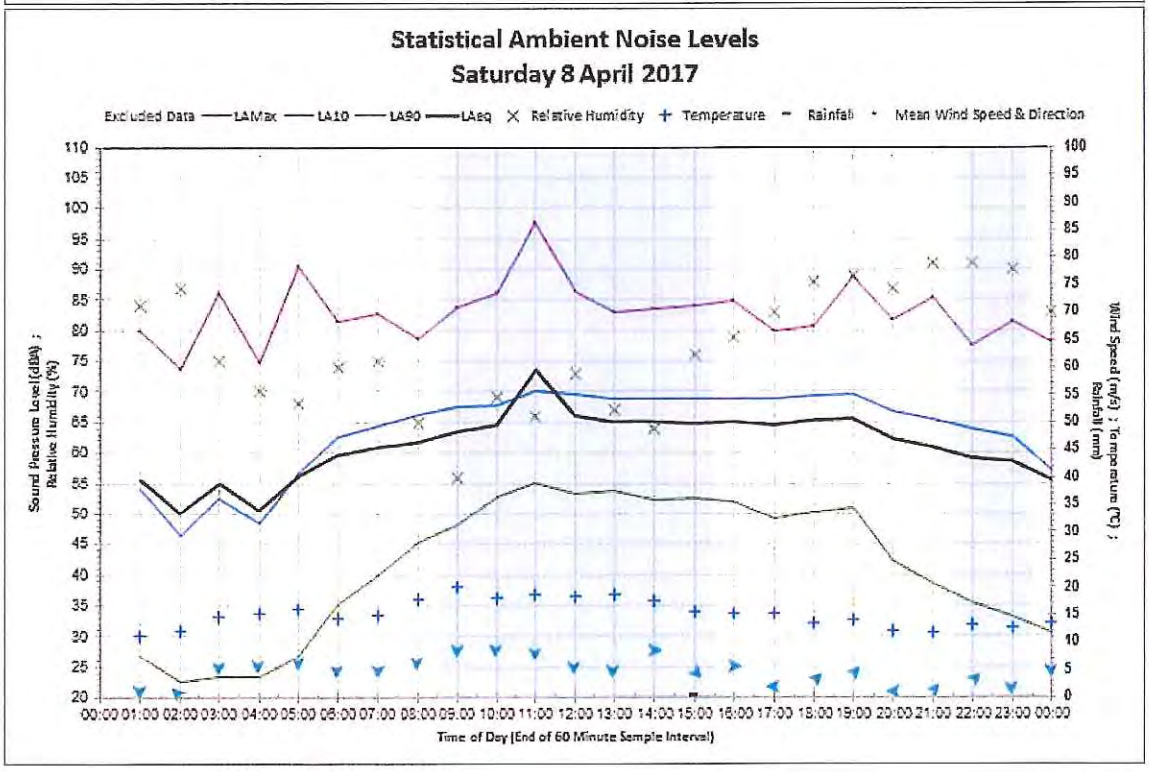
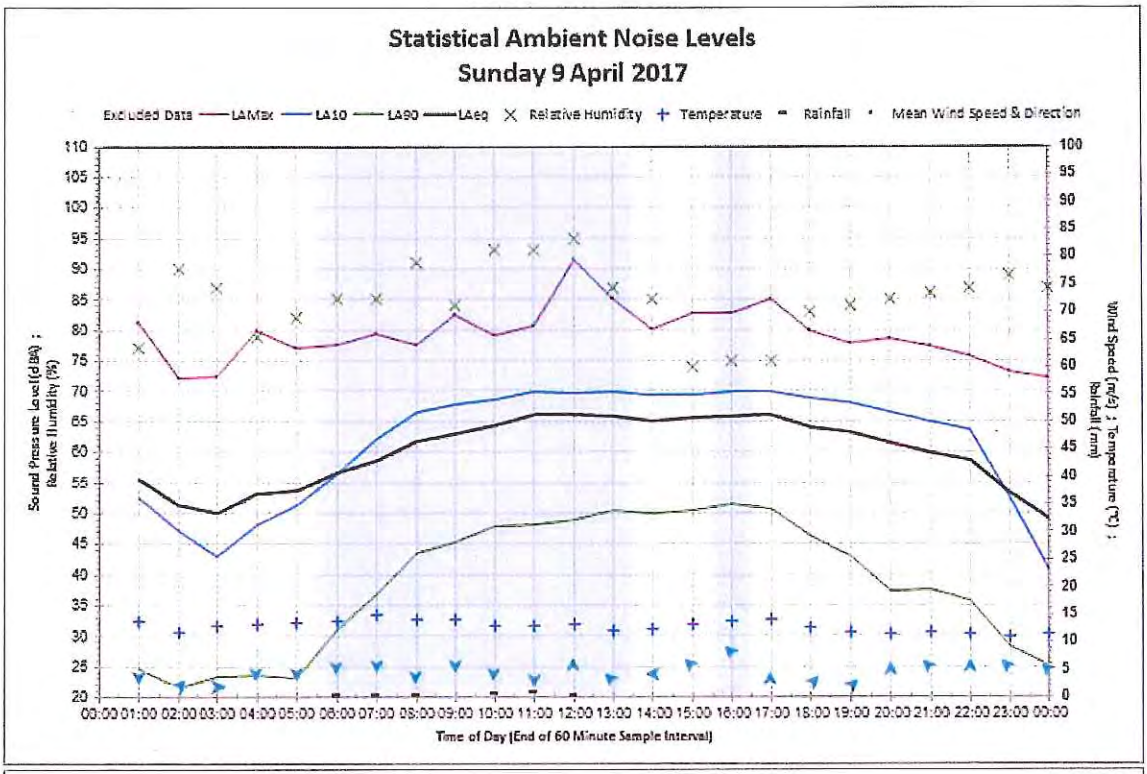
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 8 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 9 April 2017
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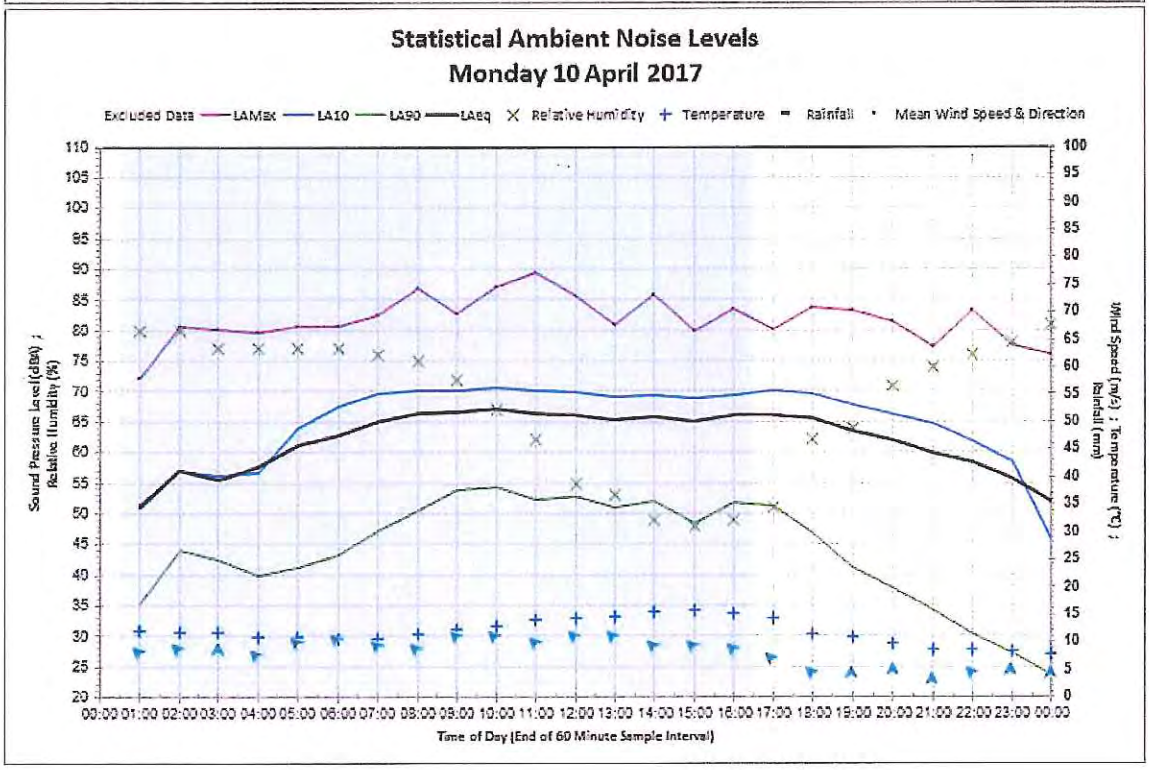
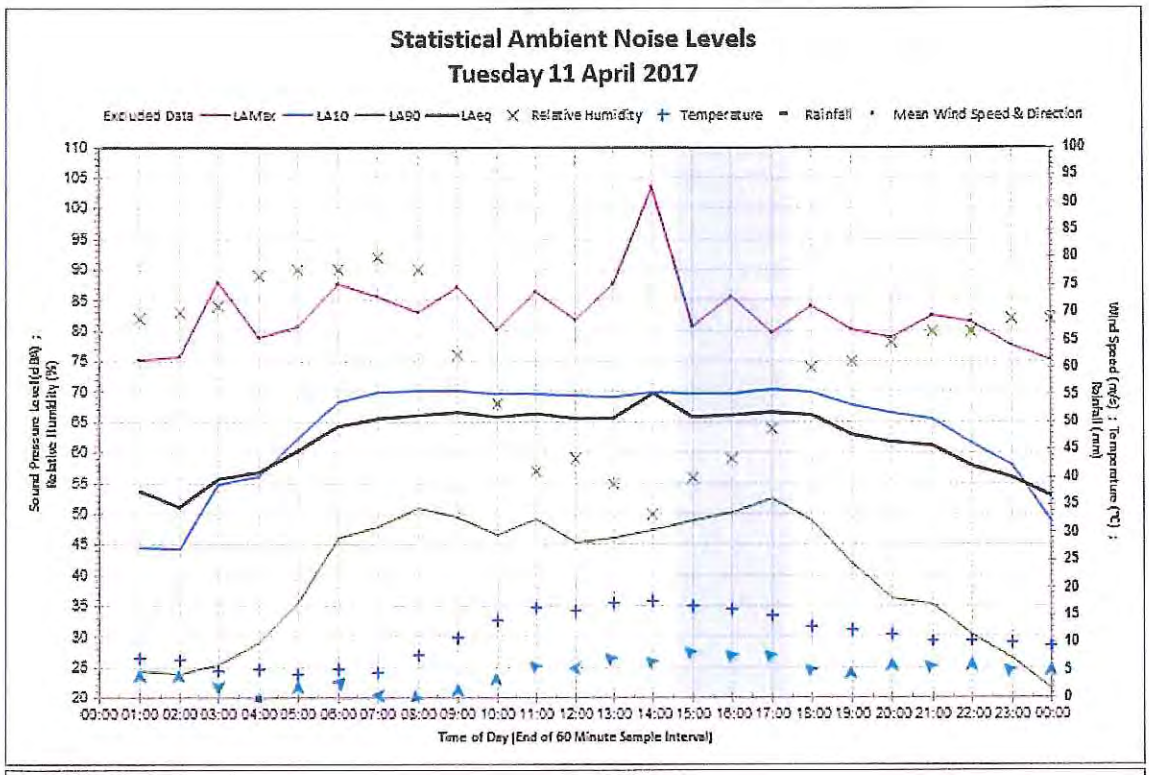
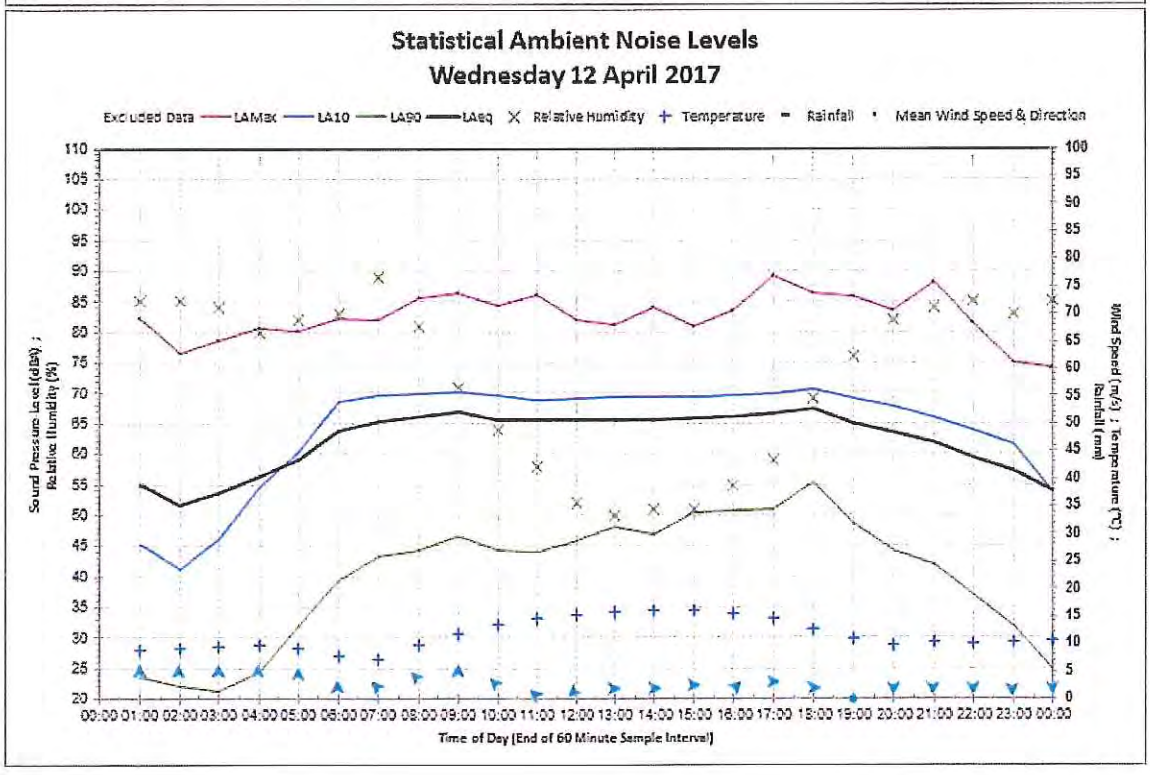
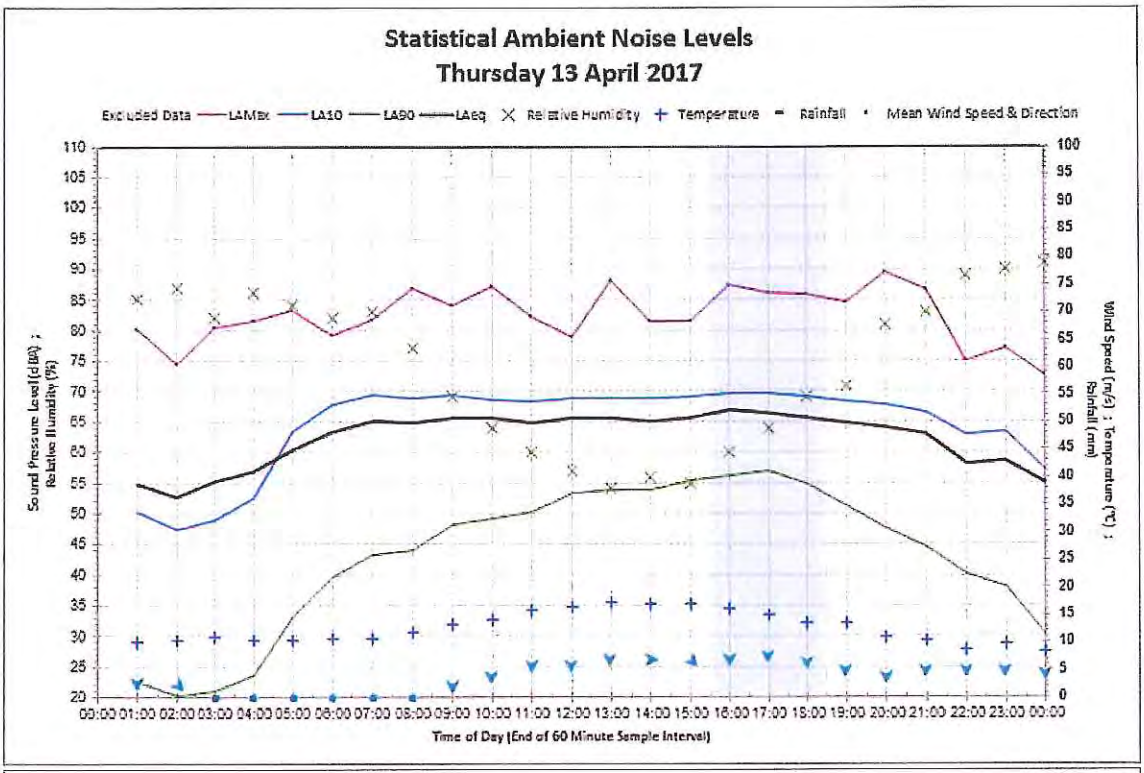
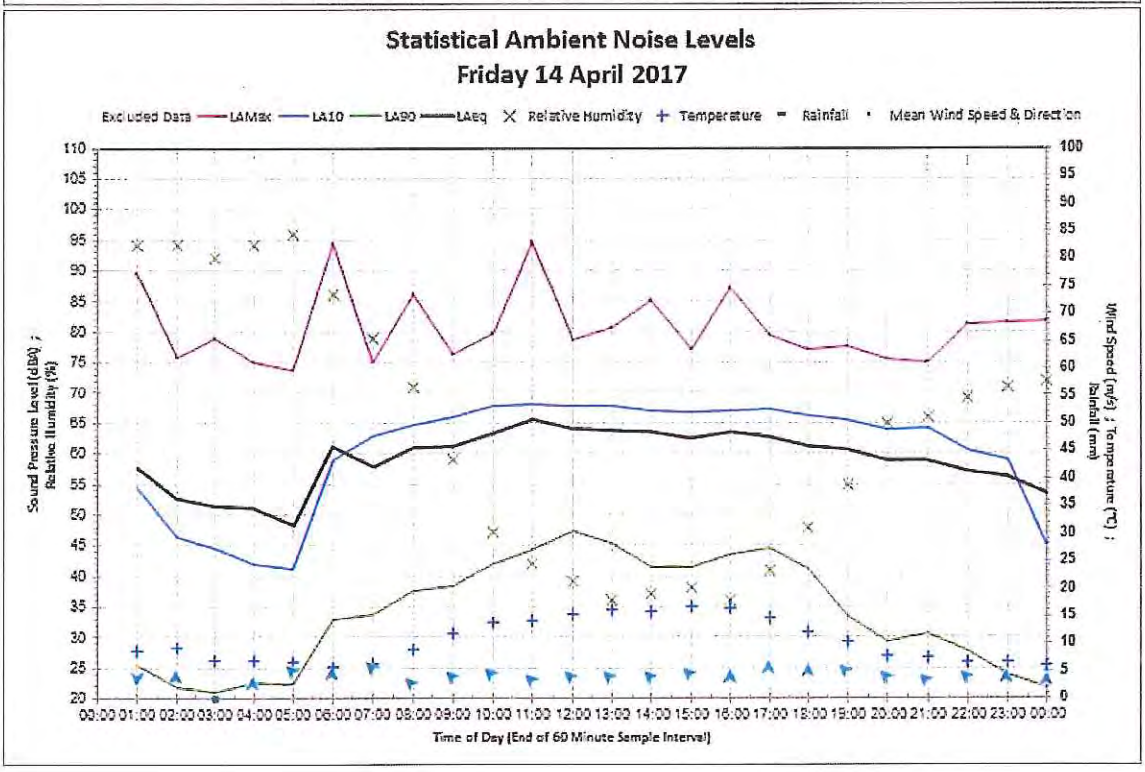
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

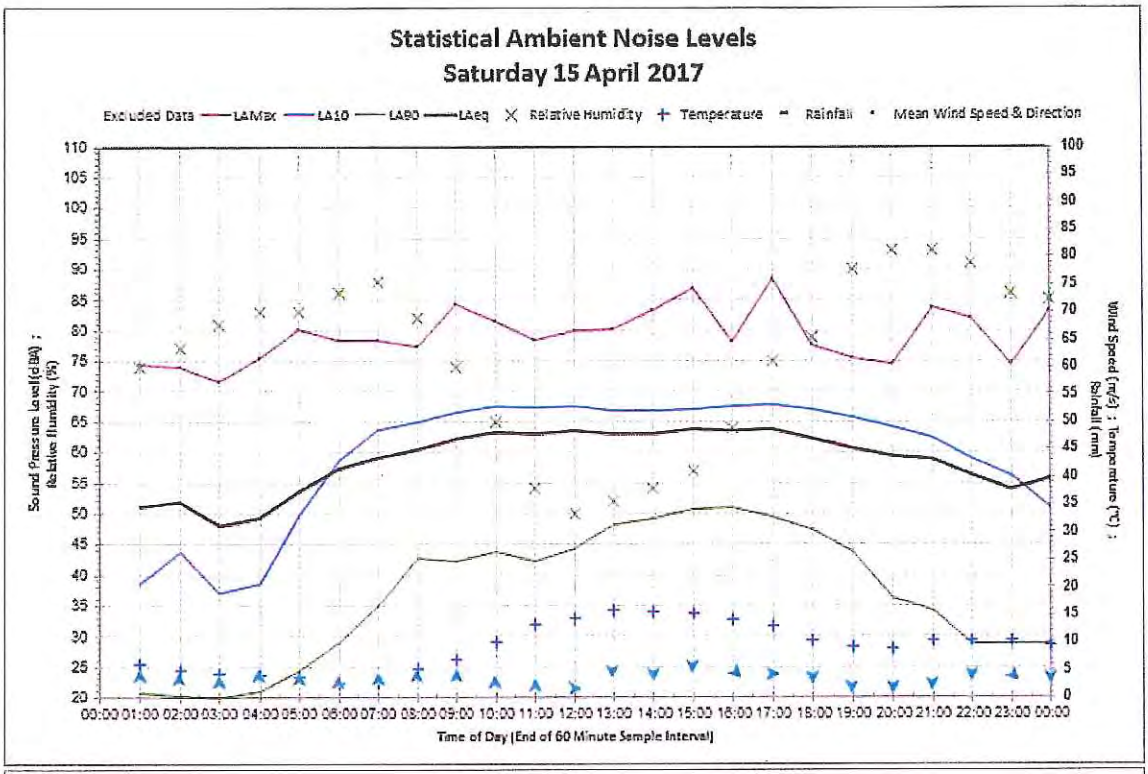

Statistical Ambient Noise Levels
Monday 10 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

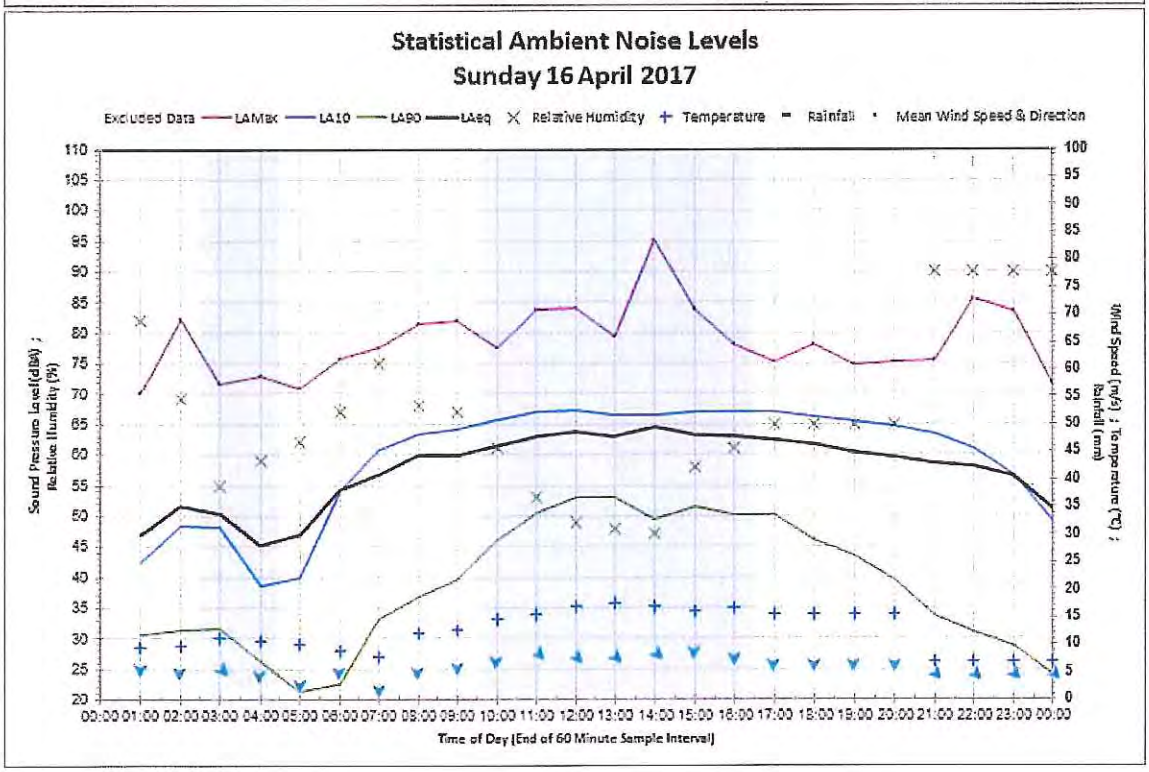

Statistical Ambient Noise Levels
Tuesday 11 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

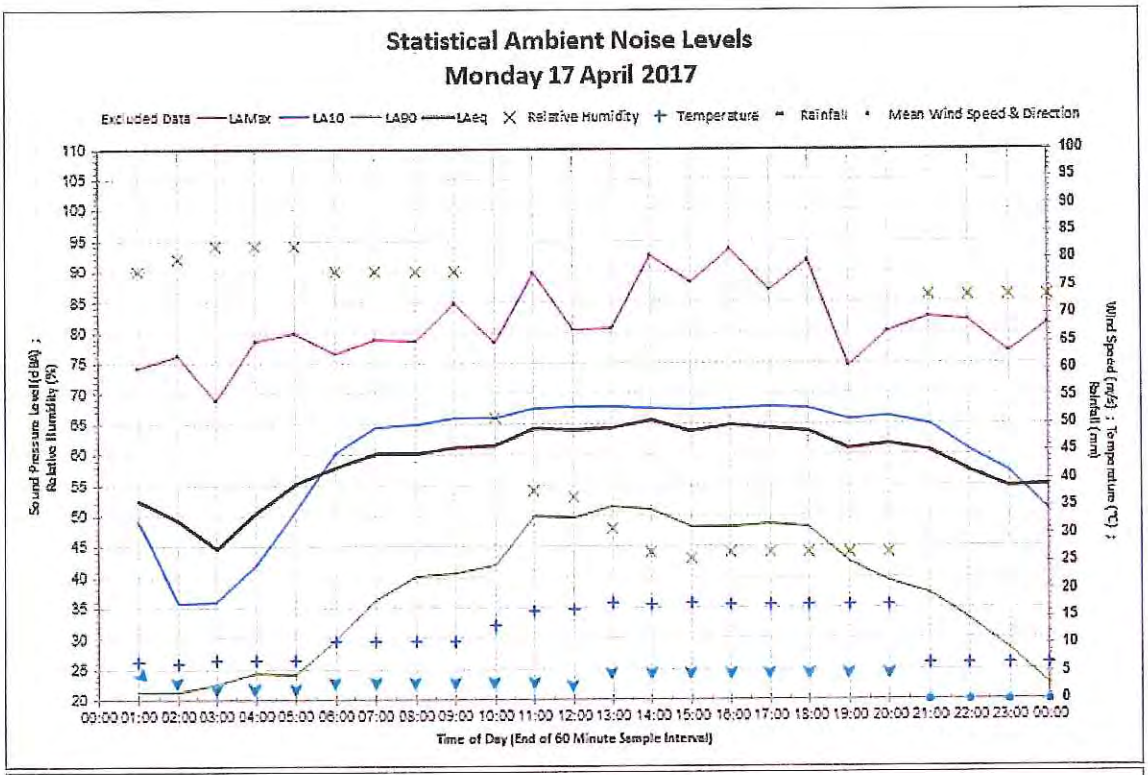

Statistical Ambient Noise Levels
Wednesday 12 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

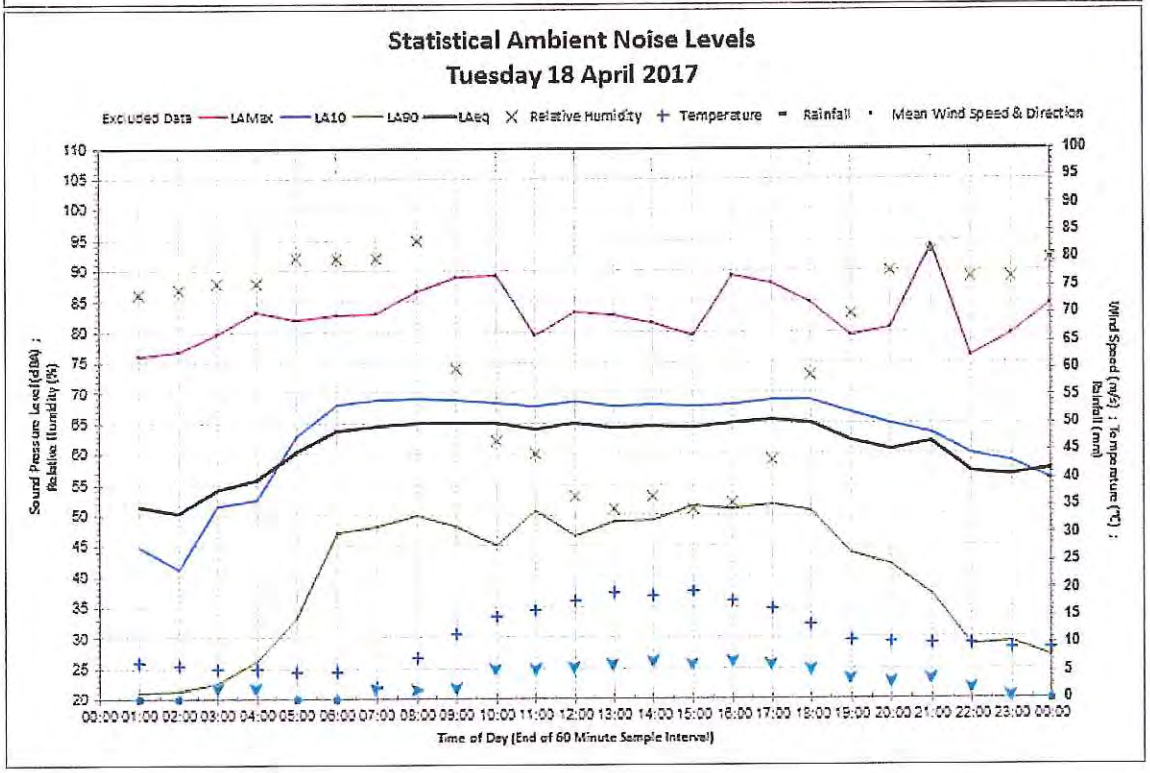

Statistical Ambient Noise Levels
Thursday 13 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

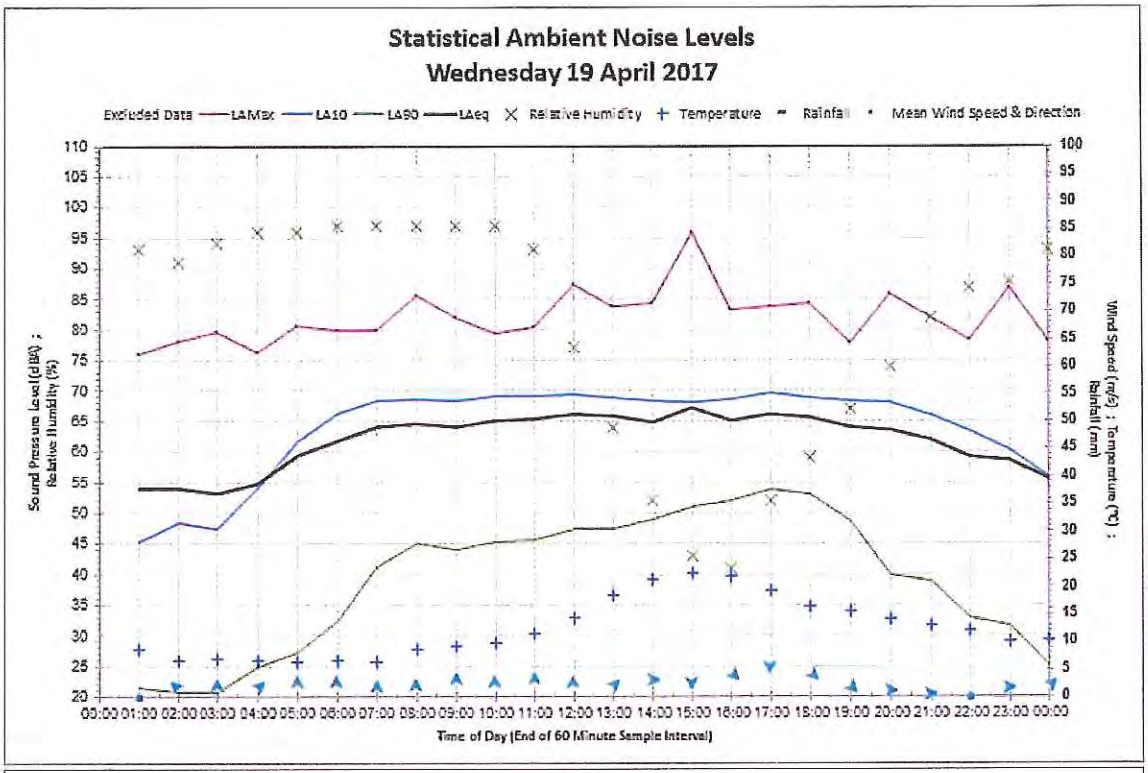

Statistical Ambient Noise Levels
Friday 14 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

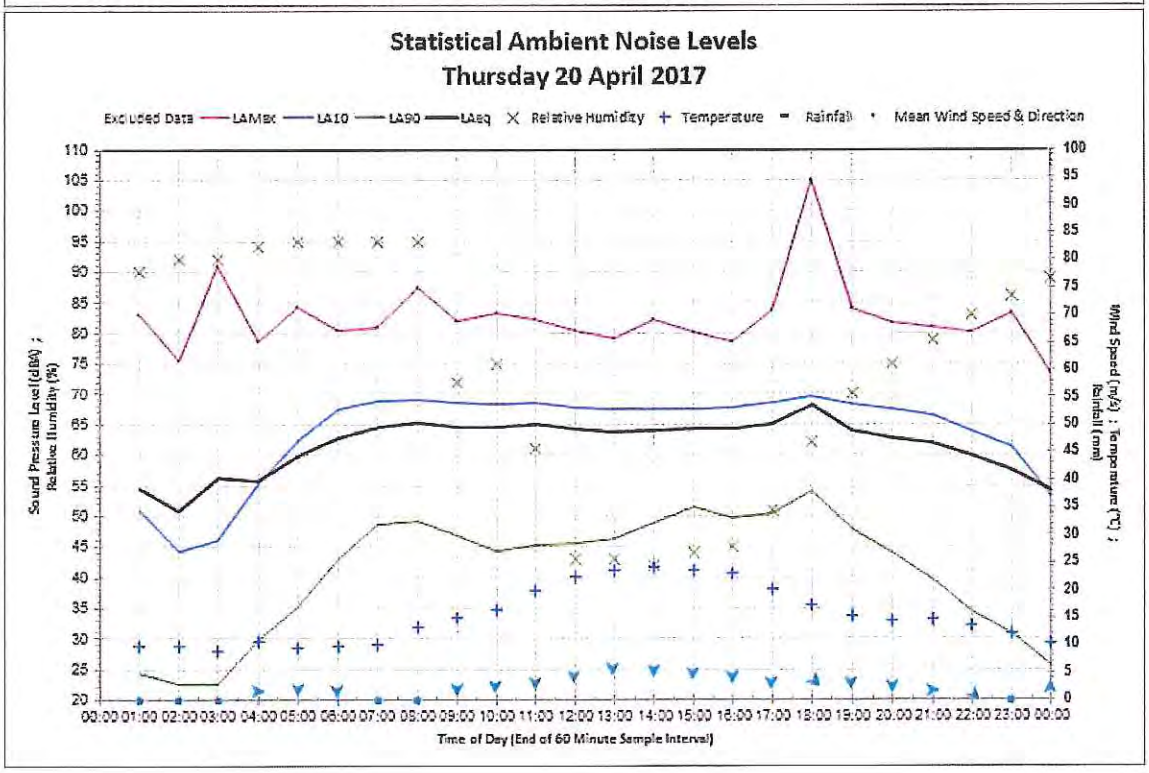

Statistical Ambient Noise Levels
Saturday 15 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level(dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 16 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level(dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 17 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 18 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 19 April 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 20 April 2017
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LA10
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Relative Humidity
Temperature
Rainfall
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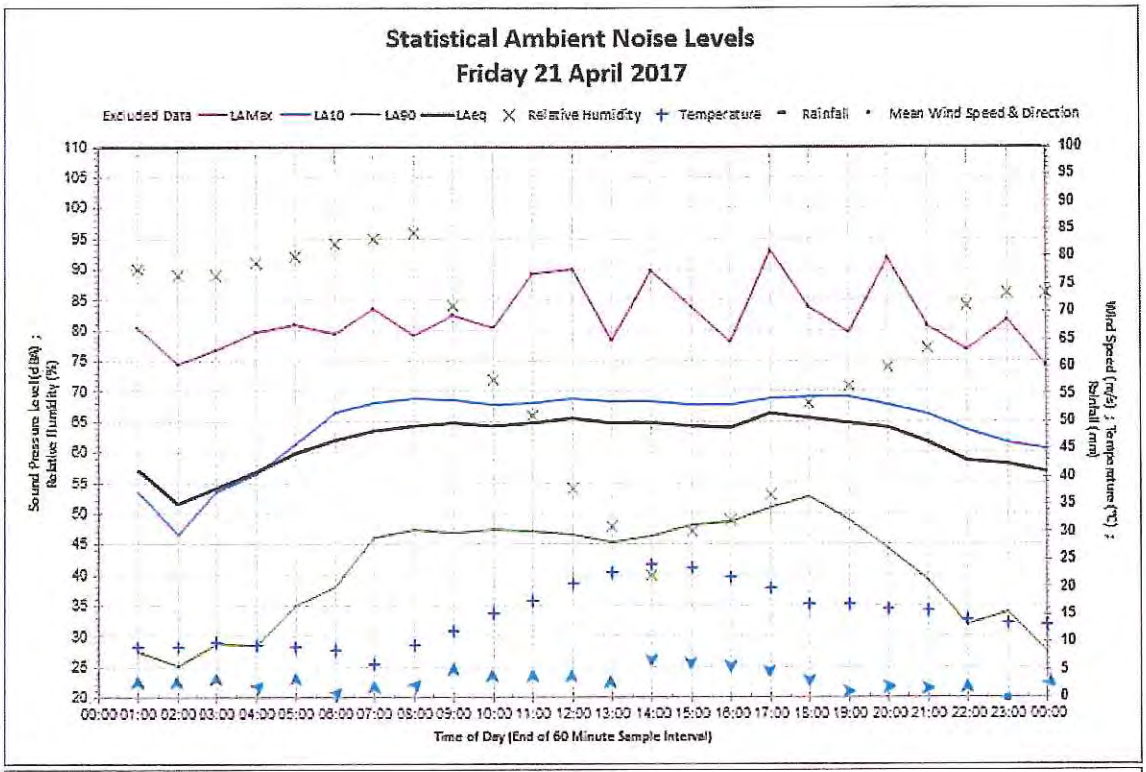
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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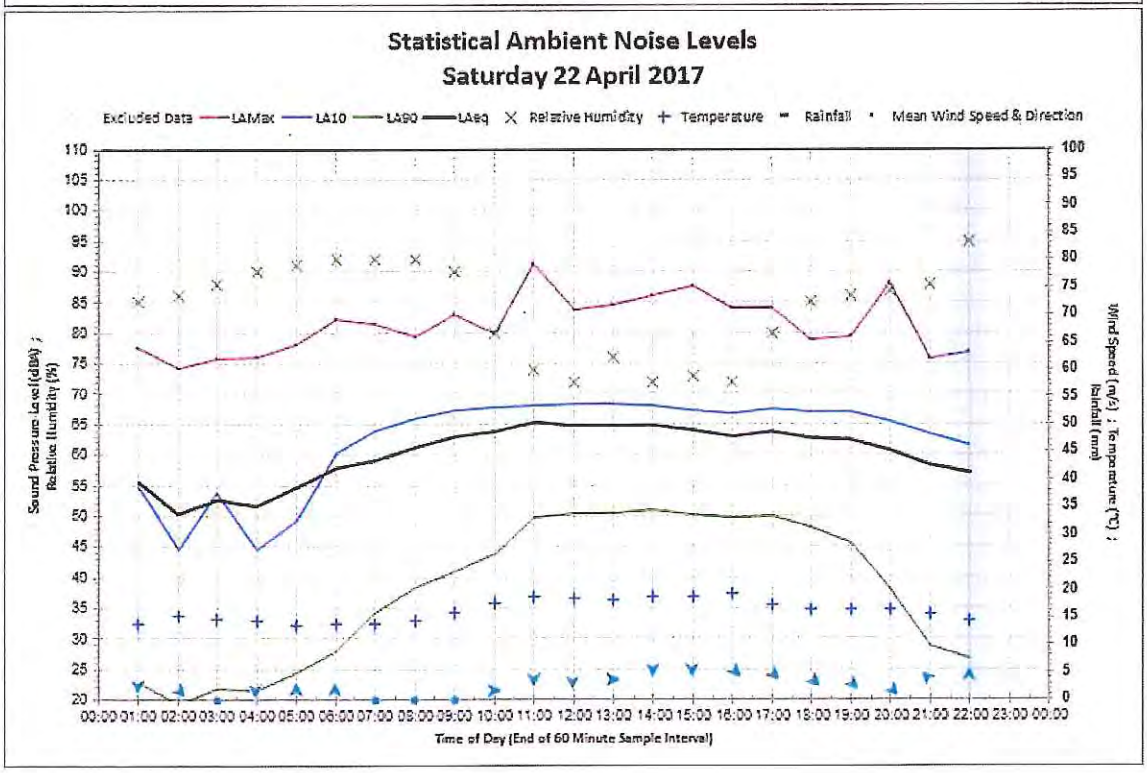
Time of Day (End of 60 Minute Sample Interval)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Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
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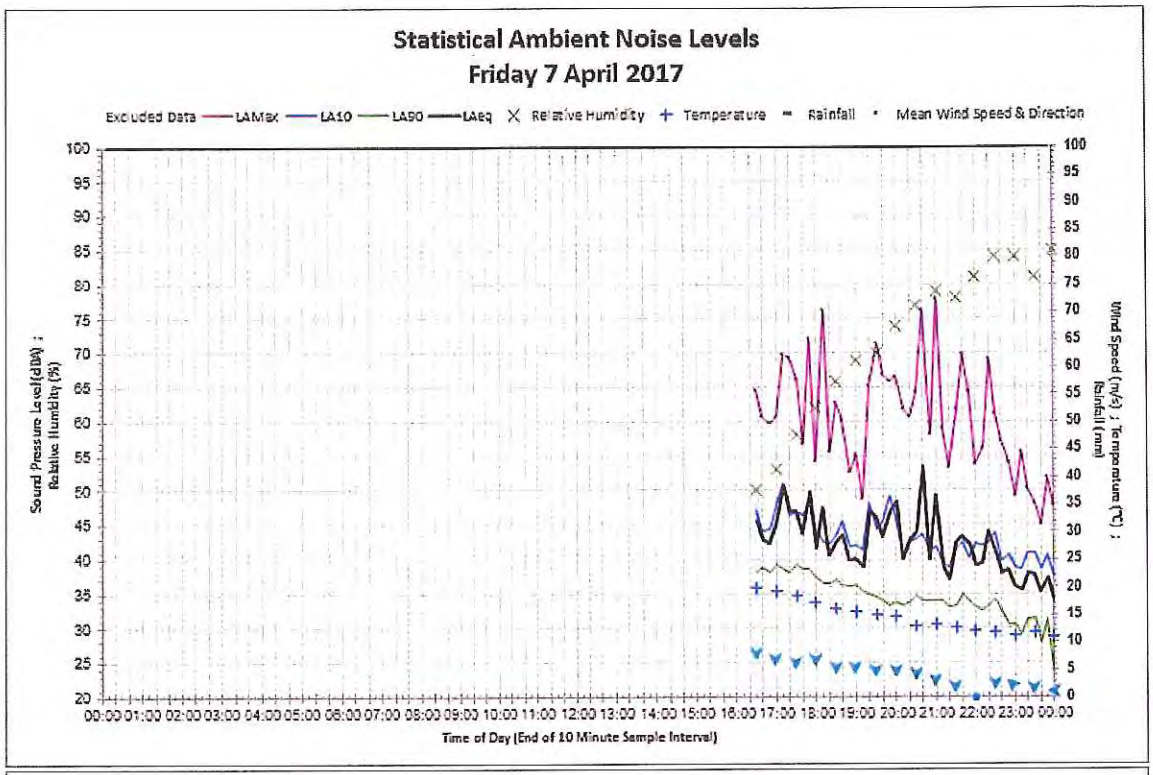
Logger L05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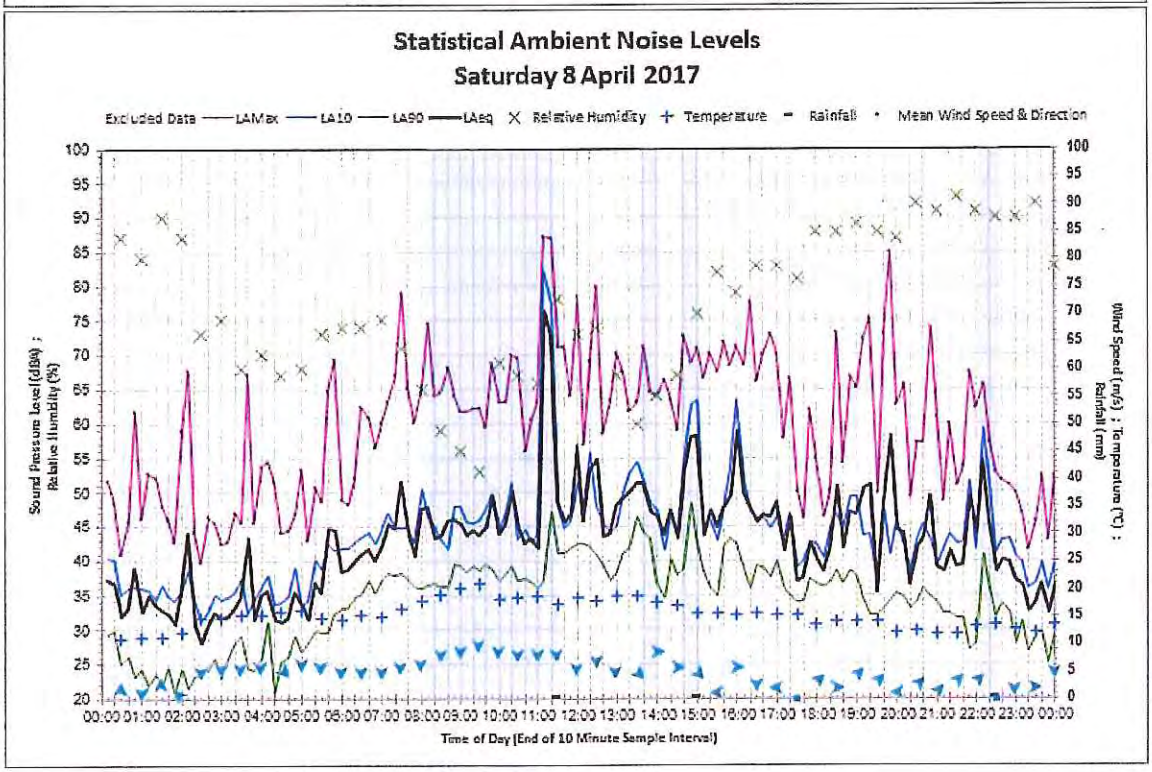
Time of Day (End of 10 Minute Sample Interval)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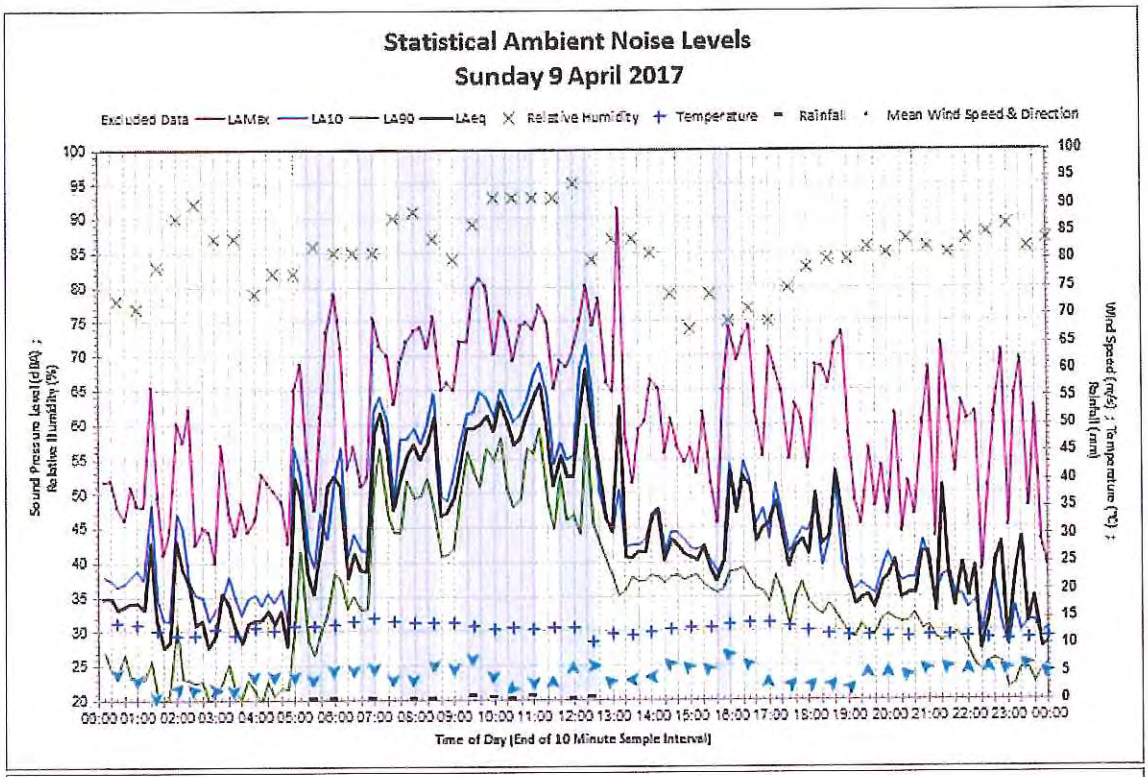
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)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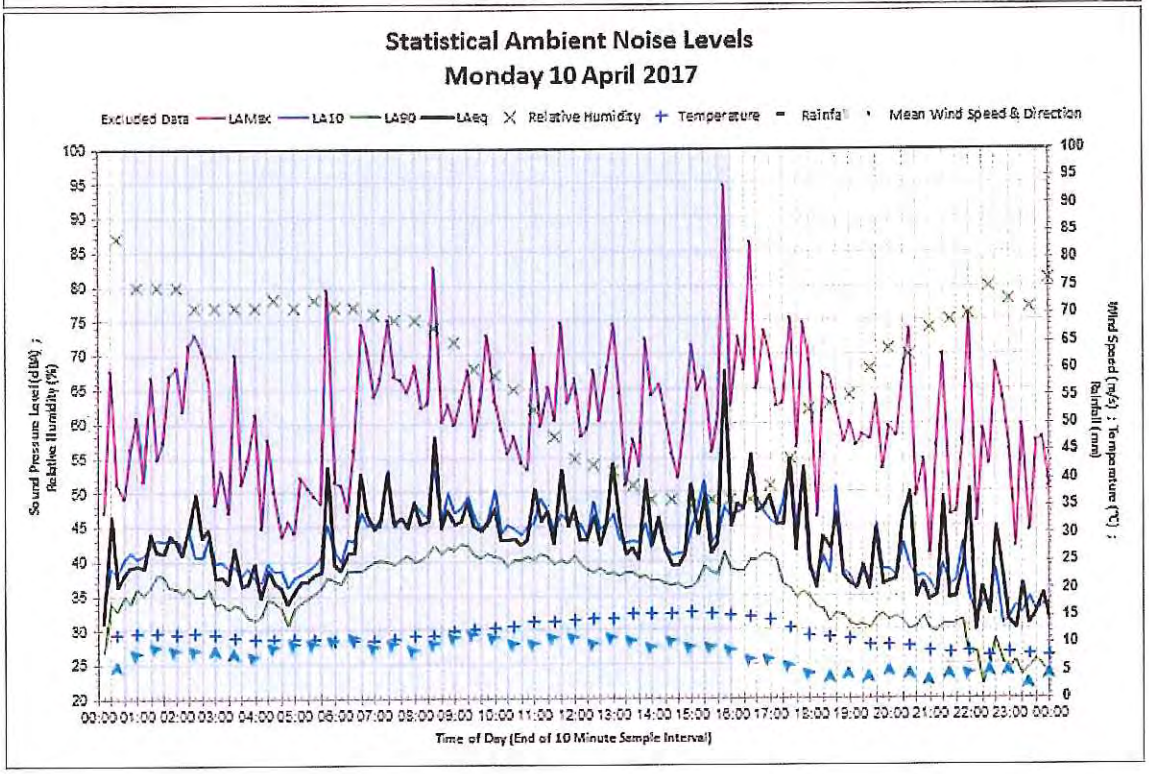
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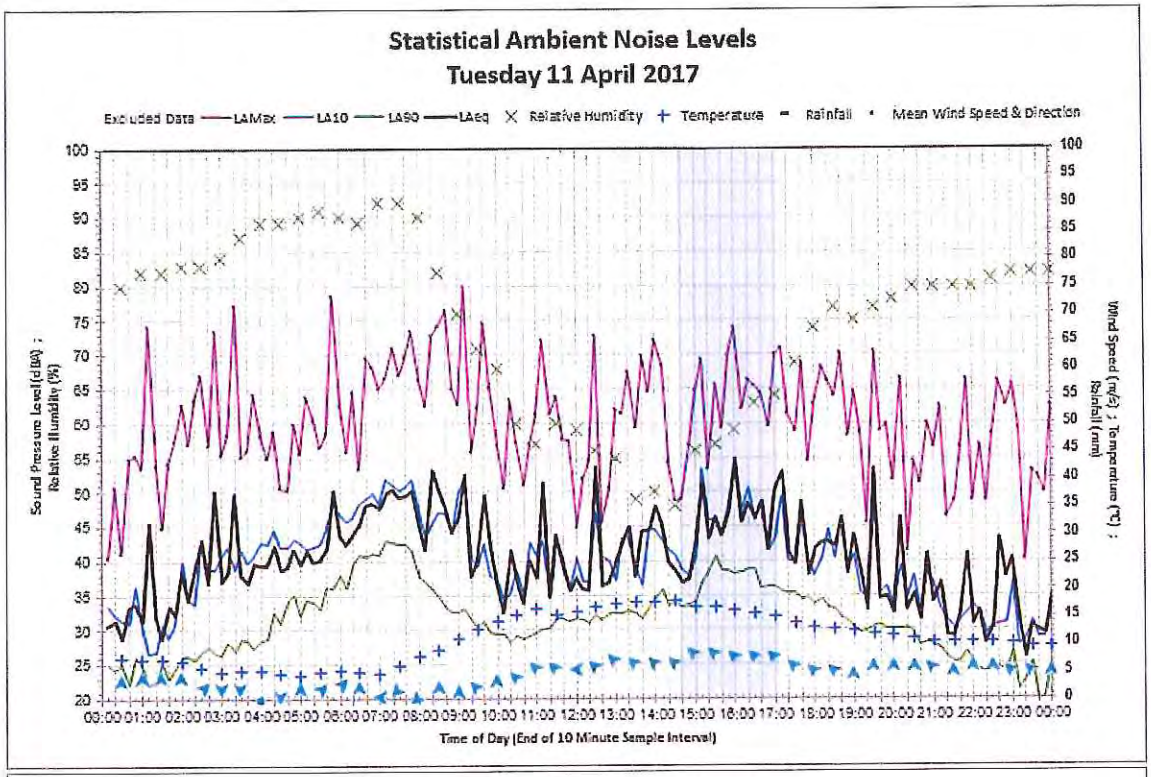
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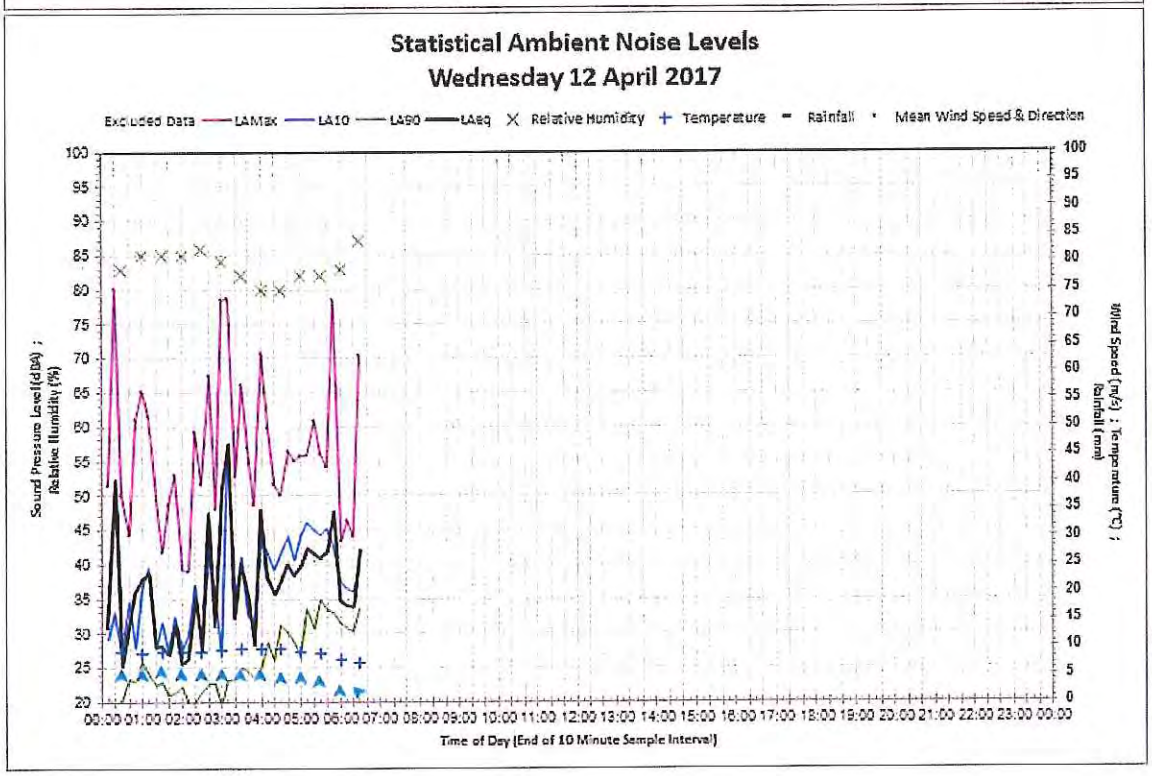
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Rainfall
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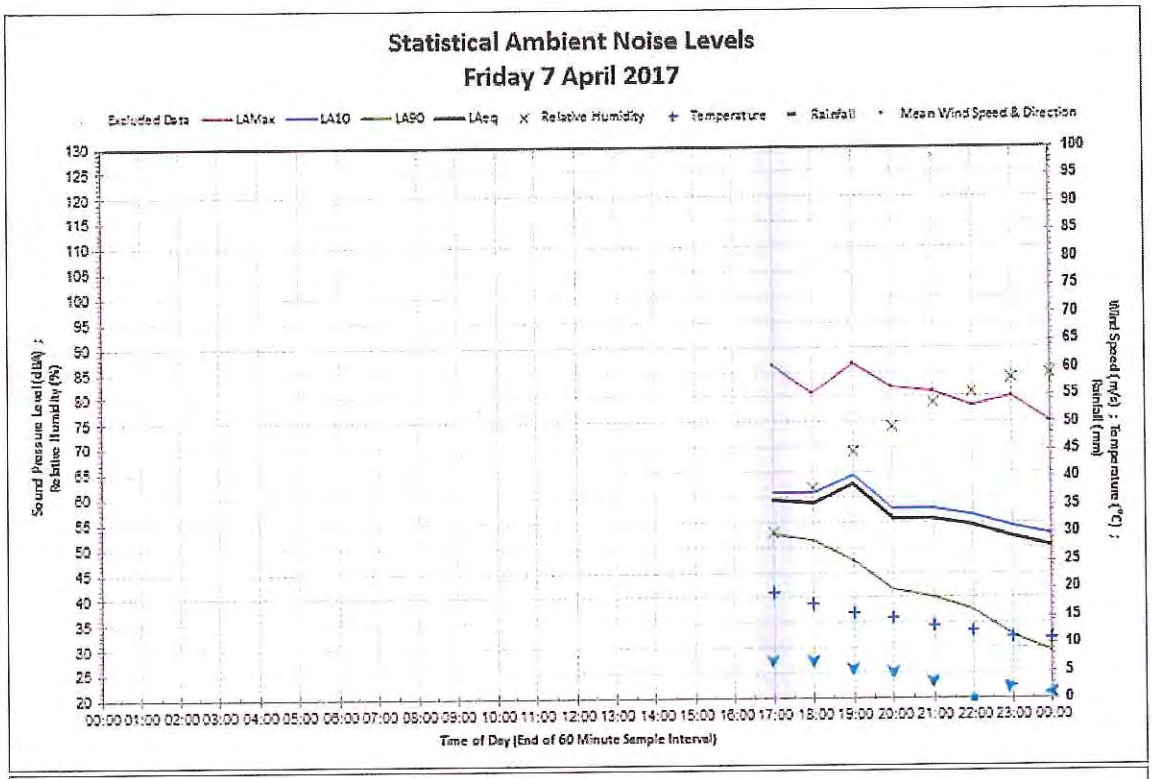
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 10 Minute Sample Interval)

Logger L06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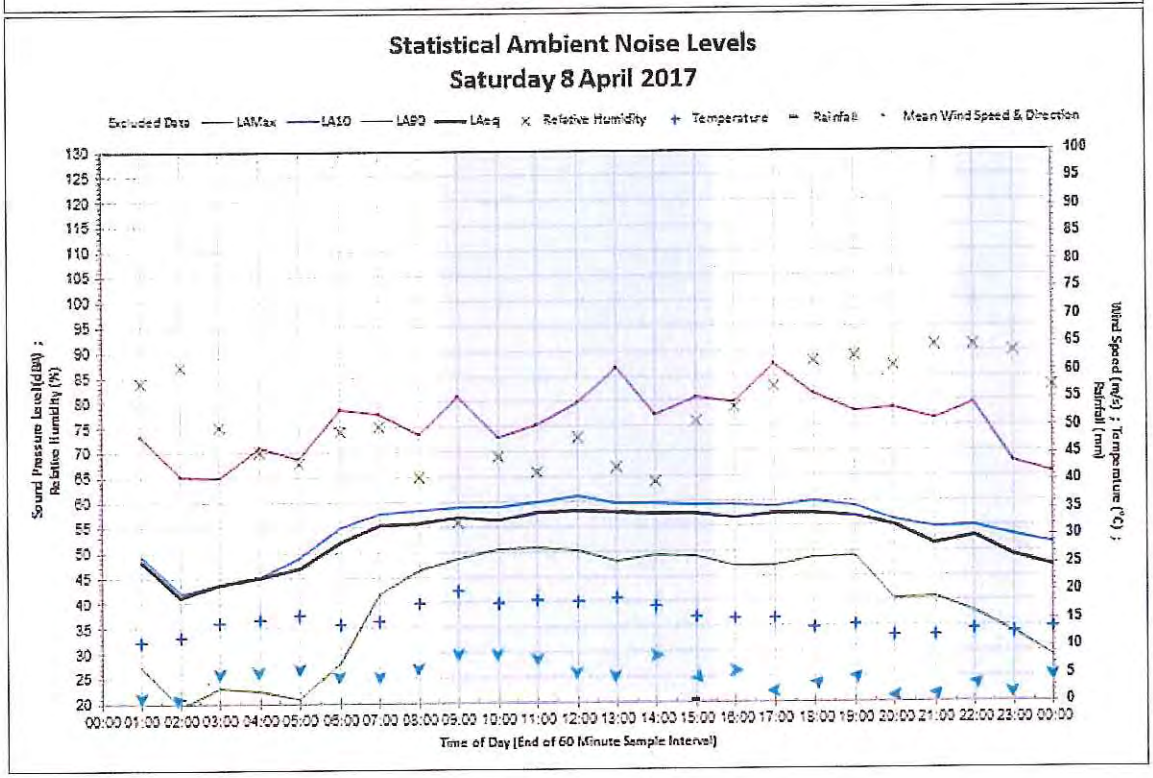
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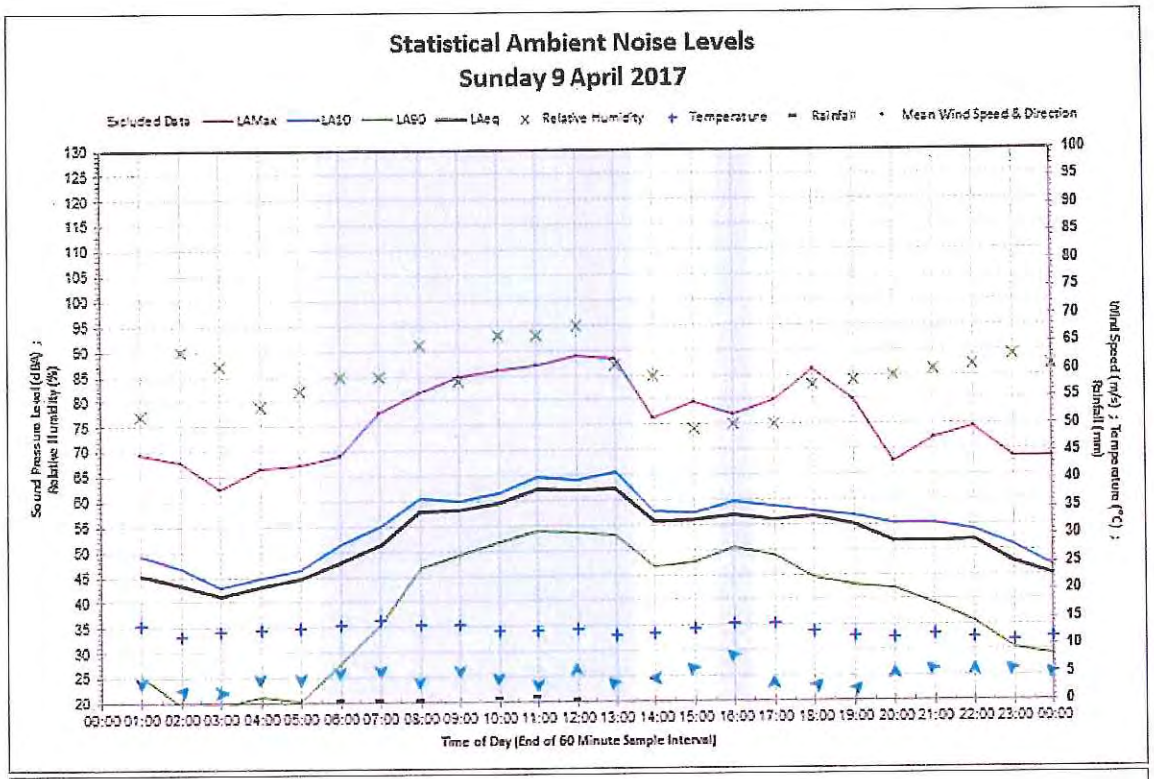
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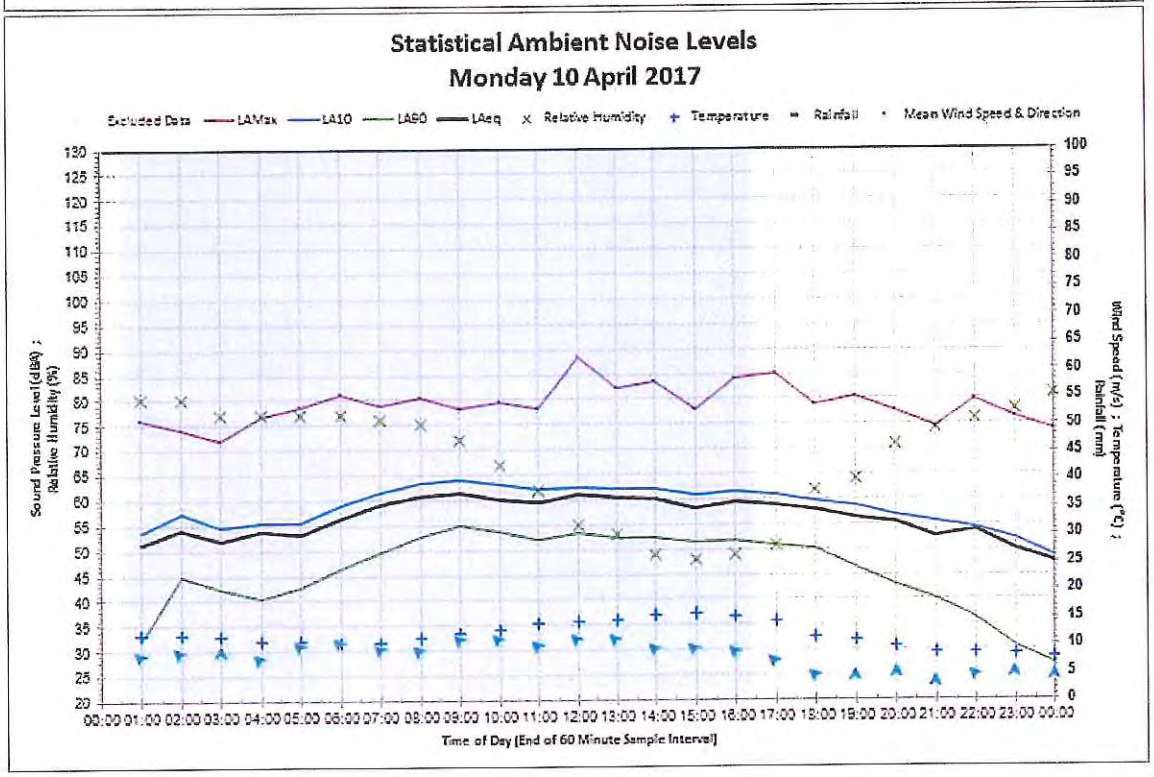
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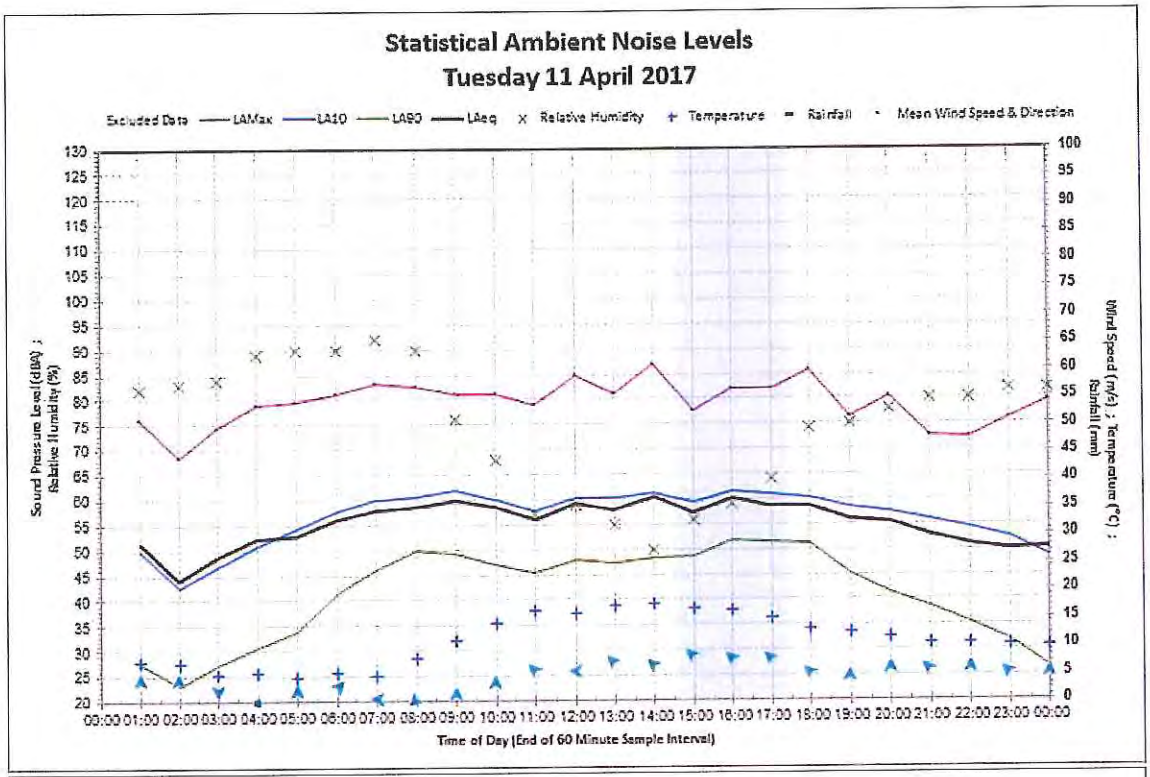
Time of Day (End of 60 Minute Sample Interval)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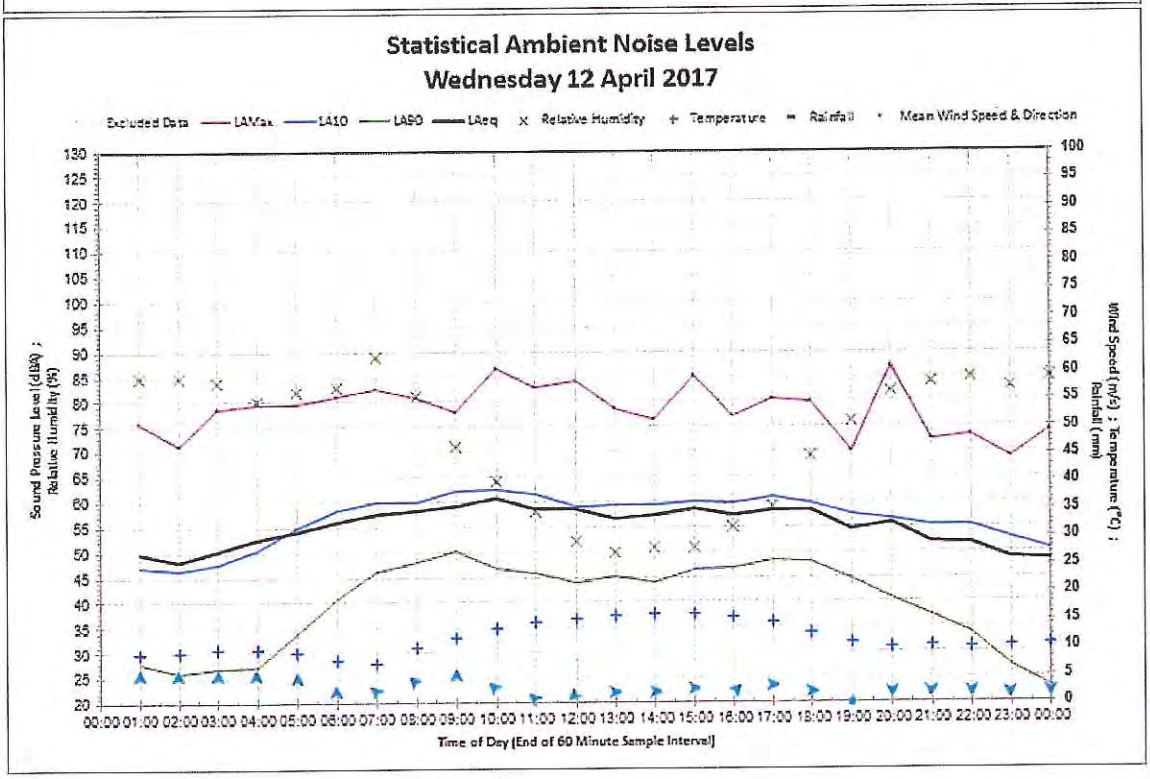
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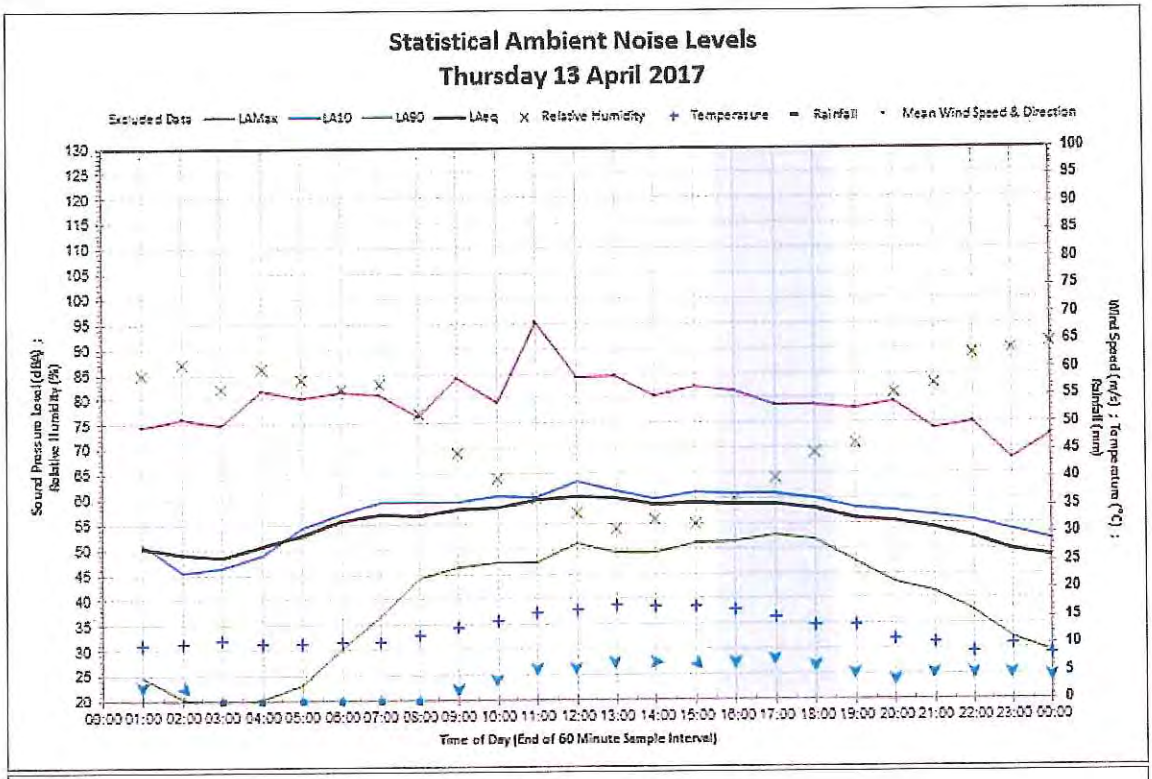
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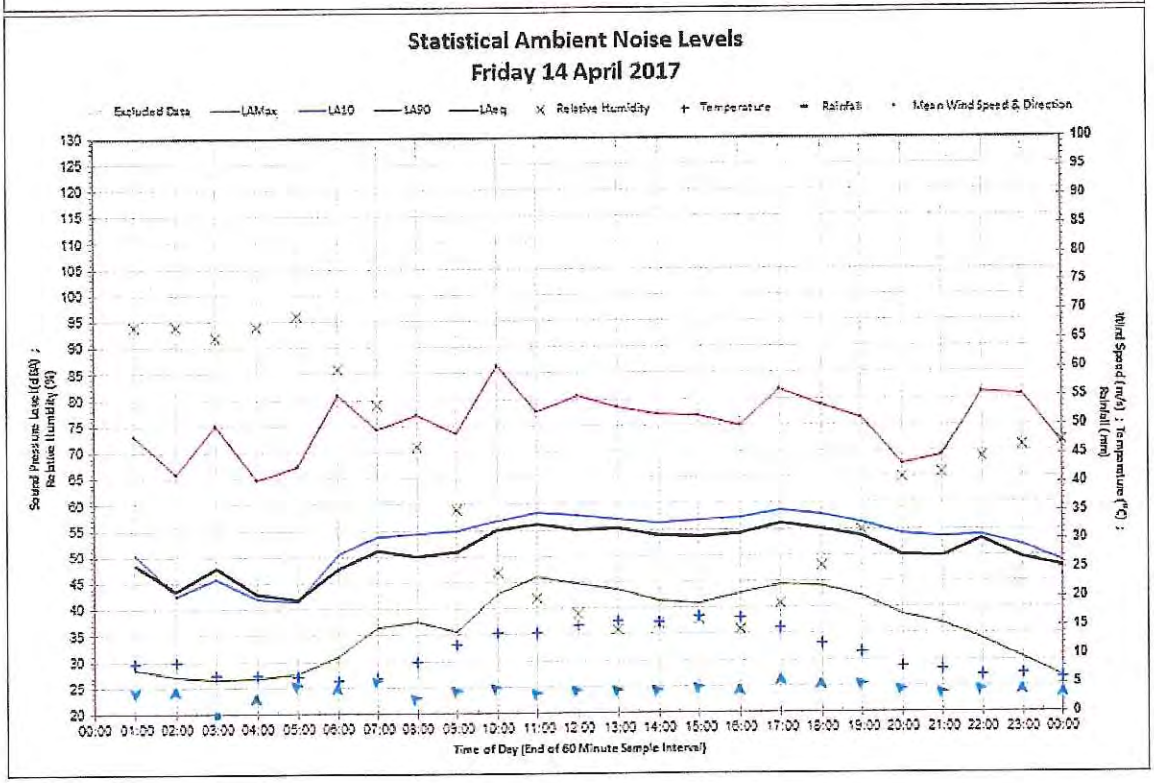
Time of Day (End of 60 Minute Sample Interval)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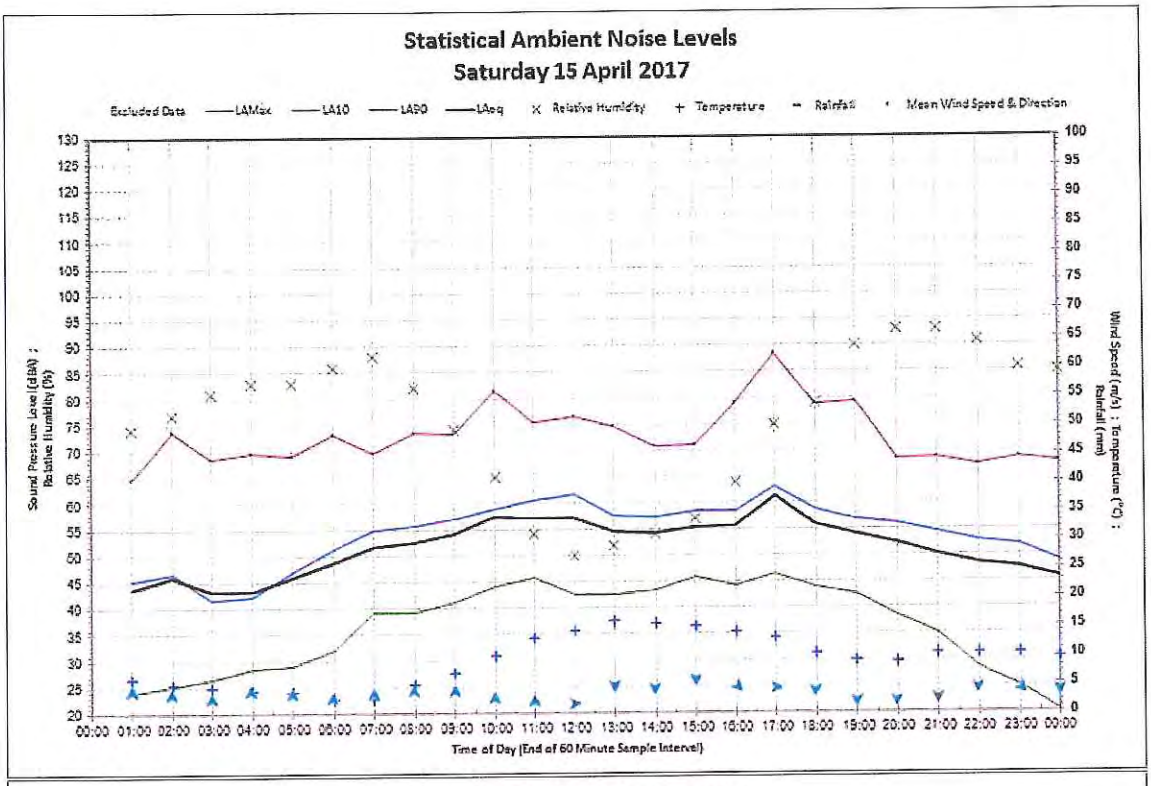
Time of Day (End of 60 Minute Sample Interval)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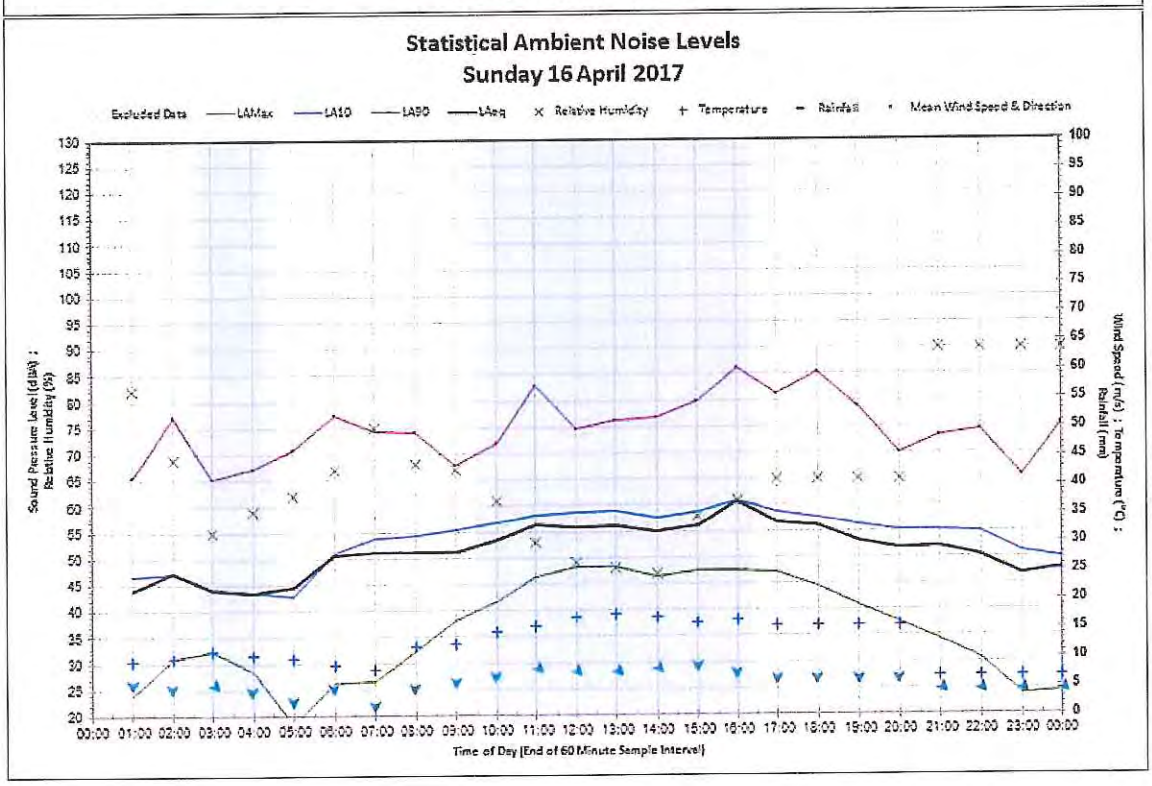
Time of Day (End of 60 Minute Sample Interval)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LAeq
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Temperature
Rainfall
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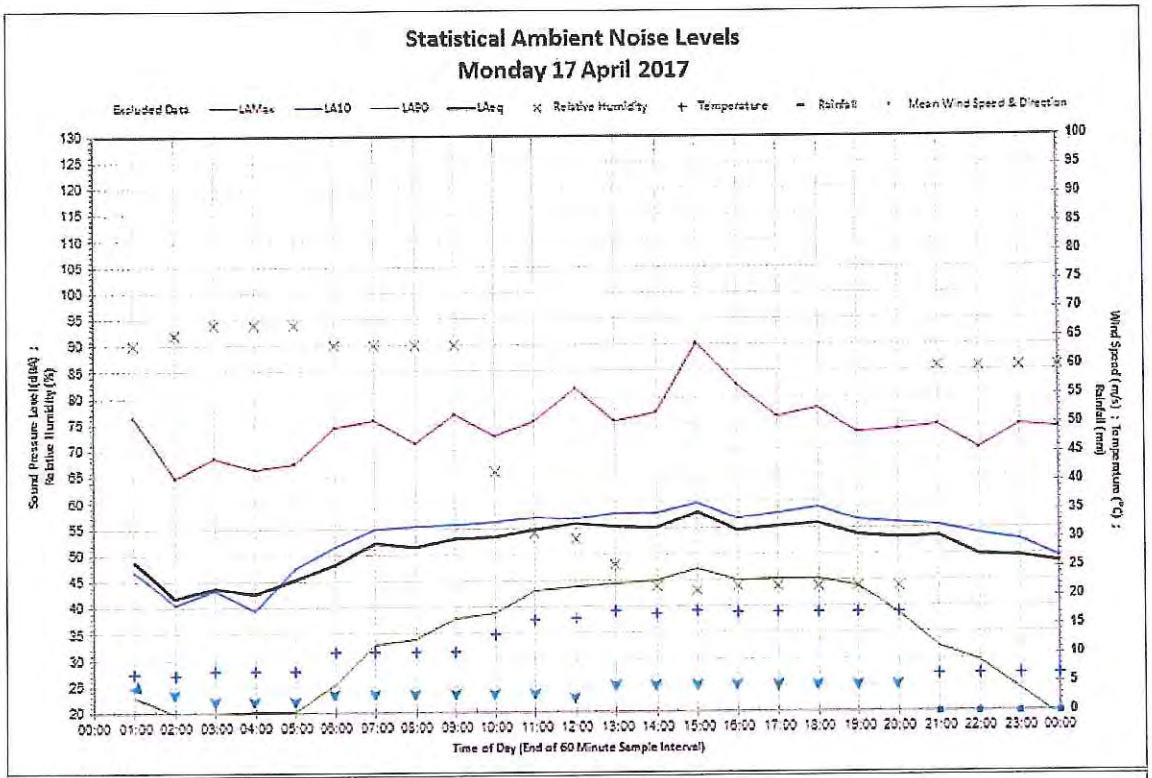
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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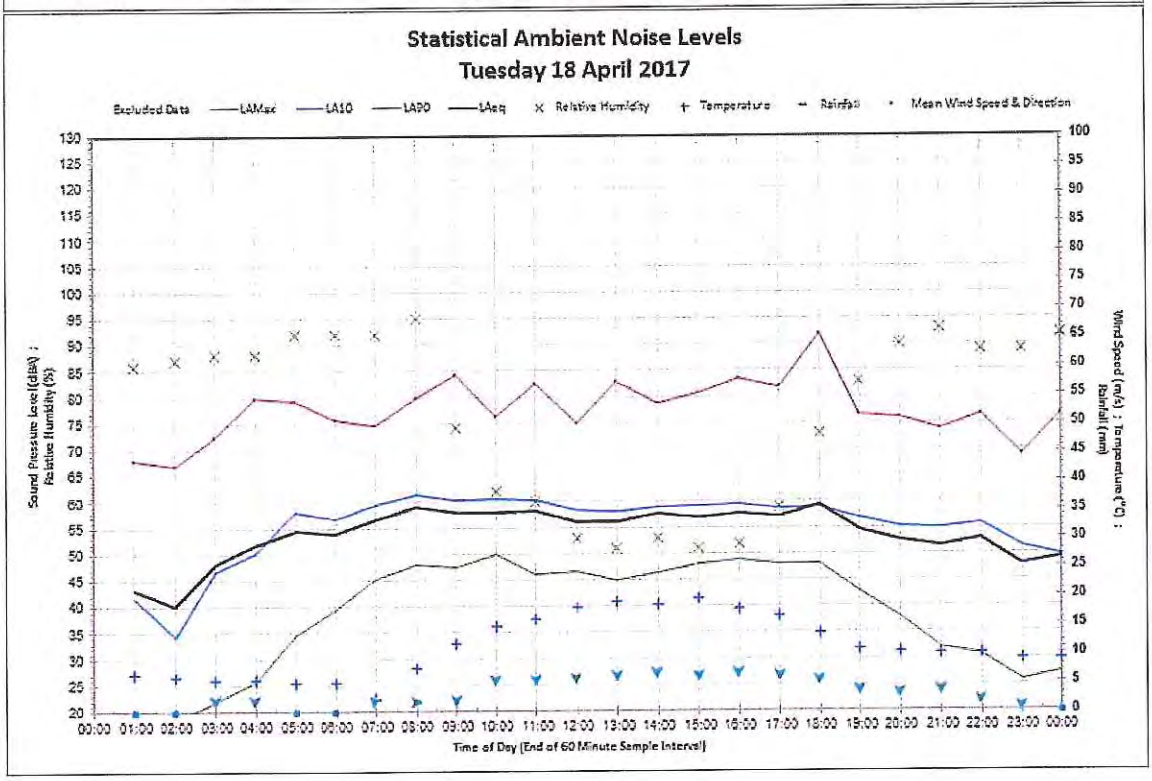
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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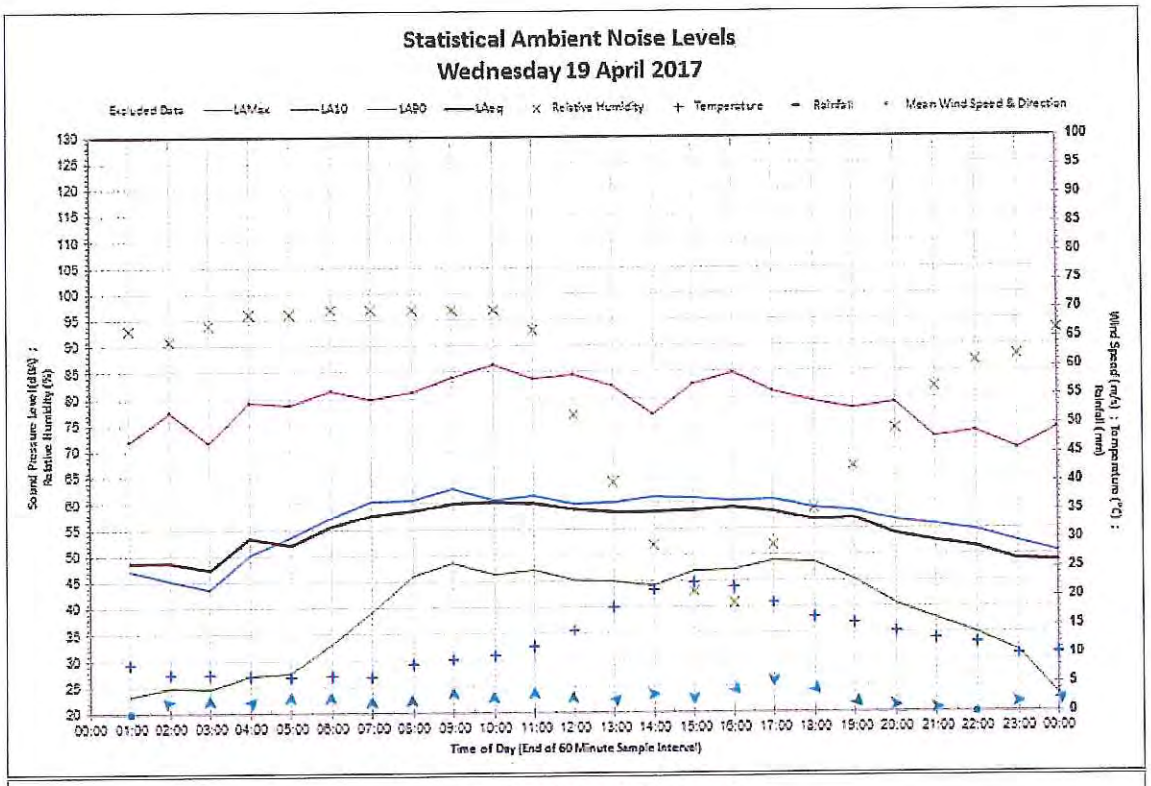
Time of Day (End of 60 Minute Sample Interval)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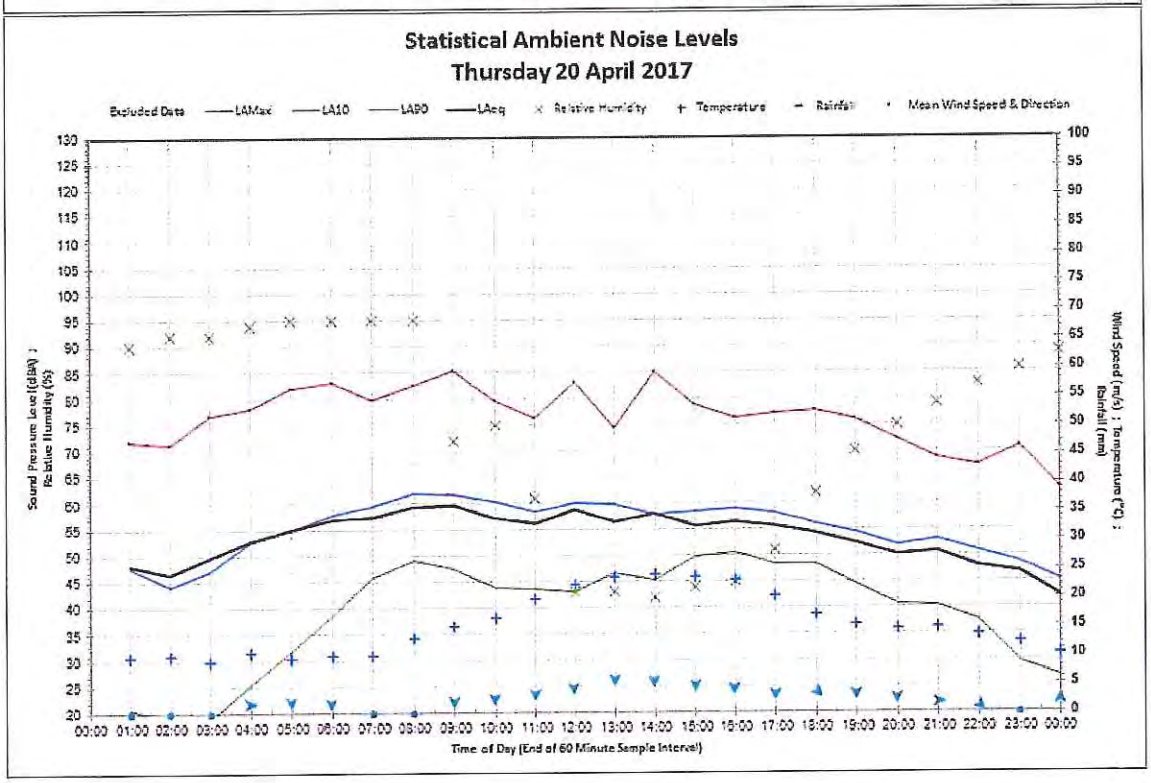
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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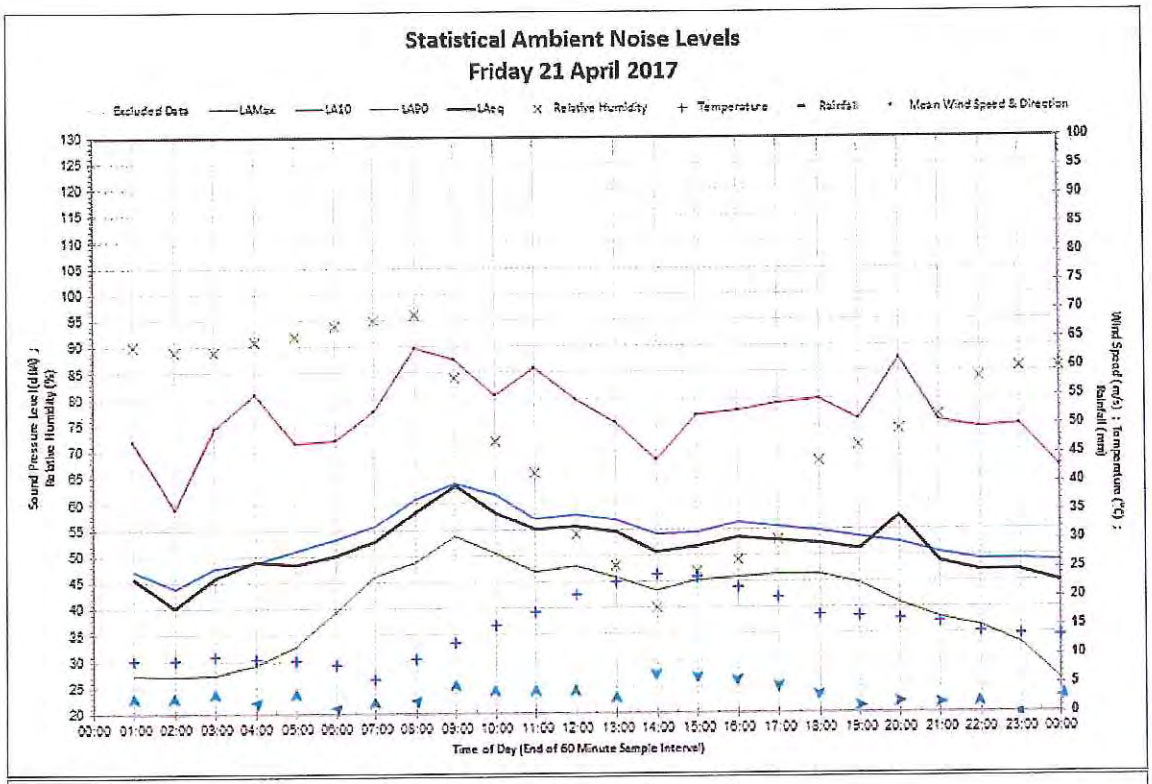
Time of Day (End of 60 Minute Sample Interval)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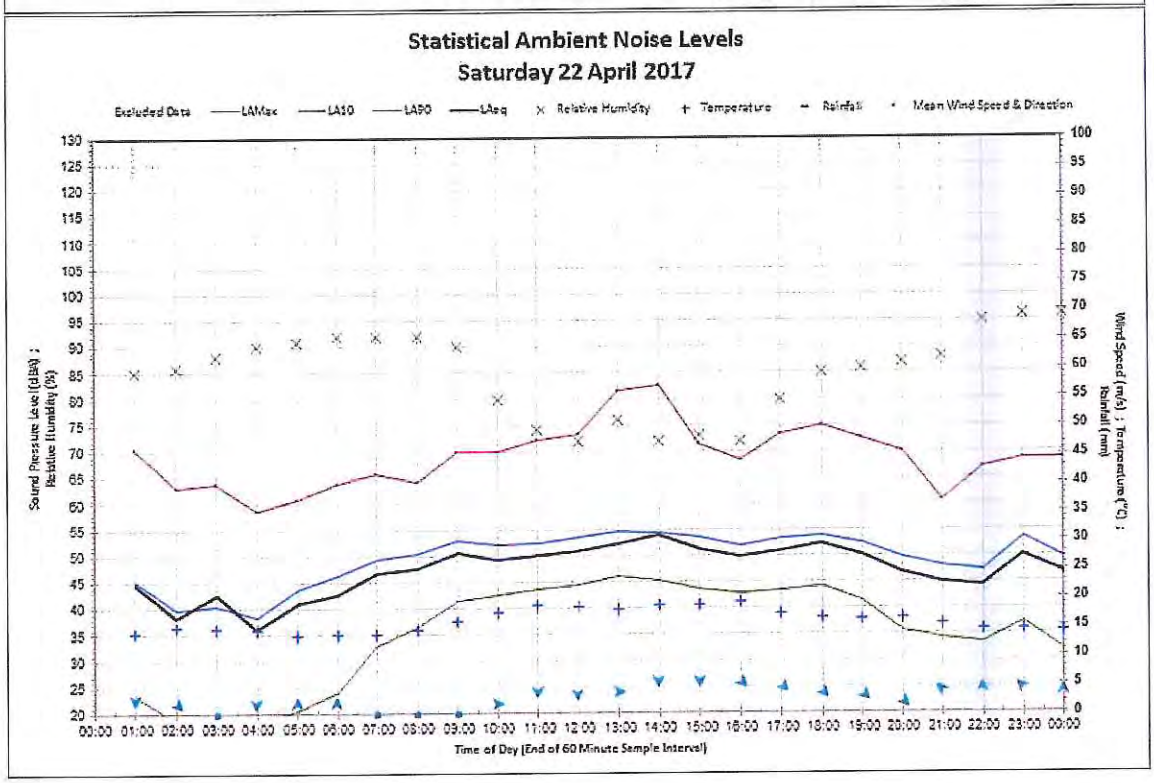
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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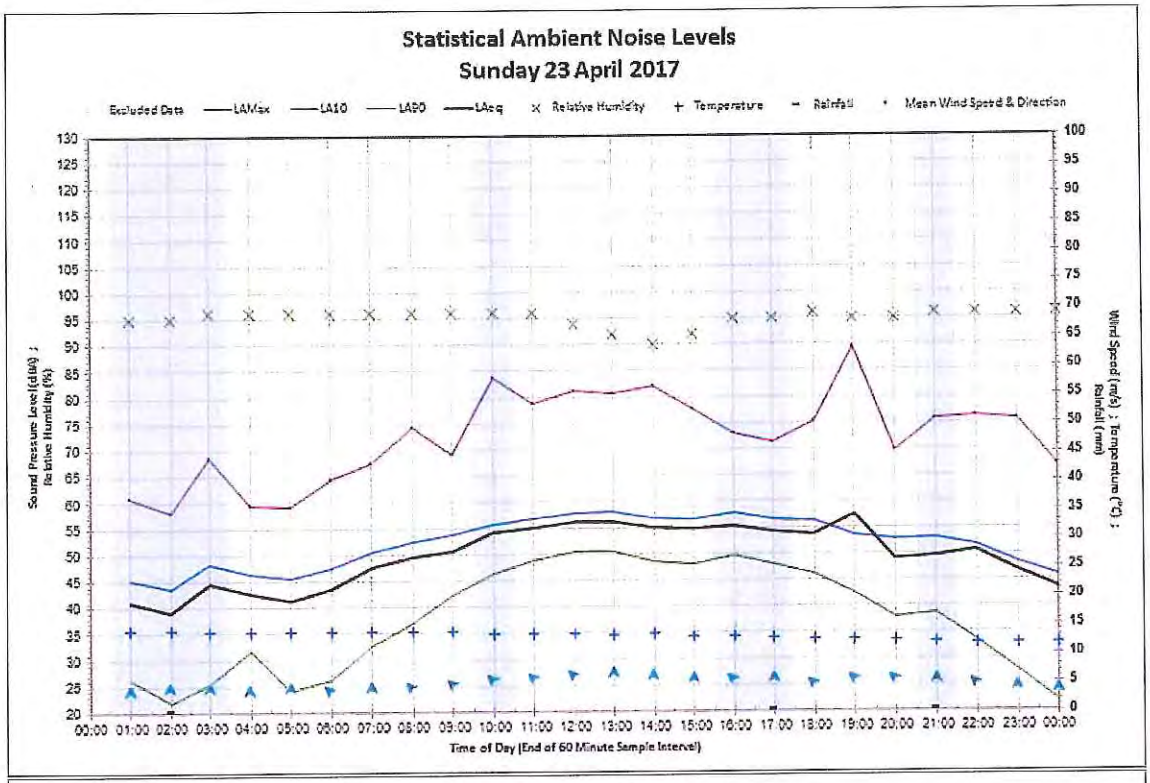
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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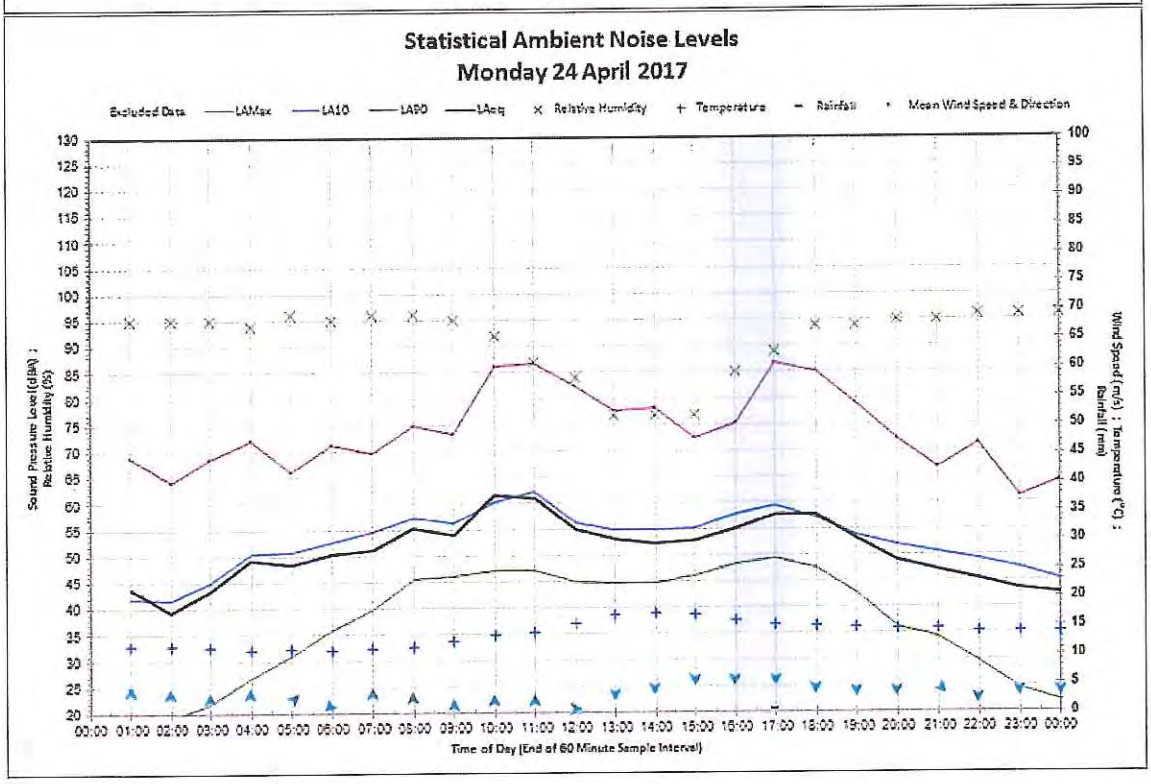
Time of Day (End of 60 Minute Sample Interval)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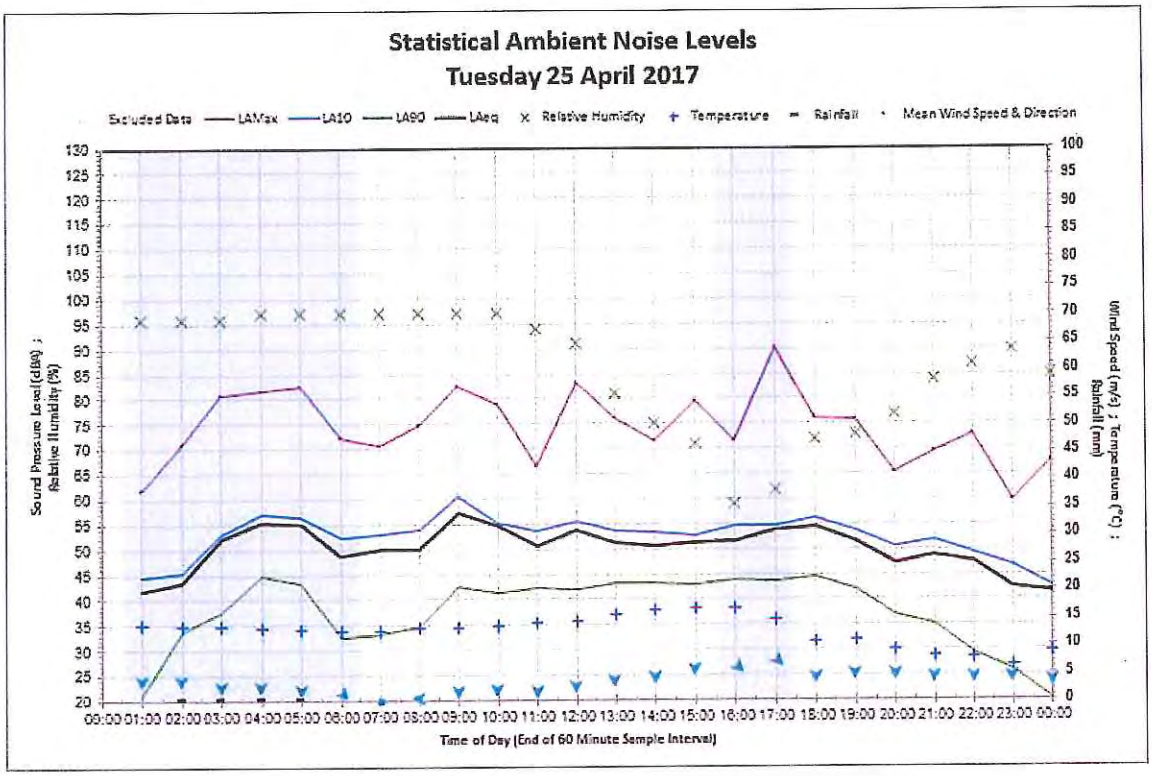
Time of Day (End of 60 Minute Sample Interval)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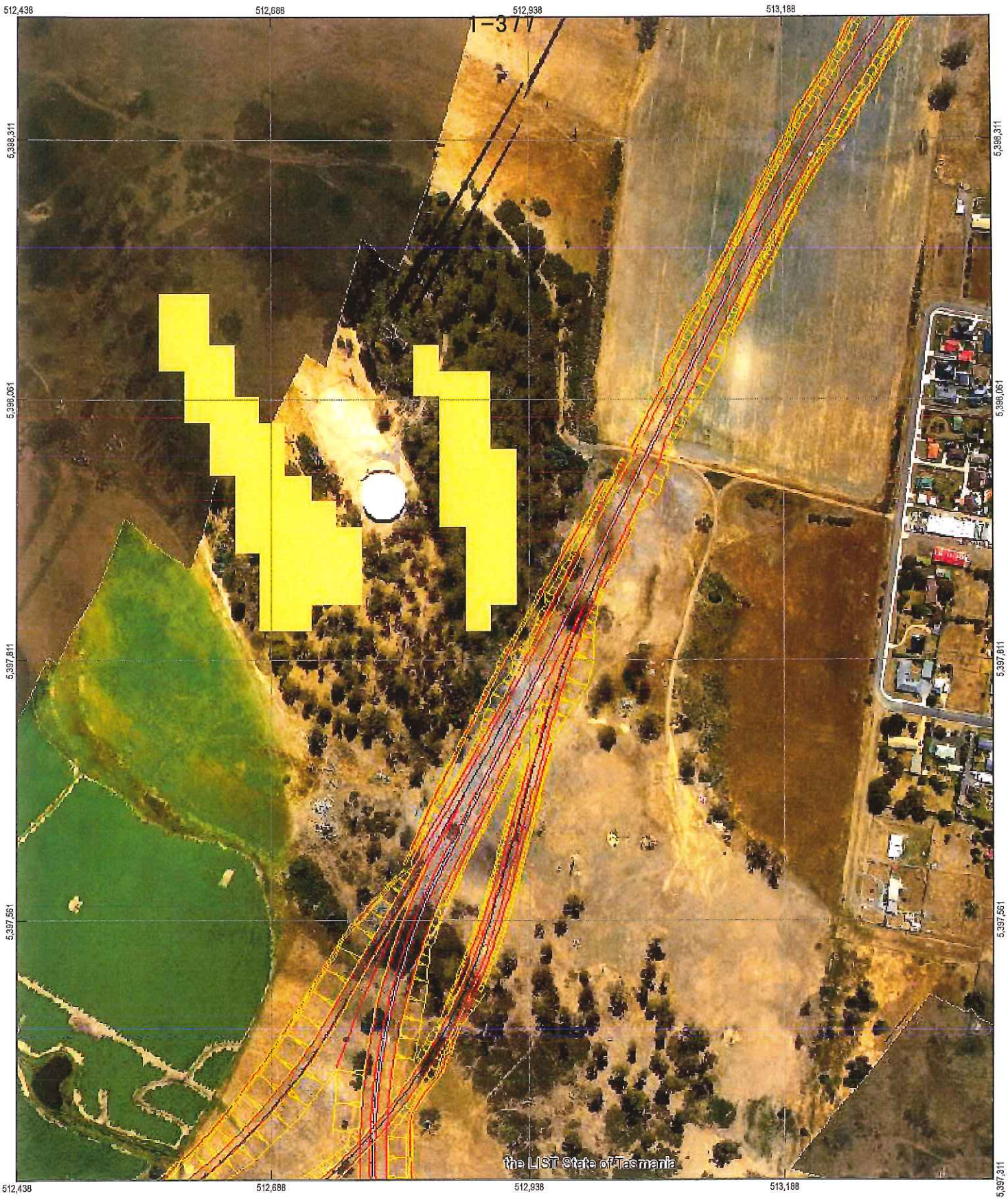
Time of Day (End of 60 Minute Sample Interval)



LEGEND - Landslide Hazard Bands (from the LIST)

Low | Medium to Active

Medium | High

Paper Size A4

0 15 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Department of State Growth
Perth Link Roads

Job Number 32-18285
Revision A
Date 10 Jul 2017

Landslide Hazard Bands
Preliminary Design

Figure 1

2 Salamanca Square, Hobart Tasmania 7000 Australia T 61 3 6210 0600 E hbamail@ghd.com W www.ghd.com

G:\32\18285\GIS\Maps\Deliverables\Landslide Hazard Bands.mxd

Analysis of *Northern Midlands Interim Planning Scheme 2013*

Department of State Growth

Perth Links Project

Compiled by Mark Wapstra, Environmental Consulting Options Tasmania, 8 May 2017

The applicable planning scheme for the project area is the *Northern Midlands Interim Planning Scheme 2013*.

The project area is zoned mainly as Rural Resource, with some General Residential and Utilities (Figure 1). The project area is not subject to the Priority Habitat overlay, although there are patches of such identified close to the project area (Figure 2).

Biodiversity Code

The PURPOSE of the Biodiversity Code is stated below:

> E8.1 Purpose of the Code
>
> E8.1.1
>
> The purpose of this provision is to:
>
> (a) protect, conserve and enhance the region's biodiversity in consideration of the extent, condition and connectivity of critical habitats and priority vegetation communities, and the number and status of vulnerable and threatened species; and
>
> (b) ensure that development is carried out in a manner that assists the protection of biodiversity by:
>
> (i) minimising vegetation and habitat loss or degradation; and
>
> (ii) appropriately locating buildings and works; and
>
> (iii) offsetting the loss of vegetation through protection of other areas where appropriate.

The project area is within a highly modified landscape.

No "critical habitats" have been identified (although noting that the *Scheme* does not provide a definition of this term).

No priority vegetation communities have been identified. Note that the *Scheme* does not define the term "priority vegetation communities" so this has taken to be equivalent to the *Scheme*'s definition of "threatened native vegetation community", which is defined as a community "that is listed in Schedule 3A of the *Nature Conservation Act 2002* or a threatened native ecological community that is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)".

No "vulnerable and threatened" species have been identified from the project area. The *Scheme*'s use of the term "vulnerable and threatened" is taken to refer to any flora and fauna species listed as threatened on the Tasmanian *Threatened Species Protection Act 1995* (TSPA) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA), not just those listed as "vulnerable". The ecological assessment has identified sites of TSPA-listed flora species only from outside the project's footprint. Only potential habitat if TSPA- and EPBCA-listed threatened fauna has been identified from the projects' footprint. Mitigation measures have been included in the design to ensure that disturbance to such potential habitat will be minimised, including installation of specially-designed culverts to allow fauna movement (in relation to the green and golden frog) to maintain connectivity.

On the basis of the above discussion, the intent of E8.1.1(a) is considered to be met.

There will be minimal clearing of native vegetation and habitat loss/degradation will be minimised through implementation of design elements such as specially-designed culverts to allow faunal movements, such that the intent of E8.1.1(b)(i) will be met.

There are constraints to the location of works due to various non-biodiversity values but it is considered that the design is such that the impact on biodiversity values is minimised, such that the intent of E8.1.1(b)(ii) will be met.

The *Scheme* defines "native vegetation" as "plants that are indigenous to Tasmania including trees, shrubs, herbs and grasses that have not been planted for domestic or commercial purposes" but herein it is taken to reasonably refer to native vegetation communities. On this basis, the works will result in essentially the clearing of little to no "native vegetation" as the works will be largely in agricultural land, meaning that formal offsetting for vegetation loss is not likely to be warranted, such that the intent of E8.1.1(b)(iii) will be met.

The APPLICATION of the Biodiversity Code is stated below:

> E8.2 Application of this Code
>
> E8.2.1
>
> This code applies to use or development of land:
>
> (a) within the area identified as priority habitat on the planning scheme maps; and
>
> (b) for the removal of native vegetation.

No part of the project area is identified as "priority habitat" (refer Figure 2), such that E8.2.1(a) has no application.

See response to E8.1.1(b)(iii) in relation to the definition of "native vegetation". In a highly technical sense only can the works be regarded as resulting on the "removal of native vegetation", such that E8.2.1(b) has limited application.

The OBJECTIVES of the DEVELOPMENT STANDARDS for HABITAT AND VEGETATION MANAGEMENT are stated below:

> E8.6 Development Standards
>
> E8.6.1 Habitat and Vegetation Management
>
> Objective
>
> To ensure that:
>
> (a) vegetation identified as having conservation value as habitat has priority for protection and is appropriately managed to protect those values; and
>
> (b) the representation and connectivity of vegetation communities is given appropriate protection when considering the impacts of use and development.

No "vegetation identified as having conservation value as habitat" has been identified from the project area such that clause (a) of the OBJECTIVE of E8.6.1 has limited application.

The works will not result in the loss of "representation and connectivity of vegetation communities" because they are largely in primary production land that is already highly modified.

On this basis, while the OBJECTIVE of E8.6.1 may have limited application, it is considered that the intent is met through the minimal clearing of "native vegetation" and works occurring in a highly modified landscape.

The ACCEPTABLE SOLUTIONS for the DEVELOPMENT STANDARDS for HABITAT AND VEGETATION MANAGEMENT are stated below:

> Acceptable Solutions
>
> A1.1
>
> Clearance or disturbance of priority habitat is in accordance with a certified Forest Practices Plan or:
>
> A1.2
>
> Development does not clear or disturb native vegetation within areas identified as priority habitat.
>
> A2
>
> Clearance or disturbance of native vegetation is in accordance with a certified Forest Practices Plan.

In relation to A1.1 and A2, the works do not require a Forest Practices Plan and the construction of "public roads" is exempt under 4.(d)(iii) of the *Forest Practices Regulations 2017*, such that these Acceptable Solutions have no application.

In relation to A1.2, while there may be some limited clearing of "native vegetation" (but see previous discussion on the applicability of the term to the vegetation identified from the project area), none of this will be within an area identified as priority habitat (refer Figure 2), such that the Acceptable Solution is met.

On this basis, the finding is that the proposed Perth Links Project will comply with the intent and specifics of the Biodiversity Code of the *Northern Midlands Interim Planning Scheme 2013*.

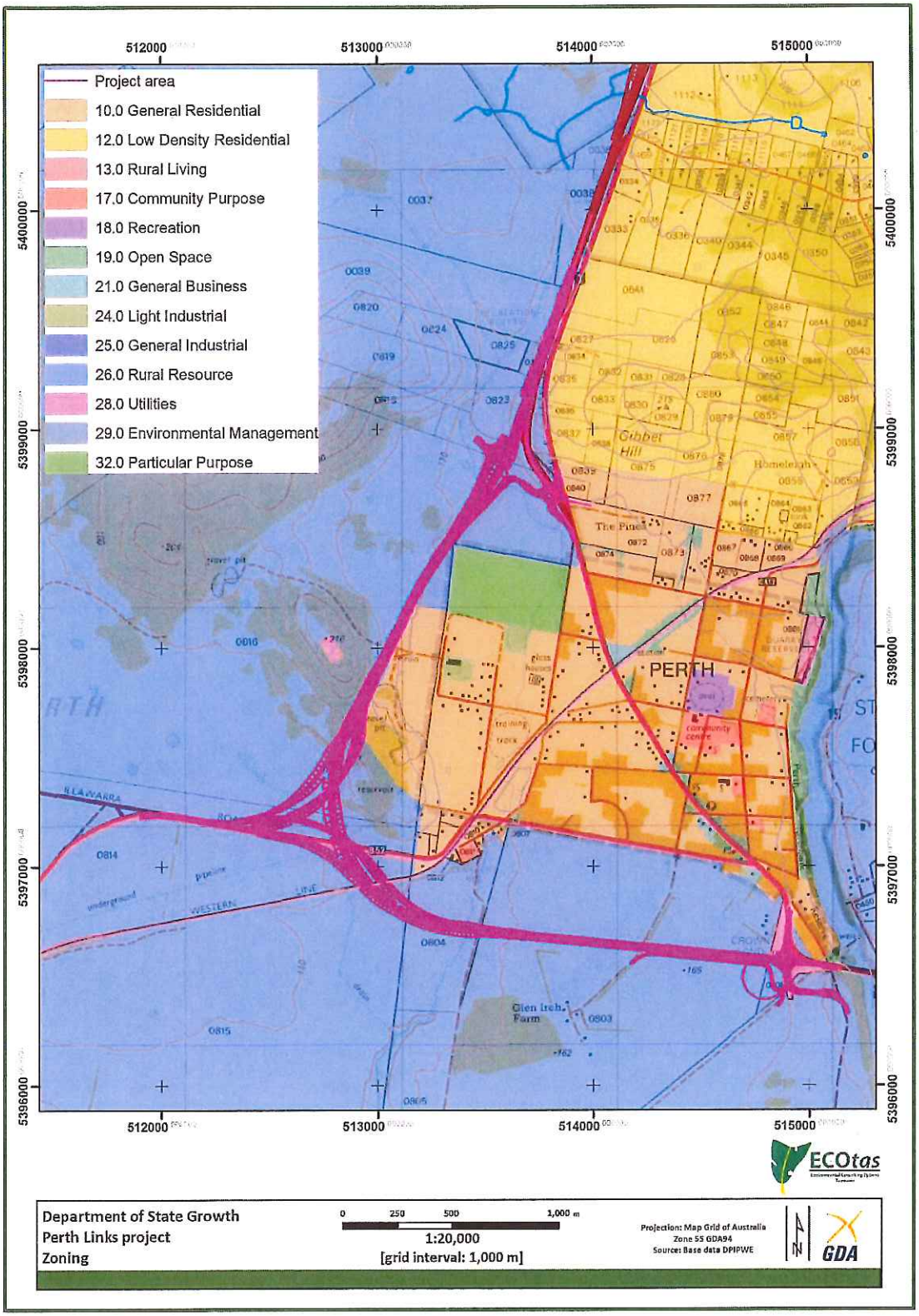


Figure 1. Zoning of the project area [source: TheList]

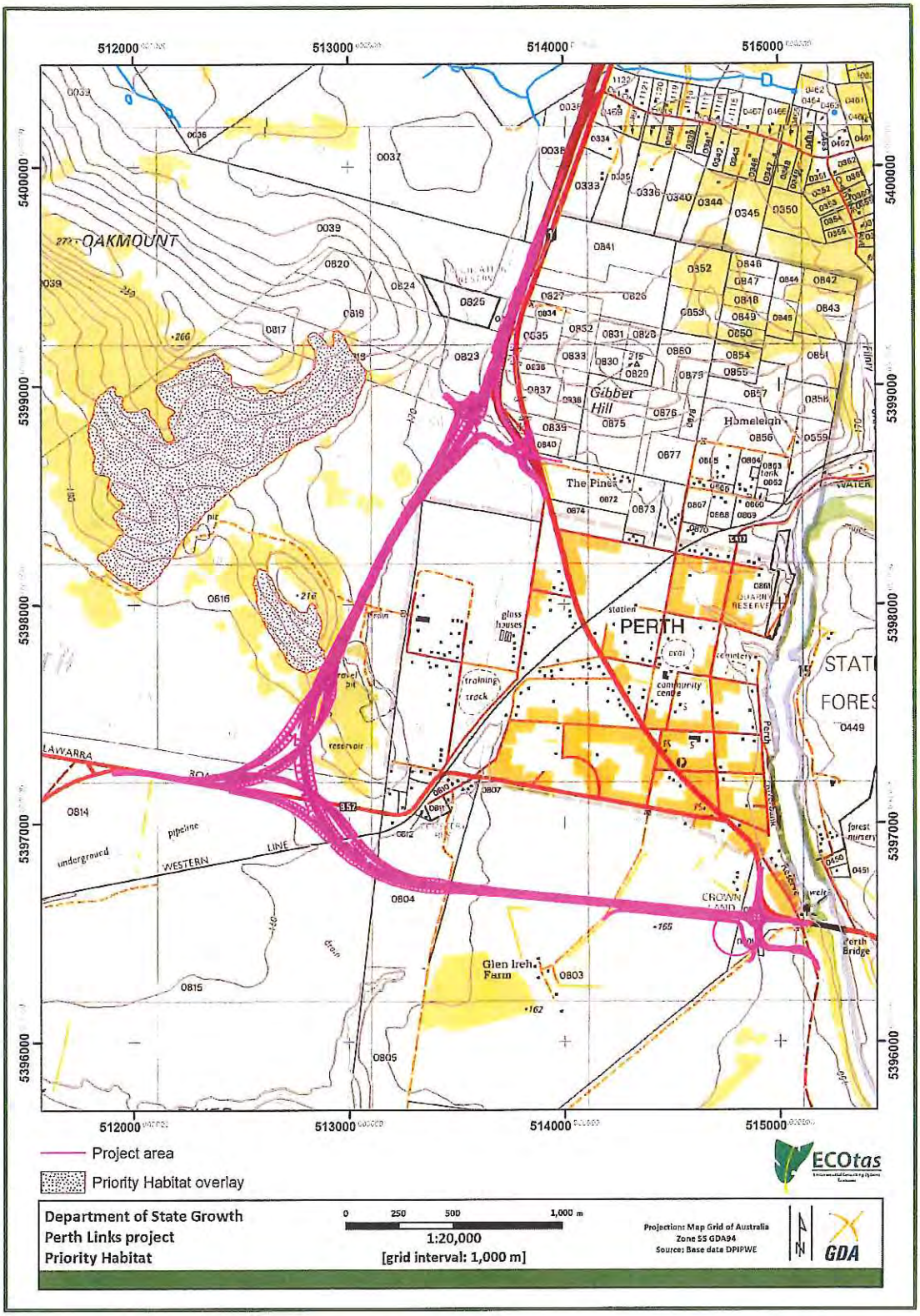


Figure 2a. Priority Habitat overlay relative to the project area [source: TheList]

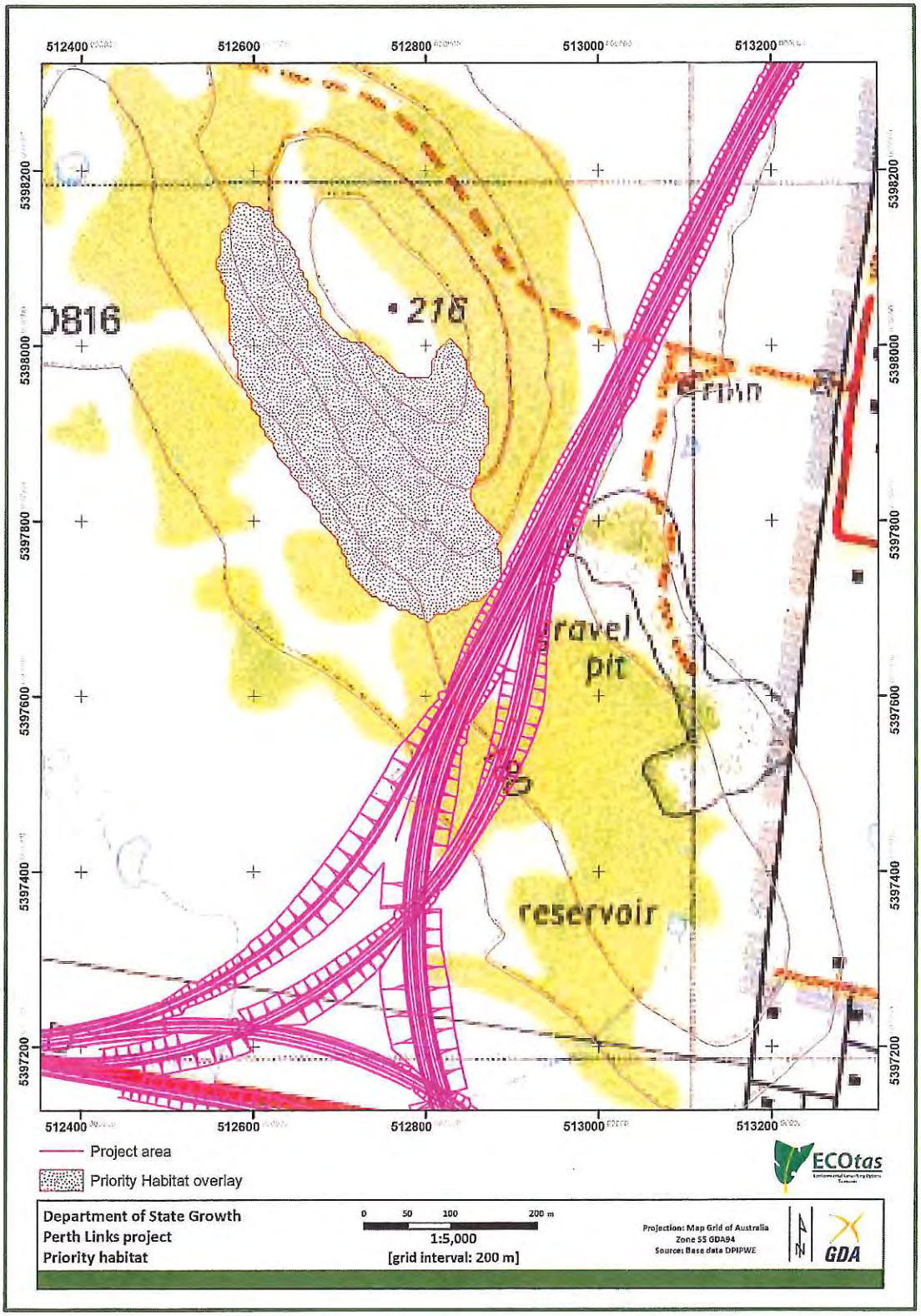


Figure 2b. Priority Habitat overlay relative to the project area [source: TheList]

Assessment of potential habitat trees for Masked Owl, *Tyto novaehollandiae castanops* at Perth Links site.

Prepared by David James 2017

Summary:

- 2 marginal potential nest hollows found.
- Potential roosting hollows exist at site.
- No Masked Owls encountered.
- No verifiable signs of Masked Owl use encountered.
- Some but not all potential hollows covered to exclude future use.

Introduction

The Tasmanian Masked Owl, *Tyto novaehollandiae castanops,* is a large nocturnal raptor listed as Endangered in state (*Threatened Species Protection Act 1995*) and Vulnerable in federal (*Commonwealth Environment Protection and Biodiversity Conservation Act 1999*) legislation. The Tasmanian Masked Owl predominately inhabits dry forests and is an obligate hollow nesting species (Bell &Mooney 2002). Masked Owl abundance is greatest in the north and east of Tasmania and home range size may be as much as 1800–2500 hectares (Young, 2006). Masked owl nest trees may be in forests, woodlands or sometimes isolated trees in paddocks. (Mooney 1997). Roosting may also occur in tree hollows but more commonly in dense vegetation or in caves and rock over hangs (Bell & Mooney 2002).

Tree hollows are used by a range of fauna for shelter and nesting and may take over 100 years to form. Hollows large enough for masked owl nesting are likely to be found only in trees 150 years or older (Bell & Mooney 2002. Mooney 1997). Hollows for Masked Owls must have an entrance diameter that allows efficient entry and exit and are deep enough to be secure from weather and predators. Suitable hollows also possess enough volume that an adult and chicks may be housed and contain a base suitable for egg laying and comfortable incubation.

The proposed Perth Links, Perth bypass in Northern Tasmania involves construction of an interchange with Illawarra Main Rd requiring the removal of some eucalypt trees in farmland and light forest. This study aimed to assess all impacted potential nest trees along the alignment for definitive presence and absence of Masked Owls and signs of use by Masked Owls for nesting and or roosting. The work also attempted to exclude Masked Owls from occupying apparently suitable hollows in the period after survey and before any felling of trees occurred.

Methods

Tree selection:

The Perth Links area covers an area of cleared agricultural land with remnant eucalypts and light highly modified native vegetation. A site visit by this author with Tori Harvey (State Growth) and Mark Wapstra (ECOTas) identified 8 potential habitat trees either on or in close proximity to the proposed layout that possessed characteristics suggesting potential masked owl hollows and requirement for hollow inspection via climbing at a later date. Four trees that may, or may not be affected by associated cut and fill during clearing construction were included as a precautionary consideration.

The co-occurrence of diameter at breast height **(DBH)** greater than 70cm and major signs of senescence suggested the possibility of Masked Owl hollow development for the purposes of this work. This is considered a cautious definition that minimises risks of overlooking more cryptic hollows and includes trees with hollows likely to be marginally viable as MO habitat. Smaller DBH trees and trees with very limited senescence are unlikely to have hollows suitable for vertebrate use generally and more so for Masked Owls which require large hollows.

Before climbing:

A search for signs of Masked Owl activity including regurgitated pellets, prey remains, and whitewash around the base of each tree was conducted. Trees were first assessed from the ground to identify potential hollows and senescence of interest to facilitate efficiency of climbing the tree and avoid missing hollows less easily seen when climbing. Diameter at Breast Height (DBH) was measured for each tree and GPS coordinates collected.

Climbing:

A slingshot was used to pull a light line over a high branch in the tree. This enabled a climbing rope to be pulled over the branch and subsequently used to access the canopy. Where possible, large stems and branches were inspected for hollows, any branch surfaces (upper) and forks that may hide hollows to a viewer on the ground were given particular attention.

Inspecting hollows:

Large hollows located were inspected directly with naked eye and supplementary light where possible and with a small video camera (GoPro Hero 4) and auxiliary light attached to the end of a 1.8m flexible tube where direct view was not possible. A smart phone enabled a wireless live view and photos and video could be taken where direct sight was not possible.

Some hollows could be photographed with a digital SLR camera and/or a smart phone camera.

For smaller hollows, brief attempts were made to flush inhabitants, e.g. birds, possums or bats to avoid chance of entrapment before coverings were attached. This was not possible for some inaccessible hollows but is also beyond the scope and intent of the survey.

Identifying hollows:

Masked Owl hollows were defined with a minimum entrance dimension >15cm based on Todd (2012) and Forest Practices Authority & Threatened Species Section (DPIPWE) (2012).

First principles suggest a hollow entrance must be large enough for the larger female Masked Owl to comfortably enter and exit and this would be difficult at less than 15cm dimensions. An additional requirement of an internal chamber big enough for an incubating female to sit (>30cm) was also considered to determine suitability for potential Masked Owl nesting use.

Potential Masked Owl roosting hollows were also defined by the same entrance requirements but considered narrower or less deep chambers. Subsequently a minimum internal diameter approximating 20cm and any depth or shape that offered shelter from daylight and disturbance while perching was considered a potential roosting hollow. Hollow roosting is not obligatory for Masked Owls and these parameters are presumptive. Nonetheless without the need to incubate or house chicks, a wider range of hollows are presumably used.

Covering hollows:

In order to eliminate the possibility of Masked Owls and other species utilising the hollows after the inspection date, hollows were covered with coreflute or filled to make them unattractive for occupation where possible. Larger hollows were covered as a priority with smaller hollows covered as time and convenience allowed. The coverings decrease the likelihood of all species occupying the tree when it is being felled resulting in death and dispossession. Priority was also given for covering those hollows from which hollow users were flushed during the inspections, mostly brushtail possums.

Results

Figure 1 below indicates the location of each potential habitat tree described in Table 1. As Table 1 shows, 8 potential habitat trees were climbed for assessment. In total, 26 tree hollows were located and inspected.

Some hollows could not be safely accessed in three dead eucalypts. Typically, these hollows were unlikely to possess the dimensions required for either nesting or roosting by MO. As a result, some other animals may have been present in such hollows. At least one brush tail possum was flushed into an inaccessible hollow that was subsequently uninspected.

Table 1 also shows 2 of the 26 hollows inspected were considered potentially suitable for Masked Owl nesting. Potential nesting hollows are included in the 6 hollows that are potential roosting sites for Masked Owl.

All potential Masked Owl hollows were visible to the end with camera or naked eye giving close to a definitive result. No individual owls were observed during the survey either in hollows or flushed from hollows or vegetation. No pellets or potential prey remains were discovered during assessments either in hollows or on the ground below the base of assessed trees. Neither was guano/whitewash that might have been from Masked Owls.

DBH of trees climbed ranged 130-207cm with a mean 175cm. All trees contained significant senescence and three trees were entirely dead.

Tree	Easting	Northing	DBH (cm)	Hollows assessed	Potential Masked Owl Nest Hollows	Potential Masked Owl Roost Hollows	Signs of Masked Owl Use	Hollows Covered
1	512971	5397180	166	1	0	0	0	0
2	513011	5397154	207	2	0	0	0	0
3	513041	5397154	190	2	1	1	0	0
4	512840	5397368	206	5	0	1	0	3
5	512926	5397350	189	3	1	1	0	3
6	512838	5397415	180	4	0	2	0	1
7	512818	5397526	136	7	0	1	0	3
8	512828	5397632	130	2	0	0	0	0

Table 1. Hollows in Potential Habitat Trees at Epping Forest and Perth.

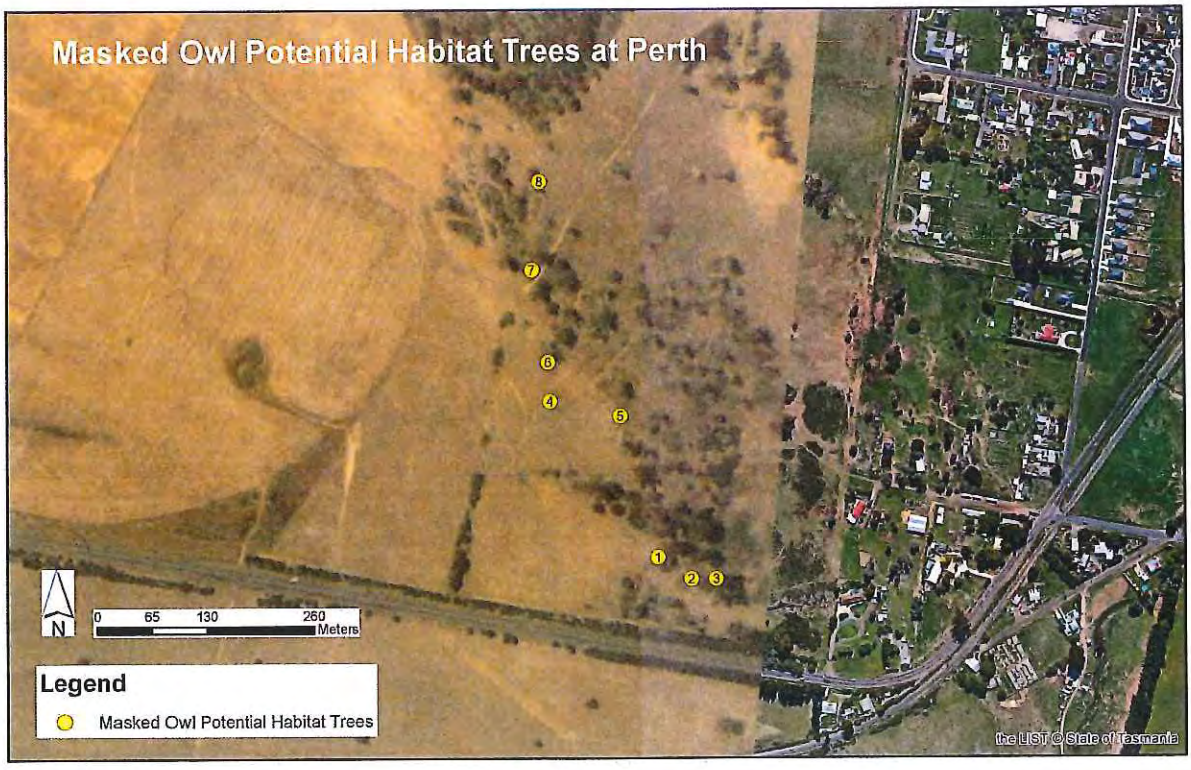


Figure 1. Location of Potential Habitat trees at Perth

Discussion

Hollow suitability for nesting

Most hollows inspected (20 of 26) were either too small in entrance size or lacking other characteristics necessary for use by Masked Owl breeding or roosting. Many of the hollows with larger entrances inspected either had insufficient internal volume for nesting or did not have a formed floor that could support eggs, being either uneven or with the cavity continuing down the trunk and exiting through other entrances lower in the tree. Some hollows had sufficient volume and a formed floor but no depth and so did not offer protection to incubating females or growing chicks.

The two hollows considered potentially suitable for nesting (Table 1) had suitable entrances and chamber floor dimensions. However, the potential nest hollow in tree 3 (Fig 1, Table 1) lacked depth (600mm) and the hollow was excessively bright quite bright due to a very large entrance (800x1300mm). It would unlikely be selected as a nest site by Masked Owls. The potential nest hollow in tree 5 was deep and dark but had a chamber floor of 300x400mm making it at the smallest end of viability for a Masked Owl to incubate eggs and raise chicks.

There is limited data in the literature to characterise Masked Owl hollows and it is likely that entrance and internal dimensions larger than the minimum used in this study are preferred. For Masked Owls generally, Debus (2009) suggests entrances >20cm are required for Masked Owl with 45cm chamber dimensions and up to 5m deep. D'Ombrain (1902) measured 20cm by 45cm for a nest hollow entrance and 1.2m depth. Taylor etal (2002) found an average entrance of 31.4x24.1cm for the Barking Owl, *Ninox connivens*, an owl not dissimilar in size to the Tasmanian Masked Owl. Taylor et al (2002) also found an average depth of 103.6cm for Barking Owl hollows.

Such large hollows require a long time to develop and are likely only in very old eucalypts with significant senescence (Koch 2007). Koch (2007) also finds large hollows are more likely in trees with greater than 100cm DBH. Bilney and L'Hotellier (2013) found a mean DBH of 110cm for Masked Owl roosting and nesting trees in Victoria. For Tasmanian Masked Owl nest trees Mooney (1997) finds average DBH at 1.24cm (0.95-1.56cm) and suggests nest trees are over 150 years old. Similarly, Gibbons and Lindemeyer (2002) suggests larger hollows may take even 220 years to develop.

All the trees in this survey had DBH larger than the mean suggested by Mooney 1997 and the co-occurrence of senescence has allowed the formation of hollows potentially suitable for Masked Owls. This is also in keeping with Koch (2007) who found large hollows were more common in trees with larger DBH. Hollow development is also affected by other factors including tree species, wildfire, and storm damage.

Both potential nest trees are considered marginal for nesting purposes, although more pertinently, both Trees 3 and 5 are in an area that may not be affected by the proposed development.

Hollow suitability for roosting

In addition to the two hollows potentially suitable for nesting, four further hollows (Table 1) appear suitable for roosting. These hollows possessed both suitable entrance and cavity dimensions for a Masked Owl to sit or perch sheltered from daylight and disturbance.

Assessment of roosting hollows is based on a general requirement for large hollows. Given that Masked Owls will use dense vegetation, caves and sometimes buildings for roosting (Bell and Mooney 1997), the species is clearly flexible. Bilney and L'Hotellier (2013) found a mean DBH of 110cm for Masked Owl roosting and nesting trees in Victoria and the trees in this survey exceed this DBH suggesting the likelihood of roost hollow development. Bilney and L'Hotelier find a preference for tree hollows in Victoria although in Tasmania (Bell and Mooney 1997) most roost sites are in vegetation.

Roost sites maybe a more flexible consideration in conservation management terms and as such, less of a concern for the Perth Links development than potential nest hollows.

Indications for Masked owl absence

In this study 6 hollows found were considered to meet dimensions suitable for either Masked Owl nesting or roosting.

Hollows inspected in this study did not reveal the current presence of Masked Owls or signs of previous use. Absence of Masked Owls either in, or flushed from hollows in the study area does not alone indicate their non-suitability. Masked Owls may not be present because inspection was undertaken outside of the breeding season and or Masked Owl were choosing to roost elsewhere at that time. In some cases nesting material introduced by possums or starlings may have obscured Masked Owl prey remains or pellets.

The timing of Masked Owl breeding varies considerably on the mainland and is more seasonal in Tasmania (Debus 2009). Most egg laying in Tasmania occurs in mid to late October (Mooney 1997), much later than the time of inspection in this study. Or similar, young Masked Owl from the previous season would have fledged prior to the inspection date in early May.

Nonetheless, close inspection of active nests would be expected to reveal fur and skeletal remains of food fed either to an incubating female or chicks, regurgitated pellets and whitewash (Hill, 1955, Kavanagh 1996). A nesting period inspection date may not be preferable due to disturbance of incubating females in particular.

Masked Owl may also use roost sites intermittently and may be absent at the time of inspection although it would be expected that either guano or pellets would also be present at regular or important roost sites.

Removal of covers in trees left standing:

If any of the potential habitat trees in which hollows were covered are not ultimately removed, then subsequent removal of those covers is recommended to remove potential littering and maintain fauna habitat.

Other wildlife

Several brush-tail possums were encountered during inspections. Some self-evacuated and the hollows they were in covered to stop reuse. At least two possums could not be encouraged to leave and were left in place and their hollows not covered. It is likely that some possums will be present during felling operations.

Conclusion

Absence of all signs of use in hollows and on the ground around the trees surveyed suggests a very low likelihood that the trees in this study are being used for either nesting or roosting.

Although some possibly suitable hollows exist in the area, no hollows were considered optimal for Masked owl nesting despite all trees having large girth and significant senescence. Some additional hollows may possibly be suitable for roosting although there was no evidence to suggest Masked Owl usage. Masked Owls were not observed during the survey and signs of use and occupation were absent.

With intent to remove the possibility of future use and occupation by Masked Owls and other animals, 10 hollows were covered. A very small chance exists that a Masked Owl may choose

to roost in one of the remaining hollows that could not effectively be covered. If this happens before felling, the normal expectation would be that a Masked Owl would flush with the operation of a nearby chainsaw or other machinery and escape harm.

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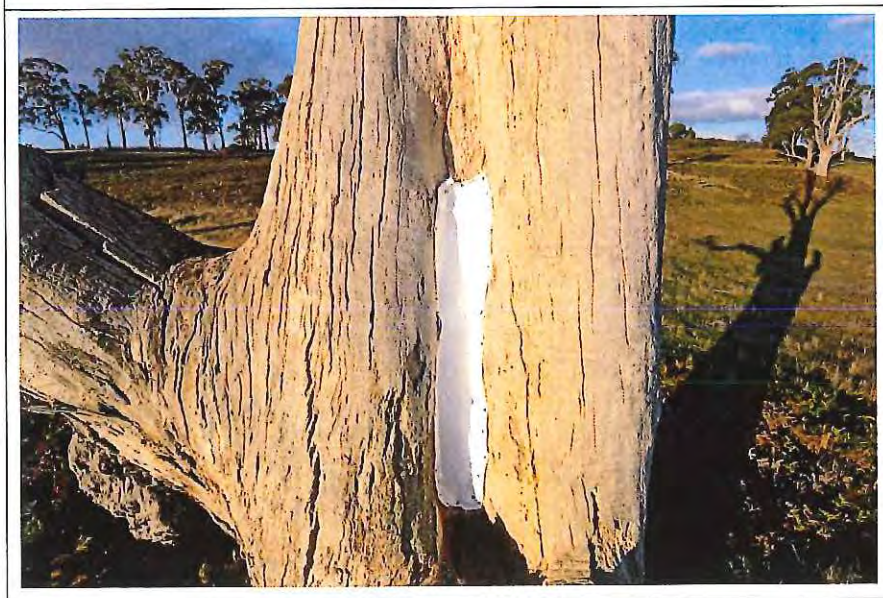
Young, D. (2006), Home range, habitat use and diet of two female Tasmanian Masked Owls. BSc Hons thesis, University of Tasmania.

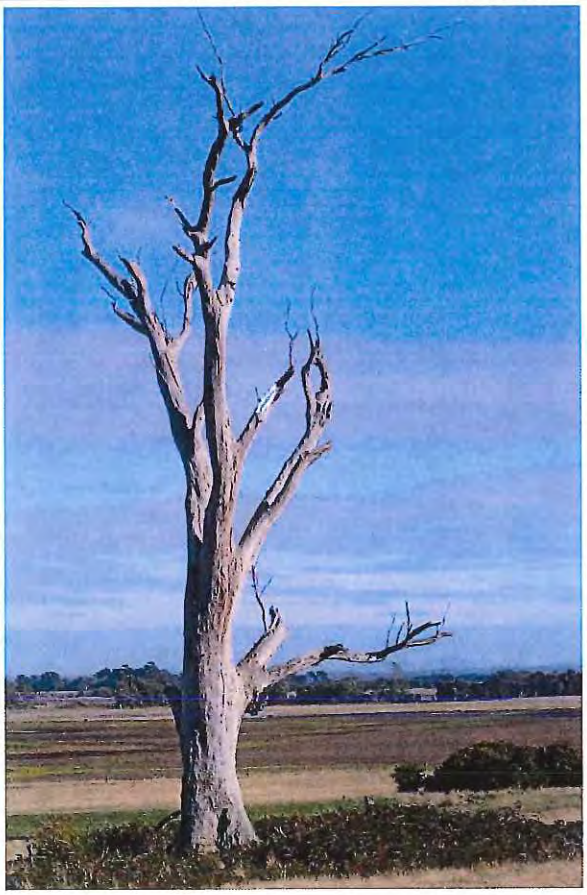
Appendix 1 : Photos

Tree 5: example of covered hollow.



Tree 4: example of covered hollow

Tree 3. Large cavity considered potential nest hollow.



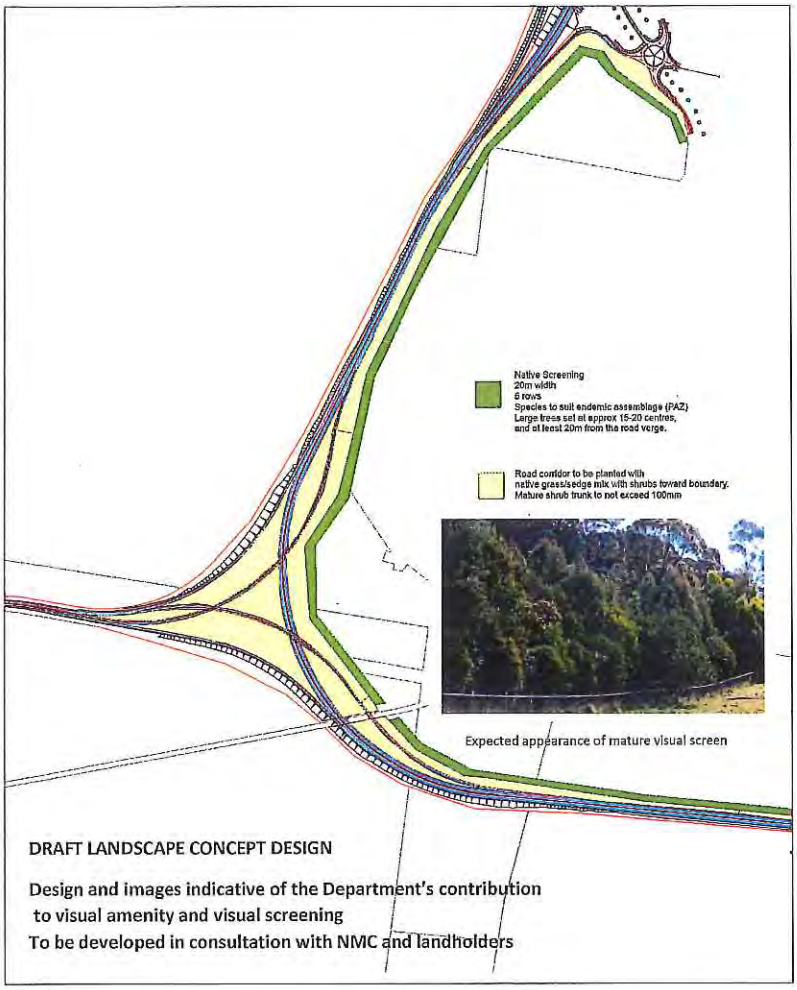
Tree 4: One of the dead trees inspected. Some higher hollows could not be safely accessed.

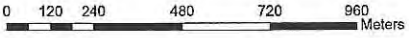
Appendix 2:

Raw data as a spreadsheet in email. Details of hollow measurements, hollow contents and notes.

PERTH LINKS LANDSCAPING CONCEPT DESIGN

Perth Links Road Design
Interchange

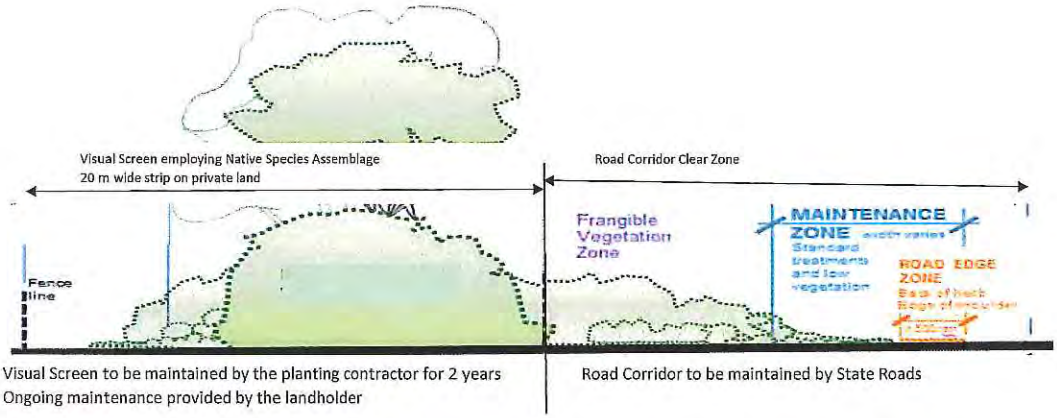




Native Screening Example

Expected appearance after 10 years

Planting One year Five years



Visual Screen to be maintained by the planting contractor for 2 years
Ongoing maintenance provided by the landholder

Road Corridor to be maintained by State Roads

Potential visual screening species selection.

Species lists:

Canopy Tree Species	Common Name
Eucalyptus amygdalina	black peppermint
Eucalyptus pauciflora	cabbage gum
Eucalyptus viminalis	white gum
Eucalyptus ovata	black gum

Typical Understorey Species *	Common Name
Acacia dealbata	silver wattle
Allocasuarina littoralis	black sheoak
Banksia marginata	silver banksia
Bursaria spinosa	prickly box
Exocarpos cupressiformis	native cherry
Aotus ericoides	golden pea
Bossiaea cinerea	showy bossia
Daviesia sejugata	leafy spiky bitterpea
Dillwynia spp.	parrotpea
Epacris impressa	common heath
Hibbertia spp.	guineaflower
Leucopogon spp.	beardheath
Lissanthe strigosa	peachberry heath
Lomatia tinctoria	guitarplant
Platylobium triangulare	arrow flatpea
Pultenaea juniperina	prickly beauty
Stenanthemum pimeleoides	propellar plant
Astroloma humifusum	native cranberry
Acrotriche serrulata	ants delight
Bossiaea prostrata	creeping bossia
Hovea heterophylla	winter purplepea
Pultenaea pedunculata	matted bushpea
Dichondra repens	kidneyweed
Gonocarpus tetragynus	common raspwort
Goodenia lanata	trailing native-primrose
Helichrysum scorpioides	curling everlasting
Lagenophora stipitata	blue bottledaisy
Orchidaceae	orchids
Oxalis perennans	grassland woodsorrel
Poranthera microphylla	small poranthera
Viola hederacea	ivyleaf violet
Austrodanthonia spp.	wallabygrass
Austrostipa spp.	speargrass
Deyeuxia spp.	bentgrass
Dichelachne spp.	plumegrass
Ehrharta stipoides	weeping grass
Themeda triandra	kangaroo grass
Dianella revoluta	spreading flaxlily
Lomandra longifolia	sagg
Lepidosperma spp.	swordsedge
Schoenus spp.	bogsedge

Town Entrance Road Landscaping.

Objectives

- Avenue plantings to be used to clearly differentiate the entrance roads from the highway.
- Trees should be reasonably closely spaced so that the canopy is touching (see examples below)
- Tree set-back from highway road verge to be no less than the expected mature tree height
- Ground cover to be "park" turf, with maintenance performed by council
- Planting avenue trees will be a more cost effective method of achiving a good visual amenity landscaping outcome over the large expenditure necessary for elaborate roundabout landscaping designs
- Roundabout design must be considered from the perspective of safety and ease of access for maintence crews

Potential Roundabout Concept Designs – to be developed in consultation with Northern Midlands Council

Objectives

- Highlight the northern and southern entrance to Perth
- Be simple to maintain and have tidy appearance
- Be safe for both road users and maintenance crews
- Be cost effective both for establishment and on-going costs

Design Suggestion

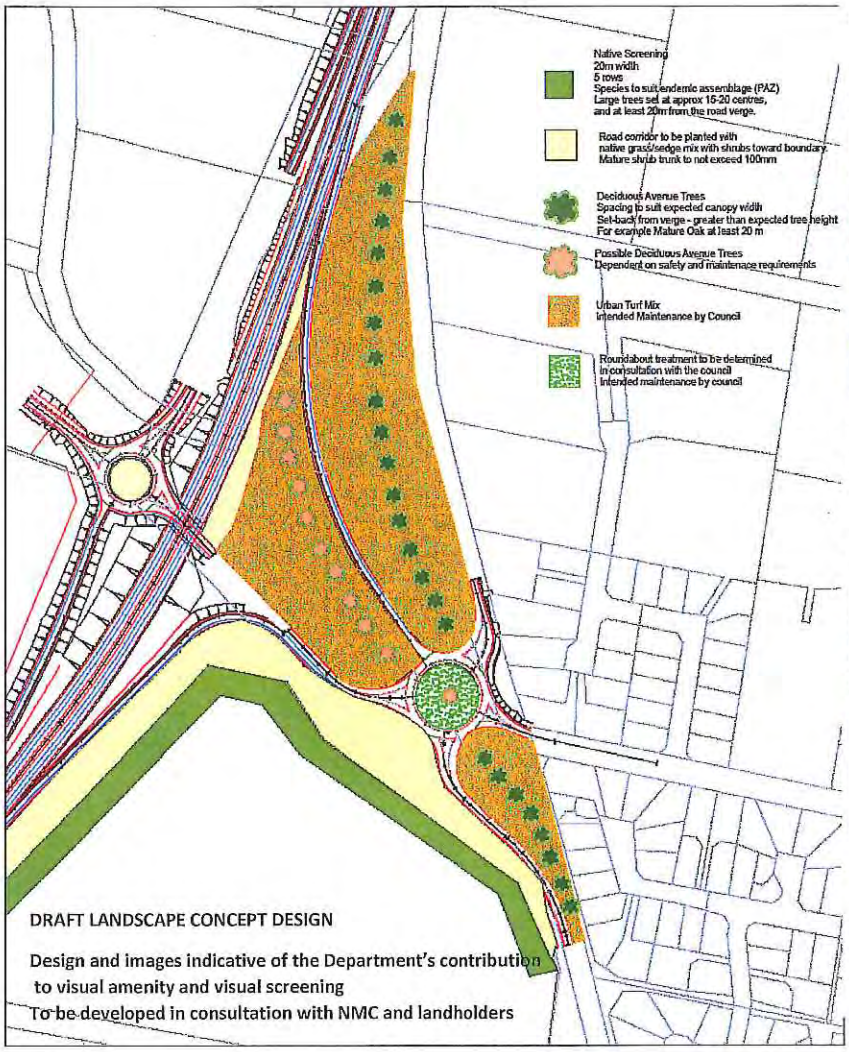
Southern roundabout.

- Paved boundary 5m wide to allow parking of maintenance vehicles
- Central feature – ie house skeleton sculpture plus simple "cottage style"garden
- Remaining area "park" style" turf

Northern Roundabouts.

- Roundabout to interchange - "park" style" turf or native tussock grass
- Roundabout to Perth – as above but Avenue trees included if safety requirements can be met.

Perth Links Northern Entrance



Examples of desired effect

Buninyong, Victoria

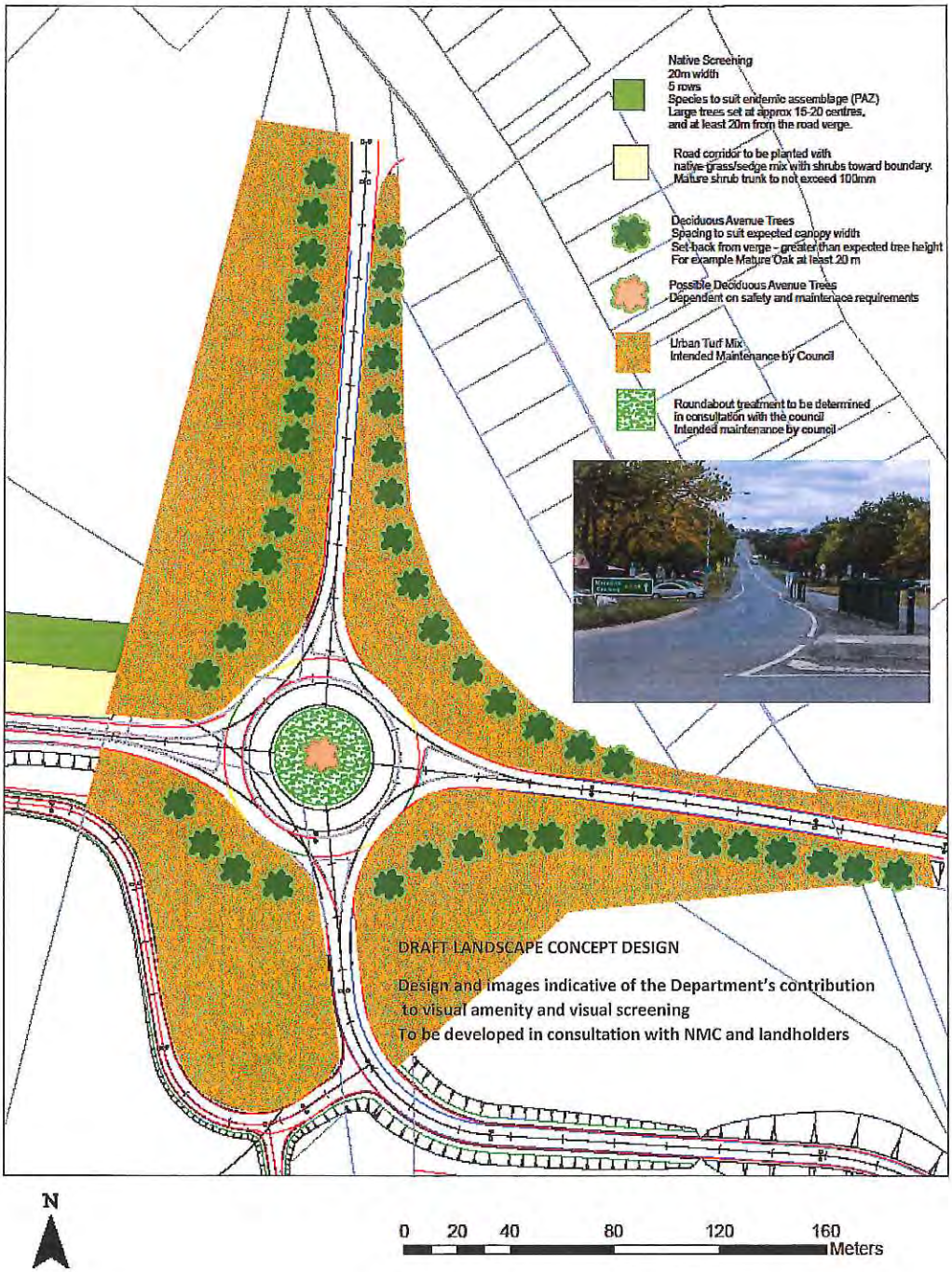
Appropriate set-back for Highway Avenue trees – Mostly Oaks of several varieties

In the area of the Northern and Southern Roundabouts

Lydiard Street Ballarat- Mostly English Elms, some English Oak

Note similar road corridor width to Main Road Perth

Perth Links Southern Entrance



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Department of State Growth
Attention: **Tori Harvey**
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Hobart TAS 7001

17 May 2017

Dear Tori

RE: Perth Links Project

ADDENDUM to ECOtas (2015)

Assessment of potential impact on *Litoria raniformis* (green and golden frog)

Assessment of potential *Tyto novaehollandiae* (masked owl) habitat

Weed mapping

Preamble

The ecological values of the project area were assessed by ECOtas in late 2014 and reported in:

> ECOtas (2015). *Assessment of Potential Impact on Ecological Values of Proposed Perth to Breadalbane Bypass and Associated Connectors, Tasmania.* Report by Environmental Consulting Options Tasmania (ECOtas) for the Department of State Growth, 31 January 2015.

The present statement is intended as an addendum to that report and should be read in conjunction with it, with particular regard to background information, methods, findings and recommendations. This present statement provides more specific information in relation to the following species/issues:

- potential impact of the project on *Litoria raniformis* (green and golden frog);
- potential impact of the project on *Tyto novaehollandiae* (masked owl); and
- distribution of weeds.

***LITORIA RANIFORMIS* (GREEN AND GOLDEN FROG)**

In relation to *Litoria raniformis*, ECOtas (2015) concluded that:

> "The southern section of the proposed project area supports potential habitat as follows:

- small farm dam between Illawarra Road and rail line – high quality potential habitat, naturally vegetated, several species of frog; daytime surveys (including call-back) on warm day unsuccessful; nocturnal call-back survey in somewhat unsuitable conditions on one night unsuccessful; links through informal paddock drains to roadside ditches;
- smaller farm dam west of Midland Highway south of the new large dam – moderate quality habitat, naturally vegetation but quite open, several species of frog; daytime surveys (including call-back) on warm day unsuccessful; nocturnal call-back survey not conducted (was going to be a cool, wet and windy night); unlinked to creeks except through open cropland but nearby creek with intermittent pools and dense vegetation; and
- creek between large dam south of Perth that runs under Illawarra Road through Perth and to the rush-grass dominated flats north of Perth – poor quality habitat (in terms of weediness, stock access, muddiness, ephemerality of pools, but better in that this species appears to utilise quite disturbed habitats, at least as connective habitat); daytime surveys (with call-back) on warm day unsuccessful (included examination of edge of large dam to south outside project area); nocturnal surveys (spotlighting and call-back) at several sites along creek and dam margin unsuccessful (but not ideal night).

On this basis, considered in isolation, works within the southern part of the proposed project area would unlikely have a significant long-term impact on known or potential sites of the green and golden frog. It is recommended that the two dams, and perhaps the creek downstream of the dam, be re-examined over 1-2 nights in better conditions, if such sites will be affected by the works. It may be possible to completely avoid the sites (recognising that the EPBCA Significant Impact Guidelines suggest 100s of metres as a buffer but that in practice we know that the species persists and thrives in dams immediately adjacent to major roads, it would appear practical and feasible to design around the highly localised potential habitat sites). If further survey detected the species at these sites, or the sites could not be avoided, further consideration of the potential significance of the project on the species under the EPBCA would need be made. However, at this early stage of planning, considered in isolation, the southern section of the project area is not considered likely to be significantly constrained by the potential presence of the green and golden frog.

However, it is important to consider the broader context of the project. FPA (2014) detected a small number of sites supporting the green and golden frog, indicating that the broader area is suitable for the species. That some highly prospective sites appeared to not support the species may represent a genuine absence but this could be temporary and based on seasonal conditions or some unknown factor. The species can occur 100s to 1000s of metres from standing or slow-flowing water and will travel across wet pasture and through crops and native vegetation, especially in suitable conditions. This means that the broad flats and adjacent gentle slopes supporting pasture, crops and remnant trees need to be considered as at least connecting habitat between permanently occupied (or potentially permanently occupied) sites such as farm dams. The changing suitability of some sites also needs to be considered. For example, FPA (2014) did not detect the species from the relatively new dam and this may be because there is still little vegetation within and around the dam and large areas of bare soil and rock but over time, this dam is likely to become highly suitable.

Further surveys of aquatic and near-aquatic habitats are likely to be required for the green and golden frog in the southern section of the project area because nocturnal play-back surveys to date have been conducted on one night only and in poor to average conditions. However, such surveys may not become necessary if the key sites can be avoided by an appropriate distance. The northern section has been well surveyed for frogs but it needs to be recognised that any survey result simply represents a snapshot in time and a site deemed negative now may be used in future. For this reason, depending on the final design of the project, further targeted surveys may become warranted".

Additional site assessments and findings

For the purposes of this statement, I identify the following sites with potential habitat (refer to Figure 1):

- Kelly dam – dam that is partly on Kelly property and partly on owner to south, linked upstream to Perth through a weed-infested creek (not shown on Figure 1 as well outside the project area);
- above weed-infested creek on Kelly land "Kelly Creek";
- Western Line dam – MacKinnon property between Illawarra Road and Western line;
- drainage lines either side of Illawarra Road;
- MacKinnon central dam – MacKinnon property in paddock between "reservoir hill" and Napoleon Street (shown on Figure 1 as "gorse paddock dam");
- Sheepwash Corner – MacKinnon property just south of current project works; and
- creek between Sheepwash Corner and Midland Highway/Your Road flats.

Apart from my initial assessments of these sites (except for the "gorse paddock dam"), which are all documented in ECOtas (2015), I have undertaken the following additional assessments of the sites of potential habitat for *Litoria raniformis*:

- 23 Jan. 2017: Kelly dam and creek ("Kelly Creek")

I undertook diurnal surveys by slow-walking the margin of the dam and creek within the Kelly property, with speaker call-back at random intervals. Several sites were staked out for periods of 5-15 minutes (binoculars used to scan water surface and vegetation margins) over the space of about 2 hours between 11.30 and 1.30 in warm to hot conditions with low to no winds. The site was re-assessed for a period of about 1 hour (slow-walked western side of creek and dam, random call-back during walk and several 5 minute stake-outs with binocular scans) between 5.30 and 6.30 pm.

No evidence of *Litoria raniformis* was detected.

The dam and some of the creekline presents as potential habitat, although the creekline is somewhat marginal and all evidence suggests *Litoria raniformis* is absent. Interestingly, I had a long chat to the landowner (Mrs Kelly) and even showed her images and played her calls of frogs. She recognised several immediately but had no memory of her (or kids and grandkids) ever seeing or hearing *Litoria raniformis*.

It is my conclusion that while this dam and associated creek are within the broader range of the species, there is presently no evidence of occupation.

- 15 Feb. 2017: Sites 3-5 (in company of Tori Harvey (State Growth) and Dave James)

Western line dam

This fringes of the dam were slow-walked by three people (MW, TH, DJ) 1-3 times. The nearby drainage line in the paddock was also examined. No evidence of *Litoria raniformis* was detected.

This site has not changed significantly since ECOtas (2015). It remains potential habitat for *Litoria raniformis* but the species is apparently absent. It is impossible to discount past or future use of the site but it is noted that the dam is somewhat isolated by the road and rail line, with very open close-cropped paddock between and little vegetation cover, and where vegetation is present, little to no coarse woody debris a shelter points. In and around the dam there is also no such debris. The vegetation of the dam is partially unideal (*Typha* and *Eleocharis sphacelata* sections) to ideal (fringes with low *Eleocharis acuta*, *Potamogeton* spp., and *Crassula* spp.). The

introduced yabby seems to be abundant in the dam – this is known to feed on tadpoles and live frogs. All that said, this dam has obvious potential for the species and there is no good reason it is apparently absent. In times of flood, these broad flat paddocks would not be a hindrance to dispersal, and even the close-cropped paddocks surrounding the dam have deep cracks in the soil and localised patches of *Juncus* tussocks that provide shelter.

MacKinnon central dam ("gorse paddock dam")

We surveyed this site by turning coarse woody debris, slow-walking the margins (MW, TH) and net sweeping the aquatic vegetation). Oddly, this site was overlooked in ECOtas (2015), possibly because it was surrounded by dense gorse at the time. At present, it provides ideal frog habitat and several species were detected. Tadpoles and morphlings of *Limnodynastes dumerilii* (banjo frog) were detected and the species was also calling. Under logs (even small ones), *Limnodynastes tasmaniensis* (spotted marsh frog) was locally abundant (this year's morphlings). We also detected adults of *Litoria ewingi* (brown tree frog) under logs. I suspect a few of the smaller tadpoles were *Crinia signifera* (common froglet). No evidence of *Litoria raniformis* was detected (ideal survey conditions: warm to hot, still). This is an ideal site for the species due to the flat floating vegetation (*Potamogeton* spp., *Crassula helmsii*, etc.) and dense surrounding vegetation and at least some coarse woody debris.

Sheepwash Corner

This dam has changed markedly since ECOtas (2015) and has changed from having a fringe of low erect and floating vegetation to being virtually vegetation-free with frequent sheep access (pugged up muddy ground). I would now regard this site as highly unsuitable for *Litoria raniformis*. We did not spend much time at this site but did make a slow-walk circuit of it.

Creek between Sheepwash Corner and highway

This remains as per ECOtas (2015) i.e. gorse-infested semi-artificial drain with occasional pools and muddy sections with several sheep crossing points. Marginal for frogs but clearly part of any dispersal area, especially during flood times.

Recommendations

Kelly dam

The dam itself will not be impacted directly by the project so no special management is recommended.

There is a minor chance for sediment input from "upstream" during and post-construction (but noting that during natural flood events this creek gets full of rubbish washed from upstream already) but standard operating procedures for sediment control should mitigate this risk.

"Kelly Creek"

My overall assessment is that while the creek is technically potential habitat, evidence suggests that *Litoria raniformis* is absent. That said, the Kelly dam is ideal (although apparently also does not support *Litoria raniformis*) and obviously at some level, creeks that link sites (even if several hundreds of metres or a few kilometres away), even during flood times need to be kept in the mix as potential habitat. The question then arises as to whether the *Green and Golden Frog (Litoria raniformis) Management Guideline* (DSG 2015) should be applied to this crossing. My basic recommendation is that I see no reason that they should not be. However, as far as I can

tell, the new road will separate the Kelly farm into two sections and I am presuming that some sort of vehicle/stock underpass will be needed. If this is the case, this may be the ideal location to provide for frog movement but it may require some thinking as to how the underpass may be linked to the creekline. The key recommendation is the *Green and Golden Frog (Litoria raniformis) Management Guideline* (DSG 2015) should to be applied but some modification may be possible to accommodate both frog passage and stock/vehicle movements.

Western Line dam

There are two scenarios here. The first is where the dam can be retained during and after construction. If this is the case, I recommend sediment control and barrier protection protocols during construction only to minimise the risk of substantially modifying the dam. The second (and this may be the more likely given the proximity of the dam to the rail line and the proposed road and the required height of the road to pass over the rail line) is where the dam cannot be retained. In the absence of the dam being a known site for *Litoria raniformis*, a permit under the Tasmanian *Threatened Species Protection Act 1995* will not be required (not indeed technically possible).

It will also be difficult to regard the loss of the site as a significant impact in its own right under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, if there is no evidence it is a known site (as the loss could not lead to a reduction in the area of occupancy of *Litoria raniformis*). However, more broadly the site may be part of the overall habitat of the species. So far, the project (northern section) has not resulted in the measurable loss of known or potential habitat (in fact, if anything it has gone the other way with the installation of the wetlands on either side of the culvert crossings) so the loss of this site would hardly be a cumulative impact that suddenly triggered the significant impact thresholds. All that said, if the dam was lost but re-created somewhere else in the general area of a similar size, I can see no way that the works would result in a significant impact.

Given the potential for the site to support the species, if it is cleared during works, the *Green and Golden Frog (Litoria raniformis) Management Guideline* (DSG 2015) should apply and the relevant section is having an expert on site when the dam gets drained to pre-clear for *Litoria raniformis* (e.g. net sweeps for tadpoles and adults) and to monitor during works (adults and tadpoles) and translocate if necessary.

For the record, this dam also supports a localised population of *Amphibromus sinuatus* (swamp wallabygrass). This species is not listed on the TSPA or EPBCA. There has been some doubt over its native vs naturalised status in Tasmania (remains unresolved). However, it is known from very few sites in Tasmania, almost all associated with small farm dams. While there are no technical requirements in relation to the species, retaining the site would ensure the persistence of the species at this site. I have lodged specimens at the Tasmanian Herbarium.

Illawarra drainage lines

Due to intensive primary production activities, these sites, while shown as distinct drainage features on 1:25,000 topographic maps, are essentially absent and now occupied by pasture.

"Gorse paddock dam"

Based on the designs, this dam will be entirely avoided by the works. There is a minor risk of sediment input from works upslope. As such, it is suggest that standard sediment control protocols are applied between the works site and the dam edge.

Sheepwash Corner Creek dam

As above but given the current condition, if this dam needed to be cleared, see comments under Western Line dam.

Sheepwash Corner Creek

This creek is marginal as habitat for *Litoria raniformis* but presumably forms part of the potential dispersal habitat, especially in times of flood but also in drier times (as the creek has several shallow pools amongst dense grass under dense shrubs)

It is recommended that the *Green and Golden Frog (Litoria raniformis) Management Guideline* (DSG 2015) should be applied in relation to the culvert crossing but see comments under the "Kelly Creek" site regarding possible option to modify the guidelines to incorporate stock/vehicle crossings.

Conclusion

Provided that the *Green and Golden Frog (Litoria raniformis) Management Guideline* (DSG 2015) is applied to the Perth Links Project, I do not anticipate that a referral under the provisions of the EPBCA will be required. I do not believe that the Perth Links Project combined with the Perth to Breadalbane project will result in a cumulative impact on the species such that the significant impact thresholds will be triggered. In terms of how the guidelines are applied, I suggest the new culvert design be applied to "Sheepwash Corner Creek" (but note stock crossing/property access issues) and "Kelly Creek" (again, note stock crossing/property access issues), and that every effort is made to design the road such that the individual dams are avoided (sediment control on any "downstream" of works) but that the loss of the southern and/or northern dam would not be significant. In terms of how the culverts are applied, I believe some flexibility in interpretation will be needed, depending on what structures are required to allow stock/vehicles to pass from one side of the affected properties to the other (incorporating the intent and some of the design elements into a stock crossing may be practical).

***TYTO NOVAEHOLLANDIAE* (MASKED OWL)**

In relation to *Litoria raniformis*, ECOtas (2015) concluded that:

> "Both parts of the project area support several large hollow-bearing trees suitable for roosting and/or nesting by the masked owl. While no evidence of the species was noted by DIER (2014) or ECOtas (e.g. pellets, prey remains, etc. under hollow-bearing trees), this can be somewhat serendipitous and opportunistic (because even occupied trees do not always show evidence of use). The management of mature and large (and therefore senescent) trees in the context of a major road will be complex if the intent is to maintain such trees is a safe and healthy condition. That said, the trees are easily identified and it suggested that their presence may not significantly affect the overall design of the project if the intent is to retain as many as possible. In my opinion, unless it can demonstrated that the loss of hollow-bearing trees will result in an actual roost and/or nest site being affected, the significant impact thresholds under the EPBCA may not be triggered. While the intent should be to retain such trees, the specific number that can be retained, and how retained trees can be effectively managed, may come down to the design phase of the project requiring project engineers and designers to assess the trees with a qualified ecologist. Undertaking surveys (e.g. call-back) at this early stage of project planning is not recommended because it would simply represent a "snapshot in time" and birds could start using currently unused trees closer to construction time. In addition, call-back surveys in such open mosaics of farmland, urban areas and forest remnants may not be definitive as it may simply result in birds being drawn in from quite far afield. A tree-by-tree assessment (e.g. evidence under tree, spotlighting, perhaps infra-red cameras mounted on a pole) of trees that may need to be removed is considered a more prudent approach as part of the design process".

Additional site assessments and findings

The project area was assessed by Mark Wapstra (ECOtas), Tori Harvey (State Growth) and David James (environmental consultant specialising in the masked owl and tree-climbing) on 15 February 2017.

The proposed project footprint area was superimposed on aerial imagery and used to find hollow-bearing trees within and close to the footprint.

Each tree was examined from the ground using binoculars and notes made on the potential suitability for the masked owl. All large trees examined were GPSed (hand-held Garmin Oregon 650) for later reference, and notes taken on the number and type of hollows (and from David James' perspective, whether the tree was likely to be safe to climb to examine the hollow). Digital images were taken of each tree.

Table 1 provides the information collected on each tree examined (refer also to Figure 2).

Table 1. Details of each tree examined

WP	easting	northing	species	comments	potential habitat for masked owl
3	512892	5397018	*E. viminalis*	paddock tree, no hollows	NO
4	512973	5397178	Dead (*E. viminalis*)	huge dead tree, huge hollows	YES
5	512985	5397185	*E. viminalis*	possible hollow spout	POSSIBLE
6	513013	5397156	*E. viminalis*	massive branch off, huge trunk hollow	POSSIBLE
7	513066	5397129	*E. viminalis*	hollows on trunk	POSSIBLE
8	513085	5397091	*E. viminalis*	on flat, no hollows, multi stems	NO
9	512907	5397266	*E. amygdalina*	on slope, no large hollows	NO
10	512917	5397271	near dead (*E. amygdalina*)	near dead peppermint, no large hollows	NO
11	512931	5397350	dead (*E. viminalis*)	huge hollow eastern side	YES
12	512839	5397368	dead (*E. viminalis*)	possible hollows upper second branch, lower trunk hollow, difficult to climb	POSSIBLE
13	512833	5397418	dead (*E. viminalis*)	trunk hollows too small, possible spout hollows, ladder may be used, starling nesting material	POSSIBLE
14	512821	5397520	dead (unknown species)	long hollow trunk, spouts	YES

WP	easting	northing	species	comments	potential habitat for masked owl
15	512829	5397625	dead (*E. amygdalina*?)	hollow in trunk, can use ladder	POSSIBLE
16	512810	5397622	part dead (*E. amygdalina*)	possible trunk fissure but not wide enough	NO
17	512970	5397919	dead (*E. viminalis*)	over fence, leaving anyway	POSSIBLE

Recommendations

It is recommended that the Department of State Growth apply the *Tree Felling Protocol* to the proposed works area in relation to the trees shown on Figure 2 and described in Table 1 that will be potentially felled i.e. where safe to do so, climb the tree examine the hollows for evidence of occupation by the masked owl. If the hollow is unoccupied and considered as potential habitat, the hollow should be blocked to prevent occupation between the time of assessment and the time of felling. If the hollow is considered unsuitable for nesting by the masked owl, it can be left exposed.

It is understood that this action has now been undertaken by David James and any findings of his report should be followed for future works. It is further understood that he did not find any evidence of occupation by the masked owl and that no hollows were considered potentially suitable for breeding such that blocking off was considered warranted. This accords with our initial field findings in which we strongly suspected that the trees within the likely disturbance footprint were unsuitable due a variety of factors including age (many prematurely dead or half-dead prior to full maturity and hollow development) and stature (most trunks and larger branches/spouts too small to support a large enough hollow for breeding by the masked owl).

Conclusion

It remains possible that the hollow-bearing trees within the project area may support other hollow-dwelling species (most likely candidates are the brushtail possum, striated pardalote, green rosella, eastern rosella, blue-winged parrot and the introduced European starling and laughing kookaburra). In the absence of recorded evidence of specific occupation (i.e. a nest) of the native species, a permit to take "products of protected wildlife" under the *Wildlife (General) Regulations* 2010, or to take known individuals of threatened species (masked owl) under the provisions of the Tasmanian *Threatened Species Protection Act 1995*, should not be required.

A detailed analysis of the Significant Impact Guidelines under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) has been undertaken and it was concluded that a referral under the EPBCA should not be required.

During works, it is recommended that the general intent of the *Tree Felling Protocol* be applied for the larger hollow-bearing trees requiring felling i.e. when the trees are felled, have a suitably qualified ecologist and/or wildlife carer on site to examine any remaining hollows for occupation and manage any injured/killed wildlife accordingly. Note that it is highly unlikely that the felling would disturb individuals of the masked owl, although they may be in occupation of a larger hollow as a temporary roost site (hollows not deep enough and well-enough developed for nesting) and therefore be flushed. It is much more likely that the hollows will be occupied by species such as the brushtail possum and European starling.

DECLARED WEEDS

In relation to declared weeds, ECOtas (2015) stated that:

> "The study area is dominated by exotic plant species. Several species, classified as "declared weeds" within the meaning of the Tasmanian *Weed Management Act 1999*, are present (refer Appendix B), as follows:
>
> - *Ulex europaeus* (gorse): widespread and locally common (with some areas mapped as the TASVEG mapping unit "weed infestation");
> - *Hypericum perforatum* subsp. *veronense* (perforated st johns-wort): localised patch in exotic grass near pine trees near Perth bridge;
> - *Lycium ferocissimum* (african boxthorn): localised around farm houses and fences in far east of study area;
> - *Rubus* spp. (recorded as *R. anglocandicans* and *R. leucostachys* but other taxa may be present): localised to fencelines and occasional elsewhere;
> - *Carduus pycnocephalus* (slender thistle) and *C. tenuiflorus* (winged thistle): occasional in "rough" pasture; and
> - *Marrubium vulgare* (white horehound): as above.
>
> It is recommended that a project-level weed and hygiene management plan be developed as part of the broader project to minimise the risk of exacerbating weed occurrences, introducing new weeds to the site, spreading weeds from the project area to other parts of the State, and to consider ongoing monitoring and control post-works".

ECOtas (2015) did not provide a map of the distribution of weeds or specific point/patch locations, except for areas mapped as "weed infestation" (TASVEG code: FWU).

Additional site assessments and findings

The distribution of declared weeds has been determined from the original site assessments and additional site assessments referred to in the two sections above. A combination of field-gathered data (from original field maps) and aerial imagery has been used to create polygon shape files of the approximate extent of key weed species (i.e. because thistle and blackberry species are widespread, these have not been specifically mapped).

Figure 1 presents the approximate distribution of weeds from the project area.

Recommendations

The original recommendations by ECOtas (2015) remain valid, as follows:

> "It is recommended that a project-level weed and hygiene management plan be developed as part of the broader project to minimise the risk of exacerbating weed occurrences, introducing new weeds to the site, spreading weeds from the project area to other parts of the State, and to consider ongoing monitoring and control post-works".

Please do not hesitate to contact me for further information.

M. Wapstra

Mark Wapstra
Manager/Senior Scientist

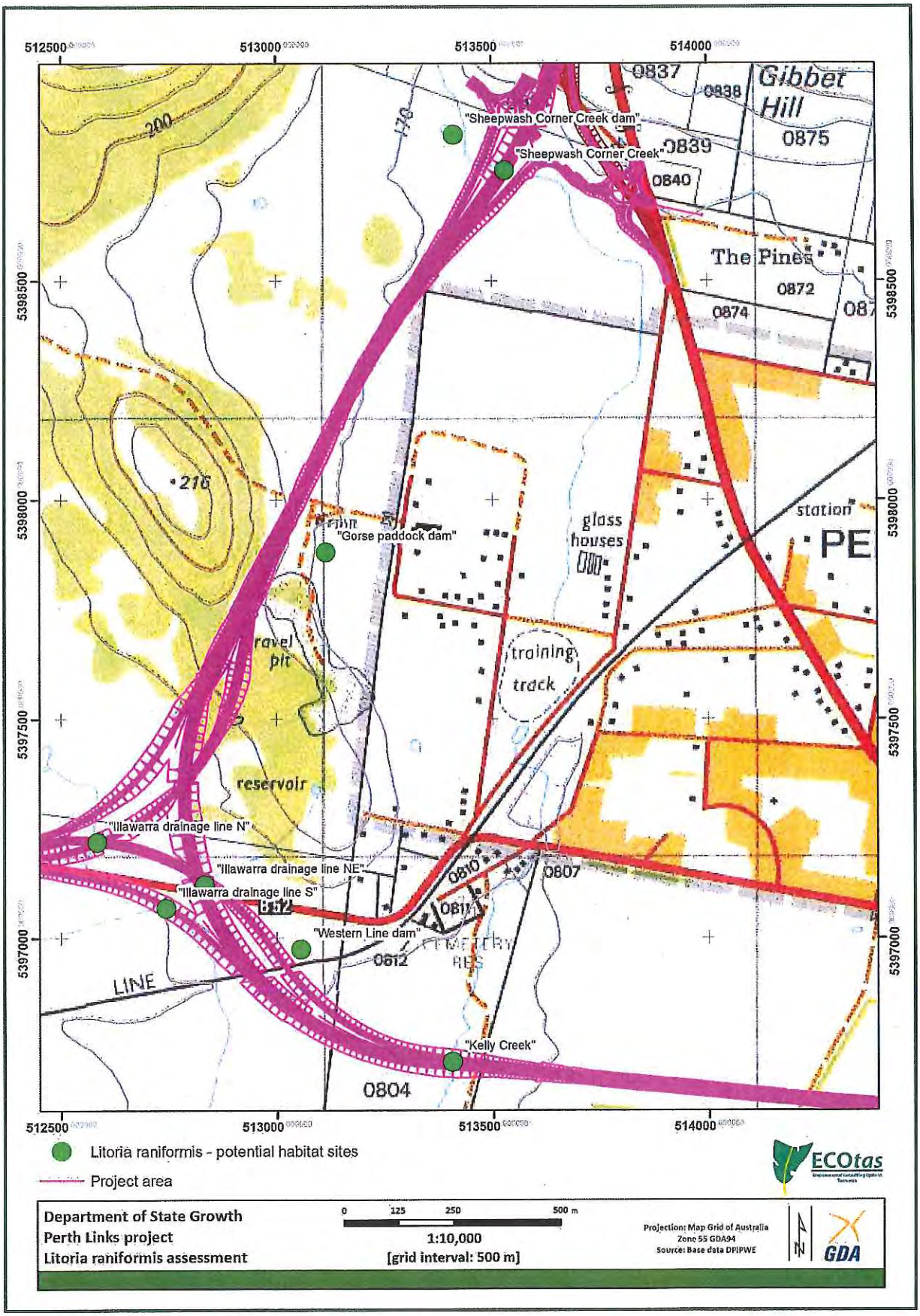


Figure 1. Sites with potential habitat for *Litoria raniformis* in Perth Links Project area

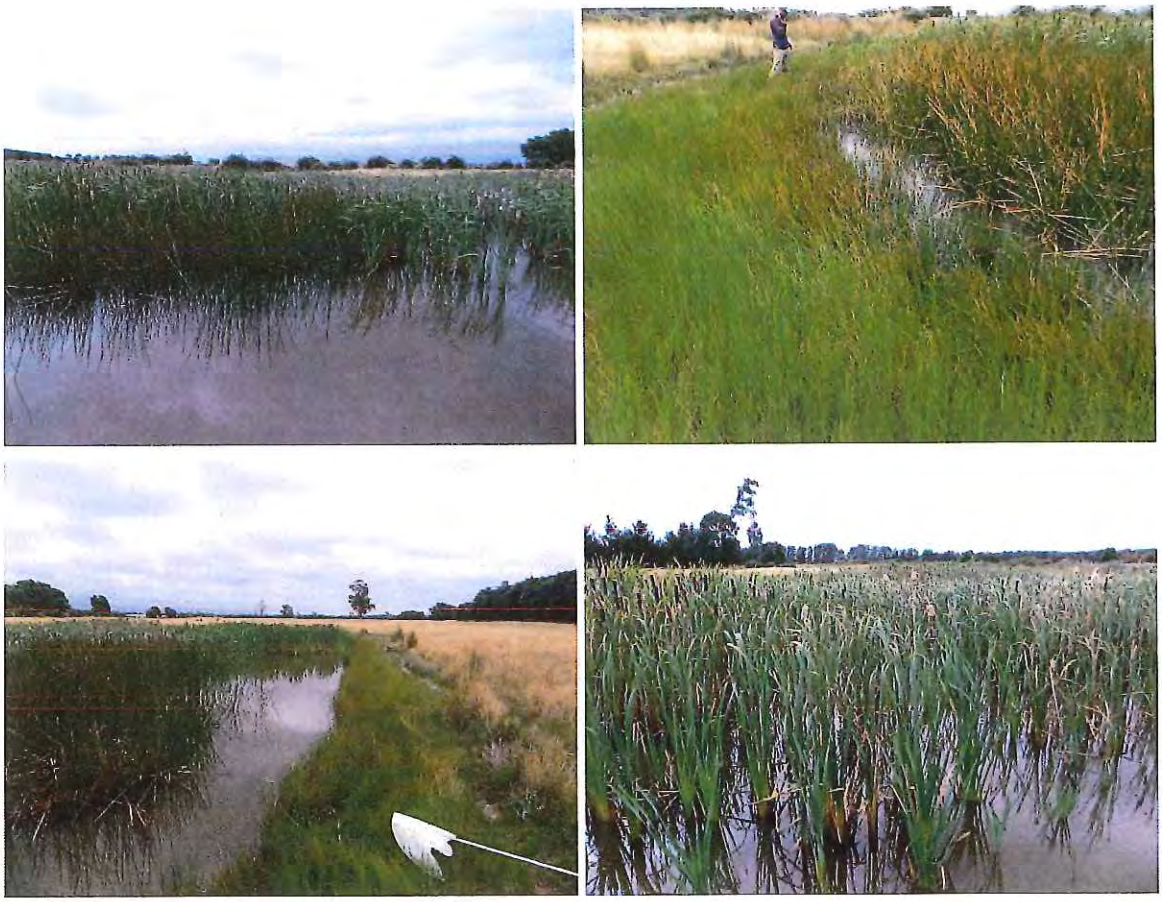
Images of potential habitat of *Litoria raniformis*

"Kelly dam" – well south of project area (23 Jan. 2017)

"Kelly Creek", upstream of likely crossing point – note dominance of *Typha* species (23 Jan. 2017)

Views of "Kelly Creek" at about the proposed crossing (23 Jan. 2017) – continued next page)

Views of "Kelly Creek" at about the proposed crossing (23 Jan. 2017) – continued from previous page



Views of Western Line dam (15 Feb. 2017)

Western Line dam (20 Nov. 2014) – note no substantial change between 2014 and 2017

Views of drainage depressions in pasture between Illawarra Road and Western Line (note the image of cracked clay soils) (15 Feb. 2017)

Views of "gorse paddock dam" (15 Feb. 2017)

Views of Sheepwash Corner dam (15 Feb. 2017) – note the stock access

Views of Sheepwash Corner dam (20 Nov. 2014) – note the substantial change in condition between 2014 and 2017

Views of Sheepwash Corner Creek (15 Feb. 2017) – note the stock access

Views of Sheepwash Corner Creek (20 Nov. 2014)

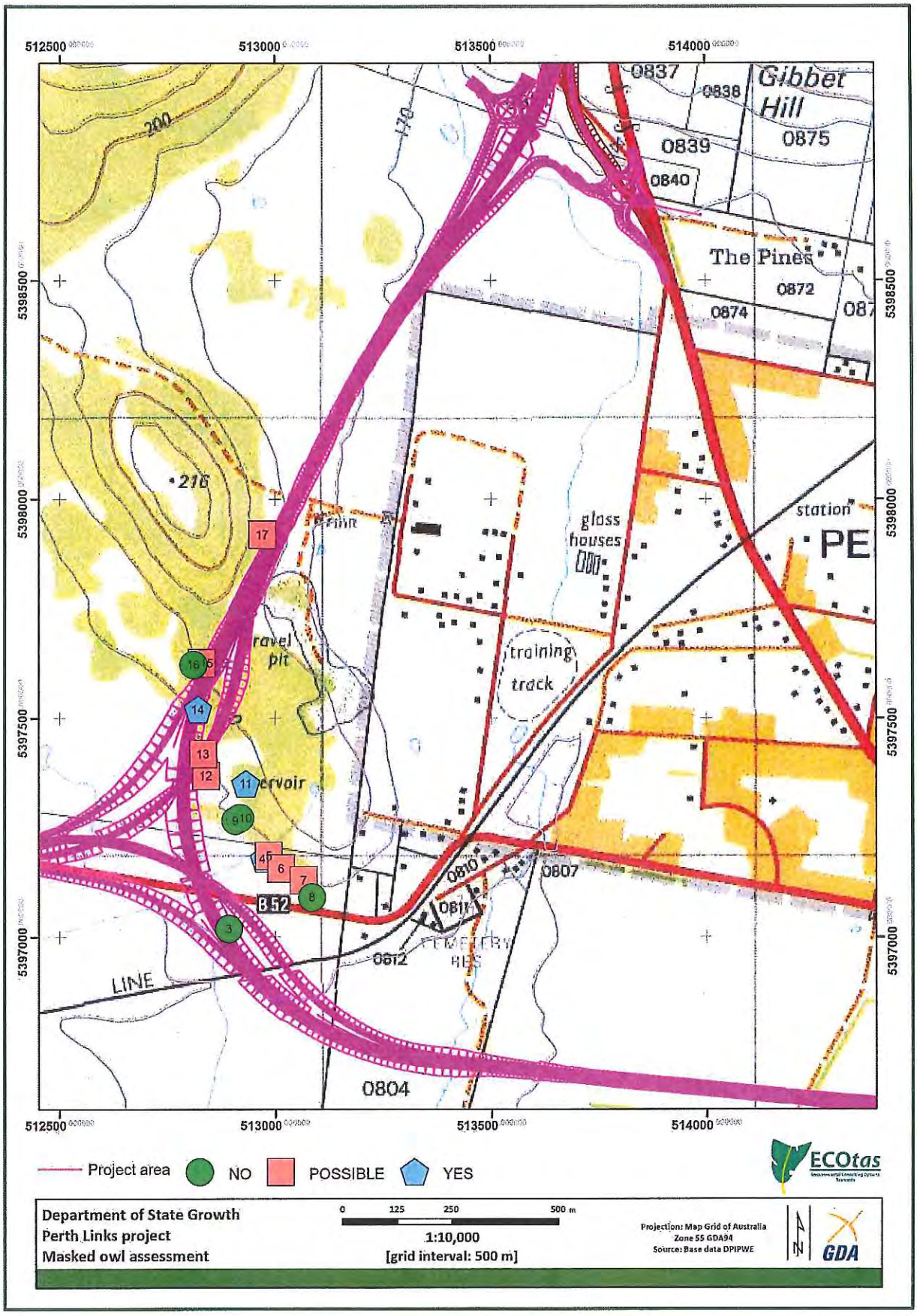


Figure 2a. Distribution of hollow-bearing trees within and close to Perth Links Project area (overview)

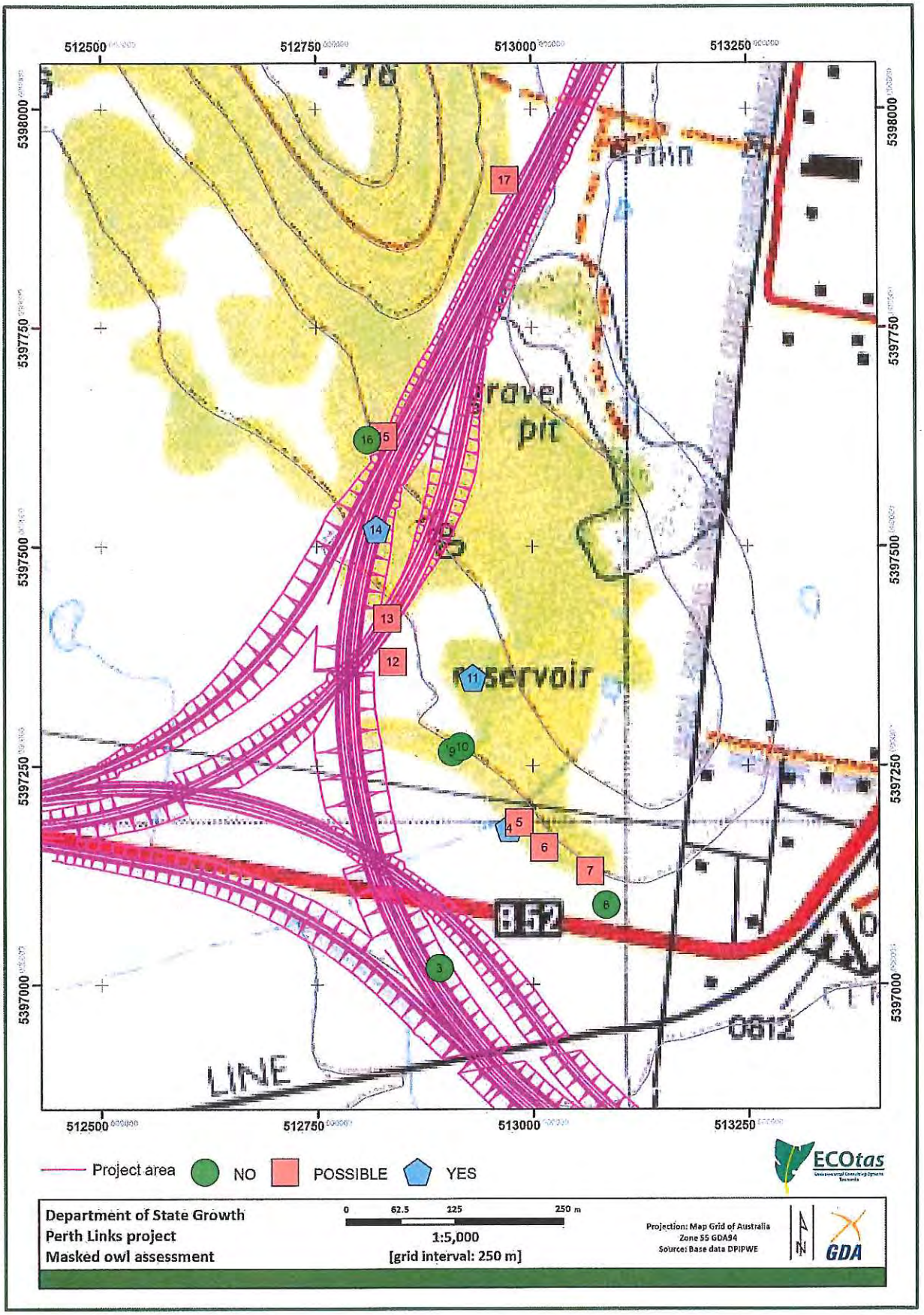


Figure 2b. Distribution of hollow-bearing trees within and close to Perth Links Project area (detailed)

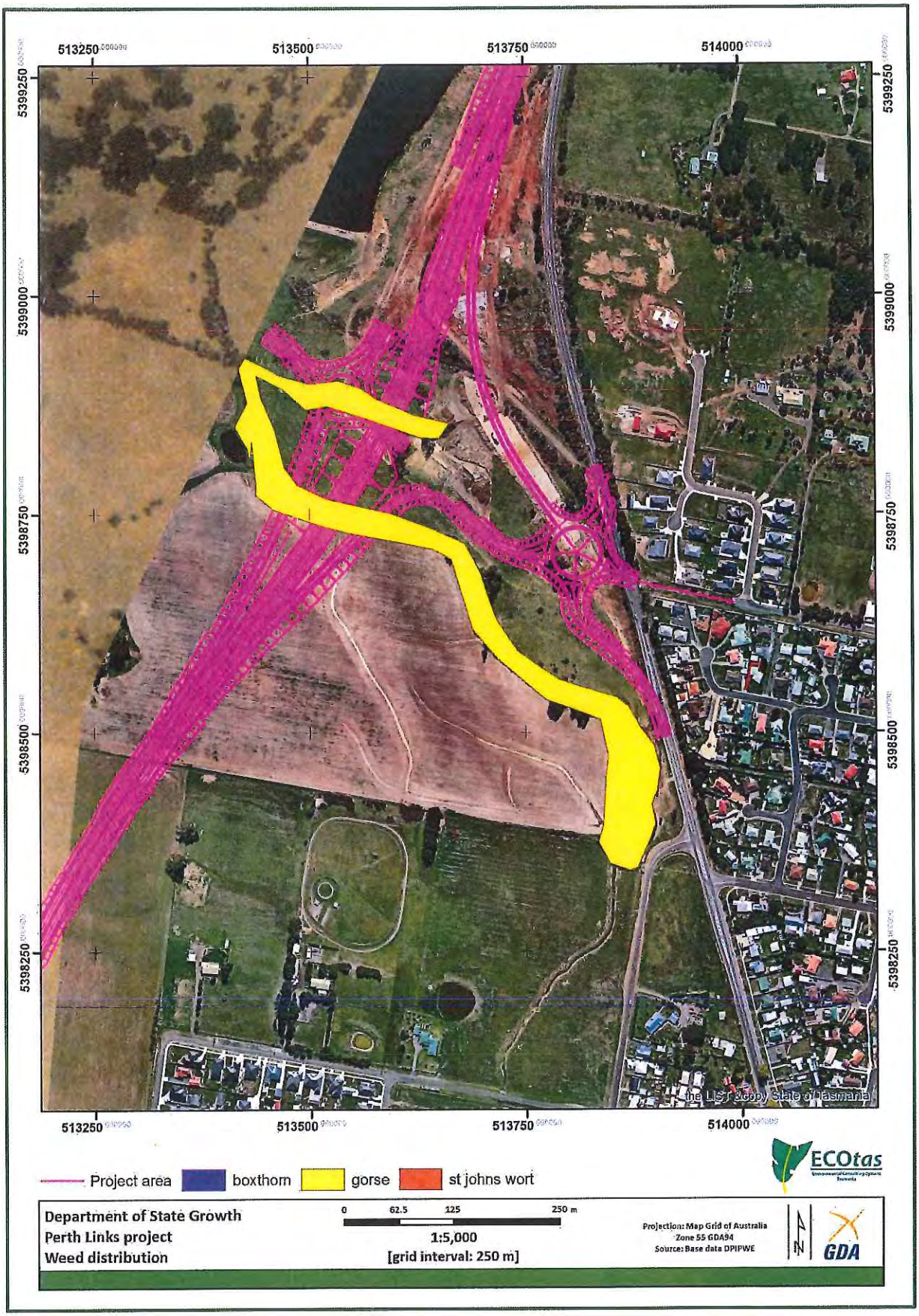


Figure 3a. Distribution of key weed species within and close to Perth Links Project area

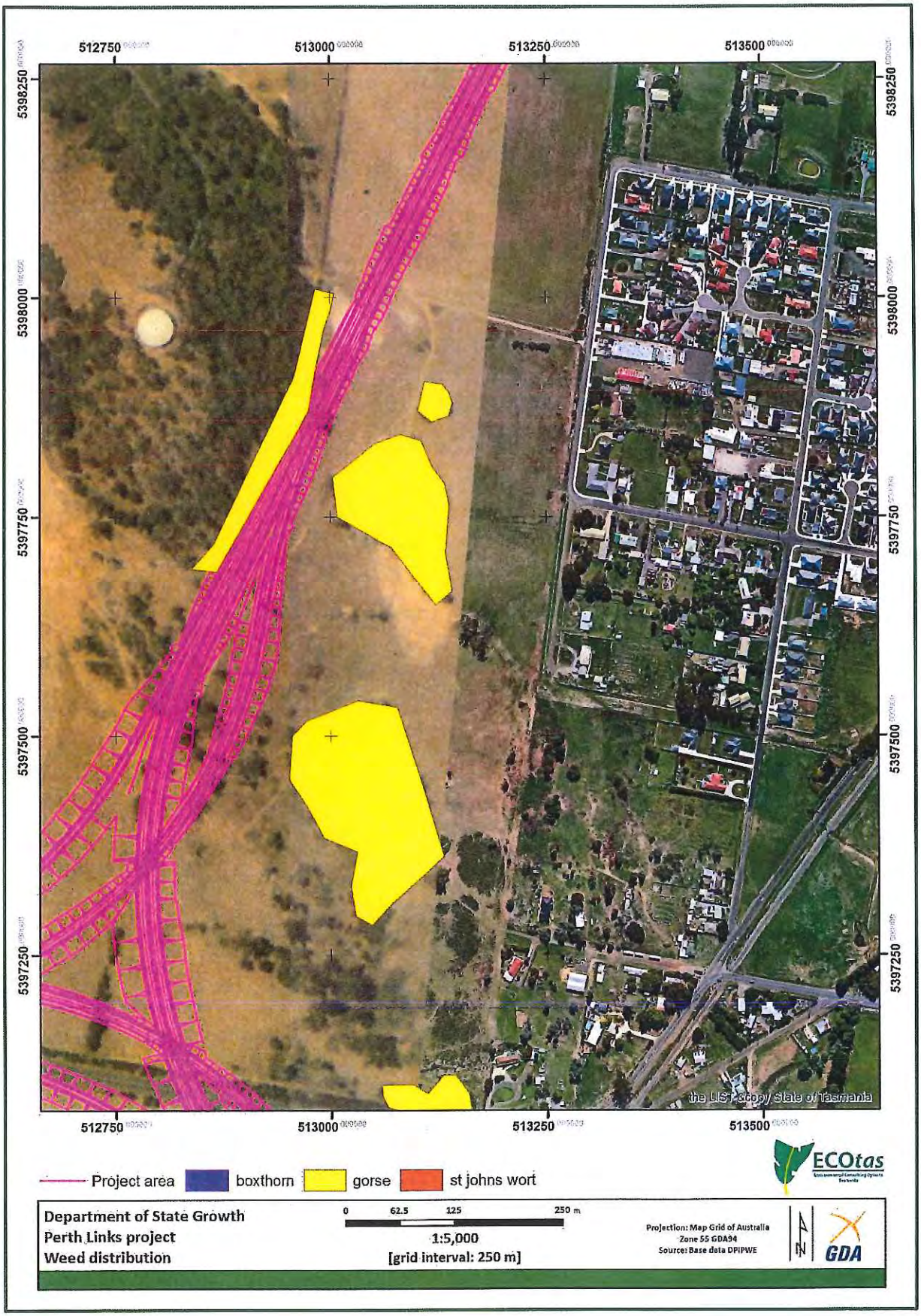


Figure 3b. Distribution of key weed species within and close to Perth Links Project area

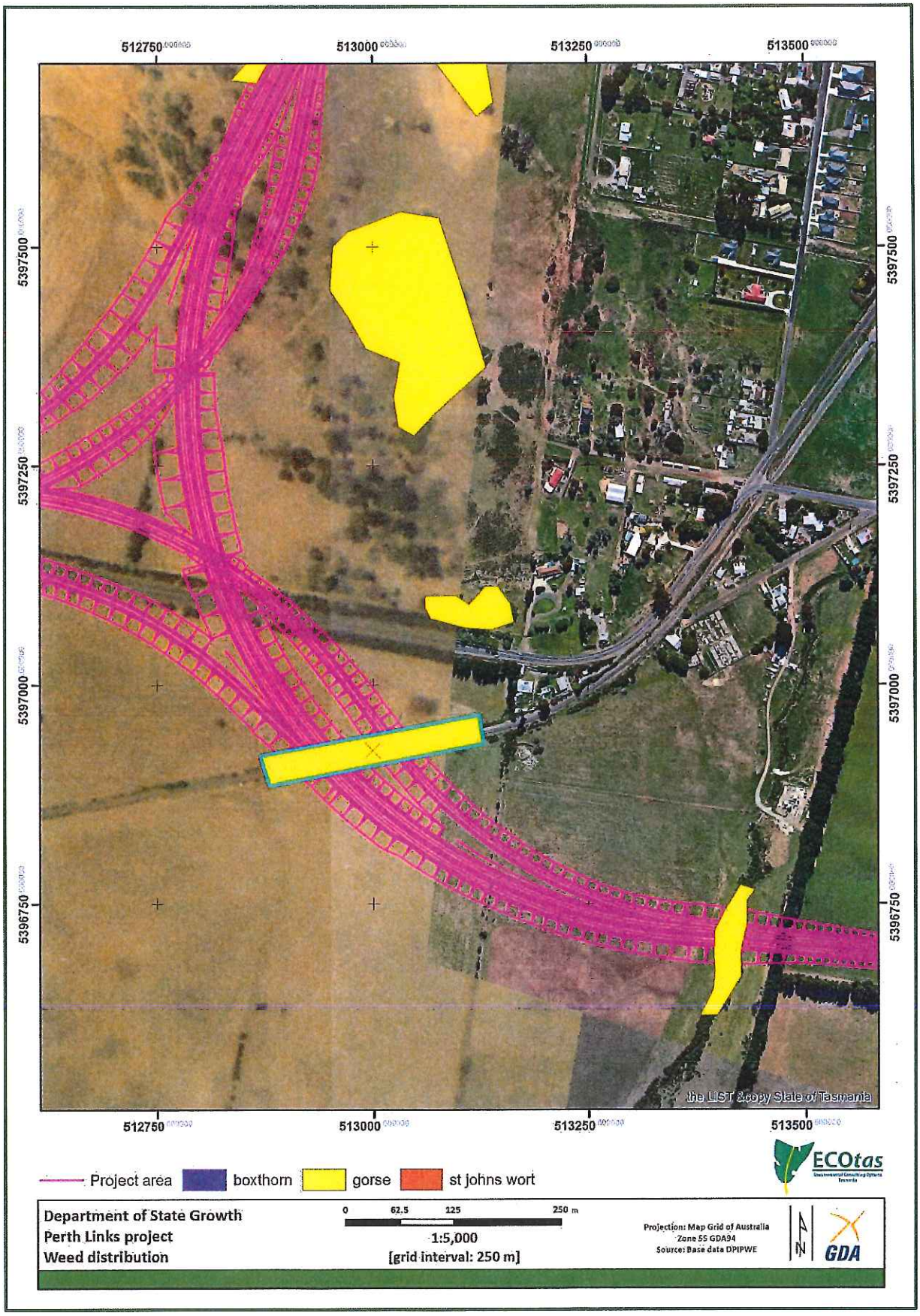


Figure 3c. Distribution of key weed species within and close to Perth Links Project area

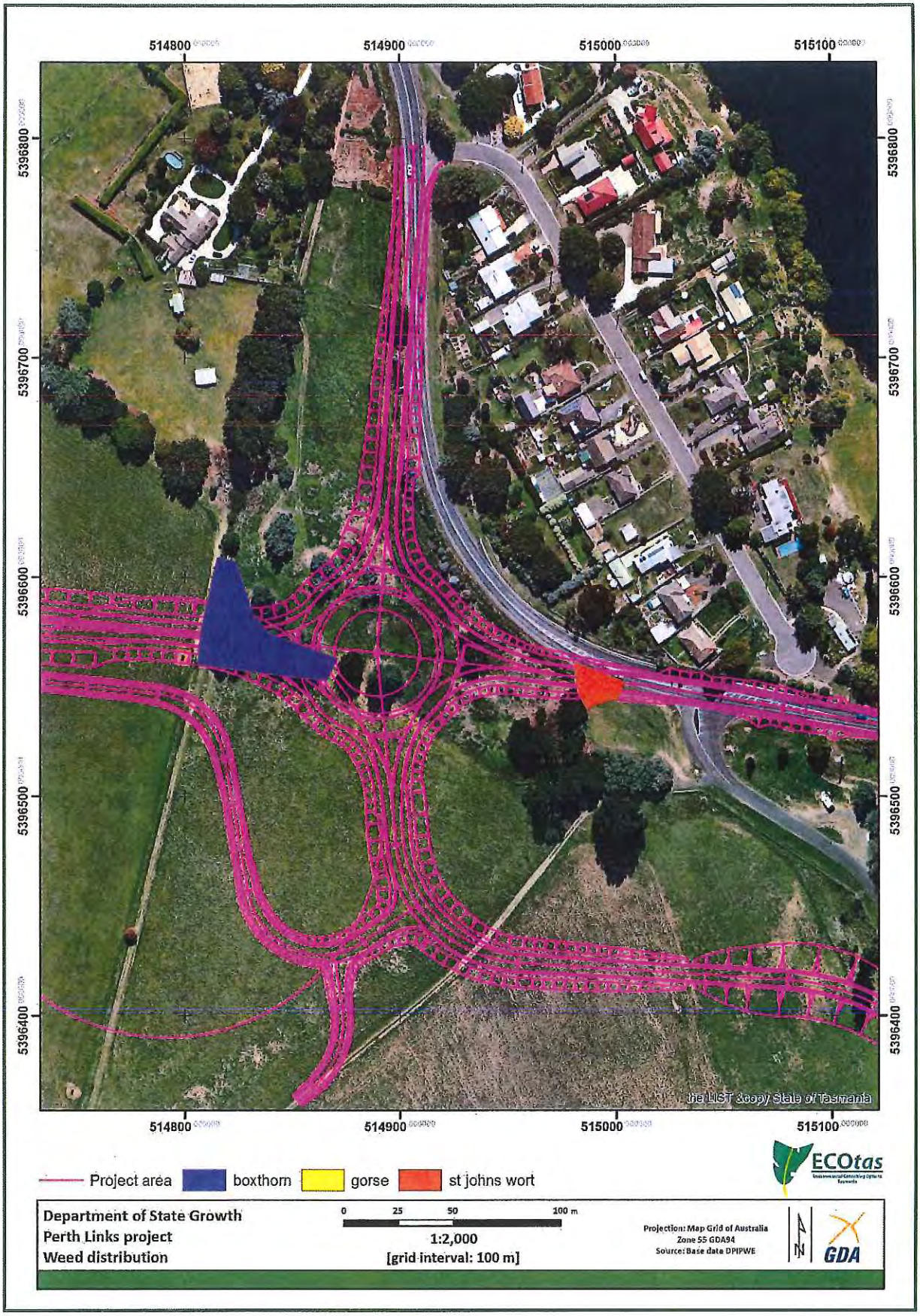


Figure 3d. Distribution of key weed species within and close to Perth Links Project area

Environmental Consulting Options Tasmania

ASSESSMENT OF POTENTIAL IMPACT ON ECOLOGICAL VALUES OF PROPOSED PERTH LINKS AND ASSOCIATED CONNECTORS, TASMANIA

Environmental Consulting Options Tasmania (ECO*tas*) for Department of State Growth

31 January 2015

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AUTHORSHIP

Field assessment: Mark Wapstra

Report production: Mark Wapstra

Habitat and vegetation mapping: Mark Wapstra

Base data for mapping: TasMap, Department of State Growth

Digital and aerial photography: Mark Wapstra, GoogleEarth, TheList

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COVER ILLUSTRATIONS

View across primary production land west of Perth. Insets (L-R): *Arthropodium strictum* (chocolate lily), *Caesia calliantha* (blue grasslily), *Haloragis heterophylla* (variable raspwort).

Please note: the blank pages in this document are deliberate to facilitate double-sided printing.

CONTENTS

SUMMARY

General

The Department of State Growth engaged Environmental Consulting Options Tasmania (ECO*tas*) to undertake an assessment of the potential impact on ecological values of the proposed construction of the Perth to Breadalbane Bypass, Tasmania, to ensure that the requirements of the identified ecological values are appropriately taken into account during further project planning.

The present survey is considered preliminary, with the main objective to identify "fatal flaws" to the broader project. More detailed surveys may become necessary as project planning progresses, and the southern section (present report) is considered in the context of the whole project.

The study area was assessed on 19 & 20 November 2014 by Mark Wapstra.

Summary of key findings and recommendations

Non-threatened flora (e.g. species of biogeographic significance)

- *Amphibromus sinuatus* (lax swampgrass) was recorded from the small dam between the railway line and Illawarra Road. This species is not reported frequently in Tasmania and is considered of some local significance. While technically not threatened, if the dam can be maintained undisturbed, the population is likely to persist. Note that this dam is also considered a potential habitat for the green and golden frog and further project design around this site is recommended.

Non-threatened fauna (e.g. species of biogeographic significance)

- The broader project area supports a relatively high diversity of frog species, including the threatened green and golden frog (*Litoria raniformis*). Management of potential habitat (still and slow-flowing waterbodies) and interconnected habitat (as dispersal corridors) and development of a chytrid disease management strategy is recommended.

Threatened flora

- No plant species, listed as threatened on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, were detected within the study area. The study area does not support significant potential habitat of EPBCA-listed species such that further surveys are not warranted.
- Three plant species, listed as threatened (all rare) on the Tasmanian *Threatened Species Protection Act 1995* (TSPA), were detected within the study area, as follows:
  - *Arthropodium strictum* (chocolate lily): localised to the better condition grassy forested ridge south of the reservoir (probably outside any area likely to be disturbed);
  - *Caesia calliantha* (blue grasslily): as above; and
  - *Haloragis heterophylla* (variable raspwort): small patch in roadside drain on northern side of Illawarra Road (impractical to avoid);
- Depending on the status of *Arthropodium strictum* at the time of project commencement (currently recommended for de-listing), and the precise extent of works, a permit may be required to disturb these threatened species, but no special management prescriptions are recommended (i.e. their presence should not constrain project design in any manner).

- Note that any consideration of threatened flora should consider the whole project, not just the southern or northern sections in isolation.

Threatened fauna

- Potential habitat of the eastern barred bandicoot (*Perameles gunnii* subsp. *gunnii*), green and golden frog (*Litoria raniformis*) and masked owl (*Tyto novaehollandiae* subsp. *castanops*) and potential impacts on these species, will need to be considered under the provisions of Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or the Tasmanian *Threatened Species Protection Act 1995*.
- The need for a referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may depend on the final project design. The key management issues requiring consideration are: (1) potential for increased roadkill; (2) habitat fragmentation; (3) introduction of chytrid disease; and (4) loss of habitat elements such as large hollow-bearing trees and aquatic features.
- Note that any consideration of threatened fauna should consider the whole project, not just the southern or northern sections in isolation.
- Further surveys of aquatic and near-aquatic habitats are likely to be required for the green and golden frog in the southern section of the project area because nocturnal play-back surveys to date have been conducted on one night only and in poor to average conditions. However, such surveys may not become necessary if the key sites can be avoided by an appropriate distance. The northern section has been well surveyed for frogs but it needs to be recognised that any survey result simply represents a snapshot in time and a site deemed negative now may be used in future. For this reason, depending on the final design of the project, further targeted surveys may become warranted.
- Further consideration of individual hollow-bearing trees may need to be given during further project design.

Vegetation types

- No vegetation types, classified as threatened on Schedule 3A of the Tasmanian *Nature Conservation Act 2002* or schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, were detected within the study area.

Declared weeds

- Seven species, classified as declared weeds within the meaning of the Tasmanian *Weed Management Act 1999*, were detected from the study area. Additional species are reported from the broader project area.
- Development of a project-level weed and hygiene management plan is recommended, principally to deal with management of vegetation debris and topsoil containing propagules of "environmental weeds".

Plant and animal disease

- Management of chytrid frog disease should be considered as part of developing management prescriptions for threatened fauna.
- Hygiene prescriptions should be incorporated into a project-level weed and hygiene management plan.

PURPOSE, SCOPE, LIMITATIONS AND QUALIFICATIONS OF THE SURVEY

Purpose

The Department of State Growth engaged Environmental Consulting Options Tasmania (ECO*tas*) to undertake an assessment of the potential impact on ecological values of the proposed construction of the Perth to Breadalbane Bypass, Tasmania, to ensure that the requirements of the identified ecological values are appropriately taken into account during further project planning.

The present survey is considered preliminary, with the main objective to identify "fatal flaws" to the broader project. More detailed surveys may become necessary as project planning progresses, and the southern section (present report) is considered in the context of the whole project.

Scope

This report relates to:

- flora and fauna species of conservation significance, including a discussion of listed threatened species (under the Tasmanian *Threatened Species Protection Act 1995* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*) potentially present, and other species of conservation significance/interest;
- vegetation types (forest and non-forest, native and exotic) present, including a discussion of the distribution, condition, extent, composition and conservation significance of each community;
- plant and animal disease management issues;
- weed management issues (within the meaning of the Tasmanian *Weed Management Act* 1999); and
- a discussion of some of the policy and legislative implications of the identified ecological values.

This report follows, in a general sense (modified to focus on key ecological findings), the government-produced *Guidelines for Natural Values Assessments* (DPIPWE 2009) in anticipation that the report (or extracts of it) will be used as part of various approval processes that will be required for works at the site.

The assessment also complies, in a general sense, with the Tasmanian EPA's *Environmental Effects Report* requirements. The report format will also be applicable to other assessment protocols as required the Commonwealth Department of the Environment (for any referral/approval that may be required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*), should such referral be warranted.

Limitations

The ecological assessment was undertaken on 19 & 20 November 2014. Many plant species have ephemeral or seasonal growth or flowering habits, or patchy distributions (at varying scales), and it is possible that some species were not recorded for this reason. However, every effort was made to sample the range of habitats present in the survey area to maximise the opportunity of recording the majority of species present (particular those of conservation significance). Late spring and into

summer is usually regarded as the most suitable period to undertake the majority of botanical assessments. While some species have more restricted flowering periods, a discussion of the potential for the site to support these is presented. The main concern with respect to timing relates to ephemeral annual herbs (e.g. *Hyalosperma demissum*, *Triptilodiscus pygmaeus*, *Aphelia* spp., *Myriophyllum integrifolium*, *Siloxerus multiflorus*, etc.), especially since previous surveys (DIER 2014) of the area to the north had detected many of these species. This issue is discussed in greater detail under **METHODS *Botanical survey – threatened flora*** and under individual species' entries in Table D1 in Appendix D.

Having said this, many priority species potentially present are detectable at this time of year (e.g. many grass and sedge species, especially species of *Austrostipa*, *Rytidosperma* and *Carex*, but also some perennial herbs, including species such as *Lepidium pseudotasmanicum* and species of *Scleranthus* and *Vittadinia*, the latter genus being targets of the survey due to nearby records along the Midland Highway).

The survey was also limited to vascular species: species of mosses, lichens and liverworts were not recorded. However, a consideration is made of species (vascular and non-vascular) likely to be present (based on habitat information and database records) and reasons presented for their apparent absence.

Surveys for threatened fauna were practically limited to an examination of "potential habitat" (i.e. comparison of on-site habitat features to habitat descriptions for threatened fauna), and detection of tracks, scats and other signs, except as indicated in **METHODS *Zoological survey***.

Qualifications

Except where otherwise stated, the opinions and interpretations of legislation and policy expressed in this report are made by the author and do not necessarily reflect those of the relevant agency. The client should confirm management prescriptions with the relevant agency before acting on the content of this report.

Permit

Any plant material was collected under DPIPWE permit TFL 13066 (in the name of Mark Wapstra). Relevant data will be entered into DPIPWE's *Natural Values Atlas* database by the author. Some plant material may be lodged at the Tasmanian Herbarium by the author.

No vertebrate or invertebrate material was collected. All zoological surveys were non-invasive and did not require destruction or disturbance of known sites or potential habitat of threatened fauna species.

THE STUDY AREA

The study area (Figures 1 & 2) is the area between the southern end of Perth (on the western side of the bridge across the South Esk River), west across paddocks south of Illawarra Road to approximately south of Oakmount, and then north across the southern, eastern and northern slopes of Oakmount including the flat terrain between Oakmount and Perth and the Midland Highway, centred on 523985mE 5242687mN (GDA94, Longford 5039 & Prospect 5040 1:25,000 series Tasmaps).

The study area comprises predominantly primary production land utilised for cropping and/or grazing, with some areas intensively managed (e.g. lower-lying flatter terrain) and other areas utilised as "rough grazing" (e.g. adjacent grassed to lightly wooded slopes used for sheep grazing). Several public roads and numerous private residence access and farm tracks are present within the study area. Numerous fences (in various condition) are present. Some parts of the study area are occupied by residential housing and related buildings.

Limited parts of the study area support native vegetation, and these are mainly restricted to steeper slopes and hilltops unlikely to be disturbed by the project works (but at this stage nominally included within the broader study area). Some parts of the study area have been planted with exotic trees (as small hardwood or softwood plantations, shelterbelts, firewood lots or ornamental sites).

The study area is in one of the drier parts of Tasmania and there is only one minor tributary of the South Esk River that dissects the study area from its northern extent (where the drainage feature starts as the outflow of the new large dam), winds its way through primary production land and weed-dominated riparian flats and the western part of Perth, before passing under Illawarra Road and again crossing primary production land in the south of the study area (where it enters and other large dam). Topographic maps and aerial photography (and landowner consultation) also indicated the presence of small farm dams, with three water-holding dams confirmed by ground-truthing.

Elevation varies from c. 150 m a.s.l. (lower-lying flatter areas) to c. 215 m a.s.l. (top of Oakmount).

Geology (which is discussed briefly here as it can affect classification of vegetation, and potential for threatened flora, and to a lesser extent threatened fauna) is mapped as (Figure 3):

- Tertiary-age "dominantly non-marine sequences of gravel, sand, silt, clay and regolith" (geocode: Ts): large areas of lower-lying terrain and adjacent gentle slopes (largely developed for primary production);
- Jurassic-age "dolerite (tholeiitic) with locally developed granophyre" (geocode: Jd): small area of elevated slopes in northern section of study area, where gorse dominates old paddocks and occasional rock plates, and across the northern section of Oakmount (mainly outside study area); and
- Quaternary (Cainozoic)-age "undifferentiated Quaternary sediments" (geocode: Q): majority of southern section of Oakmount.

Geology has had a profound impact on land use, with the areas on Ts developed for primary production (presumably reflecting fertility and depth of soils, and periodic inundation maintaining these factors). Areas on the Q substrate, mainly restricted to the dominant topographic feature of the study area, Oakmount, have been less intensively utilised, still supporting grassy forest and woodland (albeit now largely dominated by gorse) because soils are very sandy and presumably relatively infertile.

Land tenure and other categorisations of the study area are as follows:

- mainly private titles (as per information supplied to the consultant from the client - see TheList for specific details);
- Northern Midlands municipality;
- Northern Midlands Bioregion (according to the 5/6.1 boundaries used by most government agencies); and
- Northern Natural Resource Management (NRM) region.

For the purposes of the assessment of ecological values, it was assumed that works may occur, or at least disturb, any areas within the nominated zone.

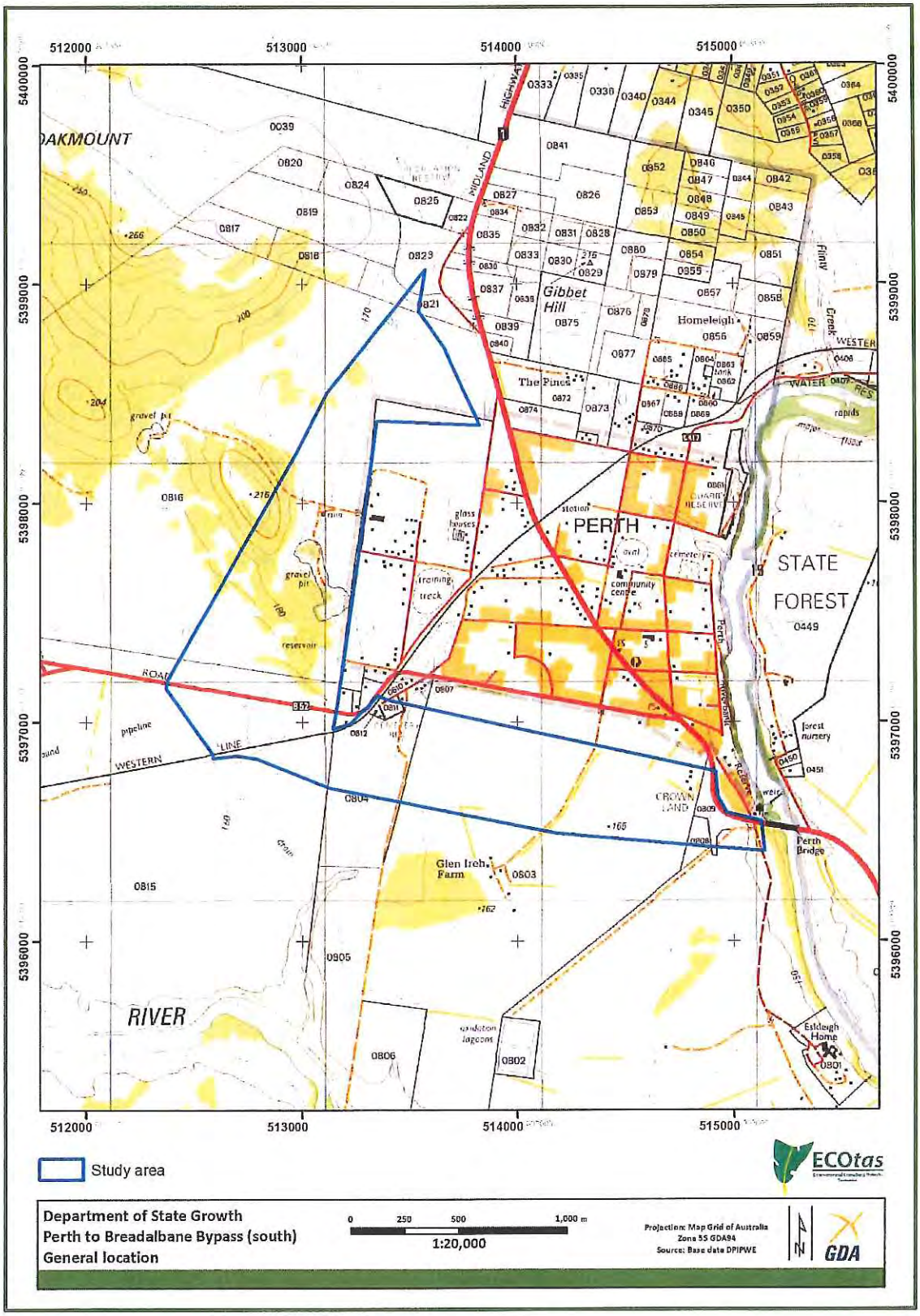

Figure 1. General location of study area

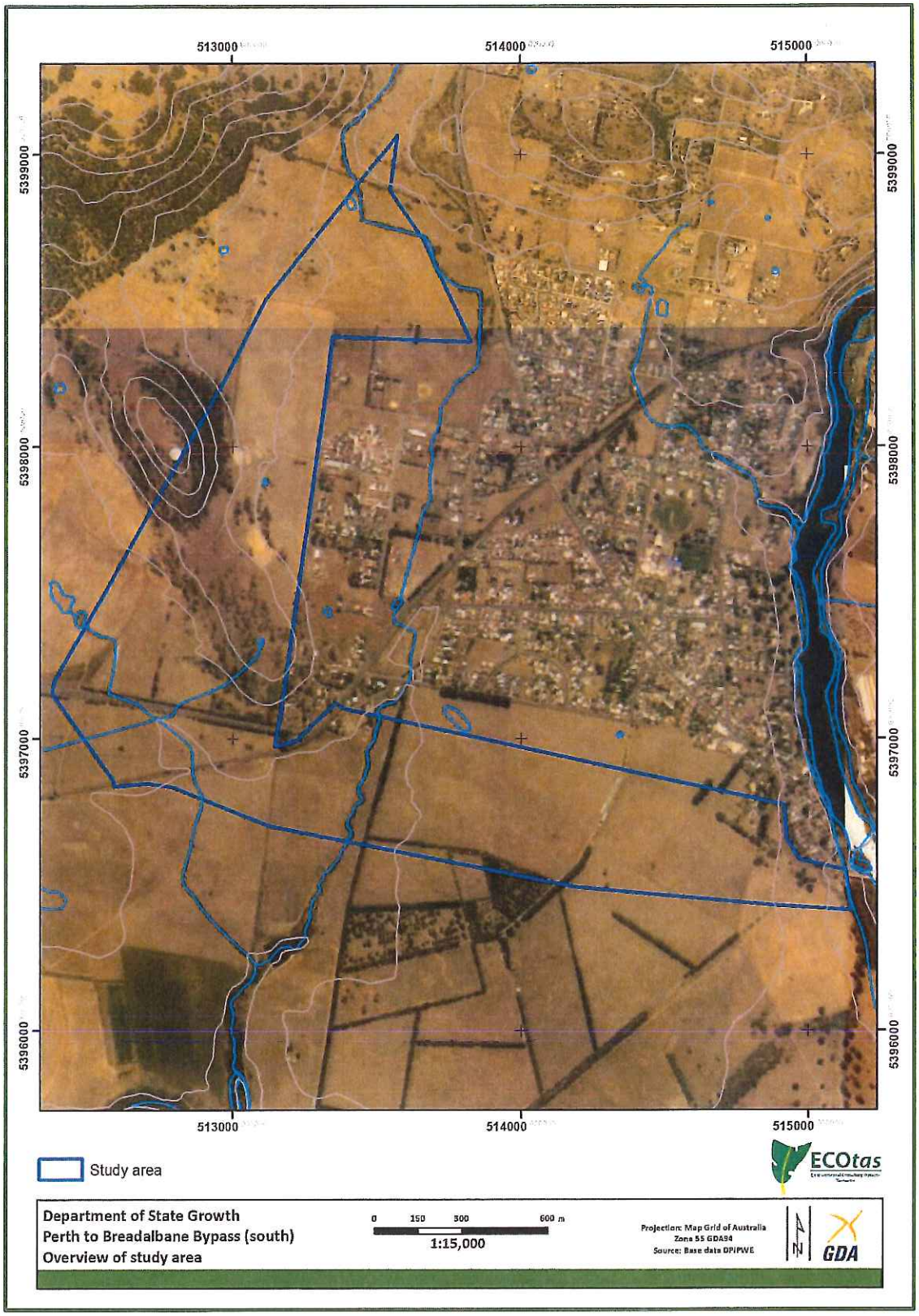

Figure 2. Current land use and vegetation condition of study area

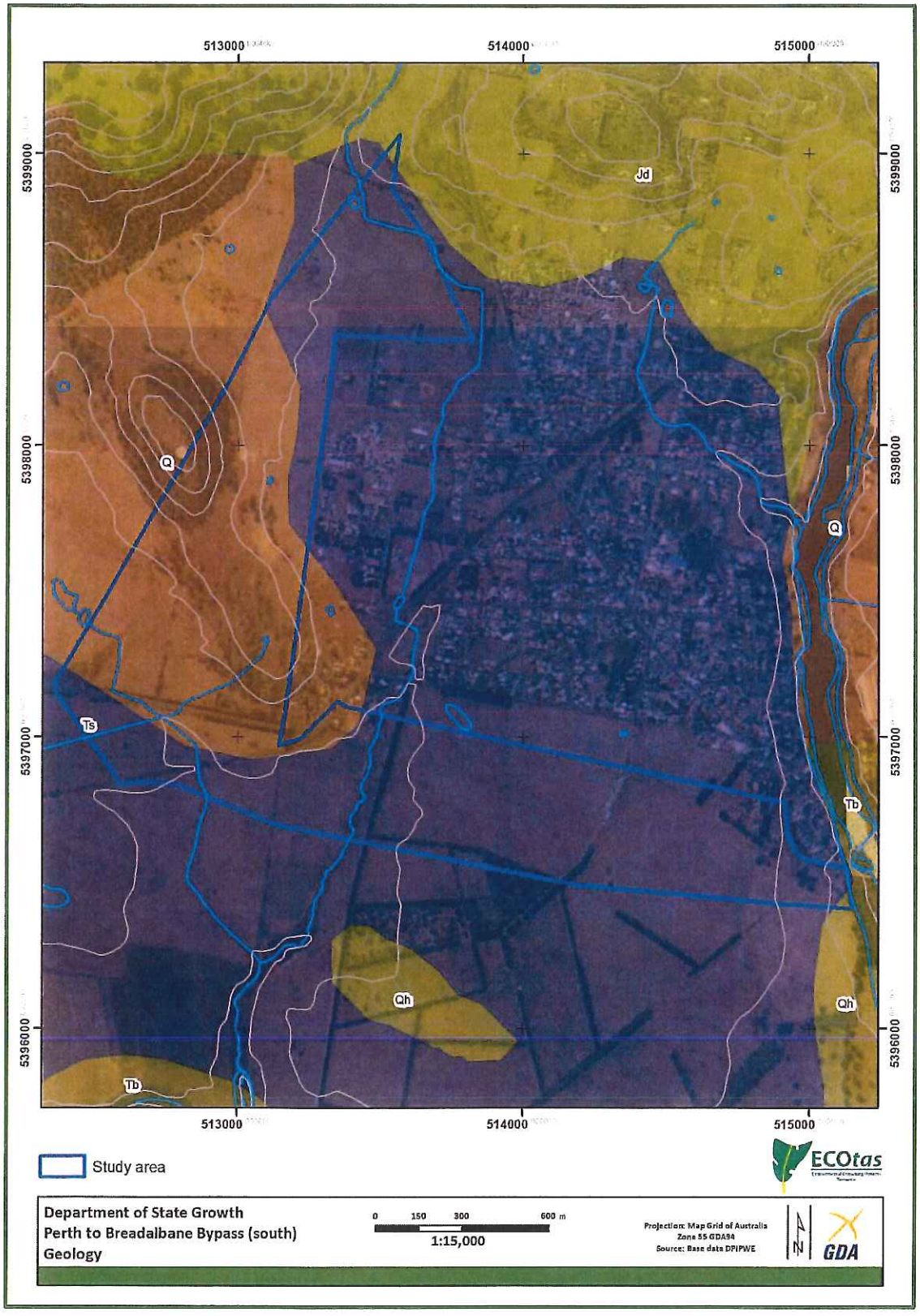

Figure 3. Geology of study area (refer to text for codes)

METHODS

Nomenclature

All grid references in this report are in GDA94, except where otherwise stated.

Vascular species nomenclature follows de Salas & Baker (2014) for scientific names and Wapstra et al. (2005+) for common names. Fauna species scientific and common names follow the listings in the cited *Natural Values Atlas* reports (DPIPWE 2015a). Vegetation classification follows TASVEG 3.0, as described in Kitchener & Harris (2013).

Preliminary investigation

Available sources of threatened flora records, vegetation mapping and other potential environmental values were interrogated. These sources include:

- Tasmanian Department of Primary Industries, Parks, Water & Environment's *Natural Values Atlas Report No. 62561 ECOtas_DofSG_BreadalbanePerthBypass* for a line approximately defining the indicated extent of works, buffered by 5 km, dated 27 January 2015 (DPIPWE 2015) – Appendix F;
- Forest Practices Authority's *Biodiversity Values Database* report, specifically the species' information for grid reference centroid 513254mE 5397415mN (nominally the centroid of the *Natural Values Atlas* search area), buffered by 5 km, hyperlinked species' profiles and predicted range boundary maps, dated 27 January 2015 (FPA 2015) – Appendix G;
- Commonwealth Department of the Environment's *Protected Matters Search Tool Report* for a line approximately defining the indicated extent of works, buffered by 5 km, dated 27 January 2015 (CofA 2015) – Appendix H;
- the TASVEG 3.0 vegetation coverage (as available through a GIS coverage);
- GoogleEarth and TheList aerial imagery (Figure 2);
- *Perth to Breadalbane Ecological Assessment Report* (DIER 2014) & *Green and Gold Frog Survey - Perth to Breadalbane* (FPA 2014); and
- other sources listed in tables and text as indicated.

Botanical survey

General

The survey aimed to assess the range of habitat types present in the study area (at the broad scale e.g. vegetation types, elevation variation, geological substrates; and at the finer scale e.g. microhabitats such as open areas, tracks, rock outcrops, poorly-drained patches, disturbed sites, etc.). In this case, there was no particular constraint to survey, due to very open terrain and the small area requiring assessment.

Reference to topographic maps (Longford 5039 & Prospect 5040 1:25000 scale TASMAPs), aerial photography (GoogleEarth, TheList) and existing vegetation mapping (TASVEG 3.0 as per the cited

Natural Values Atlas report and as available to the author as a GIS coverage) established the approximate range and distribution of topographic and habitat variation present in the study area.

Vegetation type mapping

Vegetation classification follows TASVEG 3.0, as described in Kitchener & Harris (2013). Vegetation was classified by meandering transects to identify vegetation transitions and marking with hand-held GPS (Garmin Oregon 650) for later comparison to aerial photography or key features (e.g. road verges, property boundaries, ornamental trees, etc.).

Vascular species

Vascular species were recorded within plots used to classify vegetation types and in running species lists within continuous vegetation types between plots.

Threatened flora

Areas likely to be affected by the proposed works were assessed by Mark Wapstra (ECO*tas*) on 19 & 20 November 2014. Areas were assessed by slow-walking meandering transects to sample the range of habitat types to detect populations of threatened flora. Where threatened flora were detected, hand-held GPS (Garmin Oregon 650) was used to waypoint the precise location of the individual(s) or the approximate centre and/or extent of the population (for more extensive populations). Absolute counts of individuals were made where practical, except where individuals were growing amongst dense grass and could not be separated.

Previous surveys (DIER 2014) of the broader project area (i.e. the area to the north between Breadalbane and the Evandale roundabout) reported several populations of ephemeral annual herbs, often associated with poorly-drained sites (e.g. *Aphelia gracilis*, *A. pumilio*, *Haloragis heterophylla*) or rocky outcrops (e.g. *Triptilodiscus pygmaeus, Siloxerus multiflorus*). Those surveys were undertaken between mid October 2013 and early-mid January 2014. The "problem" with many of these species is that there are "good" and "bad" years of prolific and widespread flowering to poor to sporadic flowering, respectively, very much dependent on seasonal conditions, making any survey a "snapshot in time". That said, the survey was conducted only a few days after one undertaken by Threatened Plants Tasmania (a volunteer group part of Wildcare Inc.) of private property in the Breadalbane area, where many of these species were detected, suggesting the timing was appropriate.

Declared weeds

Where "declared weeds", within the meaning of the Tasmanian *Weed Management Act 1999*, were detected, hand-held GPS (Garmin Oregon 650) was used to waypoint the location of individuals (for single individuals or small but discrete patches) or approximate centre and/or extent of the population (for more extensive populations).

For the purposes of reporting, only general information is provided at this stage of project planning.

Zoological survey

Surveys for threatened fauna were practically limited to an examination of "potential habitat" (i.e. comparison of on-site habitat features to habitat descriptions for threatened fauna), and detection of tracks, scats and other signs, except as indicated below.

Litoria raniformis (green and golden frog)

FPA (2014) detected the species from farm dams near the northern end of the northern section of the project area, although it was apparently absent from other highly suitable sites in their part of the study area.

Field assessment determined that the southern section of the proposed project area supports potential habitat as follows:

- small farm dam between Illawarra Road and rail line – high quality potential habitat, naturally vegetated, several species of frog calling during diurnal assessment; links through informal paddock drains to roadside ditches;
- smaller farm dam west of Midland Highway south of the new large dam – moderate quality habitat, natural vegetation but quite open, several species of frog calling during diurnal assessment; unlinked to creeks except through open cropland but nearby creek with intermittent pools and dense vegetation;
- creek between large dam south of Perth that runs under Illawarra Road through Perth and to the rush- and grass-dominated flats north of Perth – poor quality habitat (in terms of weediness, stock access, muddiness, ephemerality of pools) but better in that this species appears to utilise quite disturbed habitats (at least as connective habitat during periods of inundation); and
- various roadside drains and ditches.

Diurnal and nocturnal call-back was undertaken at several sites within and adjacent to the project area (Table 1, Figure 4).

Table 1. Locations of frog call-back surveys (refer also Figure 3)

Site	Location	Easting	Northing	Date/time	Weather	Results
1	middle of large dam south of Illawarra Road	513205	5396350	19/11/2014 9.50 pm	light to moderate winds cool to cold	-ve for *Litoria raniformis* +ve for *L. ewingii, Crinia signifera, Limnodynastes dumerilii, L. tasmaniensis, Geocrinia laevis*
2	top end of main section of large dam south of Illawarra Road	513310	5396525	19/11/2014 9.40 pm	As above	As above
1	at rough crossing of creek between Illawarra Road and large dam	513450	5396850	03/11/2014 9.25 pm	As above	-ve for *Litoria raniformis* +ve for *Crinia signifera*

Site	Location	Easting	Northing	Date/time	Weather	Results
4	at top end of tributary near houses	513500	5397050	19/11/2014 9.10 pm	As above	-ve for *Litoria raniformis* +ve for *L. ewingii, Crinia signifera, Limnodynastes dumerili*
5	small dam in pasture between railway line and Illawarra Road	513050	5396975	19/11/2014 10.00 pm	As above	-ve for *Litoria raniformis* +ve for *L. ewingii, Crinia signifera, Limnodynastes dumerili*
5				20/11/2014 4.30 pm	light winds mild (rain coming but humid)	As above
6	at crossing of Phillip Street and creek	513725	5398085	19/11/2014 10.25 pm	light to moderate winds cold	-ve for *Litoria raniformis* +ve for *L. ewingii, Crinia signifera*
7	near junction of Youl Main Road and Midland Highway	513890	5398345	19/11/2014 10.25 pm	As above	As above
8	small dam in pasture near northern end of study area	513410	5398825	20/11/2014 2.00 pm	light winds mild to warm	-ve for *Litoria raniformis* +ve for *L. ewingii, Crinia signifera*

Tyto novaehollandiae subsp. *castanops* (Tasmanian masked owl)

The study area supports limited area of woodland and forest, except on Oakmount (which will probably remain unaffected by the project) but there are several remnant large eucalypts with well-developed large hollows potentially suitable for nesting and/or roosting. The base of these trees was examined for evidence of occupation by the Tasmanian masked owl i.e. pellets, whitewash, feathers, prey remains, etc., although it is recognised that some long-occupied nest and roost sites display little external evidence of such use. The location of these trees was documented using hand-held GPS (Garmin Oregon 650) for later consideration during ongoing project planning.

RESULTS

Vegetation types

Comments on TASVEG mapping

This section, which comments on the existing TASVEG 3.0 mapping for the study area, is included to highlight the differences between existing mapping and the more recent mapping from the present study to ensure that any parties assessing land use proposals (via this report) do not rely on existing mapping. Note that TASVEG mapping, which was mainly a desktop mapping exercise based on aerial photography, is often substantially different to ground-truthed vegetation mapping, especially at a local scale. An examination of existing vegetation mapping is usually a useful pre-

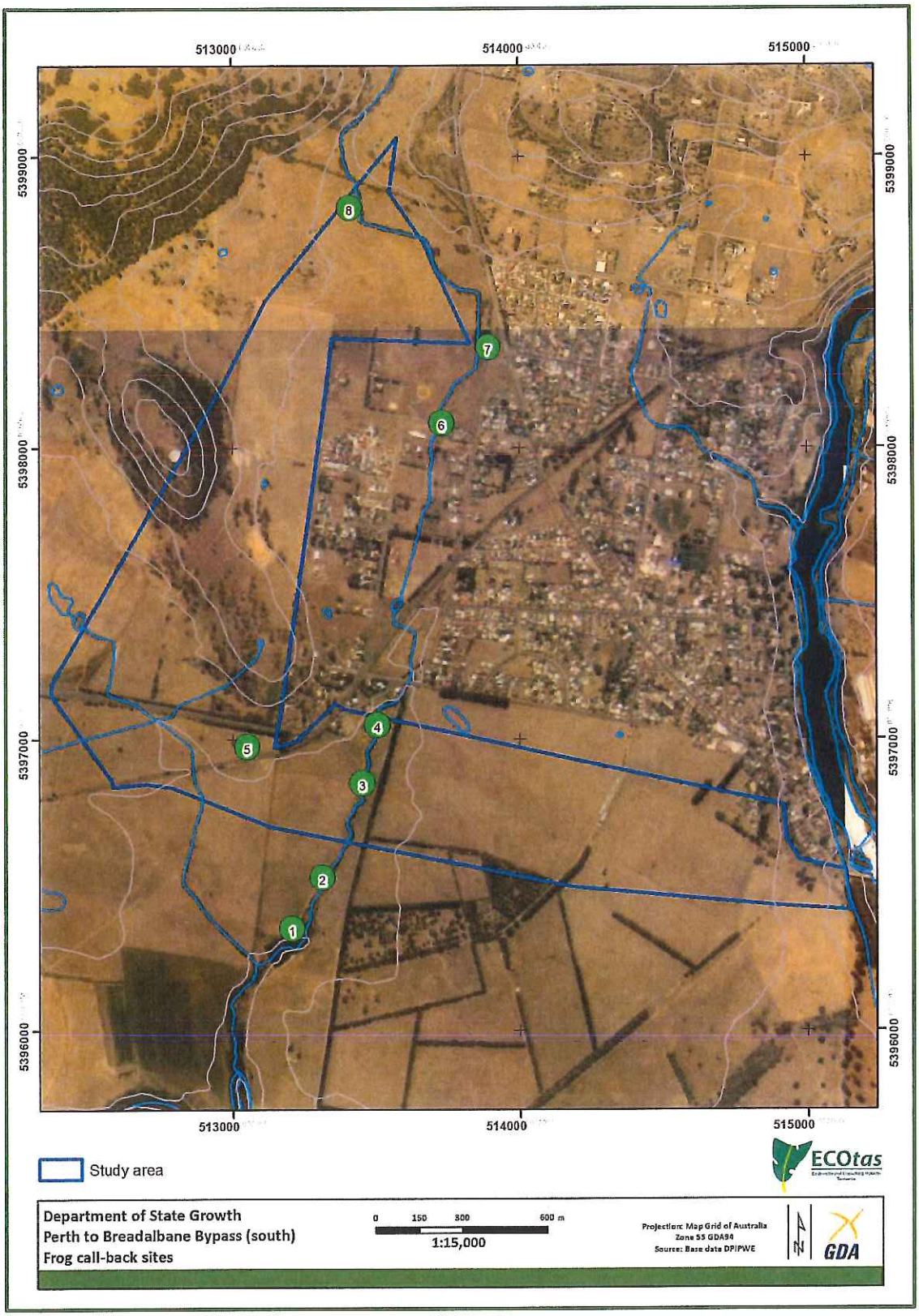

Figure 4. Location of frog call-back surveys

assessment exercise to gain an understanding of the range of habitat types likely to be present and the level of previous botanical surveys.

TASVEG 3.0 maps the study area and surrounds as (see also Figure 5):

- "agricultural land" (TASVEG code: FAG): majority of study area being utilised as primary production;
- "urban areas" (TASVEG code: FUR): residential areas of Perth;
- "weed infestation" (TASVEG code: FWU): northeast slopes of Oakmount;
- "*Eucalyptus viminalis* grassy forest and woodland" (TASVEG code: DVG): small patch of southern "ridge" of Oakmount (but also larger areas mapped outside study area);
- "*Eucalyptus amygdalina* inland forest and woodland on Cainozoic deposits" (TASVEG code: DAZ): majority of forested parts of Oakmount;
- "lowland grassland complex" (TASVEG code: GCL): lower elevation parts of Oakmount, mainly between areas mapped as FAG and DVG/DAZ.

Vegetation types recorded as part of the present study

Vegetation types have been classified according to TASVEG 3.0, as described in *From Forest to Fjaeldmark: Descriptions of Tasmania's Vegetation* (Kitchener & Harris 2013). Figure 6 and Table 2 indicates the revised mapping of the vegetation within the title area. Appendix A provides detailed description of the native vegetation mapping unit identified.

Of the vegetation types present, none are classified as threatened on Schedule 3A of the Tasmanian *Nature Conservation Act 2002* or on schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Table 2. Vegetation mapping units present in study area

[conservation priorities: NCA – as per Schedule 3A of the Tasmanian *Nature Conservation Act 2002*, using units described by Kitchener & Harris (2013), relating to TASVEG mapping units only (DPIPWE 2015b); table headings are as per modules in Kitchener & Harris (2013); EPBCA – as per the listing of ecological communities on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, relating to communities as described under that Act, but with equivalencies to TASVEG units; area approximate only]

TASVEG mapping unit (Kitchener & Harris 2013)	**Conservation priority** NCA *EPBCA*	**Area (ha)**	**Comments**
Other natural environments			
Water, sea (OAQ)	Not threatened *Not threatened*	0.55	OAQ is used to map the areas of small farm dams and obvious linear sections of drainage depressions holding water for part or all of the year. Under existing mapping, such small areas have been subsumed within the broader concept of FAG.
Agricultural, urban and exotic vegetation			
Agricultural land (FAG)	Not threatened *Not threatened*	30.26	Areas used for grazing and/or cropping have been mapped as FAG. Shelterbelts of exotic pines and eucalypts have been subsumed into the concept of FAG because such areas were not established for commercial forestry reasons.

TASVEG mapping unit (Kitchener & Harris 2013)	Conservation priority NCA *EPBCA*	Area (ha)	Comments
Permanent easements (FPE)	Not threatened *Not threatened*	30.26	Linear features such as major public roads (e.g. Illawarra Road) and railway lines are mapped as permanent easements (previously subsumed into the broader concept of FAG).
Weed infestation (FWU)	Not threatened *Not threatened*	30.26	Gorse (*Ulex europaeus*) occupies substantial areas of grazing land on the slopes of Oakmount, generally to the total exclusion of virtually all other species.
Urban areas (FUR)	Not threatened *Not threatened*	30.26	Small parts of the study area include residential housing, a cemetery and homesteads, which have been mapped as FUR. The Glen Ireh Farm is surrounded by eucalypt "plantation", although it is substantially modified and now planted out with many ornamental species, such that classification as "plantations for silviculture" (TASVEG code: FPL) has not been undertaken, and it has rather been mapped as FUR.
Pteridium esculentum fernland (FPF)	Not threatened *Not threatened*	30.26	FPF represents a transition between pasture, weed infestation and grassy forest/woodland. It is geographically and temporally transient so the mapping provided is a "snapshot" representing the approximate current extent.
Dry eucalypt forest and woodland			
Eucalyptus viminalis grassy forest and woodland (DVG)	Not threatened *Not threatened*	84.10	The classification of some parts of the study area as DVG requires additional discussion (see below Table 2). DVG occupies slopes and ridges of Oakmount. Limited areas are in relatively good condition (e.g. gentle ridge south of reservoir) and support populations of threatened flora. The majority of the eastern and northeastern part of Oakmount within the study area has an understorey of virtually impenetrable gorse and/or bracken with a very low diversity of native plants. The canopy is multi-aged, however, with several large hollow-bearing trees. The southern "ridge" of Oakmount (north of Illawarra Road) is very open and sections are barely classifiable as forest or woodland due to a very sparse canopy and very open understorey used for grazing i.e. this area is essentially open "pasture".

Oakmount is currently mapped as a mosaic of DVG, DAZ, GCL, FAG and FWU. As an aside, the present assessment did not identify any areas considered classifiable as "lowland grassland complex" (GCL) because of the dominance of exotic pasture grasses throughout the open grassy areas (all of which have now been classified as FAG). The DAZ and DVG classification requires some consideration because while DVG is not classified as threatened under Schedule 3A of the Tasmanian *Nature Conservation Act 2002*, DAZ is, which means there are potentially significant implications for land use management under different vegetation classifications.

The majority of the forested areas of Oakmount are dominated by *Eucalyptus viminalis* (white gum) with some areas locally or co-dominated by *Eucalyptus amygdalina* (black peppermint). Other species (e.g. *Eucalyptus ovata* – black gum; *Eucalyptus pauciflora* – cabbage gum) are also present but are not dominant or co-dominant. Forests dominated by *E. viminalis* and/or *E. amygdalina* are general classified on the basis of substrate. For example, forests dominated by *Eucalyptus amygdalina* can occur on sandstone ("*Eucalyptus amygdalina* forests and woodland on sandstone" – DAS), mudstone ("*Eucalyptus amygdalina* forests on mudstone" – DAM); dolerite or basalt ("*Eucalyptus amygdalina* forests and woodland on dolerite" – DAD) or siliceous substrates ("*Eucalyptus amygdalina* coastal forests and woodland" – DAC). Only DAS and DAD have potential relevant for forests and woodland on Oakmount.

Forests dominated by *Eucalyptus viminalis* can occur on various substrates. Those on dolerite usually get classified as "*Eucalyptus viminalis* grassy forest and woodland" (DVG): these are the classic open forests and woodlands with a dominantly grassy understorey (e.g. Spring Hill in the Midlands). However, *E. viminalis* can also dominate forests on sandstone, mudstone or siliceous substrates, and these usually get classified as one of the *E. amygdalina*-dominated mapping units (e.g. DAS, DAM or DAC).

The DAZ mapping unit is usually retained for forests dominated by *E. viminalis* and *E. amygdalina* (sometimes locally *E. ovata* and *E. pauciflora*) on Cainozoic deposits on broad valley floors and low undulating terrain (e.g. heathy/grassy forests around Epping Forest). DAZ is rarely mapped on steeper slopes as at Oakmount.

The current juxtaposition of DAZ and DVG on Oakmount does not fully reflect the underlying geological mapping and it is doubtful if the patches were ever ground-truthed. *Eucalyptus viminalis* is the dominant canopy species, with *E. amygdalina* sub-dominant to locally dominant. The understorey has been largely wholly modified although the southern ridgeline just below the reservoir provides guidance on the likely original composition of the slopes now dominated by gorse and/or bracken i.e. herb-rich grassy understorey with sparse low to medium shrubs. Jurassic dolerite seems to only influence the soil type on the western and northern side of Oakmount (so outside the study area), where classification as DVG would be straightforward. The slopes south of the reservoir, even though not strongly influenced by dolerite, are in many ways "classic" DVG. The remainder of the forested slopes in the study area occur on deep sands but these are not derived from weathering of sandstone so classification as DAS is considered unacceptable (as outcropping sandstone is a typical feature of DAS, even when dominated by *E. viminalis*). While the geological mapping suggests that classification as DAZ is the "obvious" path to take, my experience with this sort of site suggests that classification as DVG is more appropriate from an ecological functioning perspective i.e. if undisturbed (not weed-infested), these slopes would appear very similar in composition and structure to adjacent dolerite-based *E. viminalis*-dominated forest rather than as heath- to grass-dominated forests on broad flats (i.e. "classic" DAZ of the Midlands). On this basis, forested parts of Oakmount have been mapped as DVG.

Plant species

General observations (flora)

A total of 214 vascular plant species were recorded from the study area (Appendix B), comprising 130 dicotyledons (including 1 endemic and 91 exotic species), 80 monocotyledons (including 1 endemic and 44 exotic species), 1 pteridophyte (native) and 3 gymnosperms (exotic or ornamental plantings of native species).

Additional surveys at different times of the year may detect additional short-lived herbs and grasses. It is possible that some of these species will be threatened species (e.g. *Hypoxis vaginata*), although most are unlikely to have a high priority for conservation management.

At this stage of project planning, further targeted surveys are not recommended. At a finer-scale, localised sites may need follow-up surveys (e.g. if a rock outcrop likely to support threatened flora will be disturbed due to proposed works) but it is noted that the targeted threatened flora are likely to be State-listed only and manageable through application of practical permit conditions (i.e. Commonwealth-listed species are unlikely to be detected).

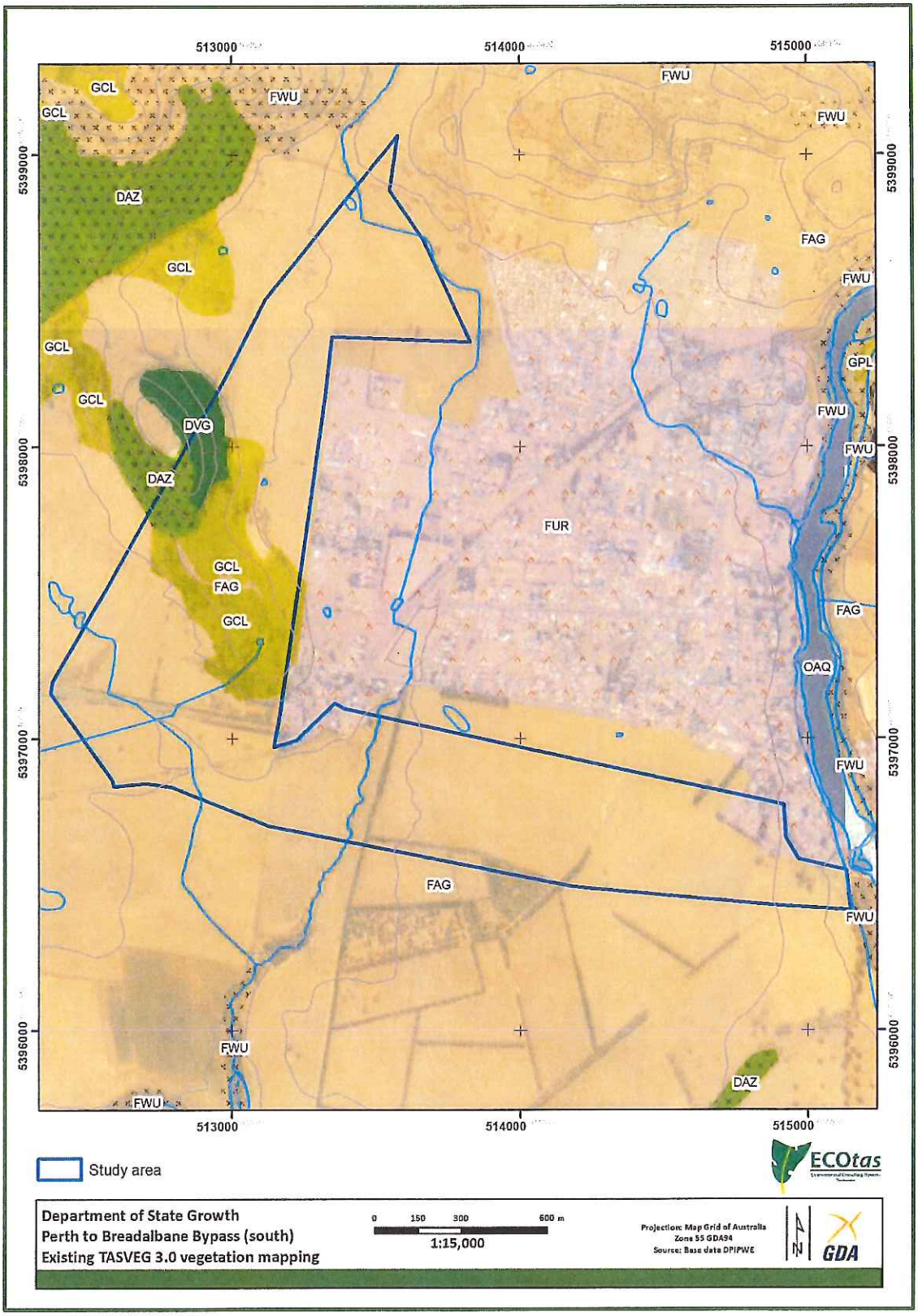

Figure 5. Existing TASVEG 3.0 vegetation mapping of the study area and surrounds (refer text for codes)

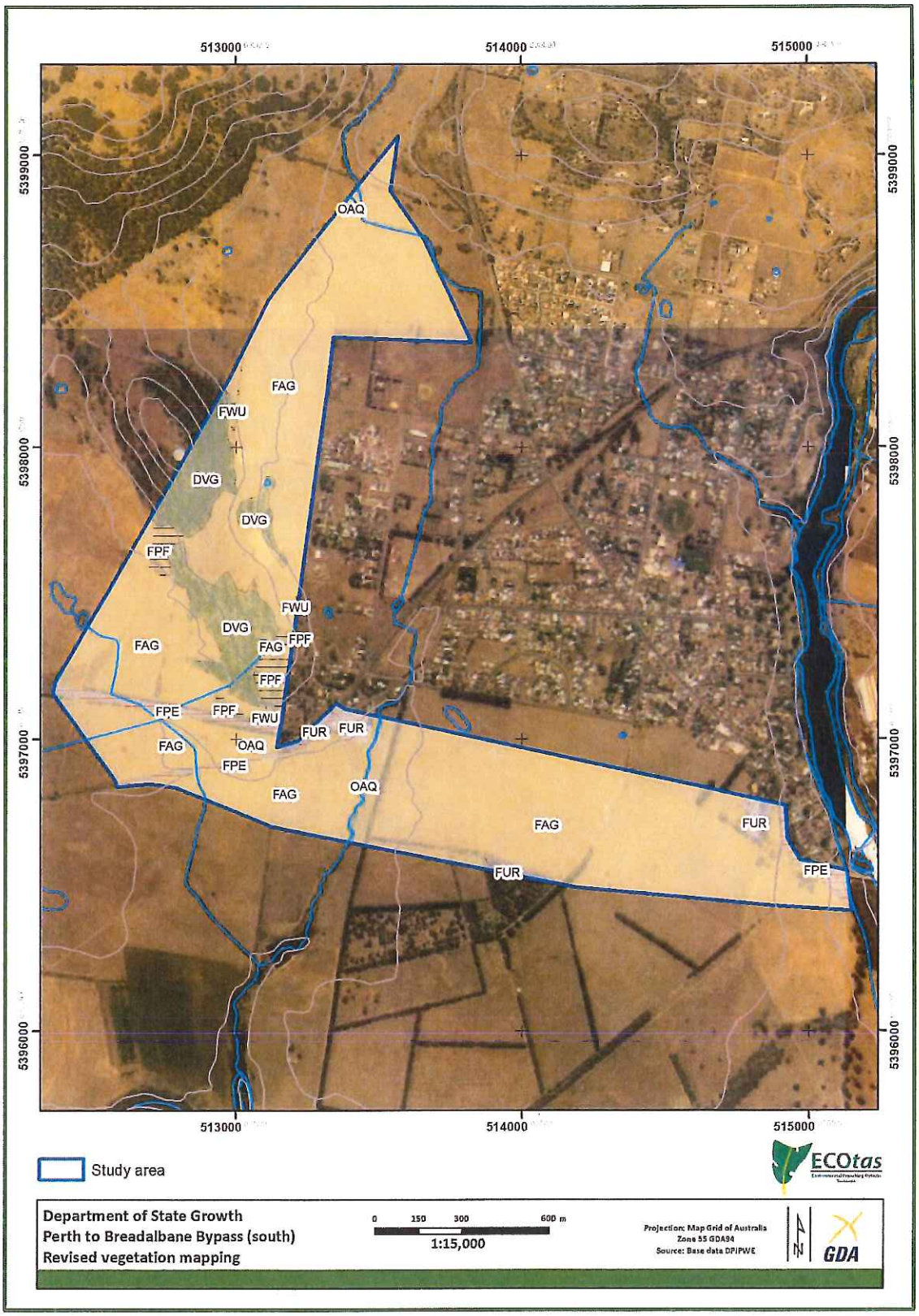

Figure 6. Revised TASVEG 3.0 vegetation mapping of the study area (refer text for codes)