Transport for NSW

Heathcote Road Koala Fencing at Deadmans Creek

Noise and vibration assessment report

November 2024

NSW GOVERNMENT

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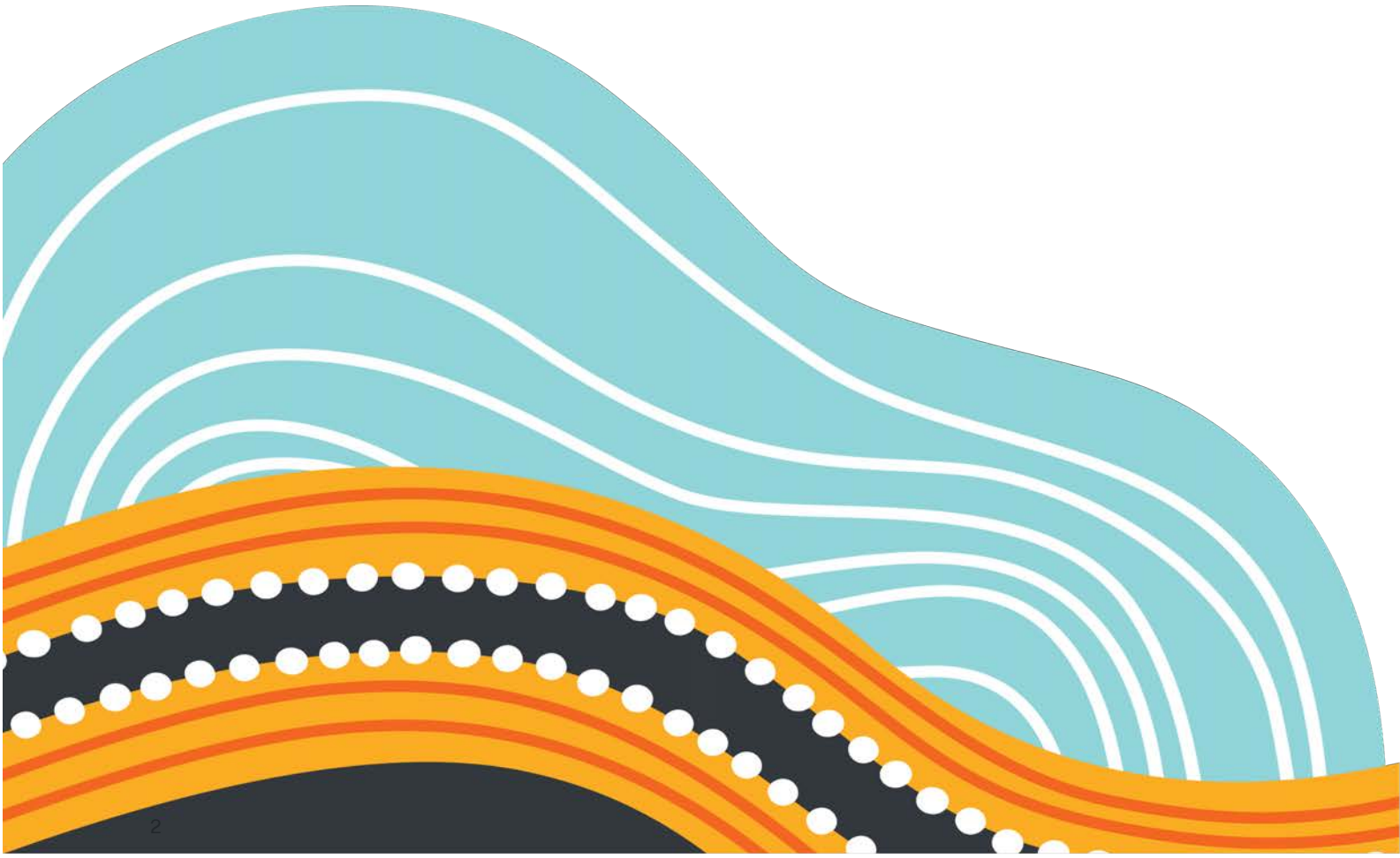
Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which we work and live.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.



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1. Introduction

Transport for NSW (Transport) proposes to construct about 1,320 metres of fencing along Heathcote Road (the proposal), to prevent koalas accessing the road where they are susceptible to vehicle strike and guide them towards safe crossing points under the road. A high number of koala fatalities have been recorded along Heathcote Road near Deadmans Creek, where the road separates large areas of habitat within Georges River National Park to the east and Holsworthy Barracks military base to the west.

The proposal comprises several sections of fencing that will be constructed on both sides of Heathcote Road near Deadmans Creek, between St George Crescent in Menai and Pleasure Point Road in Pleasure Point. The proposal also involves the installation of structures and ground treatments to further improve the safe passage of animals under Heathcote Road.

Key features of the proposal include:

- About 1,153 metres of new koala fencing that is 1.5 metres high, with galvanised steel sheeting along the top, comprising of:
    - About 360 metres (excluding the 170 metres of koala fence to be assessed by separate EIS) of continuous fencing on the eastern side of Heathcote Road, between existing Defence fencing to the north and Deadmans Creek Bridge to the south.
    - About 350 metres of fencing on the eastern side of Heathcote Road, south of Deadmans Creek Bridge. This fencing would be installed in three sections to tie into existing rock slopes and St George Crescent, to create a continuous barrier to Heathcote Road.
    - About 143 metres on the western side of Heathcote Road north of Deadmans Creek Bridge to direct fauna to cross under the road via two existing culverts and Deadmans Creek Bridge, and into the fauna access pipes installed in the Defence fencing.
    - About 300 metres on the western side of Heathcote Road, south of Deadmans Creek Bridge.
- A koala grid with a pedestrian gate across St George Crescent about 80 metres from the intersection with Heathcote Road, to prevent koalas from accessing Heathcote Road.
- About six fauna escape structures, located near fence ends or other weak points, to allow any koalas or other fauna to move from roadside to the habitat side of the fence.
- Up to three metres of selective vegetation clearing on either side of koala fencing, including:
    - Trimming of overhanging trunks or branches (that may allow koalas to climb over the fence into the road)
    - Removal of vegetation on existing rock slopes along the proposed fence alignment to deter animals from using the slopes to access the road
- Fauna access improvements around Deadmans Creek Bridge including:
    - Koala refuge poles to offer refuge from predators where trees are absent.
    - Surface treatments (shotcrete/concrete) in drains around existing fauna crossing structures under Deadmans Creek bridge to assist fauna movements.
- Gates in the fencing for emergency and maintenance access.

Of the 1,320 metres of fencing to be installed along Heathcote Road, about 170 metres of the fence is located within land mapped as 'coastal wetland' under State Environment Planning Policy (Resilience and Hazards) 2021. Works within a mapped coast wetland is designated development and triggers the need for an Environmental Impact Statement (EIS). An EIS has been prepared by Transport and will accompany a development application to Liverpool City Council.

The proposal concept design is provided in Appendix A.

2. Location

The proposal is located about 24 kilometres south-west of the Sydney Central Business District (CBD) and about 8.5 kilometres south-east of the Liverpool CBD. The proposal falls within both the Liverpool City and Sutherland Shire Local Government Areas.

Heathcote Road Is a major arterial road in the south of Sydney and plays a major role in the servicing of traffic travelling between the Illawarra and Western Sydney.

The area surrounding the proposal site is predominantly natural bushland with pocket suburbs, including Pleasure Point, Sandy Point and Picnic Point flanking the Georges River. The nearest residential receivers, located about 125 metres north east of Heathcote Road, are typical of dwellings on suburban lots. Other land uses in the locality include the Holsworthy Barracks about 2 kilometres to the northwest of the proposal site, and the Sandy Point Quarry immediately to the south of the proposal site.

The study area for the proposal is illustrated in Figure 2-1 below.

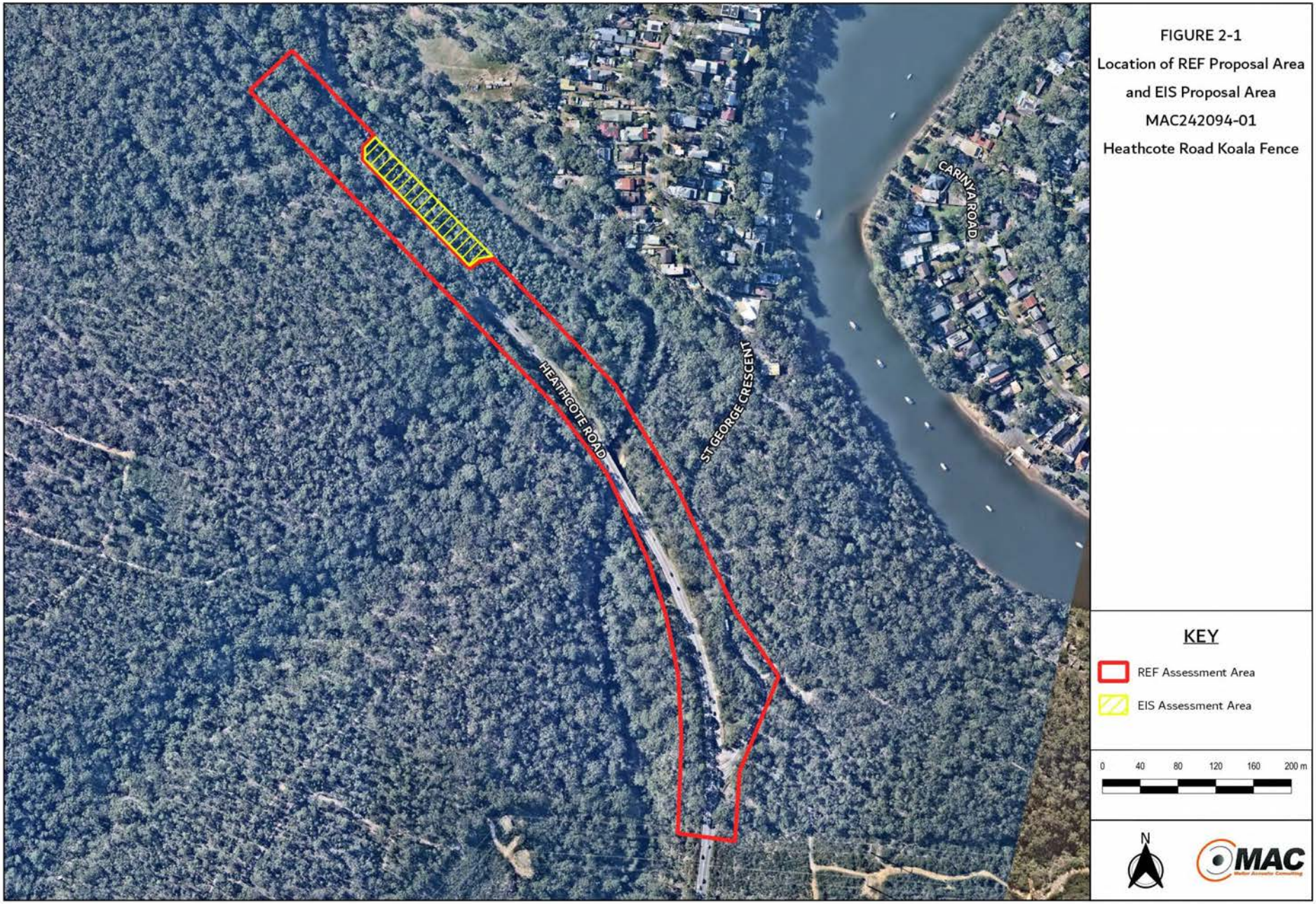


Figure 2-1 Location of EIS proposal area and REF proposal area

Design features of the proposal, comprising koala fencing, koala refuge poles and underbridge access improvements, on-way escape structures and the koala grid, are shown in Figure 2-2, including the sections of fencing that are assessed under the REF and EIS.

To support construction of the proposal, three small ancillary facilities would be required to support stockpile and laydown areas and construction staff parking. One ancillary facility would be located on the northern side of Deadmans Creek, on the eastern side of Heathcote Road, while two ancillary facilities would be located on the southern side of Deadmans Creek, on either side of Heathcote Road.

The locations of ancillary facilities are shown in Figure 2-3.

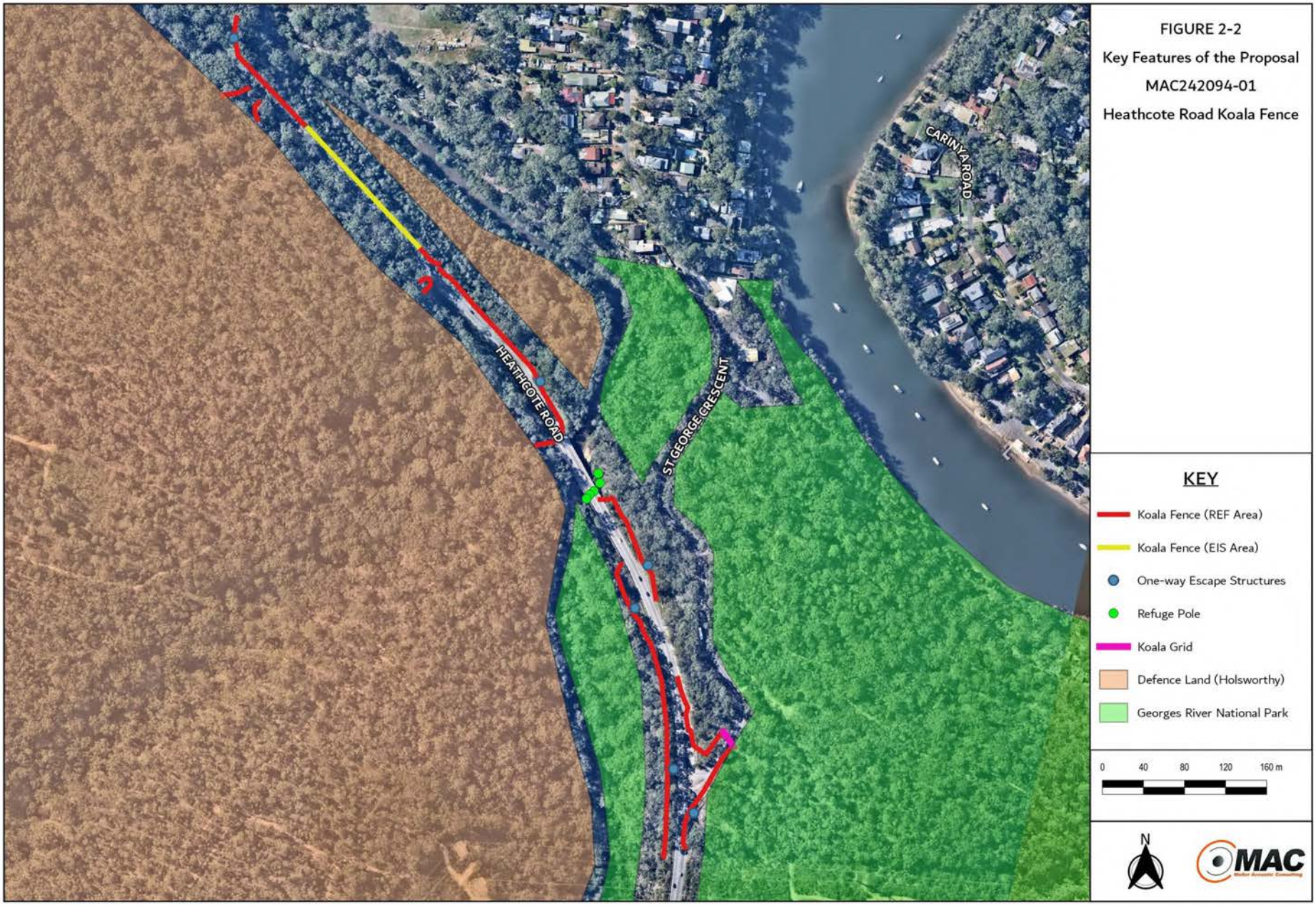


Figure 2-2: Key features of the proposal

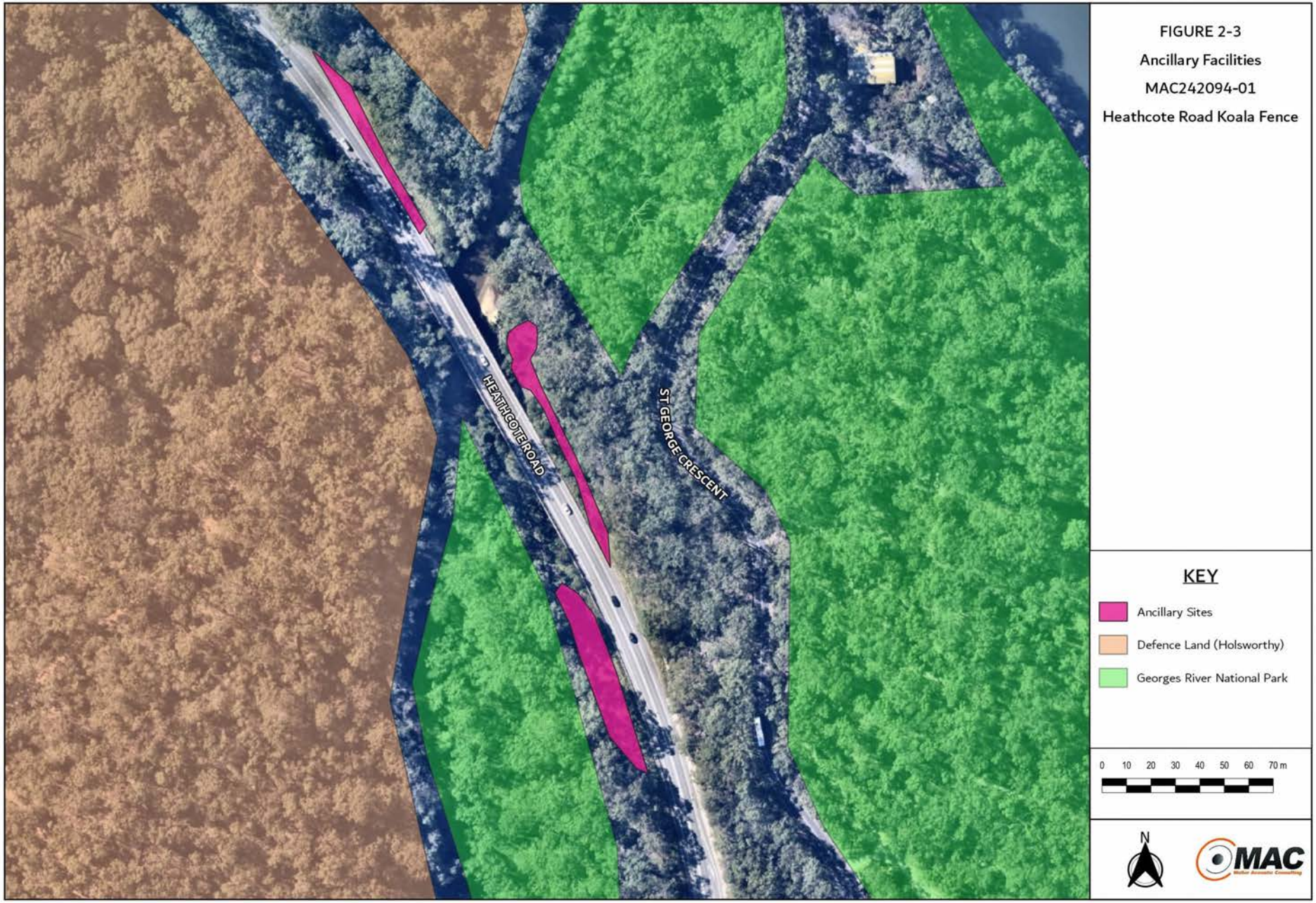


Figure 2-3: Ancillary facilities required to support construction of the proposal

3. Existing ambient noise environment

3.1 Noise sensitive receivers

A review of aerial imagery identifies that the study area is located on the peri urban fringe of Sydney's south, and includes the pocket suburbs of Pleasure Point, Sandy Point and Picnic. Residential receivers are typical of dwellings on suburban lots. Other land uses in the locality include the Georges River National Park, the Holsworthy Barracks, and the Sandy Point Quarry.

The number of modelled receivers for each NCA is provided in Table 3-1, and the location of the sensitive receivers is shown graphically in Figure 3-1.

Table 3-1: Modelled receivers

Receiver Type	Description	Number of Receivers
Residential	Pleasure Point, Sandy Point and Picnic Point	~420
Active recreation	Georges River NP, Sandy Point Reserve and Community Centre	2
Commercial premises	Sandy Point RFS	1
Industrial premises	Sandy Point Quarry	1

3.2 Representative Noise Environment

The community's reaction to noise from construction is generally influenced by the time of day that work is carried out, and the magnitude of the noise emissions above background levels. Residents are potentially more affected by work that occurs during out of hours (OOH) periods (ie evening or night periods). Therefore, it is important to understand the existing noise environment surrounding the proposal to manage and minimise potential noise impact on the environment and local community.

Representative background noise levels are determined in accordance with the TfNSW Construction and Maintenance Noise Estimator Tool (CMNET), based on the sensitivity of the acoustic environment and the proximity of potentially sensitive receivers to significant noise sources.

The proposal area is located on Sydney's peri urban fringe, with pocket suburbs located within areas of natural bushland. Predominant noise sources in the locality are expected to include road traffic on Heathcote Road and the Sandy Point Quarry. Based on an Annual Average Daily Traffic (AADT) volume of approximately 25,000 vehicles per day travelling on Heathcote Road (80km/h sign posted speed limit), and a minimum offset distance of approximately 130m to the nearest residential receiver, the CMNET Category R1 representative noise environment is used to derive Rating Background Levels (RBLs). The adopted rating background levels (RBLs), as per the CMNET methodology, are summarised in Table 3-2.

Table 3-2: Summary of existing background noise levels

Receivers	Noise Area Category[1]	Time Period[2]	RBL, dBA
All Residential	R1	Day	40
		Evening	35
		Night	30

Note 1: Representative noise environment category as per CMNET.

Note 2: Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm Sundays and public holidays; Evening – the period from 6pm to 10pm; Night – the remaining periods.

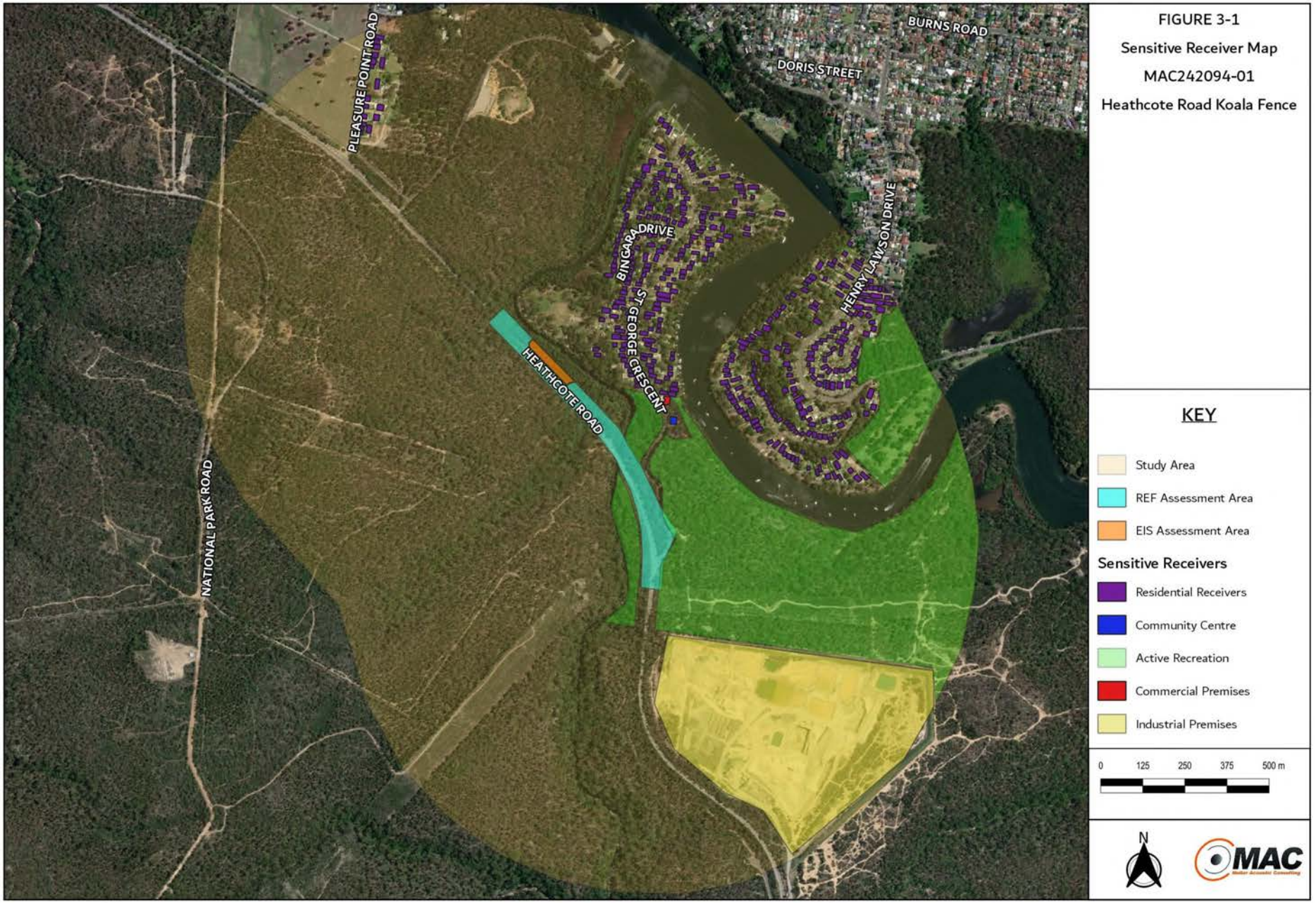


Figure 3-1: Receiver Map

4. Construction noise and vibration assessment

The following guidelines have been used for the construction noise and vibration assessment:

- Construction Noise:
  - Transport for NSW, *Noise and Vibration Assessment Procedure* (for road traffic and construction) February 2023.
  - Transport for NSW, *Construction Noise and Vibration Guideline* (Roads) July 2023.
  - NSW Department of Environment and Climate Change (DECC) (2009), *Interim Construction Noise Guideline (ICNG)*.
  - Standards Australia – AS 2436-2010 (R2016) *Guide to Noise Control on Construction, Maintenance and Demolition Sites*.
- Construction Vibration:
  - Transport for NSW, *Noise and Vibration Assessment Procedure* (for road traffic and construction) February 2023.
  - Transport for NSW, *Construction Noise and Vibration Guideline* (Roads) July 2023.
  - NSW Department of Environment and Conservation (DEC) (2006), *Assessing Vibration: A Technical Guideline*.
  - British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2"*.
  - German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150-3) – *Structural Vibration - Effects of Vibration on Structures*.

4.1 Construction noise and vibration criteria

The assessment and management of noise from construction work is completed with reference to the *Construction Noise and Vibration Guideline (Roads) (CNVG-RM)*. This guideline outlines the approach Transport takes when assessing and mitigating construction noise. The guideline provides the detail required to identify feasible and reasonable noise mitigation measures for construction, minor work and maintenance projects and needs to be considered for all Transport managed projects.

Construction noise impacts and mitigation measures need to be evaluated at various stages of a project to inform the concept design, environmental impact assessment, detail design and construction process.

The guideline describes the principles to be applied when reviewing and assessing construction noise, vibration and construction traffic. It also describes procedures to assist in reviewing noise and vibration mitigation.

The intention in all situations is to meet the following principles:

1. Good engagement with the community will be maintained to facilitate effective project delivery with balanced community impact.
2. Construction noise and vibration levels at sensitive receivers will be minimised where feasible and reasonable.
3. Feasible and reasonable mitigation will reflect the time of day, and/or the degree and duration of the impact.
4. The community will be informed of the dates for the intended work, sequencing, and timing of noisy events. Where possible this will include an indicative schedule over a 24-hour period.
5. Minimising construction noise and vibration will be viewed as a continuous improvement exercise that is inclusive of stakeholders where no idea is too small to be considered.

6. Staff and community will be informed of the effort and methods undertaken to reduce noise and vibration for the work.
7. Any operational noise and vibration improvements resulting from the work will be promoted to the community.

4.1.1 Proposed construction hours

Table 4-1 summaries the CNVG-RM recommended standard and Out of Hours (OOHs) periods for construction. Note, although not mandatory, strong justification is required to work outside of normal construction hours.

Table 4-1: Recommended hours for construction

Hour	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday																								
Tuesday																								
Wednesday								Standard																
Thursday			OOHW					Hours												Period 1				
Friday			Period 2																	(Evening)				
Saturday																								
Sunday								OOHW Period 1												OOHW				
Public Holiday										(Day)										Period 2				

OOHs work is divided into two periods of sensitivity and cover the hours listed below:

- OOH Period 1 (day/low risk period): Saturdays – 7am to 8am & 1pm to 6pm, Sundays/Public Holidays – 8am to 6pm.
- OOH Period 1 (evening/low risk period): Monday to Friday – 6pm to 10pm.
- OOH Period 2 (night/medium to high-risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays/Public Holidays – 6pm to 7am (8am on Sunday mornings and Public Holidays).

Construction of the proposal would generally be undertaken outside of standard construction hours to ensure safe working conditions and minimise disruptions to traffic on Heathcote Road and St George Crescent.

4.1.2 Construction noise objectives

In accordance with the CNVG-RM, construction Noise Management Levels (NMLs) are established with reference to the *NSW Interim Construction Noise Guideline (ICNG)*. The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to help in setting statutory conditions in licences or other regulatory instruments.

The ICNG sets out management levels for noise at residential based on the RBL, which is the overall single-figure background noise level measured in each relevant assessment period (standard construction hours or OOH work periods).

Where the predicted or measured LAeq(15min) noise level is greater than the NML, the proponent should apply all feasible and reasonable work practices to meet the relevant NML. Following the implementation of standard mitigation measures, where residual noise impacts occur, Additional Mitigation Measures (AMMs) should be implemented.

Table 4-2 reproduces the ICNG management levels for residential receivers. The construction NML is the sum of the management level and relevant RBL for each specific assessment period.

Table 4-2: ICNG residential noise management levels

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

Table 4-3 reproduces the ICNG management levels for other receiver types.

Table 4-3: Noise management levels for other noise sensitive receivers

Land use	Where objective applies	Management level LAeq(15min)[1]
Classrooms at schools and other educational institutions	Internal noise level	45dB
Hospital wards and operating theatres	Internal noise level	45dB
Places of worship	Internal noise level	45dB
Active recreation areas	External noise level	65dB
Passive recreation areas	External noise level	60dB
Commercial premises	External noise level	70dB
Industrial premises	External noise level	75dB

Note 1: Noise management levels apply when receiver areas are in use only.

4.1.3 Construction noise management levels

The NMLs for standard and OOHs work periods are summarised in Table 4-4 for residential receivers and Table 4-5 for applicable non-residential receivers.

Table 4-4: Construction NMLs for residential receivers

Receiver	Assessment period	RBL,dBA	NML dB LAeq(15min)	Highly noise affected NML dB LAeq(15min)
All residences	Standard Hours	40	50	75
	OOHW – Day	40	45	75
	OOHW – Evening	35	40	75
	OOHW – Night	30	35	75

Note 1: The highly noise affected NML is a hypothetical level that is adopted to ensure the avoidance of strong community reaction. Should this level be exceeded the construction methodology is to be reviewed to reduce the impact on surrounding sensitive receivers.

Table 4-5: Noise management levels for other noise sensitive receivers

Receiver	Assessment Period	Where NML applies	NML, dB LAeq(15min)
Active recreation	When in use	Internal noise level	65dB
Commercial premises	When in use	External noise level	70dB
Industrial premises	When in use	External noise level	75dB

4.1.4 Maximum noise level assessment (construction)

Appendix E of the CNVG-RM nominates a maximum noise level assessment (sleep disturbance) criterion of 65dB LAmax for the operation of individual items of plant and equipment during the night period.

4.1.5 Construction traffic noise criteria

The EPA ICNG references the EPA *NSW Road Noise Policy* for the assessment of construction traffic on public roads.

For Transport projects, an initial screening test should first be applied by evaluating whether noise levels will increase by more than 2dBA due to construction traffic or temporary reroute due to a road closure. Where increases are 2dBA or less, than no further assessment is required.

Where noise levels increase by more than 2dBA, further assessment is required based on Transport's RNCG. Consideration should also be given under the RNCG as to whether the construction traffic or temporary reroute triggers new road criteria due to changes in road category.

4.1.6 Construction vibration criteria

4.1.6.1 Structural Damage

Residential and non-residential buildings

British Standard BS 7385:Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2"*, gives guidance on the levels of vibration which building structures could be damaged. BS7385 also takes into consideration the frequency of the vibration which is critical when assessing the likelihood of building damage.

Guide values are set for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to result in a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and heavy commercial/industrial buildings are presented in Table 4-6. Where sources of continuous vibration may give rise to dynamic magnification due to resonance, the values provided in Table 4-6 should be reduced by 50%, this is especially the case with respect to Peak Particle Velocity (PPV) at lower frequencies.

Table 4-6: Transient vibration guide values – minimal risk of cosmetic damage

Type of building	Peak Component Particle Velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Heritage items

It is noted that the CNVG-RM and BS7385 do not specify recommended vibration limits or minimum working distances for heritage items or other sensitive structures. BS7385 indicates that heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound. If a heritage building or structure is structurally unsound (following inspection) a more conservative cosmetic damage objective as per DIN 4150 would be applicable.

German Standard DIN 4150 - Part 3: 1999 provides guideline values for vibration velocity to be used with evaluating the effects of short-term vibration on structures, including for sensitive structures such as heritage items. The DIN 4150 values are summarised in Table 4-7.

Table 4-7: Structural damage guideline – heritage structures

Type of structure	Vibration velocity in mm/s			
	Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	... at horizontal plane of highest floor (all frequencies)
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that because of their particular sensitivity to vibration do not correspond to those above and have intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8

Table 4-7 demonstrates that for sensitive buildings such as heritage structures, the guideline vibration values for effects on structures are typically half of those for dwellings. Therefore, based on the DIN 4150 structural damage guidelines, the minimum working distance for heritage structures that are found to be structurally unsound would be approximately equal to twice the minimum working distance for other building types.

4.1.6.2Human Comfort – *Assessing Vibration a Technical Guideline*

Humans are far more sensitive to vibration than is commonly realised and may detect vibration levels which are well below levels that may cause damage to buildings or structures. *Assessing vibration: a technical guideline* was published in February of 2006 by the DECC and is based on guidelines contained in BS 6472 – 1992, Evaluation of human exposure to vibration in buildings (1-80 Hz) and provides guidance on assessing vibration against human comfort.

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

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria, and has been reproduced in Table 4-8.

Table 4-8: Examples of types of vibration (from Table 2.1 of the guideline)

Continuous Vibration	Impulsive Vibration	Intermittent Vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery)	Infrequent: Activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990)	Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

Continuous Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to continuous vibration (1-80 Hz), the criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Table 4-9 reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 4-9: Criteria for exposure to continuous vibration

Place	Time[1]	Peak velocity in mm/s	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night	0.14	0.28
Residences	Day	0.28	0.56
	Night	0.20	0.40
Offices	Day or Night	0.56	1.1
Workshops	Day or Night	1.1	2.2

Note: rms velocity (mm/s) and vibration velocity value (dB re 10 -9 mm/s) values given for most critical frequency >8Hz assuming sinusoidal motion.
Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

Impulsive Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to impulsive vibration (1-80 Hz), these criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Impulsive vibration (as defined in Section 2.1 of the guideline) is generally associated with infrequent activities that create up to three (3) distinct vibration events in an assessment period e.g. occasional dropping of heavy equipment, occasional loading and unloading.

Table 4-10 reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 4-10: Criteria for exposure to impulsive vibration

Place	Time[1]	Peak velocity in mm/s	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night	0.14	0.28
Residences	Day	8.6	17.0
	Night	2.8	5.6
Offices	Day or Night	18.0	36.0
Workshops	Day or Night	18.0	36.0

Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

Intermittent Vibration

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

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

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

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

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

The Acceptable Vibration Dose Values (VDV) for Intermittent Vibration is reproduced in Table 4-11.

Table 4-11: Criteria for exposure to impulsive vibration

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

Note: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

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

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

4.2 Construction noise assessment

4.2.1 Noise assessment methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2024) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE (Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981). The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

4.2.2 Proposed works

Koala fencing

The koala fence design would be consistent with recent Transport koala fencing projects that use the 'slippery top' design. Key design features of this fence design include:

- Chain-mesh about 1.5 metres high from the ground and extending about 30 centimetres along the ground on the habitat side of the fence, to stop animals digging and passing underneath.
- Galvanised steel sheeting, about 60 centimetres wide, affixed to the top of the fence, which aims to prevent koalas (and other arboreal mammals) from being able to climb over the fence.
- The chain-mesh and steel sheeting would be affixed to vertical steel posts that are buried to a depth of about 90 centimetres and a horizontal post along the top edge.
- Bracing posts may also be required for some panels.

Where fencing crosses existing drainage swales, the fence would include a flap at the base conformed to a concrete drain lining that is self-cleaning of debris and prevents blockages from vegetation growth.

Koala grid

A koala grid is similar to a cattle grid, and is typically installed on a smaller local road, where the road creates a gap in otherwise continuous koala fencing. Koala grids do not impede traffic flow but do prevent koalas accessing busier road corridors.

One koala grid would be installed on St Georges Crescent, about 60 to 80 metres from the intersection with Heathcote Road. The koala grid would extend across both lanes of St Georges Crescent, spanning about nine metres. It would be about 1.5 metres wide. Beneath the steel grid is a trough about 0.6 metres deep. A pedestrian gate would be installed on either side of the grid, and koala fencing would extend from either side of these gates, to create an impervious barrier to Heathcote Road.

Koala refuge poles

Koala refuge poles are vertical timber poles that offer koalas (and other tree-dwelling and climbing animals) refuge from potential predators, while they are moving through an environment otherwise devoid of natural shelter (i.e. trees). About six koala refuge poles would be installed under and near Deadmans Creek Bridge, where native vegetation is absent. Koala poles would be set about one metre deep in a concrete footing, would be about three metres tall and about 200 milimetres in diameter.

Underbridge access improvements

Ground treatments are required under and near Deadmans Creek Bridge, to improve fauna access to these crossing structures. Ground treatments would include the installation of ramps, vertical logs and shotcrete to create a more favourable surfaces for koalas and other animals to walk across and access the raised ledge and concrete path.

One-way escape structures

One-way escape structures would be installed near fence ends and other weak points to allow any koalas that may become trapped in the road corridor a means to escape. The one-way escape structures would include a timber pole design, or a structure with a similar construction footprint, that allows koalas to climb over a fence from the roadside, though is not accessible from the ground on the habitat side.

4.2.3 Construction scenarios

Construction activities considered to have the greatest potential for noise impact on nearby receivers were determined in consultation with Transport. The construction scenarios included in this assessment are described in Table 4-12 and the typical plant and equipment, along with the fleet Sound Power Level (SWL) and maximum noise levels (LAmax) for each of the construction activities are provided in Table 4-13. The fleet SWL, and maximum noise levels were sourced from Transport's *Construction and Maintenance Noise Estimator Tool* (CMNET).

The precise locations and types of equipment used for construction are yet to be determined for the concept design phase of the proposal. Hence, the construction fleet for each activity was modelled across the potential extent of the proposal area, with all plant and equipment operating simultaneously and at maximum capacity for the duration of the assessment period. It is noted that typical construction plant and equipment are unlikely to operate simultaneously but may be used sequentially across the construction area. On that basis, this assessment provides a broad assessment of the likely worst-case impacts from each stage of the construction works.

Table 4-12: Proposed construction scenarios

Scenario	Description
Scenario 1 – Establishment of ancillary facilities	• Installation of temporary fencing, lighting and storage • Installation of temporary amenities • Installation of erosion and sediment controls • Installation of temporary traffic controls
Scenario 2 – Vegetation clearing and minor earthworks	• Removal of vegetation from the fence alignment • Site levelling along fence alignment
Scenario 3 – Installation of fencing	• Concrete lining of drains which interest the proposed fence alignment • Installation of fence posts using a truck-mounted auger or rock-drilling where posts would be located on rock • Installation of chain-wire fencing and galvanised steel sheeting
Scenario 4 – Supplementary fauna crossing measures	• Installation of koala poles • Installation of ground treatments under and near Deadmans Creek • Installation of one-way escape structures
Scenario 5 – Installation of koala grid	• Excavation of koala grid footprint • Construction of koala grid foundation and drainage infrastructure • Installation of koala grid and pedestrian fence • Installation of signage and line marking on the road

The construction workforce would fluctuate, depending on the stage of construction and associated activities. Between eight and 15 construction personnel are anticipated to be on site for each day of construction, including traffic control crew, depending specific work arrangement on the day.

Construction of the proposal would generally be undertaken outside of standard construction hours to ensure safe working conditions and minimise disruptions to traffic on Heathcote Road and St George Crescent. Notwithstanding, assessment has been undertaken for each construction scenario during standard and out of hours work periods.

Table 4-13: List of construction plant and associated works and sound power levels

Plant	SWL, dBA	Establishment of ancillary sites	Vegetation clearing	Fencing works	Fauna crossings	Koala grid
Light vehicles	88	X	X	X	X	X
Medium truck	103	X				
Road truck	108	X				
Franna	98	X			X	
Excavator (5t)	100		X			
Chainsaw	114		X			
Tub grinder	116		X			
Mulch blower	104		X			
EWP	87		X			
Side tipper	104		X			
Truck-mounted auger	103			X	X	
Mirco-drill rig	105			X		
Concrete Truck	103			X	X	
Truck with lifting boom	105			X		X
Hand tools	105			X		X
Concrete Saw	118					X
Jackhammer	108					X
Plate compactor	104					X
Total fleet SWL[1]		110	118	112	110	116
Maximum Noise Level Assessment (LAmax), Night-time periods (10pm to 7am)						
Fleet LAmax		116	121[2]	115	115	116
Operation of ancillary sites						
Day makers	98	n/a	X	X	X	X
Skid steer	91	n/a	X	X	X	X
Truck	103	n/a	X	X	X	X
Light vehicles	88	n/a	X	X	X	X
Total fleet SWL[1]		n/a	105	105	105	105

Note 1: Adjusted for duration as per CNMET
Note 2: Not recommended as OOHW, as per the CMNET.
Note 3: Works not anticipated to occur during OOHW periods.

4.2.4 Construction noise levels

Construction noise levels have been predicted for sensitive receiver locations for each of the construction scenarios described in Section 4.2.3, including for construction activities assessed under the REF and the EIS. The predicted LAeq(15min) noise emission ranges for each receiver type are presented in Table 4-14 and Table 4-16 for the REF and EIS components respectively, and the predicted number of exceedances are presented in Table 4-15 and Table 4-17 for the REF and EIS components respectively. Noise contours for each of the construction scenarios are provided in Appendix B.

REF assessment area

Scenario 1 - Establishment of ancillary sites

During the establishment of ancillary sites, noise impacts are predicted during the OOHW evening and night periods period, with up to 11 residential receivers within about 230 metres, and 22 residential receivers within about 330 metres anticipated to experience noise levels above the relevant NMLs respectively.

Construction noise levels are not anticipated to exceed the NMLs for standard construction hours or OOHW day, the highly affected NML of 75dB $L_{Aeq(15min)}$, or the maximum noise trigger levels (sleep disturbance) at any residential receiver locations during the establishment of ancillary sites. Furthermore, construction noise levels are not anticipated to exceed the relevant NMLs for any non-residential receivers during the establishment of ancillary sites.

Scenario 2 - Vegetation clearing and minor earthworks

During vegetation clearing works and minor earthworks, the following noise impacts to residential receivers are anticipated during standard and OOHW periods:

- Standard construction hours – up to 12 residential receivers within about 230 metres of the proposal site;
- OOHW day – up to 29 residential receivers within about 285 metres of the proposal site;
- OOHW evening – up to 51 residential receivers within about 350 metres of the proposal site;
- OOHW night – up to 180 residential receivers within about 670 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $L_{Aeq(15min)}$ or the maximum noise trigger level of 65dB L_{Amax}.

Furthermore, noise levels are predicted to be below the relevant NMLs for all non-residential receivers during the vegetation clearing works.

It is noted that in accordance with Transport's CMNET, vegetation clearing works are not recommended during OOHW – night.

Scenario 3 - Fencing works

During the installation of the fauna fence, the following noise impacts to residential receivers are anticipated:

- Standard construction hours – no residential receivers are predicted to experience noise levels above the relevant standard construction hours NML;
- OOHW day – up to 10 residential receivers within about 190 metres of the proposal site;
- OOHW evening – up to 26 residential receivers within about 260 metres of the proposal site;
- OOHW night – up to 51 residential receivers within about 540 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $L_{Aeq(15min)}$ or the maximum noise trigger level of 65dB L_{Amax}.

Furthermore, noise levels are predicted to be below the relevant NMLs for all non-residential receivers during the installation of the fauna fencing.

Scenario 4- Supplementary fauna crossings measures

During the installation of the fauna crossing works, including fauna poles, one-way escape structures and ground treatments, the following noise impacts to residential receivers are anticipated:

- Standard construction hours – no residential receivers are predicted to experience noise levels above the relevant standard construction hours NML;
- OOHW day – up to 6 residential receivers within about 160 metres of the proposal site;
- OOHW evening – up to 22 residential receivers within about 200 metres of the proposal site;
- OOHW night – up to 54 residential receivers within about 520 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $LA_{eq(15min)}$ or the maximum noise trigger level of 65dB LA_{max}.

Furthermore, noise levels are predicted to be below the relevant NMLs for all non-residential receivers during the installation of the supplementary fauna crossing measures.

Scenario 5 - Koala grid installation

During the installation of the koala grid, the following noise impacts to residential receivers are anticipated:

- Standard construction hours – no residential receivers are predicted to experience noise levels above the relevant standard construction hours NML;
- OOHW day – no residential receivers are predicted to experience noise levels above the relevant OOHW day NML;
- OOHW evening – up to 15 residential receivers within about 280 metres of the proposal site;
- OOHW night – up to 48 residential receivers within about 375 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $LA_{eq(15min)}$ or the maximum noise trigger level of 65dB LA_{max}.

It is noted that noise impacts at residential receivers during OOHW evening and OOHW night periods would result from the operation of the ancillary sites rather than the installation of the koala grid as a discrete construction activity.

Noise levels are predicted to exceed the relevant active recreation NML of 65dB $LA_{eq(15min)}$ at the Georges River National Park, which is located immediately adjacent to the koala grid construction area.

Table 4-14: Summary of construction works and predicted construction noise levels (REF Area)

Receivers	Period	NML, dBA	Typical offset	Establishment of ancillary sites	Vegetation clearing[1]	Fencing works	Fauna crossings	Koala grid
Residential (REF works)	Standard Hours	50	50 – 230m	<30 – 44dBA	<30 – 54dBA	<30 – 49dBA	<30 – 47dBA	<30 – 45dBA
	OOHW - Day	45	75 – 285m	<30 – 44dBA	<30 – 54dBA	<30 – 49dBA	<30 – 47dBA	<30 – 45dBA
	OOHW – Evening	40	115 – 350m	<30 – 44dBA	<30 – 54dBA	<30 – 49dBA	<30 – 47dBA	<30 – 45dBA
	OOHW - Night	35	185 – 670m	<30 – 44dBA	<30 – 54dBA	<30 – 49dBA	<30 – 47dBA	<30 – 45dBA
	MNLA	65	50 – 75m	<30 – 50dBA	<30 – 59dBA	<30 – 54dBA	<30 – 54dBA	<30 – 45dBA
Active Recreation	When in use	65	15 – 35m	40 – 41dBA	48 – 62dBA	43 – 55dBA	38 – 53dBA	40 – 66dBA
Commercial	When in use	70	10 – 20m	40dBA	48dBA	43dBA	43dBA	42dBA
Industrial	When in use	75	5 – 10m	36dBA	49dBA	44dBA	44dBA	47dBA

Note 1: Not recommended as OOHW, as per the CMNET.

Table 4-15: Number of predicted exceedances during each construction scenario (REF Area)

Receivers	Period	NML, dBA	Establishment of ancillary sites	Vegetation clearing[1]	Fencing works	Fauna crossings	Koala grid
Residential (REF works)	Standard Hours	50	--	12	--	--	--
	OOHW - Day	45	--	29	10	6	--
	OOHW – Evening	40	11	51	26	22	15
	OOHW - Night	35	22	180	51	54	48
	MNLA	65	--	--	--	--	--
Active Recreation	When in use	65	--	--	--	--	1
Commercial	When in use	70	--	--	--	--	--
Industrial	When in use	75	--	--	--	--	--

Note 1: Not recommended as OOHW, as per the CMNET.

EIS assessment area

A review of aerial imagery identifies that there are no non-residential receivers in close proximity to the EIS Assessment Area, hence, construction noise impacts have been considered for residential receivers only.

Scenario 2 - Vegetation clearing and minor earthworks

For the EIS works (coastal wetlands), the following construction noise impacts to residential receivers, associated with vegetation clearing and minor earthworks, are anticipated:

- Standard construction hours – no residential receivers are predicted to experience noise levels above the relevant standard construction hours NML;
- OOHW day – up to 16 residential receivers within about 250 metres of the proposal site;
- OOHW evening – up to 25 residential receivers within about 315 metres of the proposal site;
- OOHW night – up to 40 residential receivers within about 400 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $LA_{eq(15min)}$ or the maximum noise trigger level of 65dB LA_{max}.

It is noted that in accordance with Transport's CMNET, vegetation clearing works are not recommended during OOHW – night.

Scenario 3 - Fencing works

For the EIS works (coastal wetlands), the following construction noise impacts to residential receivers, associated with the installation of the fauna fence, are anticipated:

- Standard construction hours – no residential receivers are predicted to experience noise levels above the relevant standard construction hours NML;
- OOHW day – no residential receivers are predicted to experience noise levels above the relevant OOH day NML;
- OOHW evening – up to 14 residential receivers within about 250 metres of the proposal site;
- OOHW night – up to 24 residential receivers within about 300 metres of the proposal site; and
- No residential anticipated to experience construction noise levels above the highly affected NML of 75dB $LA_{eq(15min)}$ or the maximum noise trigger level of 65dB LA_{max}.

Table 4-16: Summary of construction works and predicted construction noise levels (EIS Area)

Receivers	Period	NML, dBA	Typical offset	Vegetation clearing[1,2]	Fencing works[2]
Residential	Standard Hours	50	90 – 130m	<30 – 50dBA	<30 – 44dBA
	OOHW - Day	45	up to 250m	<30 – 50dBA	<30 – 44dBA
	OOHW – Evening	40	up to 315m	<30 – 50dBA	<30 – 44dBA
	OOHW - Night	35	up to 400m	<30 – 50dBA	<30 – 44dBA
	MNLA	65	up to 40m	<30 – 57dBA	<30 – 52dBA

Note 1: Not recommended as OOHW, as per the CMNET.
Note 2: EIS component works would comprise vegetation clearing and fencing works only.

Table 4-17: Number of predicted exceedances during each construction scenario (EIS Area)

Receivers	Period	NML, dBA	Vegetation clearing[1,2]	Fencing works[2]
Residential (EIS works only)	Standard Hours	50	--	--
	OOHW - Day	45	16	--
	OOHW – Evening	40	25	14
	OOHW - Night	35	40	24
	MNLA	65	--	--

Note 1: Not recommended as OOHW, as per the CMNET.
Note 2: EIS component works would comprise vegetation clearing and fencing works only.

4.2.5 Construction traffic noise levels

Construction traffic will generate noise over a relatively wide area and beyond the construction site itself. It would be expected that traffic noise would be greatest where there is a concentration of vehicle movements, such as the main construction area.

According to Transport's *Traffic Volume Viewer*, Heathcote Road carries approximately 25,000 vehicles per day. It is understood that daily construction traffic trips would include up to six light vehicles (12 movements) and up to five heavy vehicles (10 movements) per day, including traffic control crew, which corresponds to a traffic volume increase of less than 0.1%. Hence, due to high existing road traffic noise levels in the locality, construction road noise levels would be negligible, with increases in noise levels anticipated to remain below the 2dB $LA_{eq(period)}$ increase criterion.

4.3 Vibration assessment

Table 4-18 provides the minimum working distances for the use of various vibration intensive sources to nearby receivers to meet cosmetic damage and human response criteria. It is important to note that the minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions.

A review of construction equipment for the proposal indicates that the installation of the fauna fencing, and ancillary works would not require the use of vibration intensive plant and equipment. Furthermore, a review of aerial imagery identifies that the nearest sensitive receivers are about 120 metres from the proposal site. Hence, it is anticipated that the works would be outside of the minimum working distances for the potential for vibration levels to cause human annoyance or cosmetic damage to structures to residential receivers. Furthermore, there are no heritage items or sensitive structures within the applicable minimum working distances.

Table 4-18: Construction plant – typical minimum working distances (metres)

Plant item	Rating / description	Minimum working distance		
		Cosmetic damage (BS 7385)	Heritage item (DIN 4150)	Human response (OH&E)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5m	10m	15m to 20m
	< 100 kN (Typically 2-4 tonnes)	6m	12m	20m
	< 200 kN (Typically 4-6 tonnes)	12m	24m	40m
	< 300 kN (Typically 7-13 tonnes)	15m	30m	100m
	> 300 kN (Typically 13-18 tonnes)	20m	40m	100m
	> 300 kN (> 18 tonnes)	25m	50m	100m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2m	4m	7m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7m	14m	23m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22m	44m	73m
Vibratory Pile Driver	Sheet piles	2m to 20m	up to 40m	20m
Pile Boring	≤ 800 mm	2m (nominal)	4m	4m
Jackhammer	Hand held	1m (nominal)	2m	2m
Profiler	Wirtgen W210	4m	8m	n/a
Asphalt Paver	Vogele Super 1800-3	1m	2m	n/a
Oscillating Roller	Hamm HD70 (Oscillating)	2m	4m	n/a
Static Roller	Hamm HD70 (Static)	1m	2m	n/a

Note: Source, CNVG-RM (Transport, 2023) and/or CMNET (Transport 2022).

4.4 Mitigation

4.4.1 Standard mitigation measures

The CNVG-RM outlines noise management and mitigation measures to minimise the noise and vibration impacts from construction activities on nearby sensitive receivers. Adopting the standard mitigation measures may result in an attenuation of up to 20dBA where noise source noise mitigation measures (silencers, mufflers etc) can be combined with noise barriers and other management techniques. The standard mitigation measures as per the CNVG-RM are reproduced in Table 4-19.

Table 4-19: Construction plant – typical minimum working distances (metres)

Action required	Details
Management measures	
Implementation of any project specific mitigation measures required	Implementation of any project specific mitigation measures required.
Implement community consultation or notification measures	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night-time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required. Please contact Roads and Maritime Communication and Stakeholder Engagement for guidance. ▪ Website (If required) ▪ Contact telephone number for community ▪ Email distribution list (if required) ▪ Community drop-in session (if required by approval conditions).
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: ▪ All relevant project specific and standard noise and vibration mitigation measures ▪ Relevant licence and approval conditions ▪ Permissible hours of work ▪ Any limitations on noise generating activities ▪ Location of nearest sensitive receivers ▪ Construction employee parking areas ▪ Designated loading/unloading areas and procedures ▪ Site opening/closing times (including deliveries) ▪ Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where specified under Appendix C of the CNVG-RM a noise verification program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions. Verification of noise and/or vibration levels should be undertaken as part of routine checks or following reasonable complaints. Where Additional Mitigation Measures require the spot check verification, attended measurements are to be undertaken within

Action required	Details
Management measures	
	a period of 14 days from the commencement of construction activities. Verification of construction noise emissions is required when noise levels exceed the "Moderately Intrusive" AMM trigger for standard construction hours and OOH Period 1 and the "Clearly Audible" AMM trigger for OOH Period 2.
Attended vibration measurements	Where vibration intensive works are planned to occur within the minimum working distances for cosmetic damage, attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plan	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Where vibration intensive works are planned to occur within the minimum working distances for cosmetic damage, building dilapidation surveys should be undertaken on all buildings located within the minimum working distance prior to commencement of activities with the potential to cause property damage.
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods
Construction hours and scheduling	OOH work would be undertaken over a maximum of two consecutive nights, and no more than three nights total in any week.
Construction respite period	Please refer to Appendix C of the CNVG-RM for more details on the following respite measures: ▪ Respite Offers (RO) ▪ Respite Period 1 (R1) ▪ Respite Period 2 (R2) ▪ Duration Respite (DR)
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. Ensure plant including the silencer is well maintained.
Plant noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the CNVG-RM. Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H of the CNVG-RM.
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on

Action required	Details
Management measures	
	site unless compliant with the criteria in Table 2 of the CNVG-RM.
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers. Only have necessary equipment on site.
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters. If programmed night work is postponed the work should be re-programmed and the approaches in this guideline apply again.
Reduce equipment power	Use only the necessary size and power.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise these out of hours movements where possible.
Engine compression brakes	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Path controls	

Action required	Details
Management measures	
Shield stationary noise sources such as pumps, compressors, fans etc	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS2436:2010 lists materials suitable for shielding
Shield sensitive receivers from noise activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Receptor Controls	
See Appendix C of the CNVG-RM for Additional Mitigation Measures	In some instances Additional Mitigation Measures may be required.

4.4.2 Additional Mitigation Measures

Standard noise mitigation and management measures in accordance with the CNVG-RM and ICNG would be implemented for the proposal where practicable.

The CNVG-RM also outlines a range of additional mitigation measures (AMMs) to be implemented to manage residual noise impacts following implementation of standard mitigation measures. The CNVG-RM AMMs reproduced in Table 4-20 will be considered by Transport or the construction contractor following incorporation of feasible and reasonable mitigation measures for the proposal. Appendix C provides a definition of each AMMs listed below.

Table 4-20: CNVG-RM triggers for additional mitigation measures – airborne noise

Perception	Predicted airborne LAeq(15min) noise level at receiver		Additional Mitigation Measures Type	Mitigation Levels
	dB(A) above RBL	dB(A) above NML		
All hours				
75dBA or greater			N, V, PC, RO	HA
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Holidays (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly audible	10 to 20	< 10	-	NML
Moderately intrusive	20 to 30	10 to 20	N, V	NML+10
Highly intrusive	> 30	> 20	N, V	NML+20
OOHW – day / evening: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)				
Noticeable	5 to 10	< 5	-	NML
Clearly Audible	10 to 20	5 to 15	N, R1, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR	NML+15
Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN	NML+25
OOHW - night: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Holidays (6pm – 7am)				
Noticeable	5 to 10	< 5	N	NML
Clearly Audible	10 to 20	5 to 15	V, N, R2, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR	NML+15
Highly intrusive	> 30	> 25	AA, V, IB, N, PC, SN, R2, DR	NML+25

Notes: AA = Alternative accommodation, R1 = Respite Period 1, V = Validation of predicted noise levels (not required for projects less than 3 weeks), PC = Phone calls, IB = Individual briefings (not required for projects less than 3 weeks), SN = Specific notifications, N = Notification, R2 = Respite Period 2, DR = Duration Respite, Perception = relates to level above RBL, NML = Noise Management Level (see Appendix C), HA = Highly Affected (> 75 dB(A) - applies to residences only).

REF assessment area

The noise prediction results presented in Section 4.2.4 for the REF assessment area demonstrate that construction noise levels would potentially be above the relevant NMLs for standard construction hours for vegetation clearing works, OOHW day for vegetation clearing, fencing works and installation of fauna crossing measures, and OOHW evening and night for all construction scenarios.

A summary of the number of residential receivers anticipated to experience construction noise levels above the AMM perception categories for each construction scenario is provided in Table 4-21 for the REF assessment area. The affected areas for each perception category during OOHW night are presented in Appendix D.

The results of the AMM assessment demonstrate that:

- Standard construction hours – no residential receivers are anticipated to experience construction noise levels above the AMM perception categories requiring the implementation of AMMs;
- OOHW day – residential receivers are anticipated to experience noise levels above the 'clearly audible' perception category during vegetation clearing works. Hence consideration of relevant AMMs will be considered;
- OOHW evening – residential receivers are anticipated to experience noise levels above the 'clearly audible' perception category during vegetation clearing works, fencing works and the installation of fauna crossing measures. Hence consideration of relevant AMMs will be considered; and
- OOHW night – residential receivers are anticipated to experience noise levels above the 'noticeable' and 'clearly audible' perception categories during all construction activities, and the 'moderately intrusive' perception category during vegetation clearing works. Hence consideration of relevant AMMs will be considered. Noise levels are not anticipated to be above the 'highly intrusive' perception category at any of the assessed receiver locations during the proposed construction works.

It is noted that the AMM perception category triggers assume unmitigated construction noise emissions. It is expected that in applying standard mitigation measures, construction noise emissions would be reduced by a minimum of 5 –10dBA. Hence, the assessment of applicable AMMs is considered highly conservative.

Table 4-21: Summary of residential receivers above AMM perception categories for each construction activity (REF area)

Perception category	AMM type	Number of receivers impacted				
		Establishment of ancillary sites	Vegetation clearing[1]	Fencing works	Fauna crossings	Koala grid
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Holidays (Nil)						
Noticeable	--	0	12	0	0	0
Clearly audible	--	0	12	0	0	0
Moderately intrusive	N, V	0	0	0	0	0
Highly intrusive	N, V	0	0	0	0	0
OOHW day: Sat (7am – 8am & 1pm – 6pm), Sun/Pub Hol (8am – 6pm)						
Noticeable	--	0	29	10	6	0
Clearly audible	N, R1, DR	0	12	0	0	0
Moderately intrusive	V, N, R1, DR	0	0	0	0	0
Highly intrusive	V, IB, N, R1, DR, PC, SN	0	0	0	0	0
OOHW evening: Mon – Sat (6pm – 10pm)						
Noticeable	--	11	51	26	22	15
Clearly audible	N, R1, DR	0	29	10	6	0
Moderately intrusive	V, N, R1, DR	0	0	0	0	0
Highly intrusive	V, IB, N, R1, DR, PC, SN	0	0	0	0	0
OOHW night: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Holidays (6pm – 7am)						
Noticeable	N	22	180	51	54	48
Clearly audible	V, N, R2, DR	11	51	26	22	15
Moderately intrusive	V, IB, N, PC, SN, R2, DR	0	12	0	0	0
Highly intrusive	AA, V, IB, N, PC, SN, R2, DR	0	0	0	0	0

Notes: AA = Alternative accommodation, R1 = Respite Period 1, V = Validation of predicted noise levels (not required for projects less than 3 weeks), PC = Phone calls, IB = Individual briefings (not required for projects less than 3 weeks), SN = Specific notifications, N = Notification, R2 = Respite Period 2, DR = Duration Respite, Perception = relates to level above RBL, NML = Noise Management Level (see Appendix C), HA = Highly Affected (> 75 dB(A) - applies to residences only).

Note 1: Not recommended as OOHW, as per the CMNET.

EIS assessment area

The noise prediction results presented in Section 4.2.4 for the REF assessment area demonstrate that construction noise levels would potentially be above the relevant NMLs for vegetation clearing works during OOHW day, OOHW evening and OOHW night, and for fencing works during OOHW evening and OOW night.

A summary of the number of residential receivers anticipated to experience construction noise levels above the AMM perception categories during vegetation clearing works and fencing works within the EIS area, is provided in Table 4-22. The affected areas for each perception category during OOHW night are presented in Appendix D.

The results of the AMM assessment demonstrate that during OOHW evening, the nearest residential receivers are anticipated to experience noise levels above the 'clearly audible' perception category for vegetation clearing works, while during OOHW night, the nearest residential receivers are anticipated to experience noise levels above the 'noticeable' and 'clearly audible' perception categories during vegetation clearing works and fencing works. Hence, Transport or the construction contractor will consider the implementation of relevant AMMs, where practicable.

Table 4-22: Summary of residential receivers above AMM perception categories for each construction activity (EIS area)

Perception category	AMM type	Number of receivers impacted	
		Vegetation clearing[1]	Fencing works
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Holidays (Nil)			
Noticeable	--	0	0
Clearly audible	--	0	0
Moderately intrusive	N, V	0	0
Highly intrusive	N, V	0	0
OOHW day: Sat (7am – 8am & 1pm – 6pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	--	16	0
Clearly audible	N, R1, DR	0	0
Moderately intrusive	V, N, R1, DR	0	0
Highly intrusive	V, IB, N, R1, DR, PC, SN	0	0
OOHW evening: Mon – Sat (6pm – 10pm)			
Noticeable	--	25	14
Clearly audible	N, R1, DR	16	0
Moderately intrusive	V, N, R1, DR	0	0
Highly intrusive	V, IB, N, R1, DR, PC, SN	0	0
OOHW night: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Holidays (6pm – 7am)			
Noticeable	N	39	24
Clearly audible	V, N, R2, DR	25	14
Moderately intrusive	V, IB, N, PC, SN, R2, DR	0	0

Highly intrusive	AA, V, IB, N, PC, SN, R2, DR	0	0

Notes: AA = Alternative accommodation, R1 = Respite Period 1, V = Validation of predicted noise levels (not required for projects less than 3 weeks), PC = Phone calls, IB = Individual briefings (not required for projects less than 3 weeks), SN = Specific notifications, N = Notification, R2 = Respite Period 2, DR = Duration Respite, Perception = relates to level above RBL, NML = Noise Management Level (see Appendix C), HA = Highly Affected (> 75 dB(A) - applies to residences only).

Note 1: Not recommended as OOHW, as per the CMNET.

5. Operational noise assessment

The following guidelines have been used for the operational noise assessment:

- Transport for NSW, *Noise and Vibration Assessment Procedure* (for road traffic and construction) February 2023.
- Transport for NSW, *Road Noise Criteria Guideline (RNCG)* April 2022.
- Transport for NSW, *Road Noise Mitigation Guideline (RNMG)* March 2022.
- NSW Environment Protection Authority (EPA) (2011), *NSW Road Noise Policy (RNP)*.

5.1 Noise criteria

5.1.1 Road traffic noise criteria

Noise criteria are assigned to sensitive receivers using Transport's Road Noise Criteria Guideline (RNCG). Transport's RNCG provides guidance on how to implement the EPA's *NSW Road Noise Policy*.

The proposal would involve the installation of a koala grid on St George Crescent, about 60 – 80 metres from the intersection with Heathcote Road. The koala grid is similar to a cattle grid, with a metal grate spanning both lanes of St George Crescent to prevent koalas from traversing to access the busier Heathcote Road. Hence, in accordance with Section 4.5 of the Noise Criteria Guideline (RNCG) (Transport, 2022), the proposal is classified as minor work. Section 5.5 of the NCG is reproduced below:

> *Some works may be primarily to improve safety. This may include minor straightening of curves, installing traffic control devices, intersection widening and turning bay extensions or making minor road realignments. These works are not considered redeveloped or new as they are not intended to increase the traffic carrying capacity of the overall road or accommodate a significant increase in heavy vehicle traffic.*

Section 5.6 of the NCG outlines that the existing road criteria applies where the minor work increases noise levels by more than 2dBA relative to the existing noise levels at the worst affected receiver.

5.1.2 Maximum noise level assessment for road traffic

The maximum noise level assessment (sleep disturbance) criterion of 65dB LAmax is referred to in Section 2.1.5 of the NVAP and Appendix E of the CNVG-RM. For the assessment of maximum noise levels from operational road traffic noise, the following aspects must be considered:

- maximum noise level for each passby, where the LAmax noise levels (individual) is greater than 65dB and where LAmax – LAeq(1hour) is greater than 15dB;
- number of events greater than 65dBA per hour, including the number and distribution of the LAmax – LAeq(1hour) from road traffic noise on an hourly basis between 10pm and 7am; and
- number of events greater than LAeq(1hour) per hour.

5.2 Operational noise levels

St George Crescent is a no through road, providing access to about 200 residential properties within the suburb of Sandy Point. The koala grid would be located about 60 – 80 metres from the intersection with Heathcote Road, which carries greater than 20,000 vehicles per day (Transport for NSW *Traffic Volume Viewer* – Station Id: 63109, Heathcote Road 80m east of Margate Avenue). The nearest residential receivers are located about 420 metres to the northeast of the koala grid, and about 410 metres from the nearest point of Heathcote Road.

The passage of vehicles across the koala grid would be similar in nature to typical traffic calming devices, with noise levels generated by the interactions between the vehicle tires and the koala grid. These interactions would typically occur for a duration of less than five seconds for each vehicle passby event, with maximum noise levels on the order of 109dB LAmax.

Based on the separation distance to the nearest residential receivers, low existing traffic volumes on St George Crescent with short duration of noise generation from vehicles passing over the koala grid, and the high existing traffic volumes on Heathcote Road, which represents the dominant noise source in the locality, it anticipated that the passage of vehicles across the koala grid would not result in a discernible change to road traffic noise levels at the nearest residential receivers, and therefore, would not exceed the 2dBA increase criterion. Similarly, it is anticipated that maximum noise levels from vehicles passing over the koala grid would be significantly lower than the MNLA criterion of 65dB L_{Amax}.

6. Conclusion

6.1 Construction noise and vibration

Construction noise levels have been predicted for sensitive receiver locations during establishment of ancillary sites, vegetation clearing and minor earthworks, installation of fauna fencing, installation of fauna crossing treatments, and installation of the koala grid. Construction noise levels were also predicted for vegetation clearing works and installation of fauna fencing within the coastal wetlands area, which is being assessed under a separate EIS.

6.1.1 Construction noise - REF assessment area

The assessment of construction activities within the REF assessment area demonstrated that vegetation clearing works would result in the greatest potential impact, with up to 180 residential receivers within about 670 metres of the proposal site predicted to experience noise levels above the relevant NMLs. The highest predicted exceedance was up to 19dB $LA_{eq(15min)}$ during the OOHW night period.

Construction noise levels were also predicted to exceed the relevant NMLs for residential receivers for all construction scenarios during the OOHW evening and OOHW night periods, while noise levels during vegetation clearing works, fencing works and installation of fauna crossing measures were predicted to exceed the relevant NMLs for residential receivers during the OOWH day period.

It is noted that construction works are not anticipated to occur during standard construction hours due to safety considerations and disruptions to traffic on Heathcote Road and St George Crescent. Notwithstanding, assessment of construction noise impacts during standard construction hours indicated that up to 12 residential receivers within about 230 metres of the proposal site would experience noise levels above the standard construction hours NML during vegetation clearing works only.

Maximum noise levels, above which sleep disturbance impacts may occur, are predicted to be below the MNLA criterion of 65dB LA_{max} at all receiver locations during each construction scenario.

Assessment of construction noise levels for non-residential receivers indicated that exceedance of the relevant NMLs is predicted at Georges River National Park (active recreation) during installation of the koala grid only.

Standard mitigation measures as per the CNVG-RM have been recommended to minimise construction noise impacts. Following the implementation of standard mitigation measures, it is anticipated that up to 180 receivers would experience noise levels within the 'noticeable' perception category, up to 51 receivers would experience noise levels within the 'clearly audible' perception category, and up to 12 receivers would experience noise levels within the 'moderately intrusive' perception category during OOHW night. Hence, AMMs have been recommended as per the CNVG-RM.

6.1.2 Construction noise - EIS assessment area

The assessment of construction activities within the EIS assessment area demonstrated that noise levels are predicted to exceed the relevant NMLs for OOHW day, evening and night during vegetation clearing works, while noise levels above the OOHW evening and night NMLs were predicted during fencing works. Up to 40 receivers within about 400 metres of the proposal site were predicted to experience noise levels above the relevant NMLs, with the highest exceedance predicted at up to 15dB $LA_{eq(15min)}$ above the NML for vegetation clearing works during the OOHW night period.

Noise levels were not predicted to exceed MNLA criterion of 65dB LA_{max} for any residential receivers, or the relevant NMLs for non-residential receivers during any of the proposed construction activities.

Following the implementation of standard mitigation measures, it is anticipated that up to 39 receivers would experience noise levels within the 'noticeable' perception category and up to 25 receivers would experience noise levels within the 'clearly audible' perception category. Hence, AMMs have been recommended as per the CNVG-RM.

6.1.3 Construction Vibration

As the offset distance from the closest point of the proposal site to the nearest sensitive receiver is more than 100m, it is anticipated that vibration levels would comply with the acceptable limits for human comfort and cosmetic damage at all sensitive receivers, during all construction activities.

6.2 Operational noise

The proposal to install a koala grid on St Geroge Crescent, about 60 – 80 metres from the intersection of Heathcote Road would generate operational noise from the interaction of vehicle tires with the koala grid.

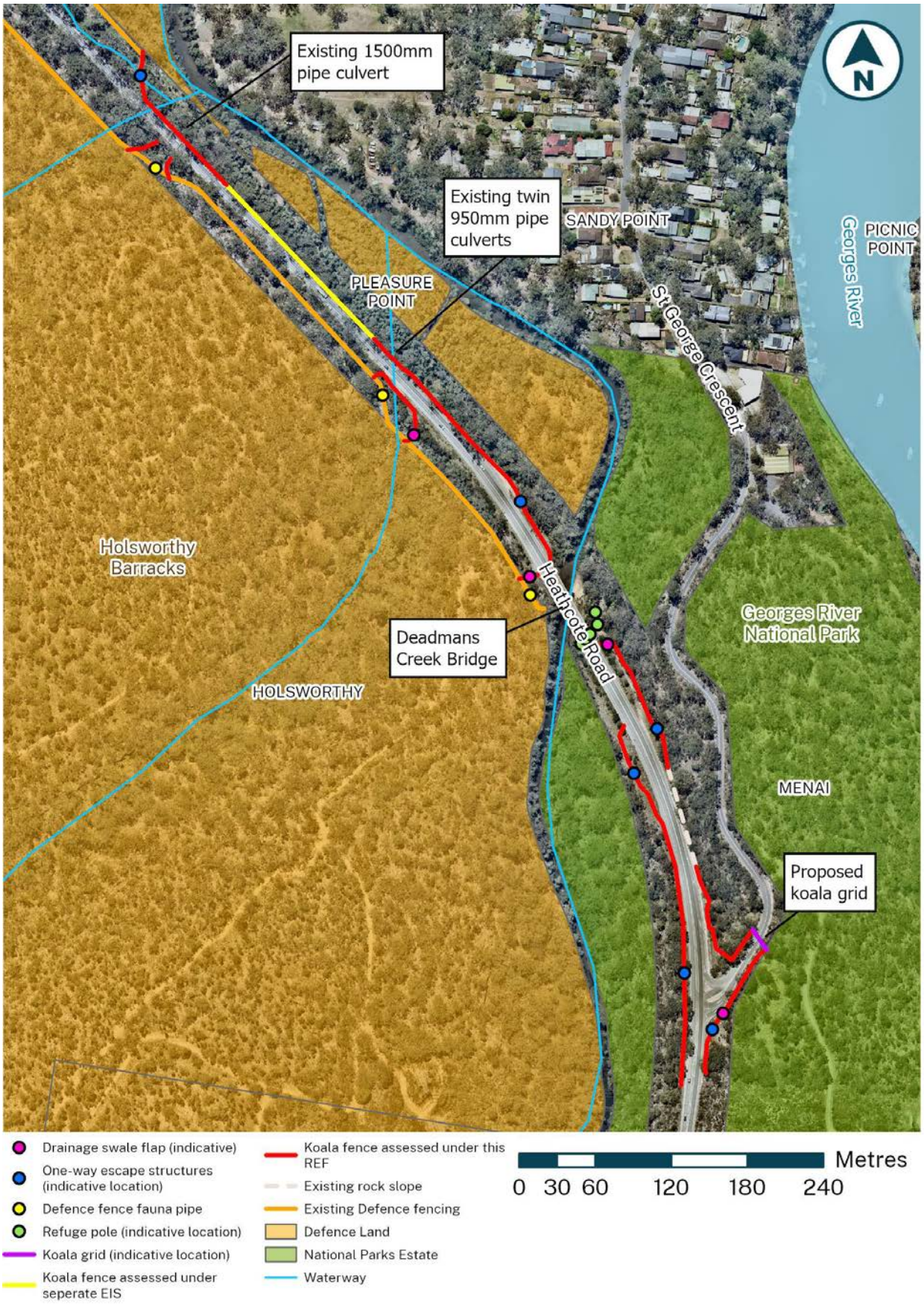
Due to the separation distance between the proposed location of the koala grid and the nearest residential receivers, high existing road noise levels from vehicles on Heathcote Road, and the low existing traffic volumes on St Geroge Crescent, short duration events from vehicles travelling over the koala grid would not result in a discernible change in road traffic noise levels at the nearest receivers, and therefore, would not exceed the 2dBA increase criterion.

Furthermore, based on the separation distance to the nearest receivers, the maximum noise levels from vehicles passing over the koala grid would be significantly lower than the MNLA criterion of 65dB L_{Amax}.

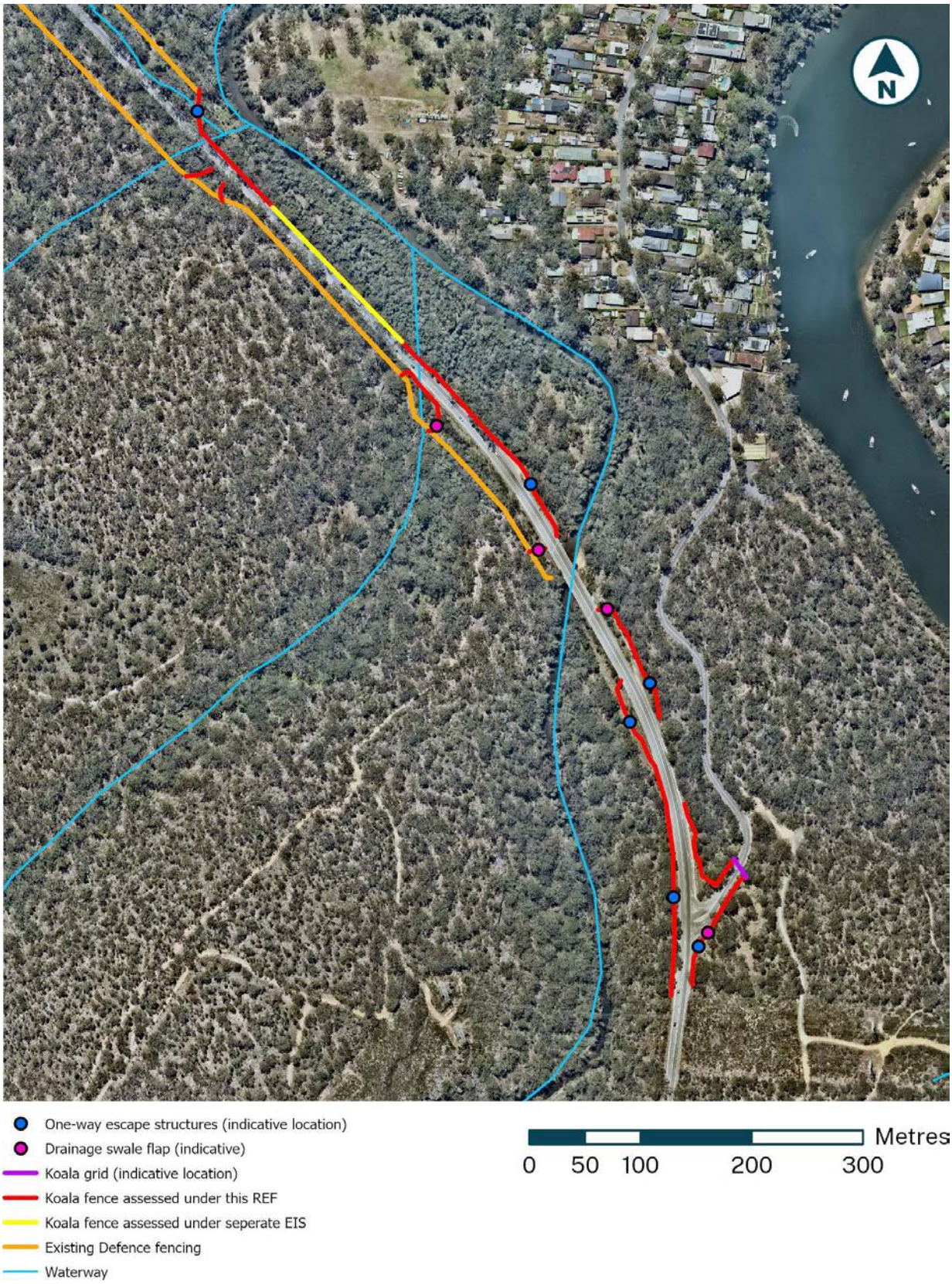
7. Definitions

Term	Definition
A–frequency weighting	A frequency based adjustment made to sound level measurement, by means of an electronic filter, in line with international standards. This approximates the frequency response of the human ear and accounts for reduced sensitivity at low frequency.
Background noise level	The underlying level of noise present in the ambient noise when extraneous noise is removed and excluding noise from the project under consideration. This is described using the L_{A90} descriptor.
CoA	Minister's Conditions of Approval
CNVG-RM	Transport's *Construction noise and vibration guideline (for roads and maritime works)*
Day	Defined as 7am-10pm.
Decibel (dB)	A measure of sound level. The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity or other parameters. In the case of sound pressure, it is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure squared to a reference sound pressure squared.
Decibel (A-weighted; dBA)	Unit used to measure 'A-weighted' sound pressure levels. A-weighting is a frequency-based adjustment made to sound-level measurement to approximate the response of the human ear.
Design year	Typically, 10 years after project opening (refer to EPA Road Noise Policy)
L_{A10}	The A-weighted sound pressure level measured using fast time weighting that is exceeded for 10% of the time over the relevant time period.
L_{A90}	The 'Background Noise Level' in the absence of project activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. It is the A-weighted sound pressure level measured using fast time weighting that is exceeded for 90% of the time over the relevant time period.
L_{Aeq}	Energy average A-weighted sound level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq(15hour)}$	The L_{Aeq} noise level between the period of 7am–10pm.
$L_{Aeq(9hour)}$	The L_{Aeq} noise level between the period of 10pm–7am.
L_{Amax}	The 'Maximum Noise Level' for an event, used in the assessment of potential sleep disturbance during night-time periods. The subscript 'A' indicates that the noise levels are filtered to match normal human hearing characteristics (i.e. A-weighted). 'Fast' time constant is used for this measurement.
Night	Defined as 10pm-7am.
RNCG	*Road Noise Criteria Guideline* (Transport for NSW)
RNMG	*Road Noise Mitigation Guideline* (Transport for NSW)
REF	Review of Environmental Factors
EIS	Environmental Impact Statement

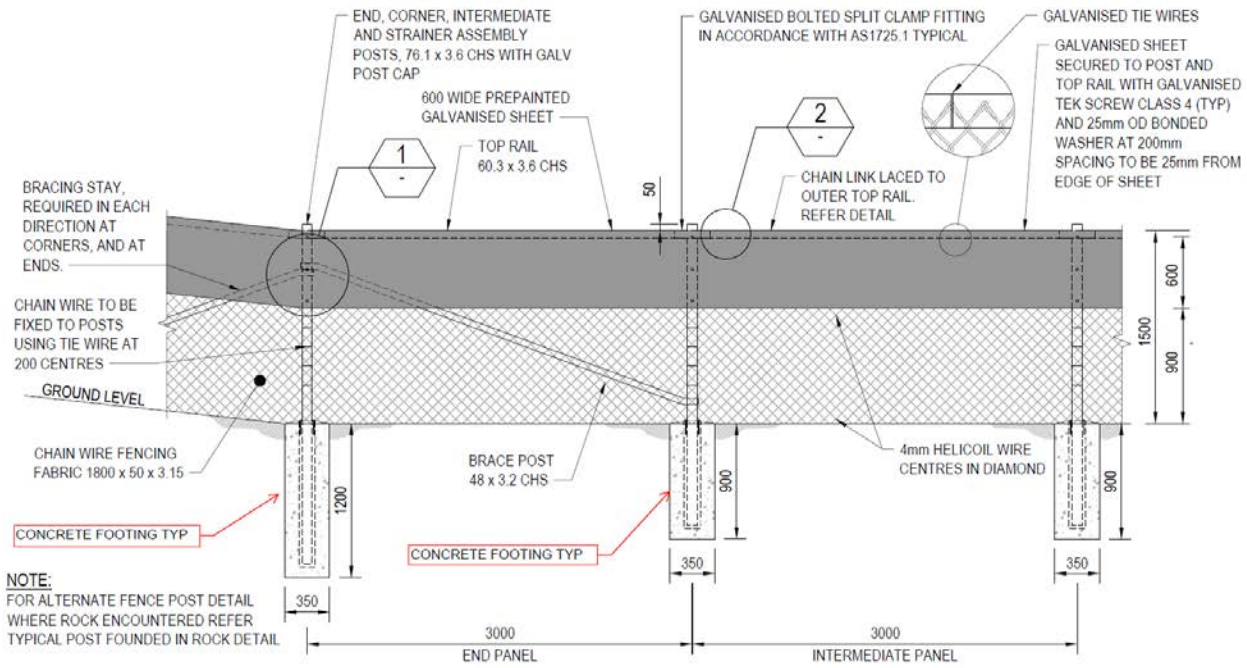
Appendix A: Concept design



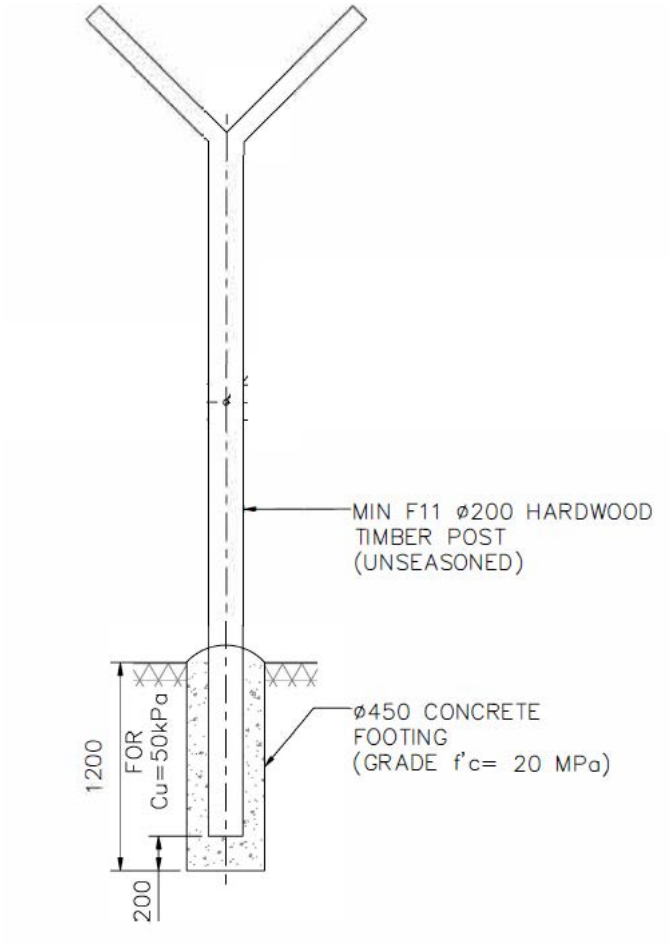
Key features of the proposal



Indicative drainage swale flap location



Typical koala fence 'slippery top' design, indicative of the fence design to be installed along Heathcote Road



Typical design of koala refuge pole

Appendix B: Construction noise contours

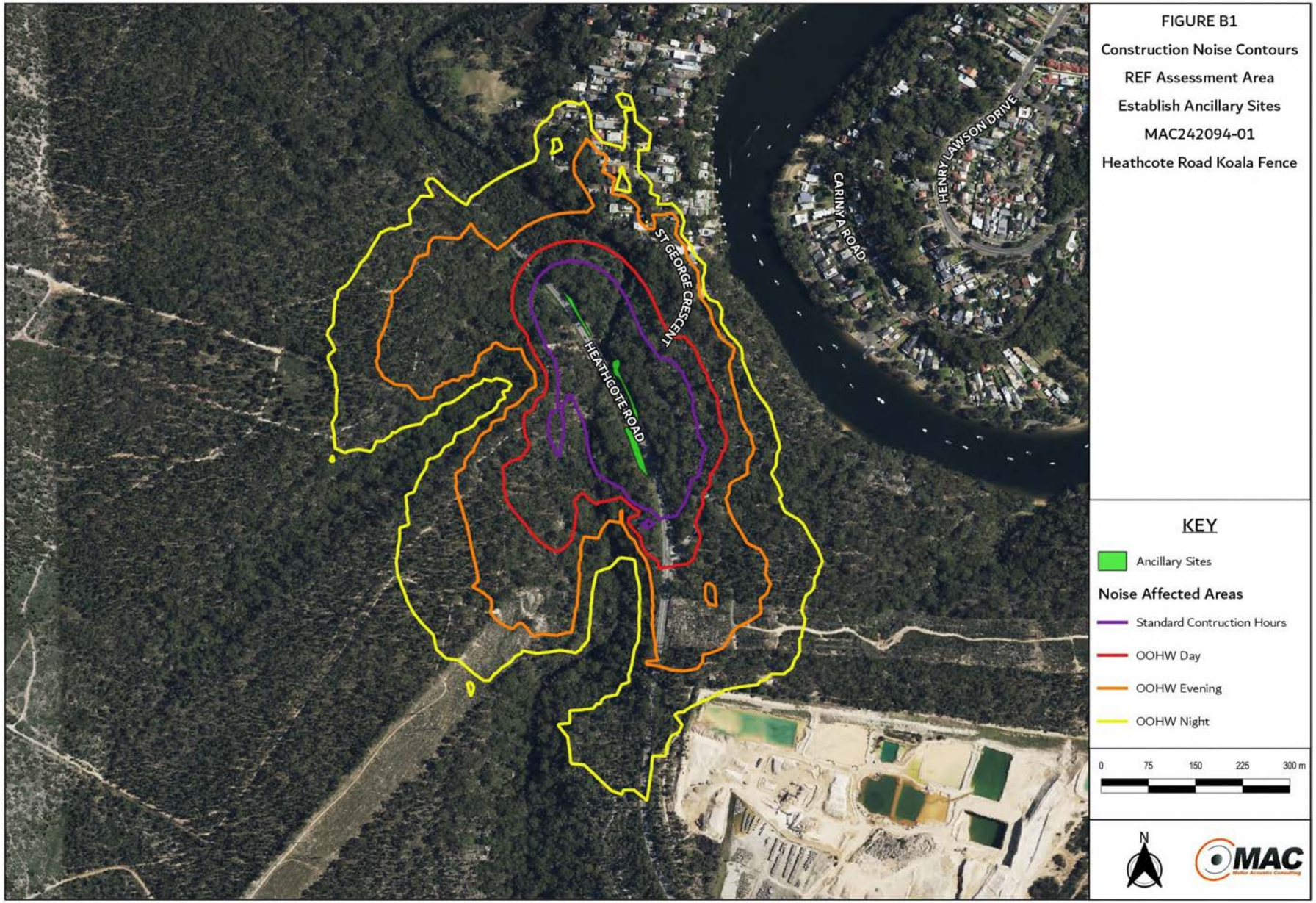


Figure B1: Noise assessment contours – establish ancillary facilities

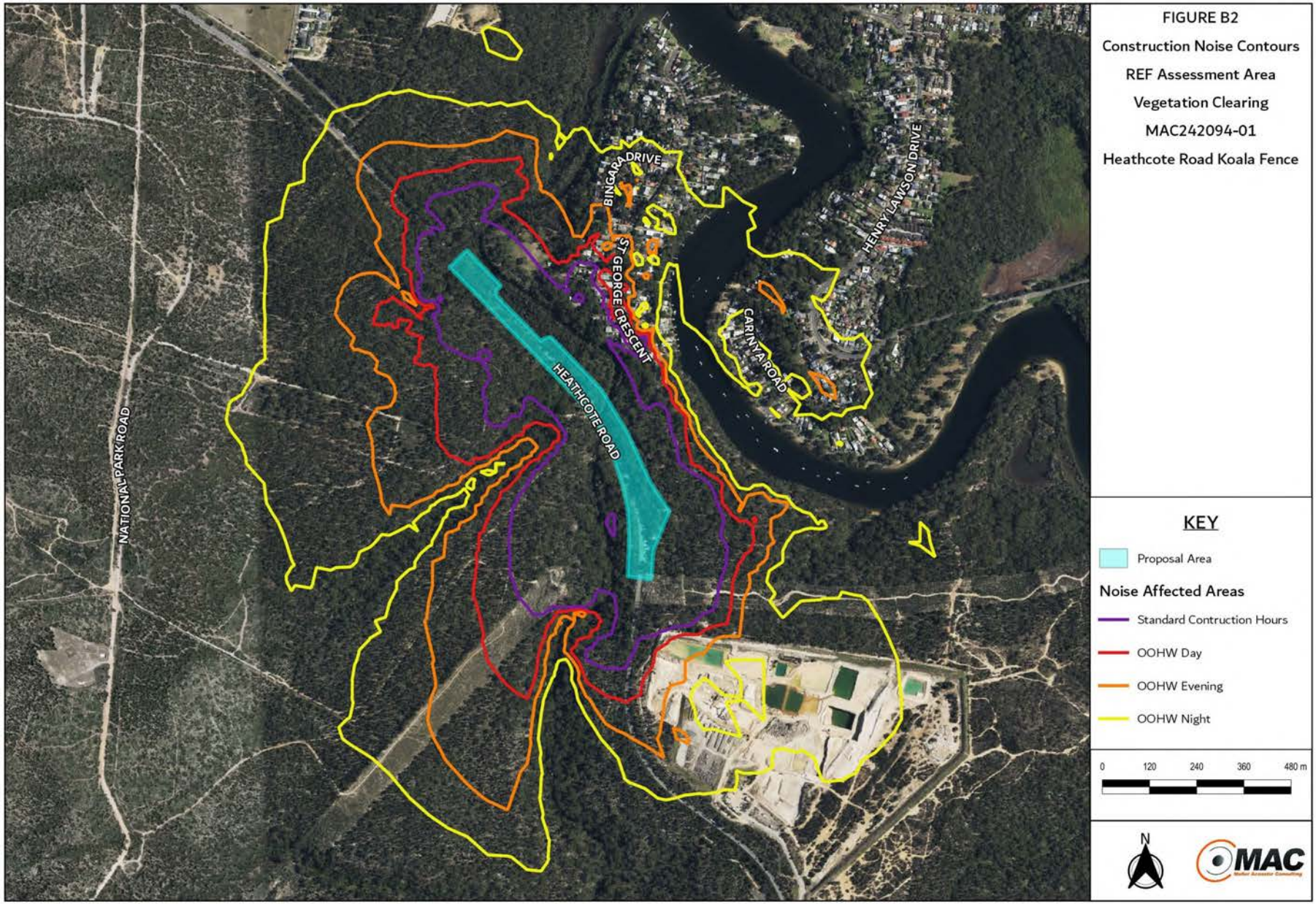


Figure B2: Noise assessment contours – vegetation clearing

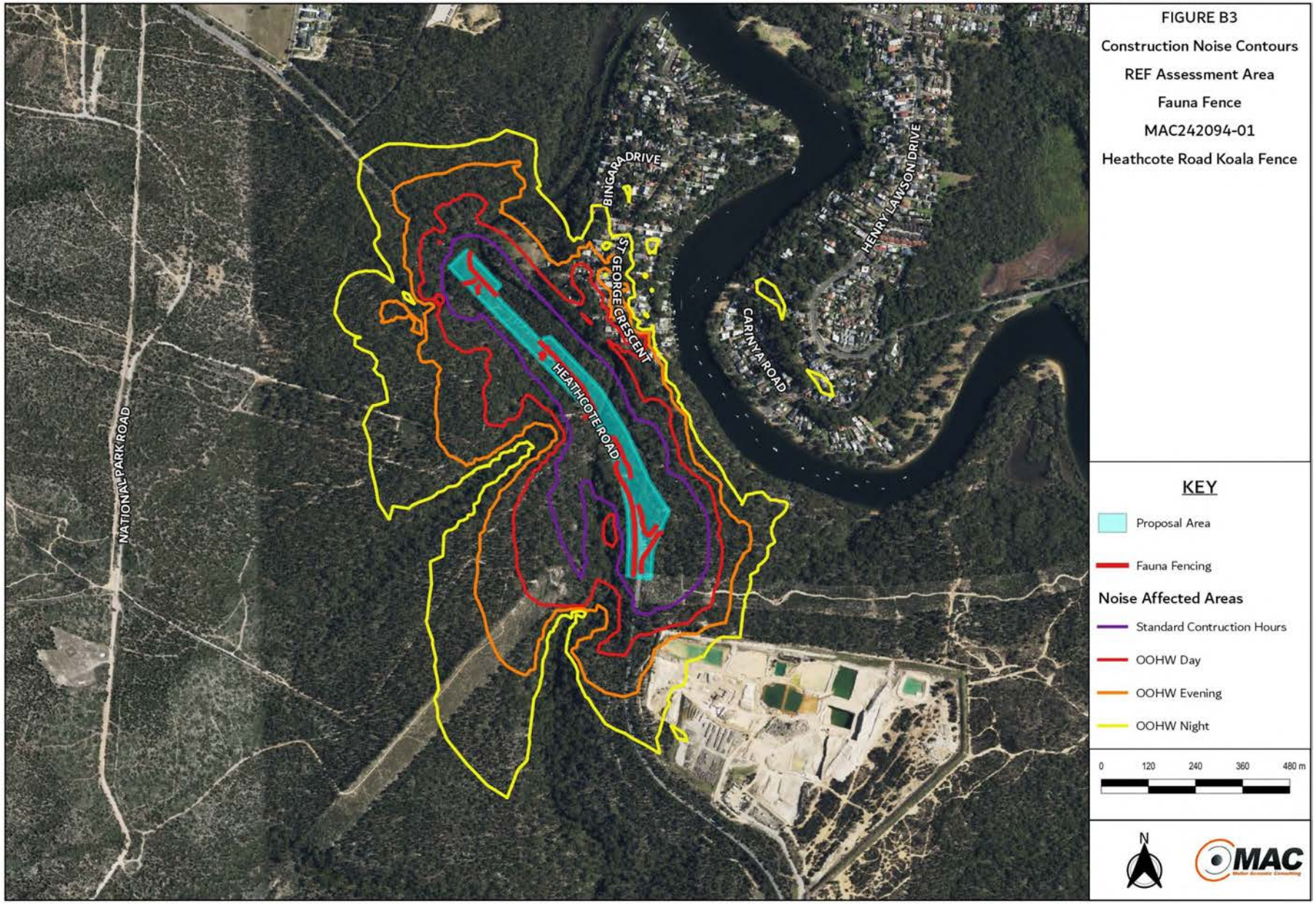


Figure B3: Noise assessment contours – Fencing

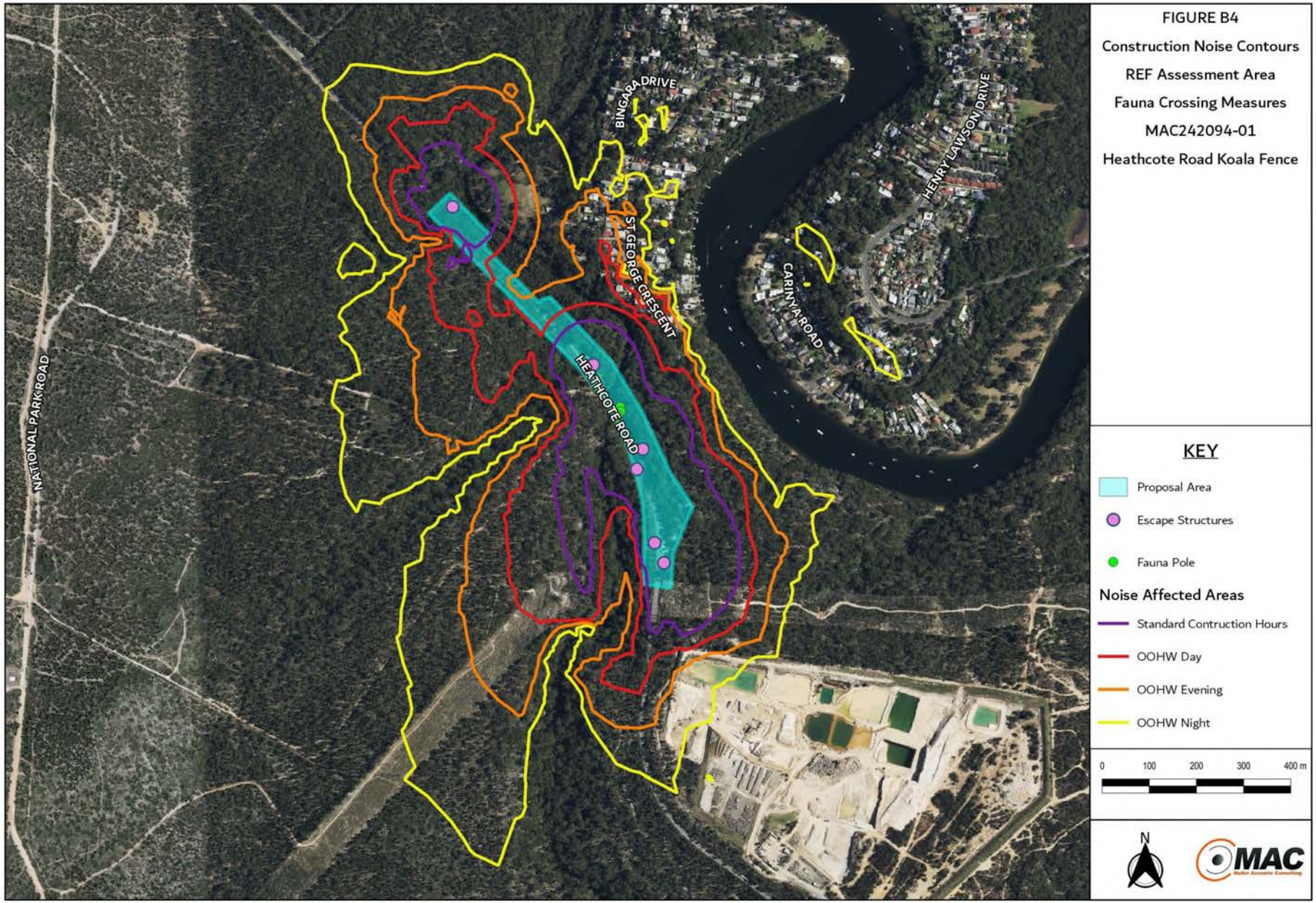


Figure B4: Noise assessment contours – fauna crossing measures

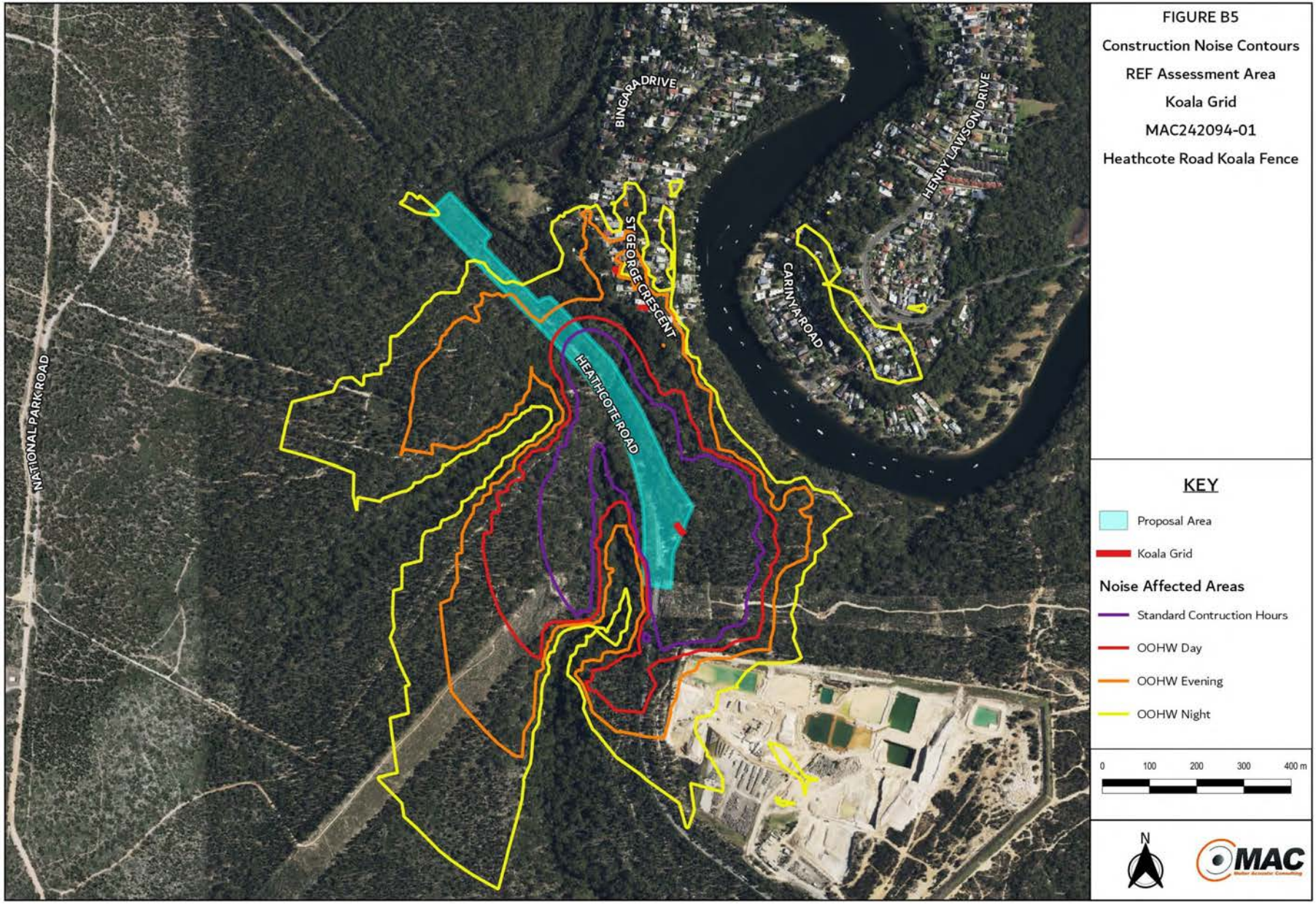


Figure B5: Noise assessment contours – Koala grid

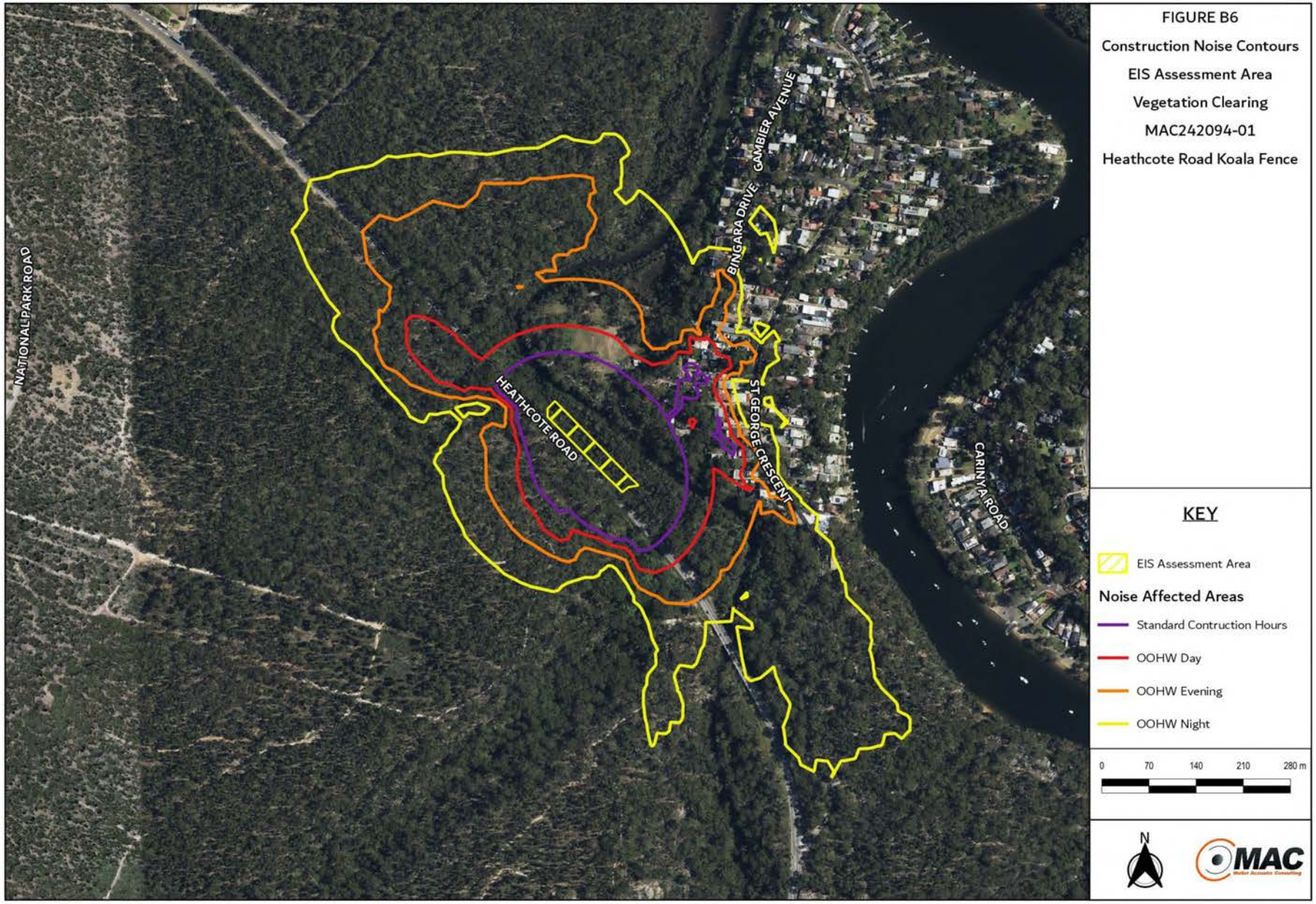


Figure B6: Noise assessment contours – Vegetation clearing (EIS proposal area)

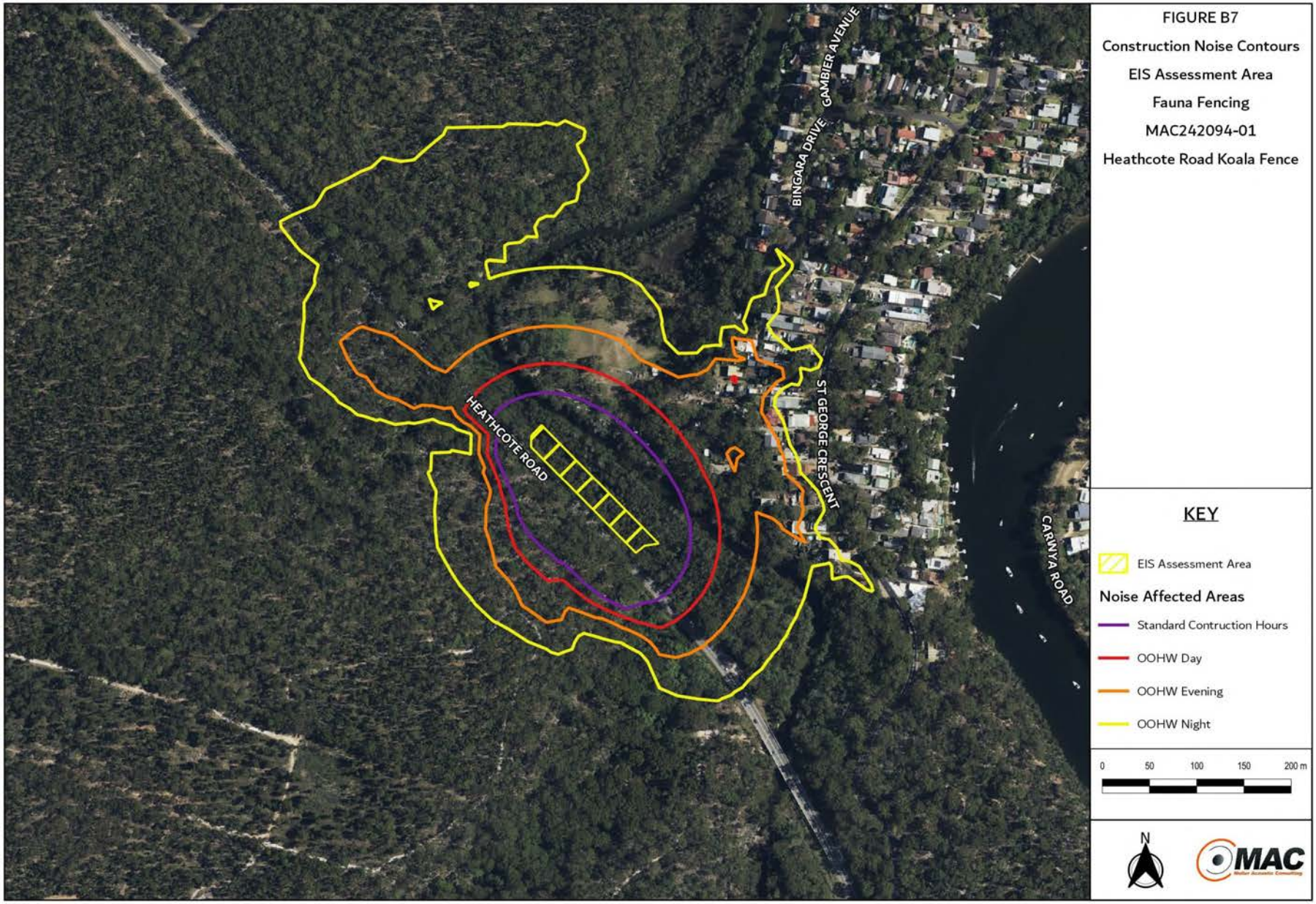


Figure B7: Noise assessment contours – fencing (EIS proposal area)

Appendix C: Additional mitigation measures

Additional Mitigation Measures as outlined in Appendix C of the CNVG-RM are summarised below. Many of these measures require communication with the community.

Notifications (letterbox drop or equivalent) (N)

Advance warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The Approval Conditions for projects may also specify requirements for notification to the community about works that may impact on them.

Specific notifications (SN)

Specific notifications are letterbox dropped or hand distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the noise objectives. The exact conditions under which specific notifications would proceed are defined in the relevant Additional Mitigation Measures (Tables C1 to C3). This form of communication is used to support periodic notifications, or to advertise unscheduled work.

Phone calls (PC)

Phone calls detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.

Individual briefings (IB)

Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the proposal.

Respite Offer (RO)

Respite Offers should be made where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers.

The purpose of such an offer is to provide residents with respite from ongoing impact. This measure is evaluated on a project-by-project basis and may not be applicable to all projects.

Respite Period 1 (R1)

Out of hours construction noise in out of hours period 1 shall be limited to no more than three consecutive evenings per week except where there is a Duration Respite. Work during these periods should be separated by not less than one week and no more than six evening per month.

Respite Period 2 (R2)

Night time construction noise in out of hours period 2 shall be limited to two consecutive nights except for where there is a Duration Respite. For night work, these periods of work should be separated by not less than one week and six nights per month. Where possible, high noise generating works shall be completed before 11pm.

Duration Respite (DR)

Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the number of evenings or nights worked through Duration Respite so that the proposal can be completed more quickly.

The project team should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.

Where there are few receivers above the NML each of these receivers should be visited to discuss the proposal to gain support for Duration Respite.

Alternative accommodation (AA)

Alternative accommodation options should be provided to residents living in close proximity to construction work that are likely to incur noise levels significantly above the applicable level (Tables C1-C3). The specifics of the offer will be determined on a proposal-by-proposal basis.

Verification

Appendix F of the CNVG-RM provides details about verification of Noise and Vibration levels following complaints and as part of routine checks of noise levels.

Appendix D: Additional mitigation measures contours

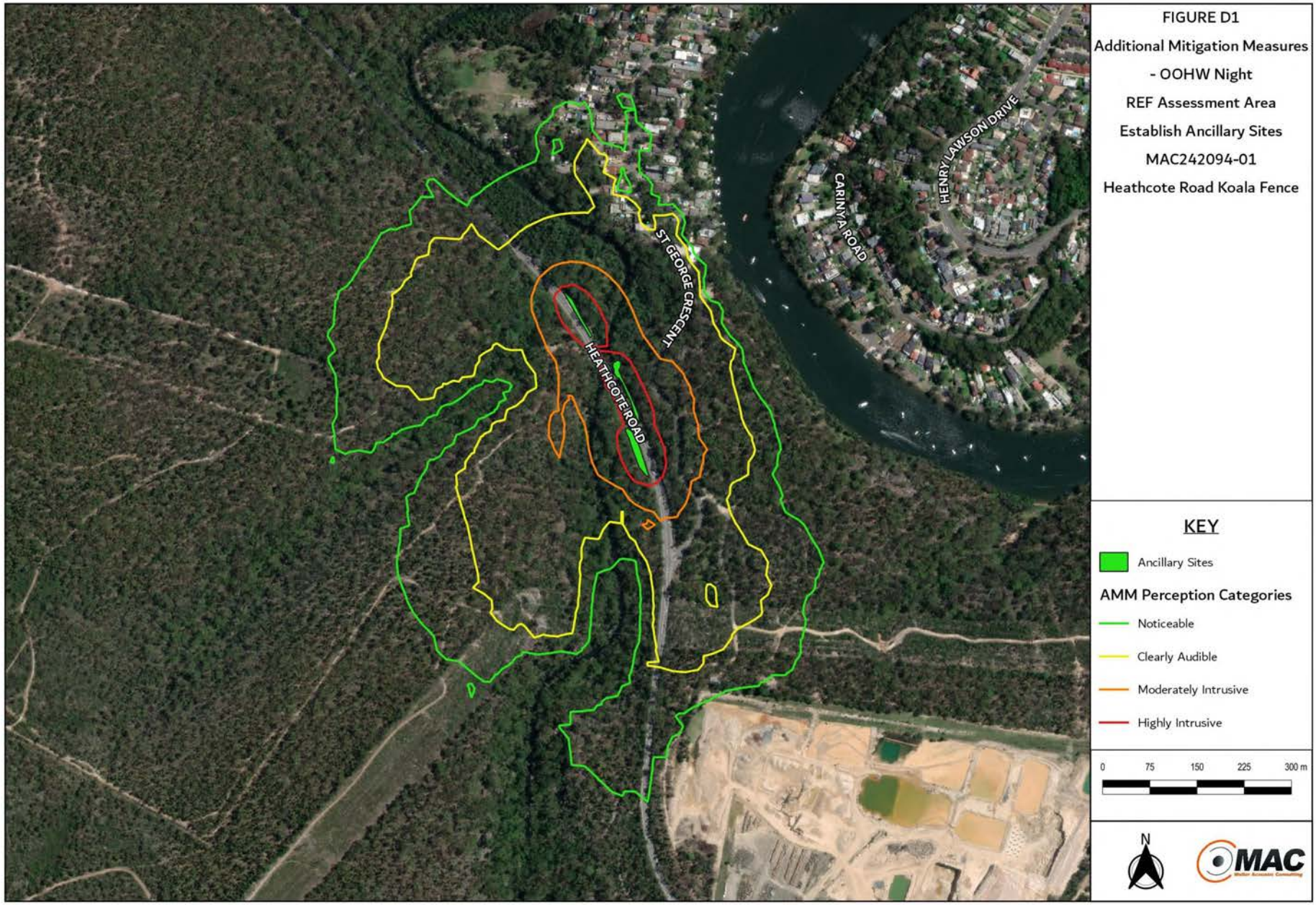


Figure D1: Perception categories OOHW night - fencing

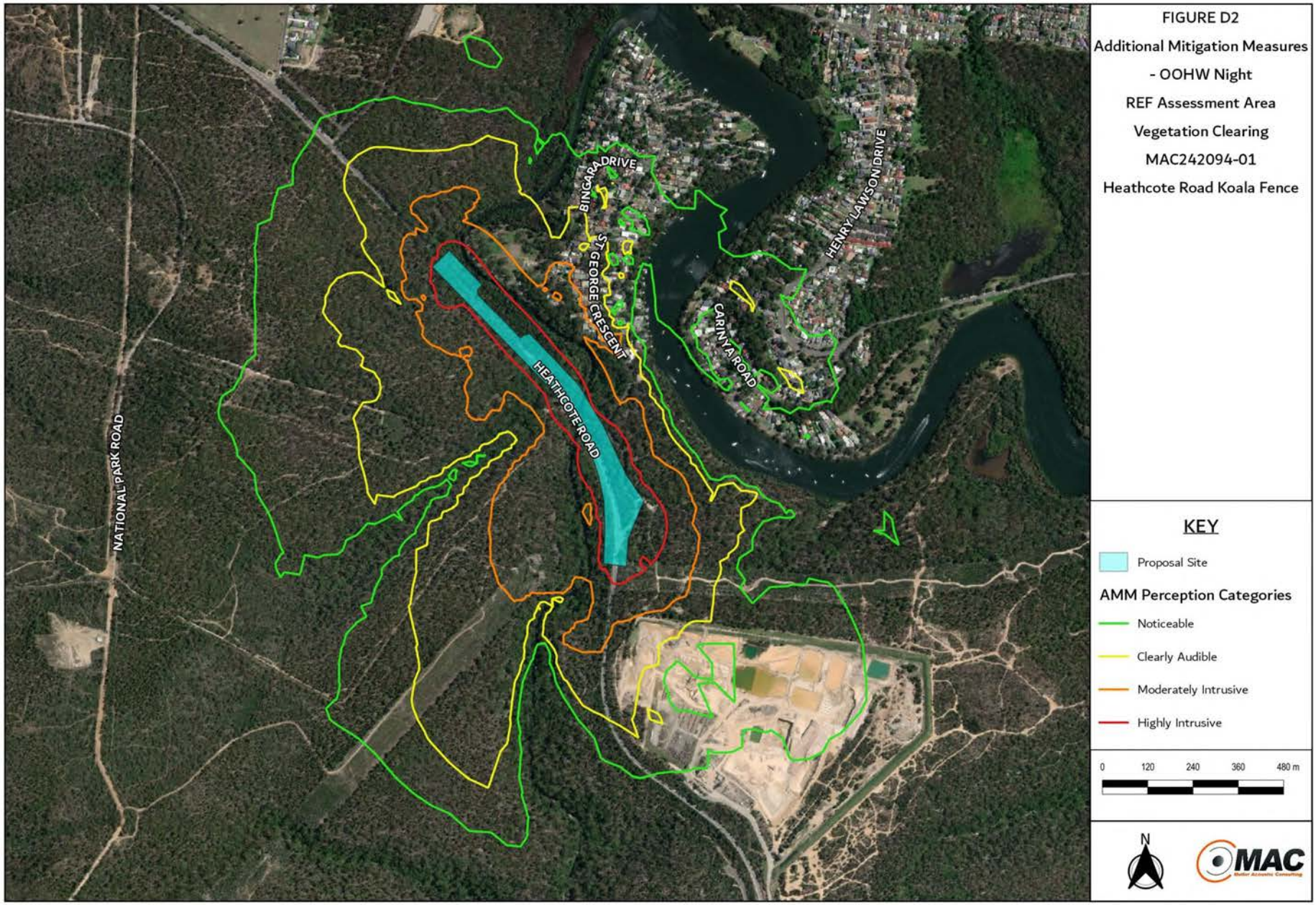


Figure D2: Perception categories OOHW night -vegetation clearing

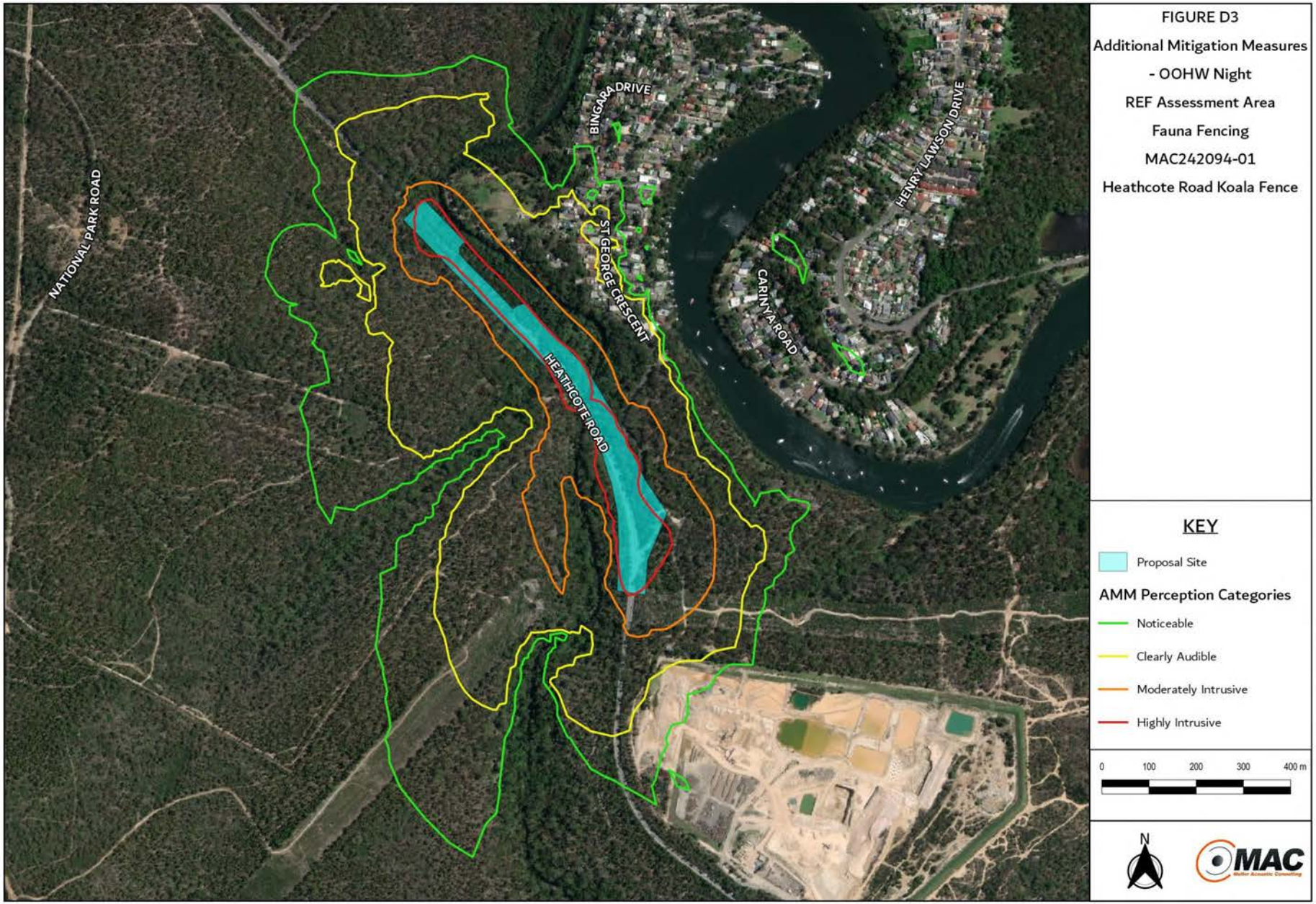


Figure D3: Perception categories OOHW night - fencing

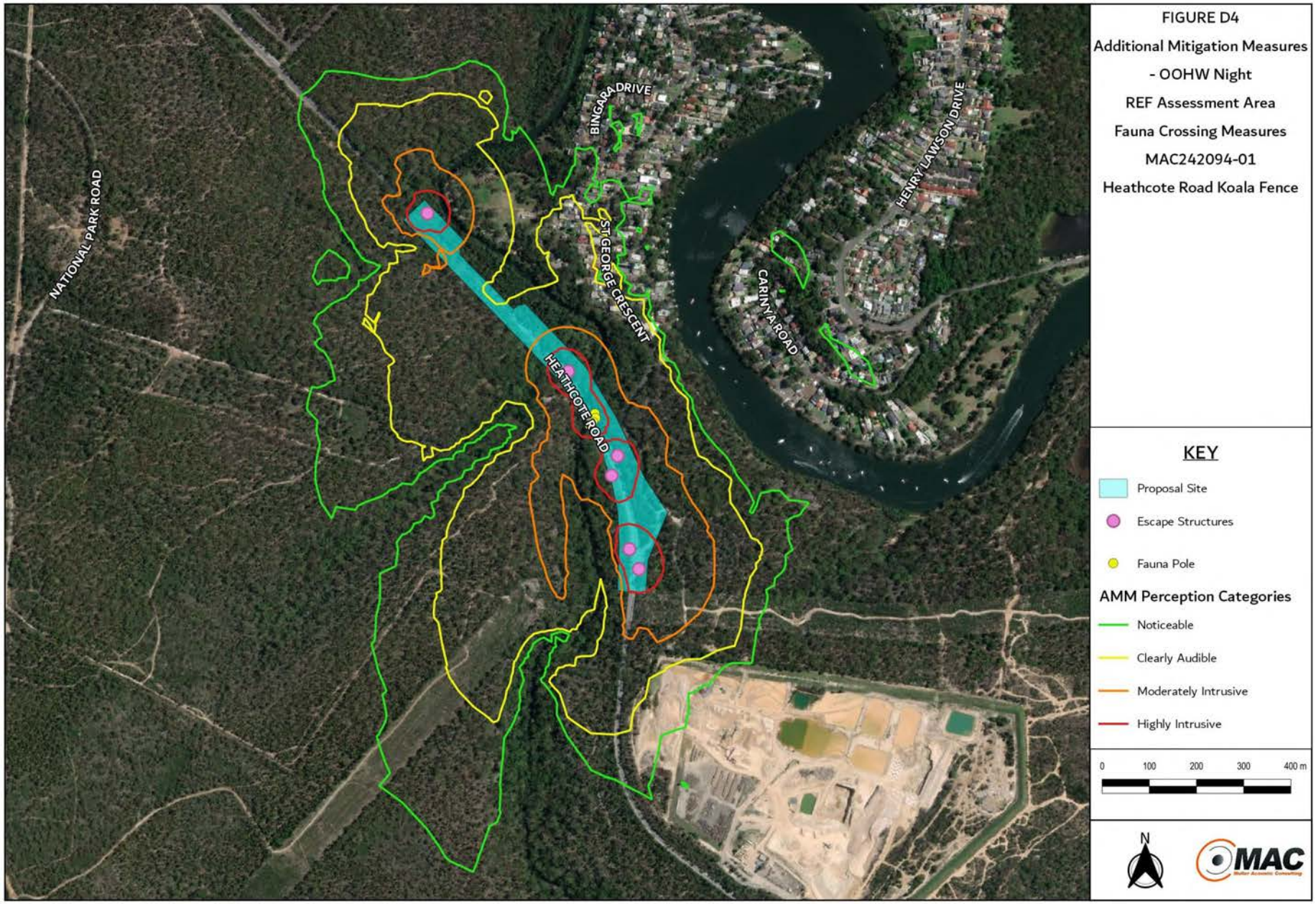


Figure D4: Perception categories OOHW night – fauna crossing measures

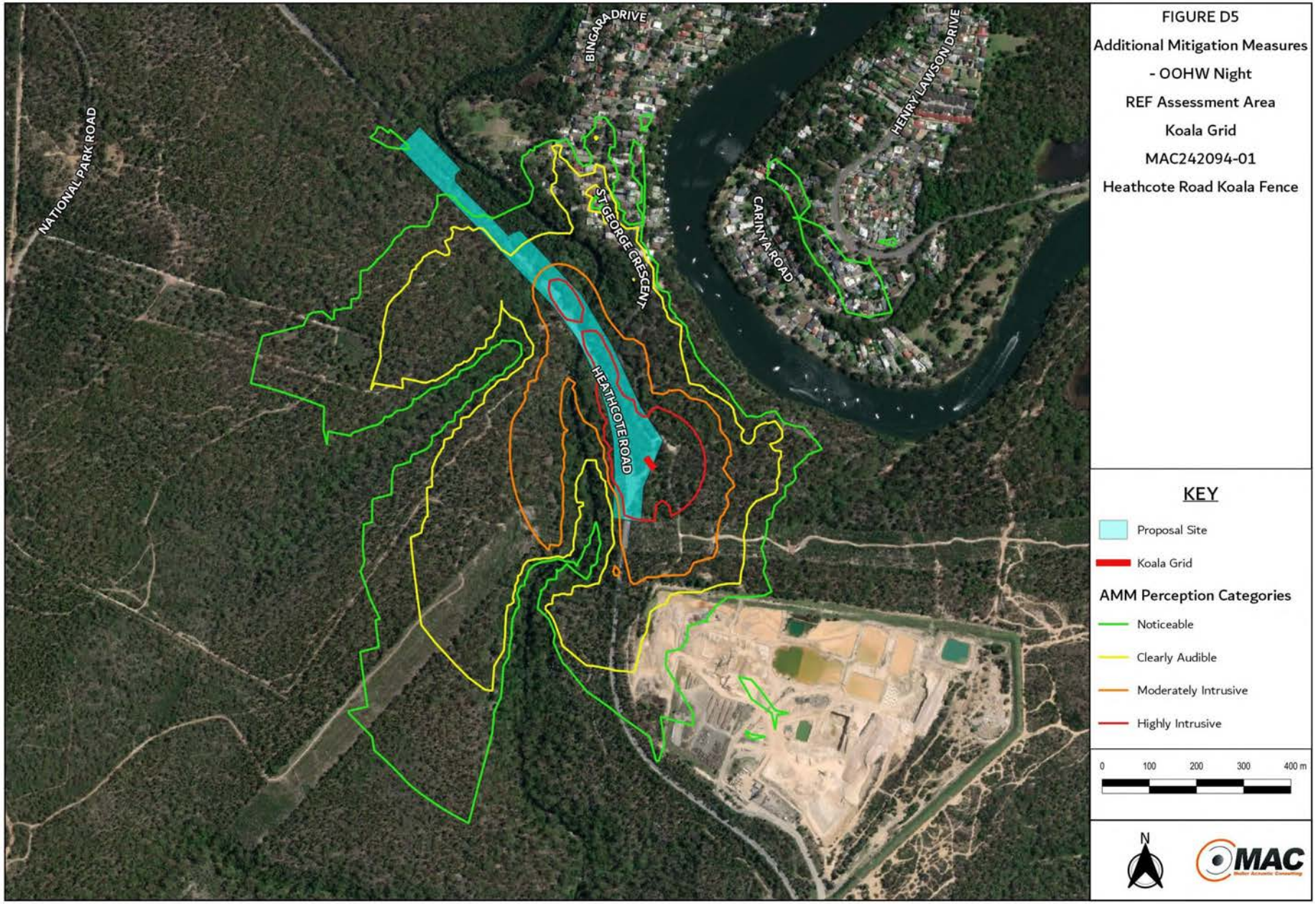


Figure D5: Perception categories OOHW night – Koala grid

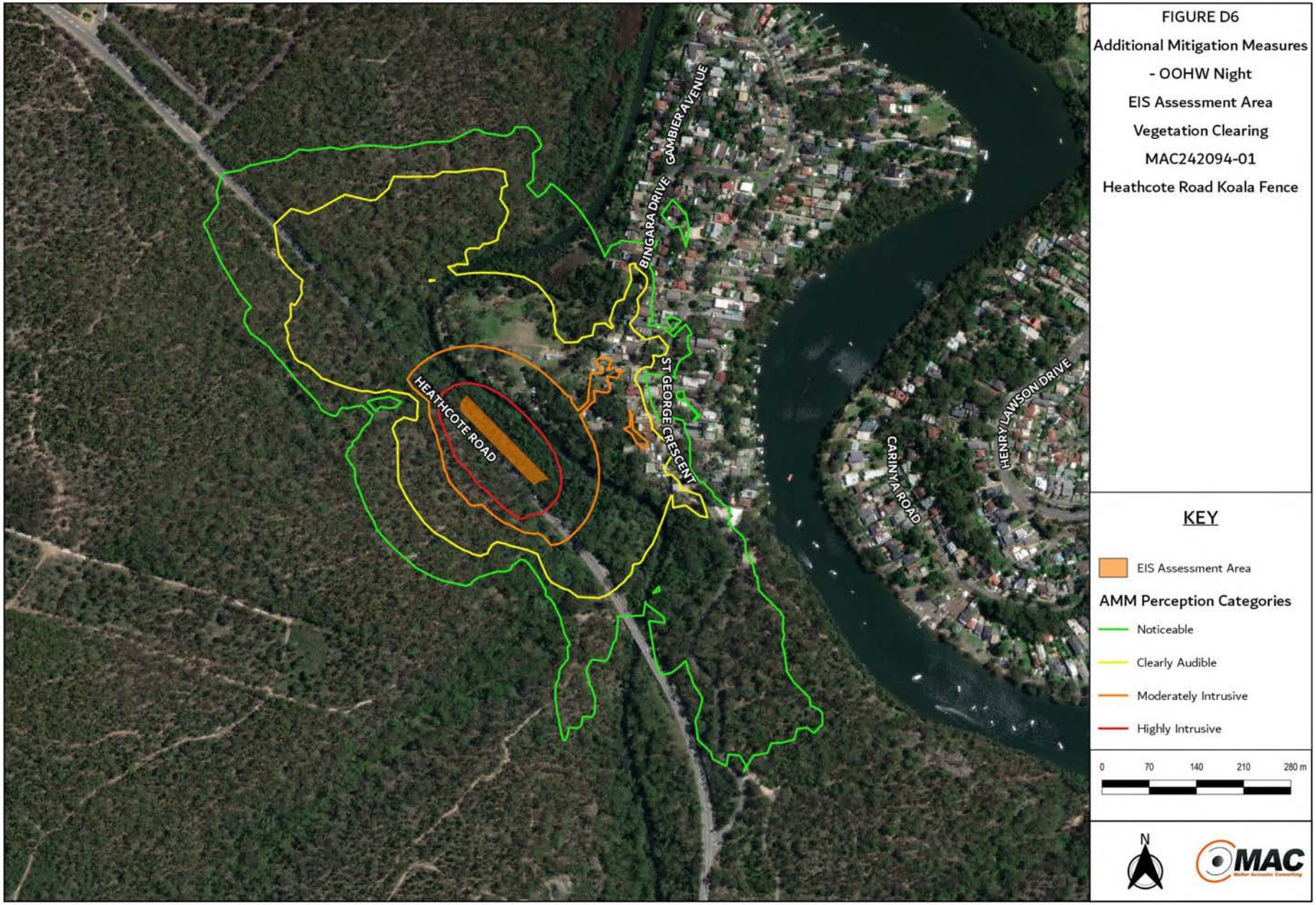


Figure D6: Perception categories OOHW night – vegetation clearing (EIS proposal area)

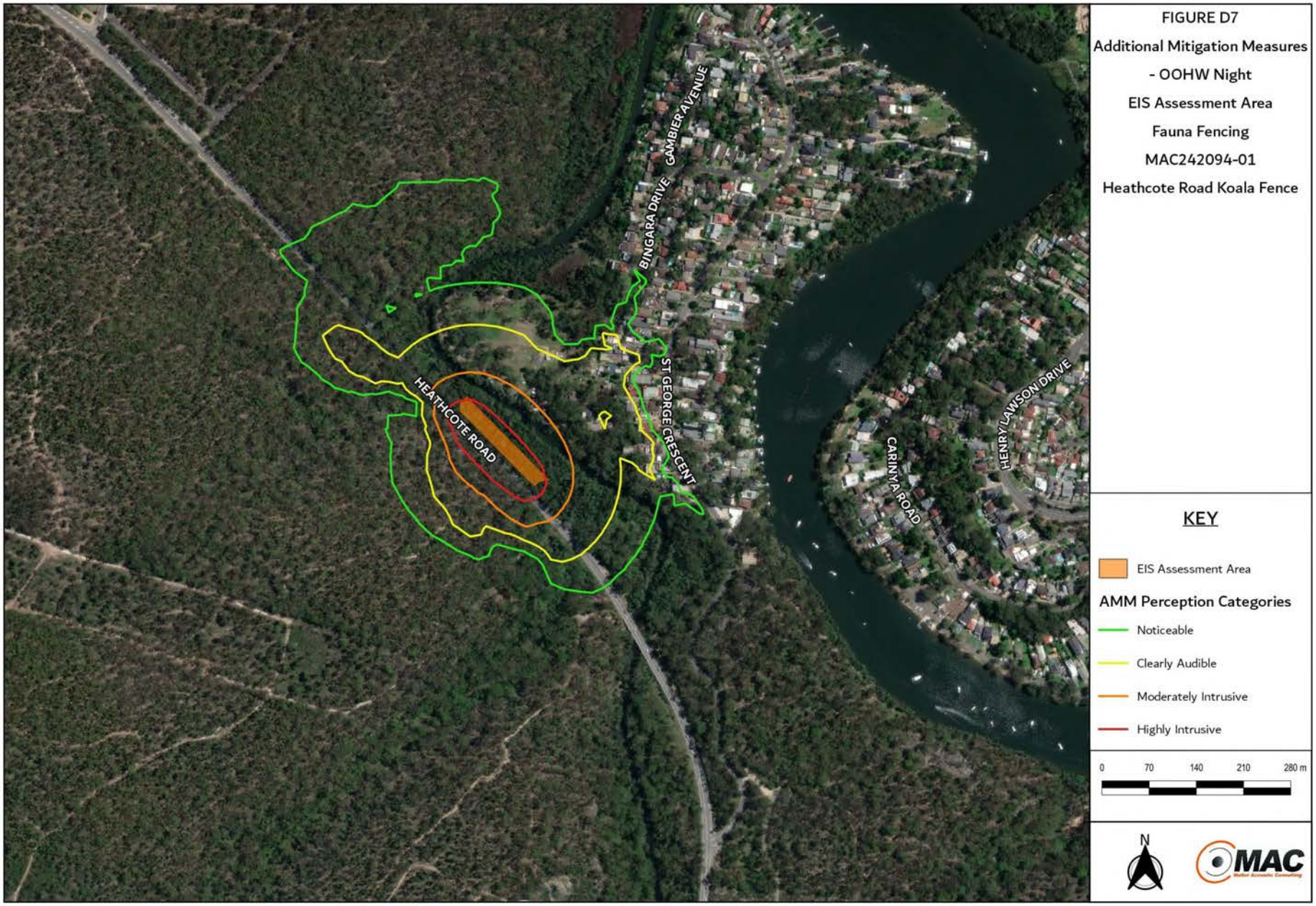


Figure D7: Perception categories OOHW night –fencing (EIS proposal area)

NSW GOVERNMENT