

Epping Road widening between Essex Street and Blaxland Road, Epping

Appendix D Noise and vibration impact assessment Part B

November 2015

5. Noise and vibration mitigation measures

5.1 Operational noise mitigation

The key NMG principles to consider at this stage of the road design include:

- Noise mitigation should be designed to reduce noise levels to the criteria for qualifying receivers
- Following road design, residual exceedances of noise criteria may be addressed at qualifying receivers using, in order of preference (RNP section 3.4.1), quieter road surfaces and at-property treatments
- Noise mitigation shall be evaluated and installed where feasible and reasonable.

Noise levels are predicted to increase by more than 2.0 dBA and exceed the noise criteria at the following 8 sensitive receivers during the day time period:

- 20C Essex Street
- 28 Pembroke Street
- 26 Essex Street
- 30 Pembroke Street
- 30 Essex Street
- 1 Crandon Road
- 41 Essex Street
- 43 Essex Street.

Noise levels are predicted to increase by more than 2.0 dBA and exceed the noise criteria at the following 6 sensitive receivers during the night time period only:

- 28 Pembroke Street
- 20C Essex Street
- 30 Pembroke Street
- 1 Crandon Road
- 41 Essex Street
- 43 Essex Street.

These receivers would qualify for noise mitigation. The NMG recommends noise mitigation in the following order of preference:

- Quieter pavement surfaces
- Noise Mounds
- Noise Walls
- At property treatments.

The NMG states that quieter pavement surfaces are the preferred form of noise mitigation as it reduces source noise levels. Quieter pavements are only effective for speeds of 80 km/hr or above so are not recommended for this proposal.

Noise mounds and noise walls provide similar benefits to those provided by a quieter pavement surface through reducing both external and internal levels of noise and should be considered where there are four or more closely space receivers. As most of the receivers' along Epping Road have adjoining driveways, neither noise mounds and/or noise walls are not likely to be a reasonable or feasible method to reduce noise.

At-property noise mitigation measures such as façade treatments and localised screens may replace at-road mitigation, subject to a reasonable and feasible assessment. At-property treatments should be considered for sensitive receivers predicted to exceed the NCG criteria and qualify for additional mitigation in accordance with the NMG, for the proposal.

5.2 Construction noise mitigation

There is the potential that construction activities could exceed the construction noise and vibration management levels for the proposal. Roads and Maritime have advised that the CNS may be used as guidance on how to minimise the impacts on the community from noise and vibration.

It is recommended that the following CNS standard noise mitigation measures be implemented where feasible and reasonable and all potentially impacted residents should be informed of the nature of the works, expected noise levels, duration of works and provided a point of contact.

Table 5-1 Standard mitigation measures for construction noise and vibration

Action required	Details
Management measures	
Implement community consultation measures	<ul style="list-style-type: none"> • periodic notification (letterbox drop or equivalent) • website • project info-line • construction response line • email distribution list • community based forums (if required by approval conditions)
Site inductions	<p>All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include:</p> <ul style="list-style-type: none"> • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/ unloading areas and procedures • construction traffic routes • site opening/closing times (including deliveries) • environmental incident procedures
Behavioural practices	<p>No swearing or unnecessary shouting or loud stereos/radios on site.</p> <p>No dropping of materials from height, throwing of metal items and slamming of doors.</p>
Monitoring	<p>A noise monitoring 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.</p>

Action required	Details
Attended vibration measurement	Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Source controls	
Construction hours and scheduling	<p>Where reasonable and feasible, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.</p> <p>Further to this, It is recommended that the use of mulchers, jack hammers, concrete saws, rock breakers, compaction or other equipment used in very close proximity to the receivers should be limited where feasible and reasonable to the standard construction hours.</p>
Construction respite period	<p>If highly noise affected impacts are predicted high noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.</p> <p>If highly noise affected impacts are predicted no more than four consecutive nights of high noise and/or vibration generating work may be undertaken over any seven day period, unless otherwise approved by the relevant authority.</p>
Equipment selection	Use quieter and less vibration emitting construction methods where reasonable and feasible.
Maximum noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria listed in Table 2 of the <i>Construction Noise Strategy</i> .
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 site unless compliant with the criteria in Table 2 <i>Construction Noise Strategy</i> .
Use and siting of plant	<p>Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided.</p> <p>The offset distance between noisy plant and adjacent sensitive receivers is to be maximised.</p> <p>Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.</p>
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/ unloading areas to minimise reversing movements within the site.
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.
Minimise disturbance arising from delivery of goods to construction sites	<p>Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers.</p> <p>Select site access points and roads as far as possible away from sensitive receivers.</p> <p>Dedicated loading/unloading areas to be shielded if close to sensitive receivers.</p> <p>Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.</p>

Action required	Details
Path controls	
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.
Shield sensitive receivers from noisy 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 siting plant.

Due to the highly variable nature of the activities and the potential for work to be undertaken outside the standard construction hours, the Proposal's noise management levels are likely to be exceeded at times. Consultation and cooperation with the neighbours of the site will assist in minimising uncertainty, misconceptions and adverse reactions to noise.

5.2.1 Project specific noise mitigation

In circumstances where the noise levels are predicted to exceed construction noise management levels after implementation of the general work practices, the relevant additional mitigation measures detailed in Table 5-2 should be considered where feasible and reasonable. Based on the predicted noise levels, additional mitigation measures are likely to be required for works during standard construction hours and any activities outside of standard construction hours. The noise management zones show the additional mitigation measures recommended by the CNS. Noise management zones have been calculated for each scenario showing the recommended additional mitigation measure for the day time period. The noise management zones have all been based on the background noise level at monitoring location 2 in order to be conservative. Noise management zones are shown in Figure 5-1 to Figure 5-10. Houses identified as Moderately Intrusive or Highly Intrusive during the day time would be eligible for letter box drops or compliance noise monitoring as per the table below. Additional mitigation would be required for any night time works where feasible and reasonable. The minimum level was set at the ICNG background + 5 dBA criteria for determining the noise management zones.

Table 5-2 Additional mitigation measures

Criteria	Time period	L _{Aeq(15 min)}	noise level	above rating	background level
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA	>30 dBA
		Noticeable	Clearly audible	Moderately intrusive	Highly intrusive
Standard	Weekday (7 am– 6 pm)	-	-	LB, M	LB, M
	Saturday (8 am – 1 pm)	-	-	-	-
OOHW Period 1	Weekday (6 pm–10 pm)	-	LB	M, LB	M, IB, LB, PC, SN
	Saturday (1 pm – 10 pm)	-	-	-	-
	Sunday (8 am – 6 pm)	-	-	-	-
OOHW Period 2	Weekday (10 pm–7 am)	LB ¹	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN
	Saturday (10 pm – 8 am)	-	-	-	-
	Sunday (6 pm – 7 am)	-	-	-	-

Monitoring (M): Compliance noise monitoring

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.

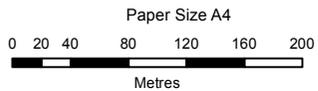
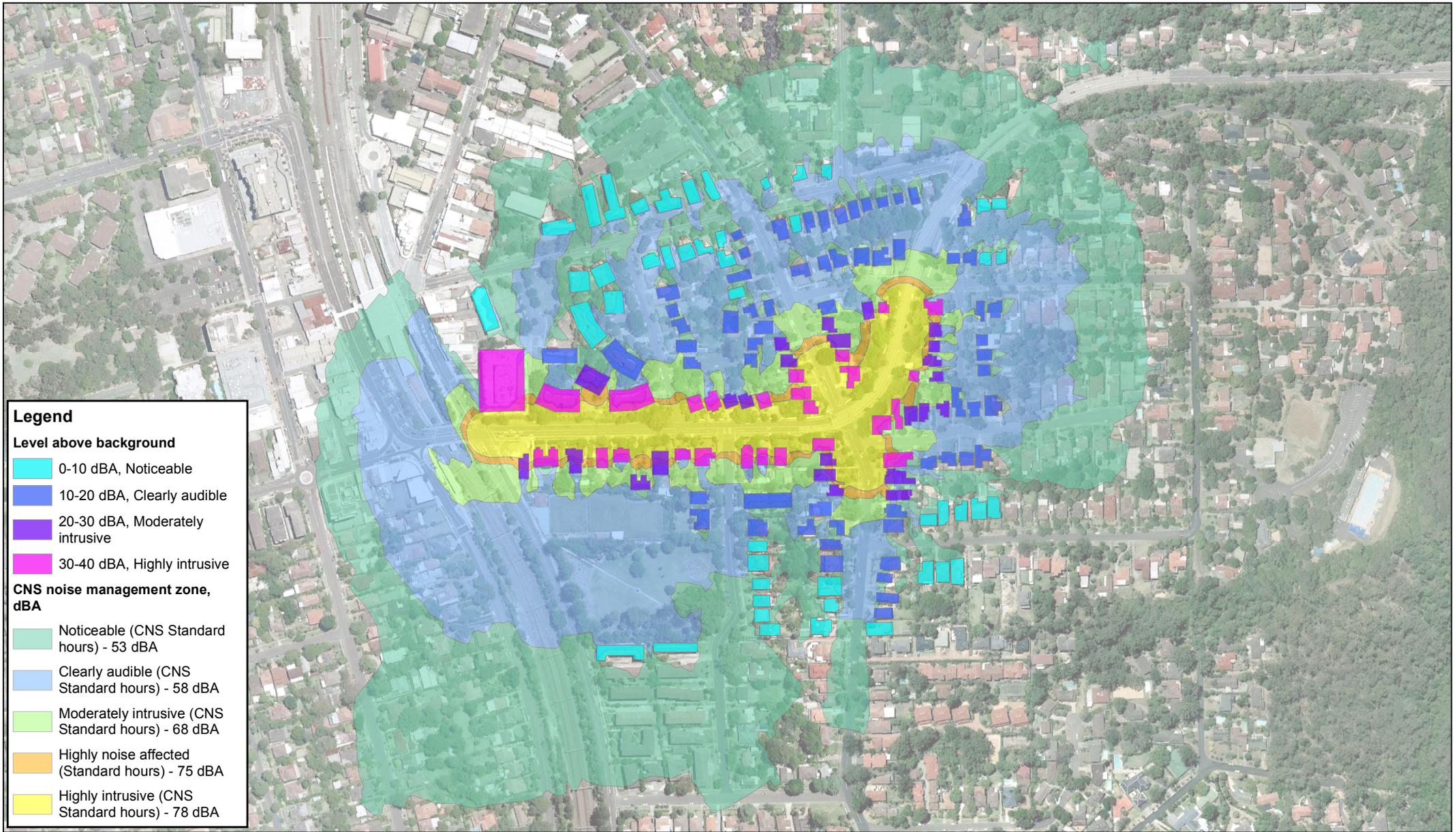
Letter box drops (LB): Letter box drops or media advertisements.

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.

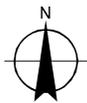
Specific Notifications (SN): Specific notifications are letterboxed or hand distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications.

Alternative accommodation (AA): Alternative accommodation options would be offered to residents.

Source: *Construction Noise Strategy (Rail Projects)*, (TfNSW, 2012)



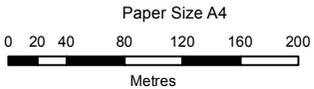
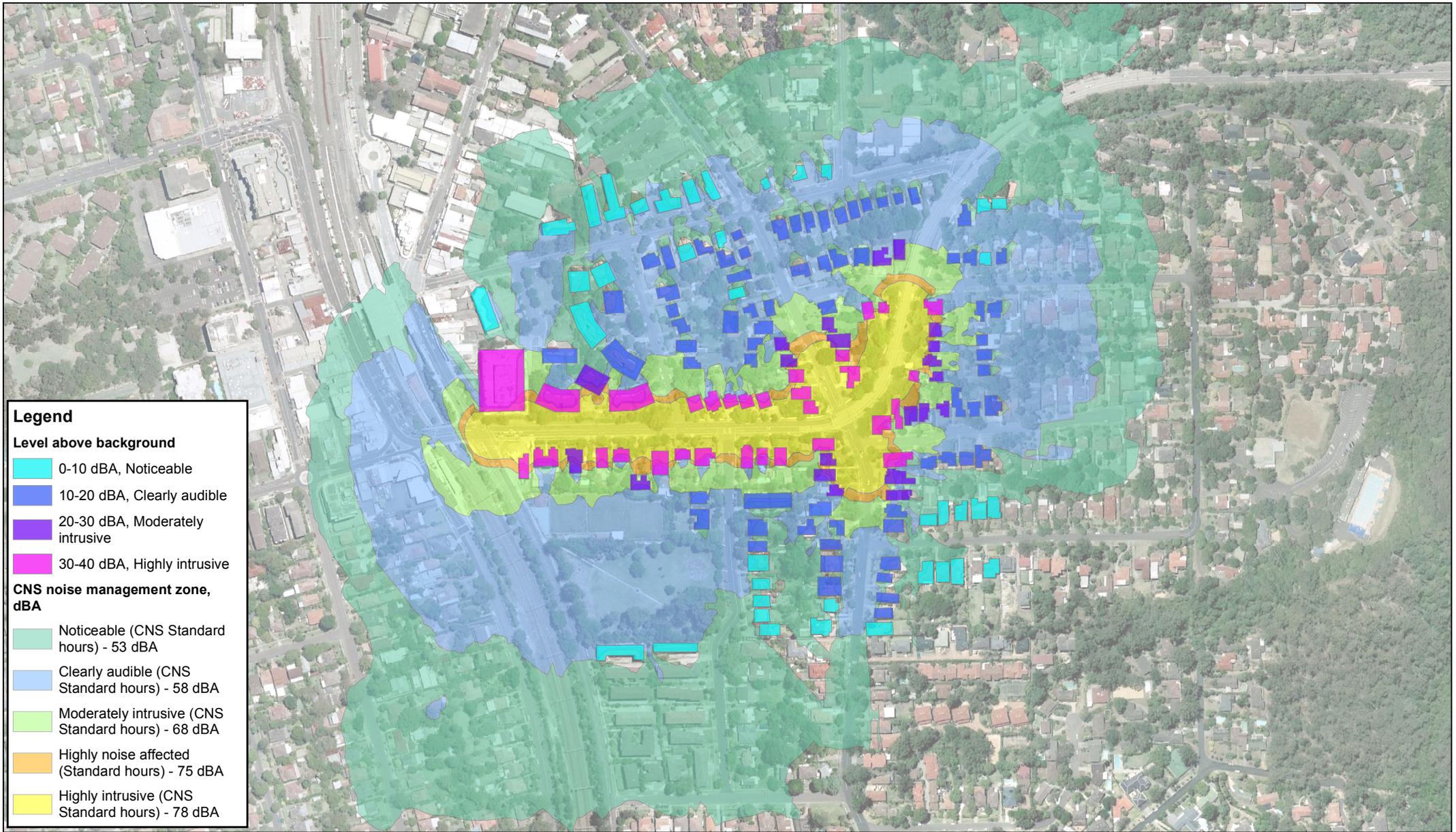
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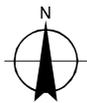
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Scenario 1: Site establishment
construction noise management levels

Figure 5-1

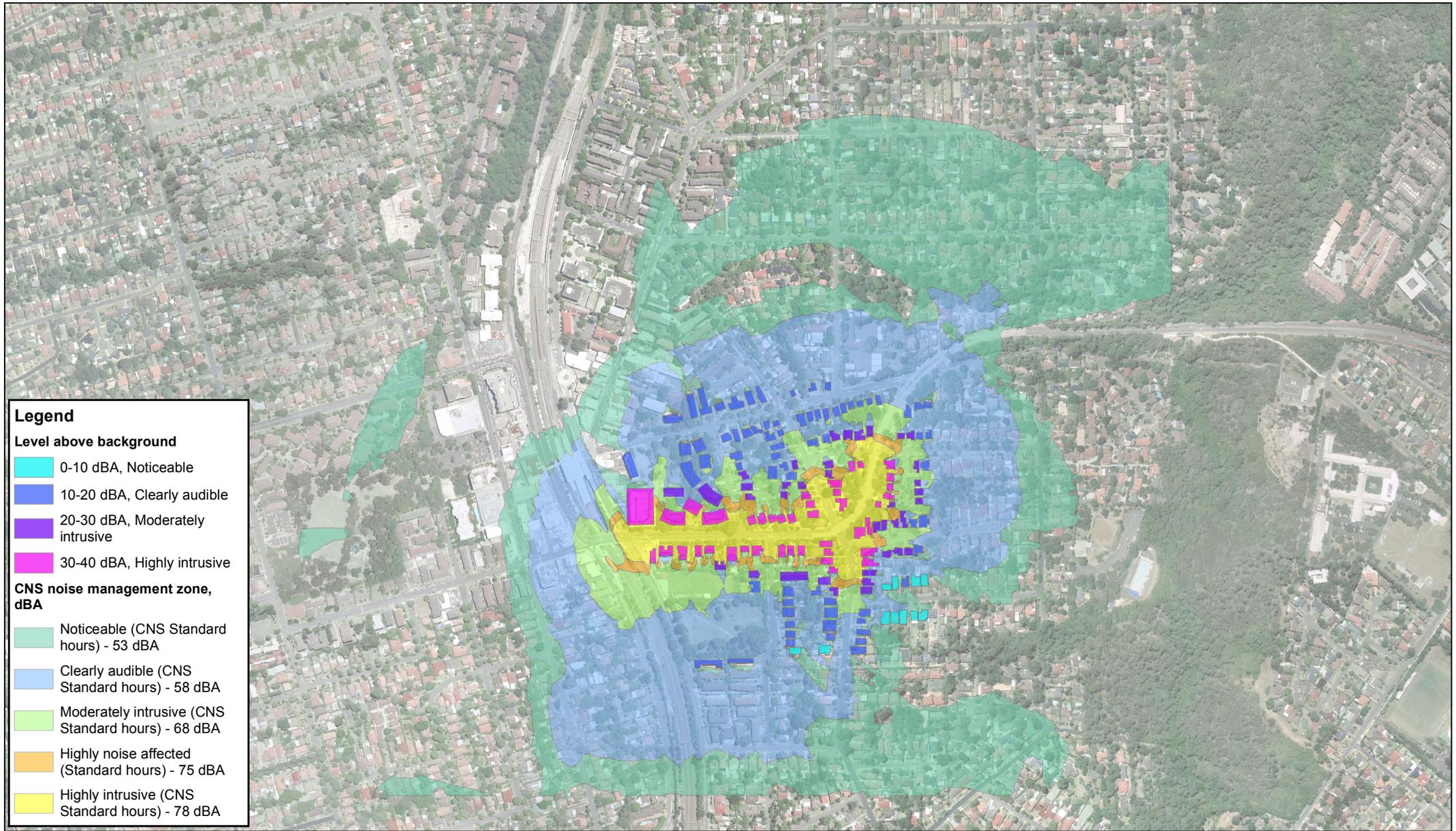


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Scenario 2: Utility, property, service adjustment
construction noise management levels **Figure 5-2**



Legend

Level above background

- 0-10 dBA, Noticeable
- 10-20 dBA, Clearly audible
- 20-30 dBA, Moderately intrusive
- 30-40 dBA, Highly intrusive

CNS noise management zone, dBA

- Noticeable (CNS Standard hours) - 53 dBA
- Clearly audible (CNS Standard hours) - 58 dBA
- Moderately intrusive (CNS Standard hours) - 68 dBA
- Highly noise affected (Standard hours) - 75 dBA
- Highly intrusive (CNS Standard hours) - 78 dBA

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Scenario 3: Vegetation clearing
construction noise management levels

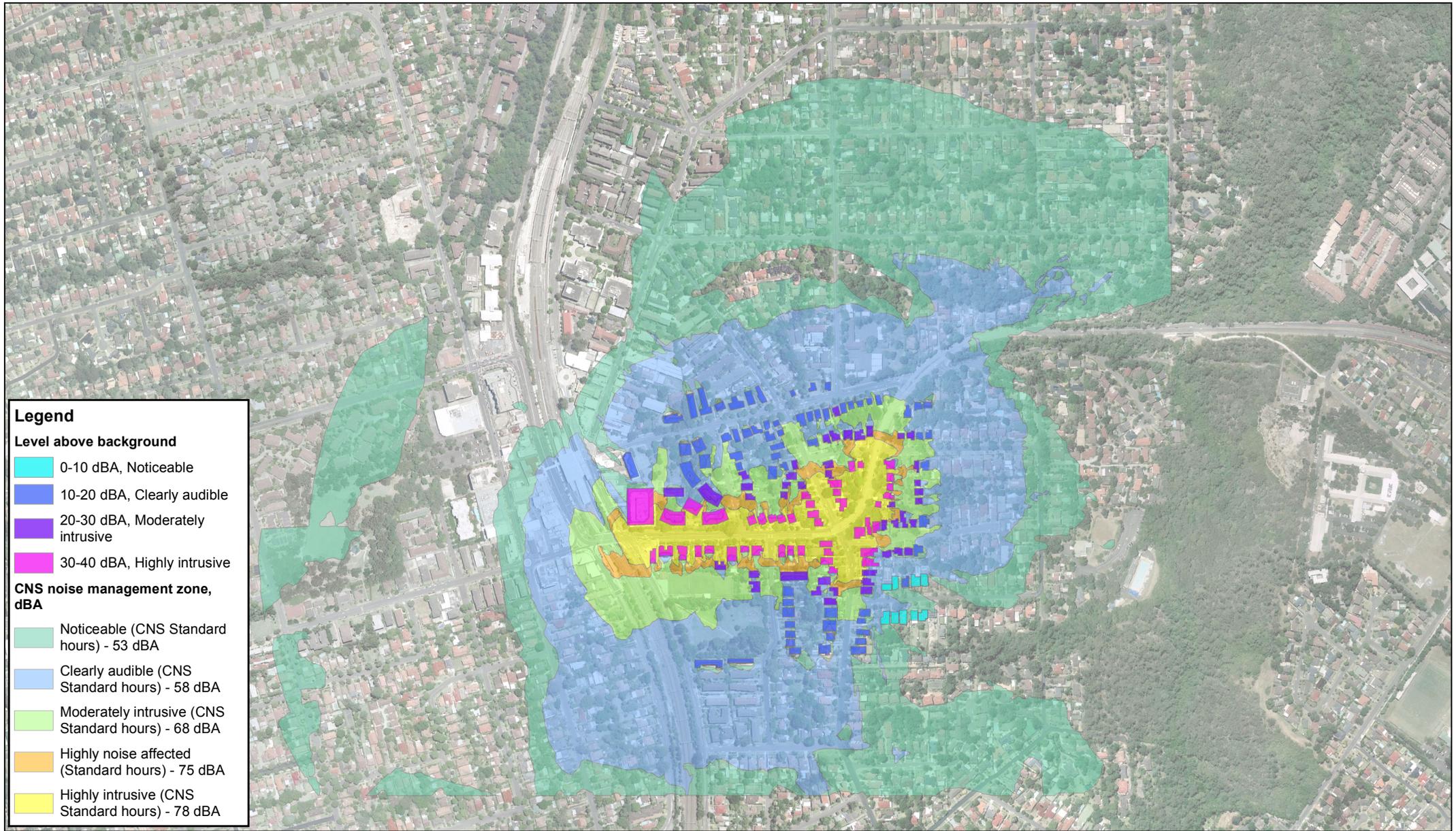
Figure 5-3

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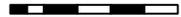
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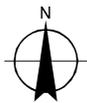
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Scenario 4: Structural demolition
construction noise management levels

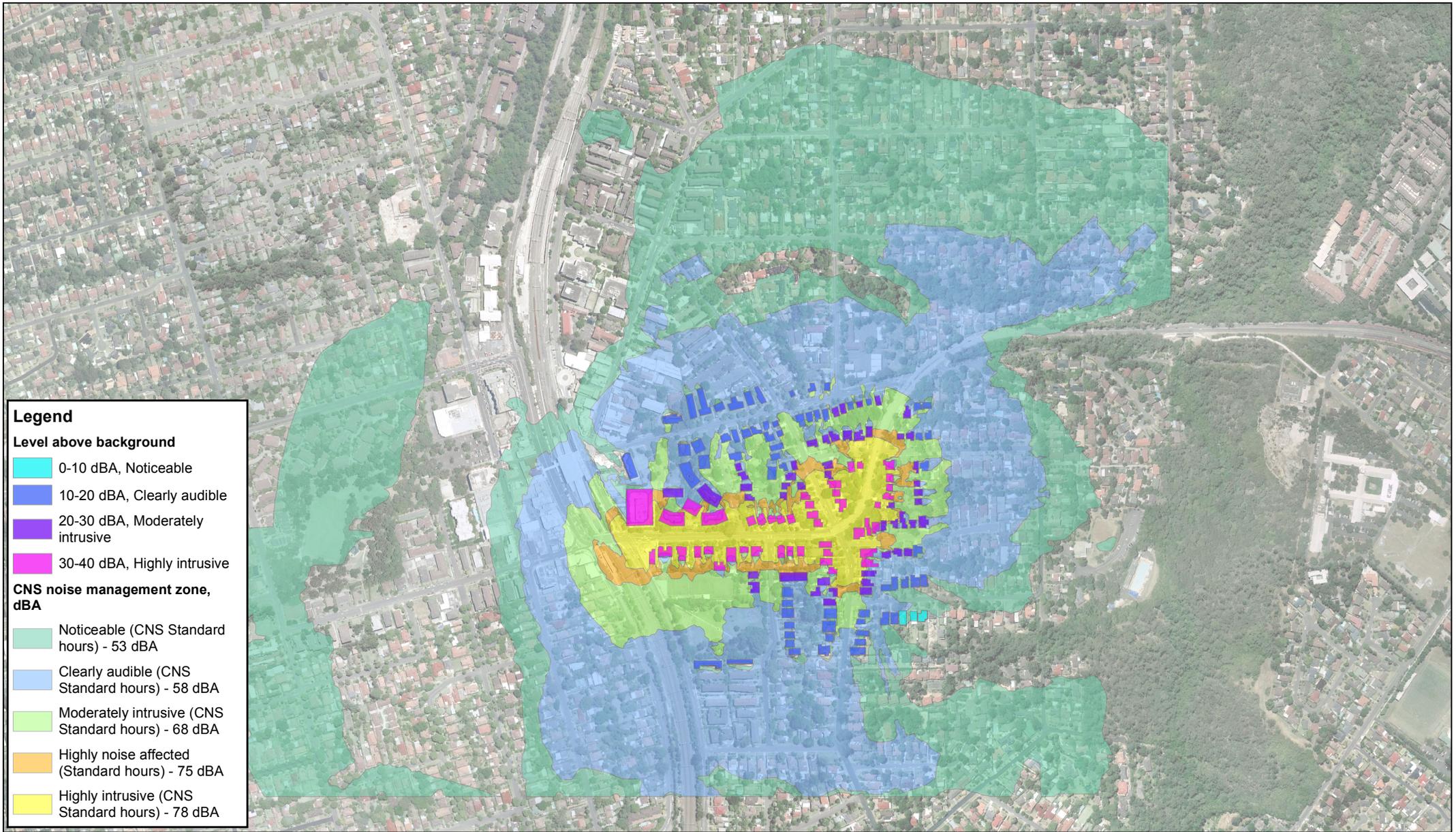
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Scenario 5: Bulk earthworks
construction noise management levels

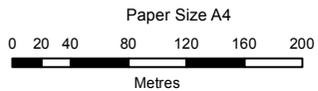
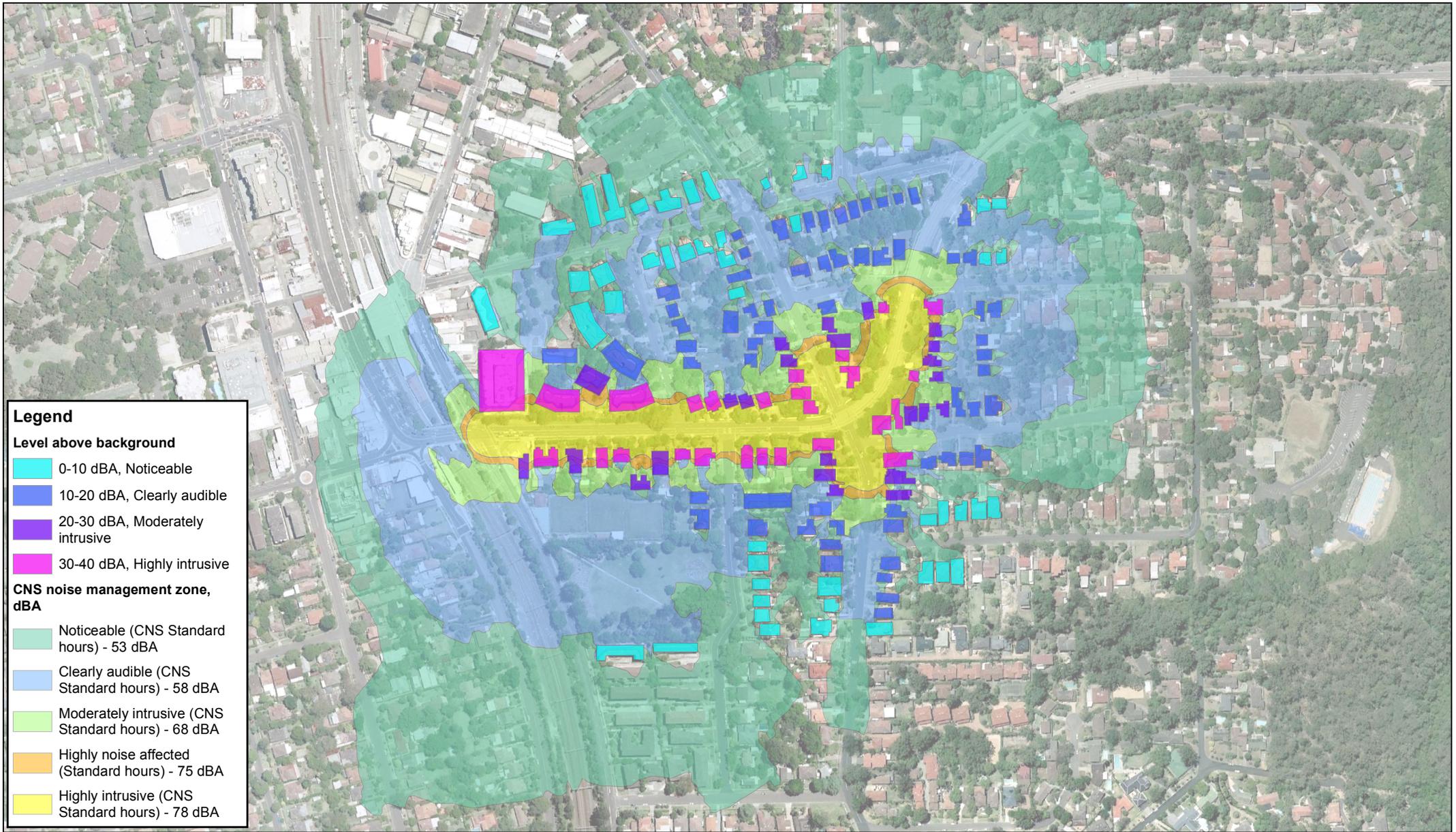
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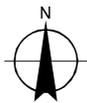
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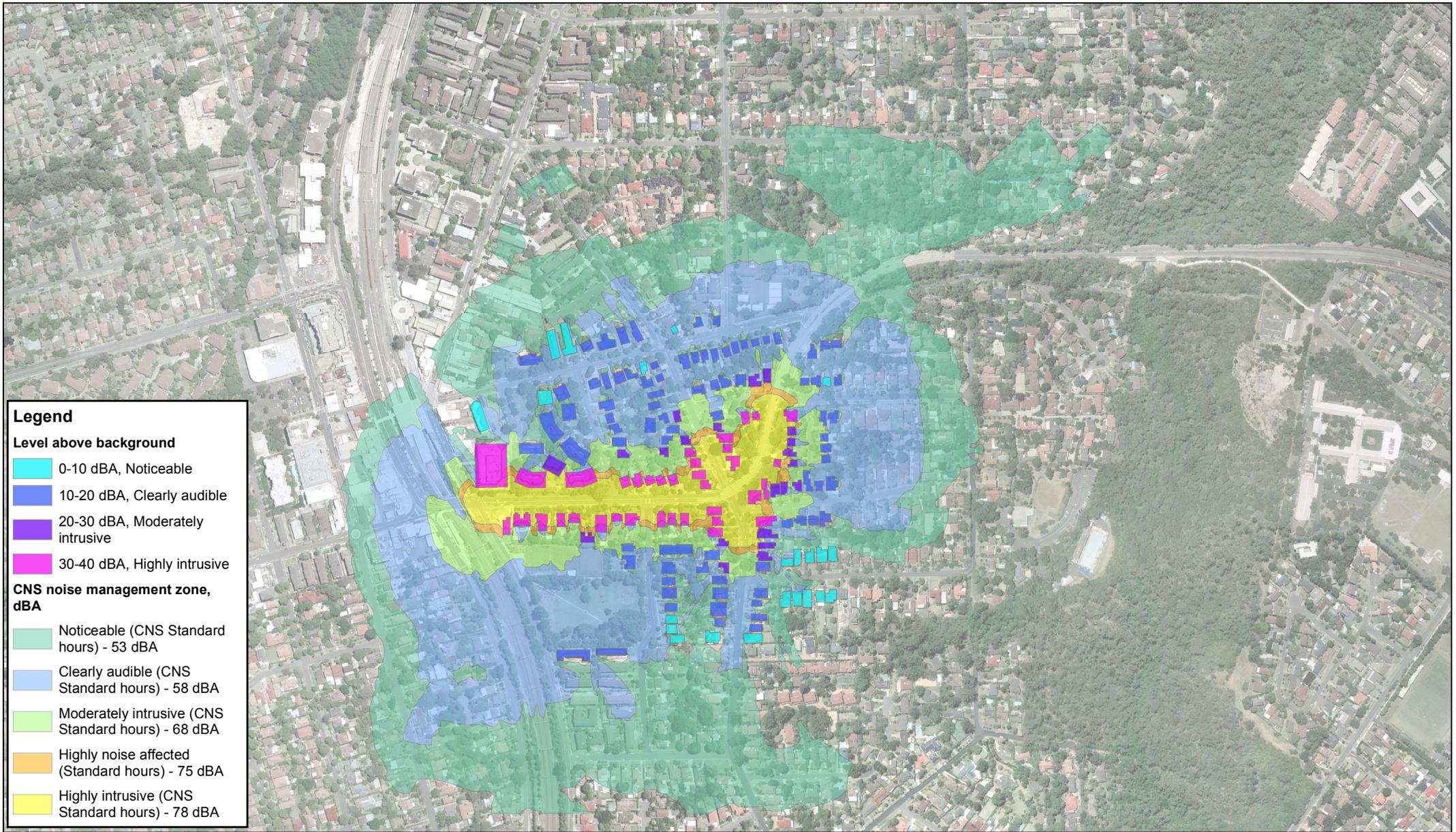
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Scenario 6: Drainage infrastructure
 construction noise management levels

Figure 5-6

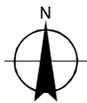


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Scenario 7: Paving/asphalting
construction noise management levels

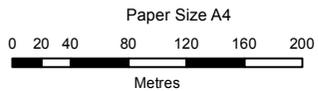
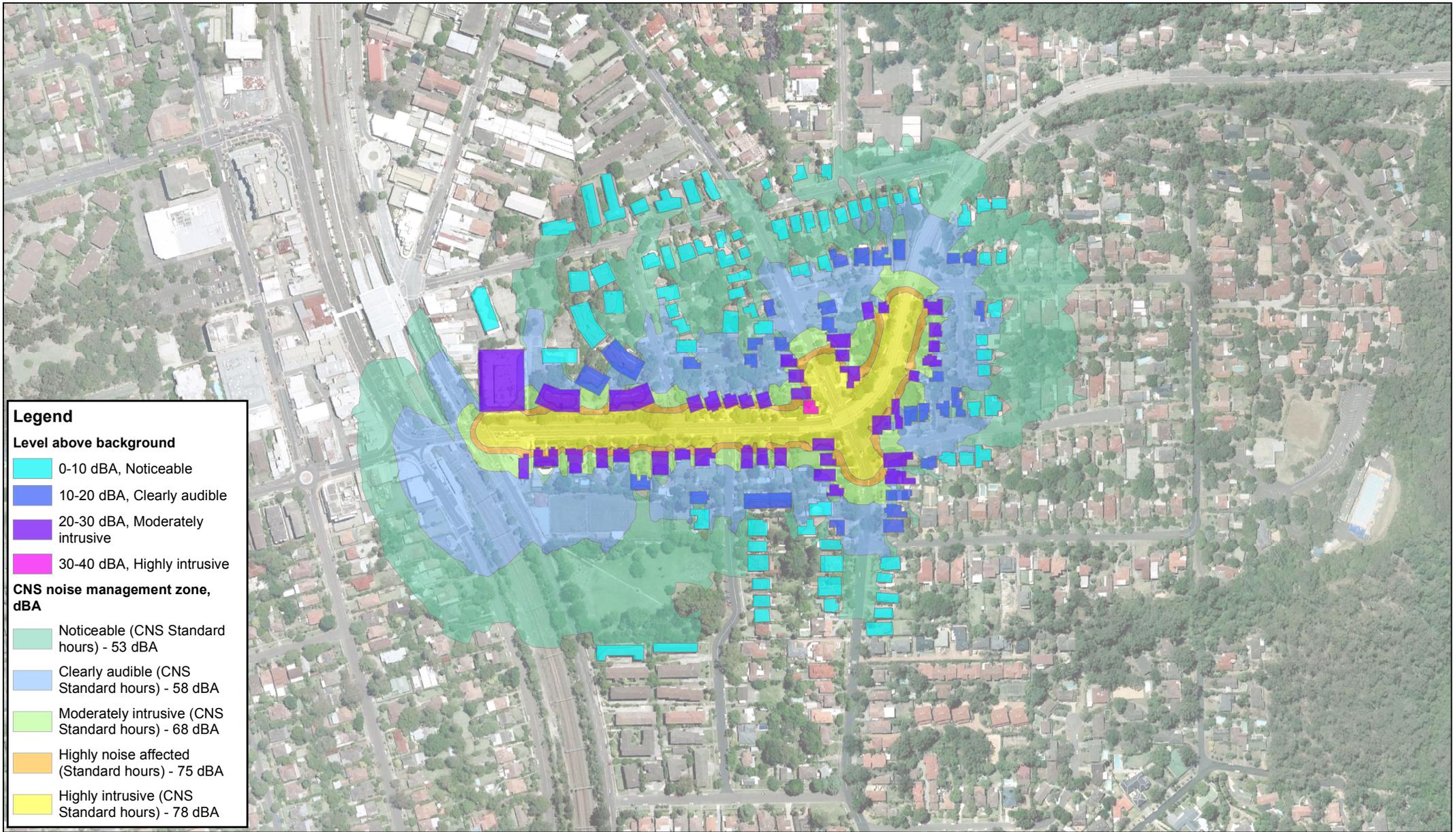
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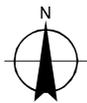
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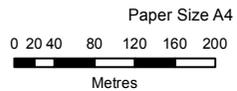
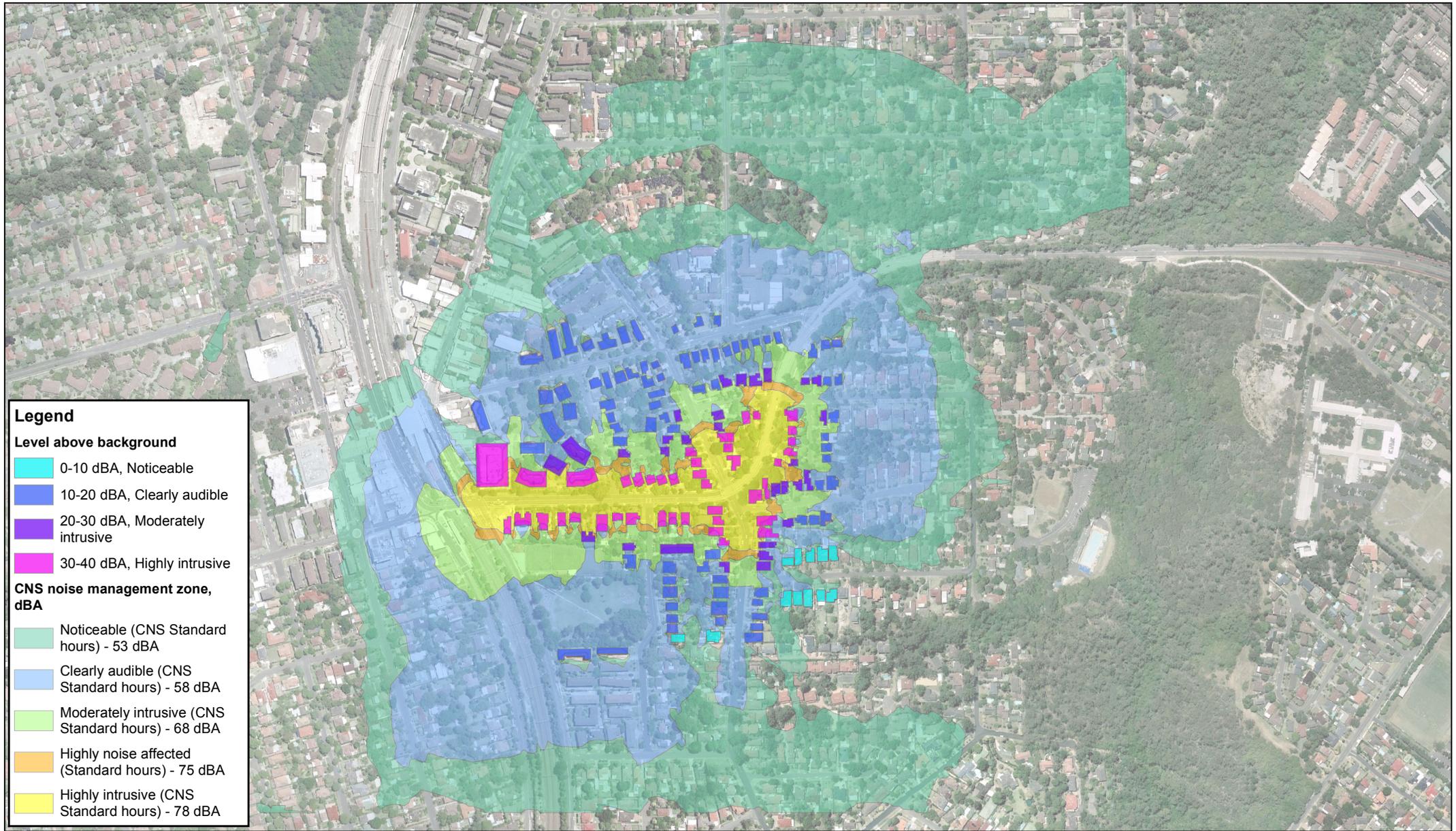
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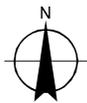
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Scenario 8: Road furniture installation
 construction noise management levels

Figure 5-8



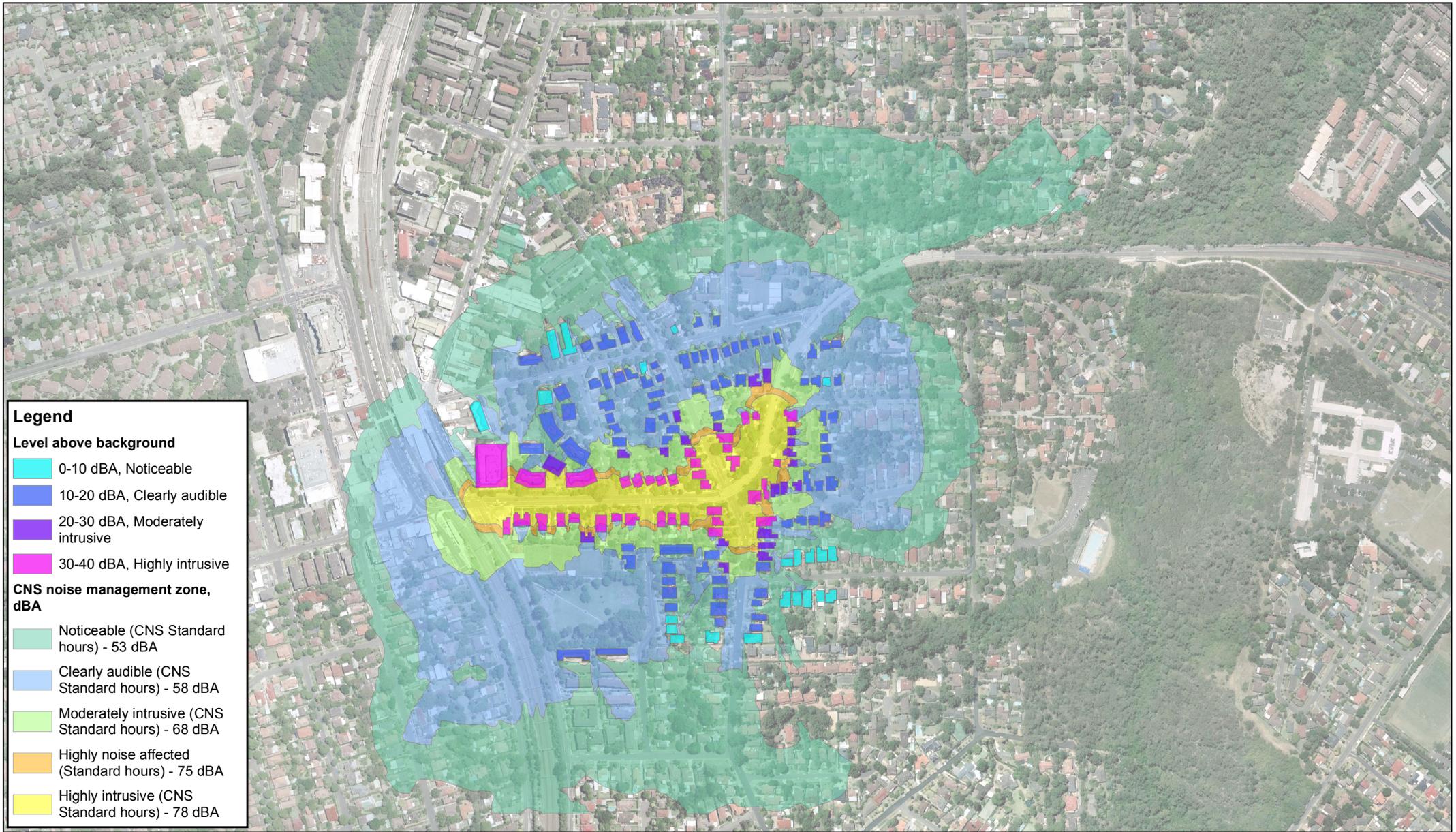
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Scenario 9: Local road works
construction noise management levels

Figure 5-9

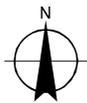


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Scenario 10: Resurfacing works
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Figure 5-10

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5.2.2 Compliance noise and vibration monitoring

Attended compliance noise or vibration monitoring should be undertaken to confirm the predicted noise or vibration levels upon receipt of a complaint. The ICNG guidelines state that complaint monitoring measurements should be taken at the complainant's location and the monitoring should cover the time of day when the impacts were reported to occur.

In the case that exceedances of the relevant annoyance criteria levels listed in this report are detected in relation to the complaint, the situation should be reviewed in order to identify means to minimise the impacts to residences.

In all cases, noise or vibration monitoring should be undertaken by a suitably qualified professional in accordance with ICNG guidelines.

5.2.3 Building condition inspections and vibration trials

Building condition inspections are recommended for any utility, structure or building when vibration generating activities are planned within 16 m and any heritage building within 27 m. Any utility, structure or building requiring a building inspection will be determined prior to construction works commencement.

Building condition inspection reports should also classify building structure and susceptibility to damage in accordance with the DIN 4150-3 classifications. The resulting building classifications are to be used for determination of the applicable DIN 4150-3 vibration criteria curves. Condition inspections are to identify high-risk buildings where additional vibration restrictions and more stringent criteria may apply.

Where construction activities generating vibration are to be undertaken at a distance of less than 16 m from a building and 27 m from a heritage building, initial vibration monitoring trials should be undertaken at the commencement of breaking, rolling and compacting activities. The initial vibration trials should include:

- Determine the frequency dependent DIN 4150-3 vibration criteria from the vibration generating equipment dominant frequencies
- Confirming safe working buffer distances for that equipment in that work area based on the frequency dependent DIN 4150-3 vibration criteria
- When vibration generating equipment is operating within the above confirmed buffer distances, additional vibration monitoring equipment should be deployed at the building foundation with a trigger level based on the frequency dependent DIN 4150-3 vibration criteria. If the vibration level on the equipment is reached a visual alarm should be triggered to alert the operators that the vibration criteria have been exceeded.

5.2.4 Human comfort impacts (vibration)

The construction works are considered short term by the *Assessing Vibration: a Technical Guideline* (DEC, 2006), therefore where alternative non-vibration inducing construction methods are impractical, the following principles from the guideline can be utilised to assist with minimisation of adverse reactions from the community.

- Confining vibration-generating operations to the least vibration-sensitive part of the shift – which could be when the background disturbance is highest
- Determining an upper level for vibration impact also considering what is achievable using feasible and reasonable mitigation
- Consulting with the community regarding the proposed events.

5.2.5 Community relations

Consultation and cooperation between the site and surrounding residents will assist in minimising uncertainty, misconceptions and adverse reactions to noise and vibration.

The *Environmental Noise Management Manual* (RTA, 2001) *Practice Note (vii)* provides community consultation procedures for road works outside normal working hours. This includes the following:

- Contact the local community potentially affected by the proposed works (outside of recommended construction hours) and inform them by letter of the proposed work, location, type of work days and dates of work and hours involved. The contact should be made five days prior to commencement of works
- A suitable advertisement should be placed in local papers including a reference to night-time noise impacts
- A community liaison phone number and permanent site contact should be provided so that complaints can be received and addressed in a timely manner
- Upon receipt of a noise complaint monitoring should be undertaken and reported as soon as possible. If exceedances are detected, the situation should be reviewed in order to identify means to attempt to reduce the impact to acceptable levels.

5.2.6 Minimum road works programming requirements

As road works are proposed and it is likely that sensitive receptors will be affected by noise and vibration above guideline levels, and/or receivers are within minimum distance setbacks set out in the CEMP.

- Program the work so that noise and vibration at night will not affect any single dwelling or group of dwellings, flats, units and other places of residence on more than two consecutive nights, or on more than a total of six nights over a period of one calendar month
- When night work is programmed in stages to comply with this requirement, the periods of work should be separated by not less than one week
- If programmed night work is postponed for any reason, the work should be reprogrammed and the programming requirements described above apply again
- Very noisy activities should be programmed for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11 pm
- Where practicable, work should be scheduled to avoid major student examination periods and times when students are studying for examinations, such as before and during the Higher School Certificate and at the end of higher education semesters.

If it is not practical to apply these minimum programming requirements, extra care will need to be taken in selecting and applying alternative and effective noise and vibration management measures. The CEMP must be regularly revised to account for changes in noise and vibration management strategies.

6. Conclusions

6.1 Construction

Construction works during standard construction hours are predicted to exceed the construction noise criteria at most residential receivers within the proposal area, with the most affected receivers located on Epping Road directly adjacent the construction activities. Feasible and reasonable noise mitigation measures have been recommended for implementation. Mitigation measures will minimise impacts at the surrounding residential receivers.

However, it is unlikely that implementation of all reasonable and feasible noise mitigation measures would reduce noise levels to below the construction noise criteria under all circumstances. These levels are anticipated to be short term for individual receivers as the works progress along the construction area, with receivers located off the main construction area (Epping Road) likely to have reduced levels due to screening from existing buildings.

6.2 Operational

The proposal is predicted to exceed the noise criteria, as discussed in Section 5.1. A review of the predicted noise levels and exceedances shows that eight sensitive receivers qualify for consideration of noise mitigation. At property treatments would be considered for these eligible sensitive receivers.

7. References

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