

Chapter 11

Operational noise and vibration



11 Operational noise and vibration

This chapter considers the potential noise and vibration impacts associated with the operation of the project. Potential noise and vibration impacts associated with the construction of the project are included in Chapter 10 (Construction noise and vibration).

A detailed noise and vibration assessment has been carried out for the project and is included in Appendix G (Technical working paper: Noise and vibration).

Common acoustic terms used throughout this chapter are explained in Chapter 10 (Construction noise and vibration).

The Secretary’s environmental assessment requirements as they relate to operational noise and vibration and where in the environmental impact statement these have been addressed, are detailed in Table 11-1.

The proposed environmental management measures relevant to operational noise and vibration are included in Section 11.7.

Table 11-1 Secretary’s environmental assessment requirements – operational noise and vibration

Secretary’s requirement	Where addressed in EIS
Noise and Vibration - Amenity	
1. The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must take into consideration and address the redistribution of traffic (including on local feeder roads) and operational plant and equipment, and must include consideration of impacts to sensitive receivers and include consideration of sleep disturbance and, as relevant, the characteristics of noise and vibration (for example, low frequency noise).	<p>Section 11.5 documents the impacts from the redistribution of traffic (including on local feeder roads) and operational plant and equipment.</p> <p>Chapter 10 (Construction noise and vibration) outlines the relevant NSW noise and vibration guidelines informing the construction noise and vibration assessment.</p>
Noise and Vibration - Structural	
1. The Proponent must assess construction and operation noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage).	<p>Section 11.2, Section 11.6 and Appendix G (Technical Working Paper: Noise and Vibration) presents details on the assessment of operation noise and vibration impacts in respect to relevant NSW noise and vibration guidelines as well as the consideration of impacts on the structural integrity of buildings and heritage significance items.</p> <p>Chapter 10 (Construction noise and vibration) details similar information in respect to construction impacts.</p>

11.1 Legislative and policy framework

Operational road traffic noise relating to State significant infrastructure projects is primarily regulated by the Department of Planning, Industry and Environment through project approval requirements under the *Environmental Planning and Assessment Act 1979*.

In addition, the *Protection of the Environment Operations (Noise Control) Regulation 2017* includes controls on noise from motor vehicles, while the *Heavy Vehicle (Vehicle Standards) National Regulation (NSW)* includes controls on noise from heavy vehicles.

The *Road Noise Policy* (DECCW, 2011) is the NSW Environment Protection Authority guideline which defines criteria to be used in assessing the impact of road traffic noise and to protect amenity and wellbeing. The policy is intended for use during the environmental assessment of road proposals to develop feasible and reasonable noise mitigation measures.

The *Road Noise Policy* (DECCW, 2011) is supported by the *Noise Criteria Guideline* (Roads and Maritime, 2015a) and the *Noise Mitigation Guideline* (Roads and Maritime, 2015b), which present a practical approach in applying the Road Noise Policy and address specific situations relevant to Transport for NSW road projects.

The *Noise Policy for Industry* (NSW EPA 2017a) provides intrusiveness and amenity criteria for fixed facilities that operate continuously and is relevant to the assessment of project components including substations, wastewater treatment plants and ventilation facilities.

11.2 Assessment methodology

The operational noise assessment for the project considered the potential impacts associated with changes in traffic noise and noise from the operation of fixed facilities. The assessment included the following key steps:

- Identification of potentially affected noise catchment areas (NCAs) and noise sensitive receivers, development of a study area for the assessment, and background noise monitoring to determine existing noise levels. These are documented in Chapter 10 (Construction noise and vibration)
- Confirmation of noise and vibration objectives with reference to the Road Noise Policy (DECCW, 2011) and the *Noise Criteria Guideline* (Roads and Maritime, 2015a)
- Selection and definition of the road traffic noise scenarios to be modelled and compared. Operational road traffic noise scenarios are presented in Table 11-2
- Calculation of road traffic noise changes for each scenario and for both the year of opening of the project and ten years after opening
- Prediction of operational noise from fixed facilities using the sound power levels expected from typical plant and equipment, for comparison against Noise Policy for Industry (NSW EPA, 2017a) intrusiveness and amenity criteria
- Identification of environmental management measures to avoid, minimise and mitigate noise and vibration impacts during operation.

Operational road traffic noise scenarios have been modelled at the anticipated year of opening of the project (2027) and ten years later (2037) (Table 11-2). These scenarios have been informed by road traffic volumes from the Sydney Motorway Planning Model (refer to Chapter 9 (Operational Traffic and Transport)).

Table 11-2 Operational road traffic noise modelling scenarios for year of opening of the project (2027) and ten years later (2037)

Scenario	Included projects				
	Western Harbour Tunnel and Warringah Freeway Upgrade	Beaches Link and Gore Hill Freeway Connection	WestConnex program of works	Sydney Gateway	F6 extension ¹
'Do nothing' ²	x	x	x	x	x
'Do minimum'	x	x	✓	x	x
'Do something'	✓	x	✓	x	x
'Do something cumulative'	✓	✓	✓	✓	✓

Note 1: For assessment at the year of opening Stage 1 of the F6 extension was included in the 'Do something cumulative' scenario. For 2037, the full F6 extension was included.

Note 2: The 'Do nothing' scenario was developed to investigate the project traffic noise impacts on receivers surrounding the surface connection to City West Link at Rozelle without the approved M4-M5, to address the issue of separate projects introducing or redistributing traffic across the road network in the area surrounding the Rozelle Interchange.

11.3 Assessment objectives and criteria

The operational noise and vibration assessment objectives and criteria applied to the project are summarised in the following sections and consider recommendations provided in the guidelines, policies and standards discussed in Section 11.1.

11.3.1 Road traffic noise

Residential receivers

Road traffic noise impacts on residential receivers are assessed using assessment criteria which are based on the type of road a residence is affected by the project. In some instances, residences may be exposed to noise from new and redeveloped roads or different functional classes of roads.

In addition to road traffic noise which exceeds the assessment criteria, large increases in the level of noise can change in the acoustic environment of a location, particularly for quieter areas. To address large increases in noise levels, relative increase criteria are used.

Where criteria for a particular road category or relative increase criteria are exceeded due to the project, reasonable and feasible mitigation is required.

A summary of the applicable road traffic noise criteria for residential receivers in accordance with the *Noise Criteria Guideline* (Roads and Maritime, 2015a) is presented in Table 11-3.

Table 11-3 Road traffic noise criteria for residential receivers (external)

Road category	Type of project/land use	Assessment criteria dB(A) ¹	
		Daytime (7am – 10pm)	Night-time (10pm – 7am)
Freeway/arterial/sub-arterial roads	Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors.	55 L _{Aeq(15hour)} ²	50 L _{Aeq(9hour)}
	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	60 L _{Aeq(15hour)}	55 L _{Aeq(9hour)}
	Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a transition zone ³ .	55–60 L _{Aeq(15hour)}	50–55 L _{Aeq(9hour)}
	Existing residences affected by increases in traffic noise of 12dB(A) or more from new freeway/arterial/sub-arterial roads.	42–55 L _{Aeq(15hour)}	42–50 L _{Aeq(9hour)}
	Existing residences affected by increases in traffic noise of 12dB(A) or more from redevelopment of existing freeway/arterial/sub-arterial roads.	42–60 L _{Aeq(15hour)}	42–55 L _{Aeq(9hour)}
Local roads	Existing residences affected by noise from new local road corridors.	55 L _{Aeq(1hour)}	50 L _{Aeq(1hour)}
	Existing residences affected by noise from redevelopment of existing local roads.		
	Existing residences affected by additional traffic on existing local roads generated by land use developments.		

Note 1: dB(A) stands for A-weighted decibel, a unit used to measure noise. Refer to Chapter 10 (Construction noise and vibration) for a comparison of dB(A) for various activities.

Note 2: L_{Aeq(15hour)} is the A-weighted equivalent noise level. It is the summation of noise events and integrated over a period of time.

Note 3: The applicable noise criteria for a particular receiver would be dependent on its location relative to where the new road joins the redeveloped road (transition zone). See Section 7.1 and Table 1 of the *Noise Criteria Guideline* (Roads and Maritime, 2015a) for further information.

Non-residential receivers

The *Noise Criteria Guideline* (Roads and Maritime, 2015a) also sets criteria for the assessment of road traffic noise on the internal and external areas of non-residential land uses, such as schools, hospitals, places of worship and recreation areas. For sensitive land uses such as schools, hospitals, places of worship and childcare centres, the criteria has been applied to internal areas to provide a conservative assessment of impacts. It is generally accepted that most buildings provide a noise reduction of at least 10dB(A) when windows are left 20 per cent open, without providing additional treatment. Therefore, where the noise goals are internal, a 10dB(A) reduction from

external noise levels to internal noise levels has been adopted to allow an external assessment. The applicable criteria are shown in Table 11-4.

Table 11-4 Criteria for non-residential sensitive land uses

Existing sensitive land use	Assessment criteria dB(A) ¹	
	Day (7am – 10pm)	Night (10pm – 7am)
School classrooms	40 L _{Aeq,1hour} ² (internal)	–
Hospital wards	35 L _{Aeq,1hour} (internal)	35 L _{Aeq,1 hour} (internal)
Places of worship	40 L _{Aeq,1hour} (internal)	40 L _{Aeq,1 hour} (internal)
Open space (active use)	60 L _{Aeq,15hour} (external) when in use	–
Open space (passive use)	55 L _{Aeq,15hour} (external) when in use	–
Childcare facilities	Sleeping rooms 35 L _{Aeq,1hour} (internal) Indoor play areas 40 L _{Aeq,1hour} (internal) Outdoor play areas 55 L _{Aeq,1hour} (external)	–
Aged care facilities	Residential land use noise assessment criteria apply	Residential land use noise assessment criteria apply

Note 1: dB(A) stands for A-weighted decibel, a unit used to measure noise. Refer to Chapter 10 (Construction noise and vibration) for a comparison of dB(A) for various activities.

Note 2: L_{Aeq(period)} is the A-weighted equivalent noise level. It is the summation of noise events and integrated over a period of time.

Road traffic noise impacts from existing roads

The *Noise Criteria Guideline* (Roads and Maritime, 2015a) provides guidance for assessing traffic noise from existing roads not subject to any redevelopment. This is where there is a predicted increase in traffic noise levels by more than 2 dB(A) on other roads due to changes in traffic volumes associated with the project. The criteria are provided in Table 11-5.

Table 11-5 Criteria for existing roads not subject to redevelopment

Existing road category	Target noise level dB(A) ¹	
	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/ arterial/ sub-arterial road	$L_{Aeq(15hour)}^2$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local road	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

Note 1: dB(A) stands for A-weighted decibel, a unit used to measure noise. Refer to Chapter 10 (Construction noise and vibration) for a comparison of dB(A) for various activities.

Note 2: $L_{Aeq(period)}$ is the A-weighted equivalent noise level. It is the summation of noise events and integrated over a period of time.

Maximum road traffic noise levels

Maximum noise levels are generally due to heavy vehicles passing by. The measured maximum noise level and the number of maximum noise level events are used as an indicator of the potential for sleep disturbance.

11.3.2 Sleep disturbance

Guidance for considering sleep disturbance due to maximum noise levels is provided in Practice Note iii of the *Environmental Noise Management Manual* (RTA 2001). The relevant considerations are:

- Calculation of maximum noise levels
- The extent to which the maximum noise levels for individual vehicle pass bys exceed the L_{Aeq} noise level for each hour of the night
- The number of maximum noise events.

At locations where road traffic is continuous rather than intermittent, the $L_{Aeq(9hour)}$ criteria for operational noise assessment accounts for sleep disturbance impacts. However, where the emergence of L_{Amax} over the ambient L_{Aeq} is equal to or greater than 15 dB(A), the $L_{Aeq(9hour)}$ criteria may not sufficiently account for sleep disturbance impacts.

The sleep disturbance assessment does not influence the degree of mitigation required but is used to rank and prioritise design options and noise mitigation strategies.

11.3.3 Operational road traffic mitigation

The 'Do minimum' (without the project but with the WestConnex program of works) and the 'Do something cumulative' (with the project and other projects) operational road traffic noise model scenarios were used to identify receivers impacted by the project.

The following *Noise Mitigation Guideline* (Roads and Maritime, 2015b) triggers were applied where a sensitive receiver may qualify for consideration of noise mitigation beyond the adoption of road design and traffic management measures:

- The predicted 'build' (with the project) noise level exceeds the *Noise Mitigation Guideline* (Roads and Maritime, 2015b) controlling criterion and the noise level increase due to the project (ie the noise predictions for the 'build' (with the project) minus the 'no build' (without the project)) is greater than 2 dB(A)

- The predicted 'build' (with the project) noise level is 5 dB(A) or more above the criteria (meets or exceeds the cumulative limit) and the receptor is significantly influenced by project road noise, regardless of the incremental impact of the project
- The noise level contribution from the project is acute then it qualifies for consideration of noise mitigation even if noise levels are dominated by another road. Acute noise level for day time (7am to 10pm) $L_{Aeq(15hour)}$ is 65 dB(A) or higher, and for night time (10pm to 7am) $L_{Aeq(9hour)}$ is 60 dB(A) or higher.

A noise barrier analysis was also completed to identify reasonable and feasible locations where barriers would be provided. The analysis follows the *Noise Mitigation Guideline* (Roads and Maritime, 2015b) and *Noise Wall Design Guideline* (Roads and Maritime, 2016b).

11.3.4 Operational noise from fixed facilities

Noise impacts from fixed facilities were assessed against the *Noise Policy for Industry* (NSW EPA, 2017a) which includes both intrusiveness and amenity criteria. The intrusiveness criterion aims to minimise noise increases from a single new development by applying a criterion of 5 dB(A) above background levels, while the amenity criteria aims to limit continuing increases in ambient noise by applying recommended levels for certain receiver types. The more stringent of the two applies.

11.4 Existing noise environment

The existing noise environment, including ambient noise levels, is described in Chapter 10 (Construction noise and vibration). This environment status would also be applicable to the operation stage of the project.

11.5 Assessment of potential impacts – noise

11.5.1 Overview

This section provides an assessment of operational road traffic noise impacts for surface roads associated with the project as well impacts from project operational facilities. This assessment is for environmental impact assessment and planning approval purposes and will be reviewed and adjusted if required during the detailed design phase.

11.5.2 Operational tunnel traffic noise

Noise from traffic travelling through the tunnels would be contained within the tunnels and would not impact noise sensitive receivers or heritage structures. Refer to Section 11.6 for a discussion on ground-borne noise and vibration impacts from traffic travelling through tunnels and portals.

11.5.3 Operational road surface traffic noise before mitigation

The operational road traffic noise model scenarios listed in Table 11-2 were first considered before the inclusion of additional or augmented noise barriers, but do consider the following:

- Existing noise barriers

- Quieter pavement for some surface roads providing up to 2 dB(A) noise reduction benefits (compared to dense graded asphalt).

This analysis is presented below.

‘Do something’ scenario

Table 11-6 shows predicted changes in noise levels for receivers under a ‘Do minimum’ (without the project but with the WestConnex program of works) and ‘Do something’ (with the project and the WestConnex program of works) noise model scenarios for sensitive receiver buildings surrounding the surface connection to City West Link at Rozelle and the Warringah Freeway.

Table 11-6 Predicted changes in noise levels before mitigation (2037 ‘Do minimum’ scenario compared to ‘Do something’ scenario)¹

Location	Number of receiver buildings experiencing changes in noise levels from operational traffic					
	Noise level reduction		0 dB(A) ² – 2 dB(A)		> 2 dB(A)	
	Day	Night	Day	Night	Day	Night
Surface connection to City West Link at Rozelle	590	442	2498	2647	7	6
Warringah Freeway	4652	5487	2058	1223	54	54

Note 1: The ‘Do something’ scenario includes the Western Harbour Tunnel and Warringah Freeway Upgrade project and WestConnex program of works.

Note 2: dB(A) stands for A-weighted decibel, a unit used to measure noise. Refer to Chapter 10 (Construction noise and vibration) for a comparison of dB(A) for various activities.

Overall:

- The project is predicted to reduce traffic noise for about 57 per cent of receiver buildings within noise catchment areas surrounding the project surface road works
- Forty-two per cent of receiver buildings are predicted to experience traffic noise level increases of less than 2 dB(A) which represents a minor impact that is likely to be barely perceptible
- One per cent of receiver buildings are predicted to experience increases greater than 2 dB(A) due to the project.

The project is predicted to decrease the number of receiver buildings exceeding the relevant noise criteria when compared to the ‘Do Minimum’ scenario during the day and night periods at noise catchment areas surrounding the Warringah Freeway Upgrade and the Gore Hill Freeway Connection. This is due to traffic being moved from the existing surface roads into the proposed tunnels.

The project is also predicted to increase the number of receiver buildings exceeding the relevant noise criteria when compared to the ‘Do minimum’ scenario during the day and night periods at noise catchment areas surrounding the surface connection to City West Link at Rozelle. This is due to an anticipated increase in traffic volumes on some surface roads in the area leading to and from the tunnels as motorists travel to and from surrounding areas to utilise the tunnels.

‘Do something cumulative’ scenario

Table 11-7 shows predicted changes in noise levels for receivers under a ‘Do minimum’ (without the project but with the WestConnex program of works) and ‘Do something cumulative’ (with the project and other projects) noise model scenarios for sensitive receiver buildings surrounding the surface connection to City West Link at Rozelle and Warringah Freeway Upgrade

Table 11-7 Predicted changes in noise levels before mitigation (2037 ‘Do Minimum’ scenario compared with ‘Do something cumulative’ scenario)¹

Location	Number of receiver buildings experiencing changes in noise levels from operational traffic					
	Noise level reduction		0 dB(A) ² – 2 dB(A)		> 2 dB(A)	
	Day	Night	Day	Night	Day	Night
Surface connection to City West Link at Rozelle	509	319	2505	2724	81	52
Warringah Freeway Upgrade	5140	5923	1588	808	36	33

Note 1: ‘Do something cumulative’ scenario includes the following projects: Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, WestConnex program of works, Sydney Gateway, and the F6 extension.

Note 2: dB(A) stands for A-weighted decibel, a unit used to measure noise. Refer to Chapter 10 (Construction noise and vibration) for a comparison of dB(A) for various activities.

Refer to Appendix P of Appendix G (Technical working paper: Noise and vibration) for the location of receiver buildings identified in Table 11-7.

Overall:

- The project in combination with other projects is predicted to reduce traffic noise for about 60 per cent of receiver buildings within noise catchment areas surrounding the project surface road works
- Thirty-nine per cent of receiver buildings are predicted to experience traffic noise level increases of less than 2 dB(A), which represents a minor impact that is likely to be barely perceptible
- One per cent of receiver buildings are predicted to experience increases greater than 2 dB(A).

The cumulative traffic from the project and other major road projects is predicted to reduce the number of receiver buildings exceeding the relevant noise criteria when compared to the ‘Do minimum’ scenario during the day and night periods at noise catchment areas surrounding the Warringah Freeway. This is due to traffic being moved from the existing surface roads into the proposed tunnels.

The cumulative traffic from the project and other major road projects is predicted to increase the number of receiver buildings exceeding the relevant noise criteria when compared to the ‘Do minimum’ scenario during the day and night periods at noise catchment areas surrounding the surface connection to City West Link at Rozelle. This is due to an anticipated increase in traffic volumes on some surface roads in the area leading to and from the tunnels as motorists travel to and from surrounding areas to utilise the tunnels.

11.5.4 Operational surface road traffic noise after mitigation

Noise barriers

Noise barriers are considered reasonable and feasible where four or more receivers trigger consideration of noise mitigation and are closely grouped (ie facades are separated by less than 20 metres), where the barriers do not make access to properties difficult, and where they are visually acceptable. A maximum allowable height has been adopted for each new and adjusted noise barrier, considering the following factors:

- Noise abatement
- Urban design, overshadowing and visual impacts
- Impacts to private land (including future land uses and development potential)
- Constructability and engineering constraints.

Noise barriers would be provided or extended as part of the project where reasonable and feasible to reduce road traffic noise to acceptable levels for sensitive receivers. Refer to Chapter 5 (Project description) for noise barrier proposed locations.

The project does not propose to remove existing noise barriers.

Receiver buildings potentially eligible for consideration of additional noise mitigation

Further assessment has been conducted to compare the 'Do minimum' and the 'Do something cumulative' scenarios, including proposed low noise pavement and proposed new and existing extended noise barriers.

Table 11-8 identifies the number of receivers to be considered for at-property treatment after low noise pavement and new and existing extended noise barriers have been included. At-property treatments may include but are not limited to ventilation, glazing, window and door seals, sealing of vents and underfloor areas.

Noise mitigation options (quieter pavement, noise barriers, at-property treatment or a combination) will be reviewed and confirmed as part of the further design development taking into consideration community preferences.

Receivers identified for at-property treatment within noise catchment areas surrounding the surface connection to City West Link at Rozelle will be mitigated either:

- Under the M4-M5 Link project Minister's Conditions of Approval (Condition E87), or
- When predicted operational road traffic noise increases greater than 2 dB(A) due to multiple projects.

Therefore, Table 11-8 does not present a summary of at-property treatment for receivers within noise catchment areas surrounding the surface connection to City West Link at Rozelle. At-property treatment requirements will be confirmed during further design development.

Refer to Appendix R of Appendix G (Technical working paper: Noise and vibration) for the location of receiver buildings identified in Table 11-8.

Table 11-8 Receiver buildings potentially eligible for consideration of additional noise mitigation¹

NCA ²	Location	Number of receiver floors ³	Number of receiver buildings
Surface connection to City West Link at Rozelle			
At property treatment to be provided under the M4-M5 Link project Minister's Conditions of Approval (Condition E87) or when predicted operational road traffic noise increases greater than 2 dB(A) due to multiple projects. At-property treatment requirements will be confirmed during further design development.			
Warringah Freeway			
15.4	Lavender Bay	1	1
16.1	Milsons Point	193	17
16.3	North Sydney – south-west	43	5
17.1	Kirribilli	22	12
17.2	Kirribilli	37	10
17.3	North Sydney – east	86	37
17.4	Neutral Bay	67	30
18.1	Kirribilli	2	1
19.1	North Sydney – north-west	55	16
20.1	North Sydney – north-west	37	10
21.1	North Sydney	26	11
21.2	North Sydney	49	13
22.1	North Sydney	41	23
22.3	Crows Nest	14	5
23.1	Neutral Bay	64	43
23.2	North Sydney	48	16
24.1	Crows Nest	13	5
25.1	Cammeray	43	27
28.1	Cremorne	2	1

NCA ²	Location	Number of receiver floors ³	Number of receiver buildings
29.1	Cremorne	33	20
30.1	Crows Nest	35	24
30.2	Naremburn	12	11
30.3	Cammeray	11	11
31.2	Cammeray	3	2
31.3	Naremburn	21	18
Total Warringah Freeway		958	369

Note 1: Number of receivers considered for at-property treatment would be subject to consideration of community preferences and to further design development

Note 2: Noise catchment area is an area where noise and vibration sensitive receivers have similar acoustic environment. Refer to Figure 10-1 in Chapter 10 (Construction noise and vibration) for location of noise catchment areas.

Note 3: Receiver floors represent the individual receiver floor levels of a multi-level building. For example, a 10-storey residential apartment block would have ten receiver floors and one receiver building.

11.5.5 Maximum road traffic noise level

Where road traffic noise dominates the noise environment, maximum noise levels (mainly generated by heavy vehicles) have the potential to cause disturbance to sleep.

Changes in the maximum noise levels and the number of events generating these levels would depend on changes in traffic volumes and changes on road alignment or width.

The project is predicted to increase maximum noise levels events at sensitive receivers within NCA 23.1 where sensitive receivers to the east of the Warringah Freeway are predicted to experience an increase in maximum noise levels and the number of events compared to the existing situation. This is due to the widening of the Warringah Freeway resulting in the southbound carriageway moving closer to the receivers in these NCAs.

Maximum noise levels are not expected to significantly change as a result of the project within other noise catchment areas where no major road realignments or widening would be carried out.

Changes in maximum noise levels are a consideration when prioritising and ranking mitigation strategies and will be considered during further design development. Mitigation measures to be considered are described in Section 11.5.4.

11.5.6 Operational facilities

Table 11-9 compares predicted fixed facility noise levels with *Noise Policy for Industry* (NSW EPA 2017a) intrusiveness and amenity criteria. No criteria exceedances are predicted with the exception of a 3 dB(A) exceedance for the nearest receiver building within NCA 4.2 due to the operation of the Rozelle wastewater treatment plant. Noise predictions and assessment of operational fixed facilities will be updated, when actual types, makes and models of the plant and equipment are confirmed.

Table 11-9 Predicted noise levels ($L_{Aeq,15min}$)¹ from fixed facilities, dB(A)

Location	NCA ²	Project noise criteria ³		Predicted noise level
		Intrusiveness	Amenity	
Rozelle	NCA 3.2	49	43	35
	NCA 3.3	49	43	37
	NCA 4.2	42	43	45
Cammeray	NCA 26.2	42	43	40
	NCA 26.1	46	43	38
	NCA 23.1	49	43	39
	NCA 23.2	42	43	39
	NCA 24.1	42	43	37
	NCA 25.1	48	43	36
	NCA 29.1	52	43	35

Note 1: $L_{Aeq(15min)}$ is the A-weighted equivalent noise level. It is the summation of noise events and integrated over a period of 15 minutes.

Note 2: Noise catchment area is an area where noise and vibration sensitive receivers have similar acoustic environment. Refer to Figure 10-1 in Chapter 10 (Construction noise and vibration) for location of noise catchment areas.

Note 3: Project noise levels based on night time period. Most stringent criteria used for assessment is shown in bold font.

11.6 Assessment of operational impacts – ground-borne noise and vibration

The potential for operational ground-borne noise and tactile vibration impacts on nearby sensitive receivers from traffic on project surface roads and tunnels has been reviewed.

Vibration emissions from traffic travelling on roads typically occur where there are irregularities in the road surface (eg pot holes).

As the new and upgraded roads on the surface and in the tunnels associated with the project would be designed and constructed to avoid road irregularities, operational ground-borne noise and tactile vibration impacts from operation traffic are not expected.

Vibration impacts from traffic travelling on the proposed surface roads, through tunnels and portals are considered negligible and are unlikely to result in ground-borne noise or tactile vibration impacts to sensitive receivers directly adjacent to surface roads, tunnels and portals.

Similarly, vibration from operational fixed facilities is not anticipated to exceed objectives given the distance between these facilities and the nearest sensitive receiver.

11.7 Environmental management measures

Environmental management measures for potential noise and vibration impacts during operation are outlined in Table 11-10. Additional measures to address cumulative impacts are included in Chapter 27 (Cumulative impacts).

Table 11-10 Environmental management measures for operational noise and vibration impacts

Ref	Phase	Impact	Environmental management measure	Location
ONV1	Operation	Operational road traffic noise	The operational noise performance of the project will be reviewed during detailed design and operational noise mitigation (low noise pavement, noise barrier, at-property treatment or a combination of treatments) will be confirmed in accordance with relevant policies and guidelines.	WHT/WFU
ONV2	Operation	Operational road traffic noise	Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance (as reviewed during detailed design) to analyse the effectiveness of the operational road traffic noise mitigation measures. Additional reasonable and feasible mitigation will be considered where any additional receivers are identified as qualifying for consideration of noise mitigation under the <i>Noise Mitigation Guideline</i> (Roads and Maritime, 2015b).	WHT/WFU
ONV3	Operation	Operational fixed facilities	Operational fixed facilities will be designed to meet project specific noise criteria derived in accordance with the <i>Noise Policy for Industry</i> (NSW EPA, 2017a).	WHT/WFU

Western Harbour Tunnel = WHT, Warringah Freeway Upgrade = WFU.

