

## Chapter 6

# Noise



A full assessment of the potential impacts on noise from the project was conducted as part of the Environment Effects Statement (EES) (Technical Report I: *Noise and vibration impact assessment*, hereafter referred to as the EES noise study).

The EES noise study predicted that noise levels during dredging and operation of the project are expected to be within limits set by the Environment Protection Regulations 2021 at noise sensitive receivers. The potential for cumulative noise impacts from the existing industries combined with noise emissions from project operation was predicted at Geelong Grammar School at night only. However, it was considered highly unlikely that this exceedance would occur as it represented the 'worst case' night period scenario (including noise enhancing weather conditions). The EES noise study concluded that potential cumulative noise impacts would be avoided through scheduling of operational activities to avoid the concurrence of all activities at night.



The Inquiry and Advisory Committee (IAC) found that the operational noise modelling had been undertaken to an acceptable level and showed that the operational noise effects of the project would be able to be managed to an acceptable level. (IAC Report No. 1, section 12.5 (iv)). However, this conclusion was contingent on further assessment of background and cumulative noise effects with the refinery and other industrial sources and the assessment in future of the actual FSRU and project components (IAC Report No. 1, section 12.4 (iv)).

This chapter provides a summary of the supplementary noise impact assessment that has been undertaken in response to Recommendation 10 in Table 1 of the Minister for Planning's Directions (Minister's Directions) for the Viva Energy Gas Terminal Project (the project) Supplementary Statement.

This chapter summarises the outcomes of the following technical assessment:

- Technical Report D: Supplementary noise impact assessment.

The objectives of this chapter are to:

- Provide a summary of the technical response to Recommendation 10 of the Minister's Directions.
- Integrate the outcomes of the supplementary noise impact assessment with key outcomes of the EES noise study.
- Provide an update to the EES noise mitigation measures where necessary.

## Overview

The Minister's Direction relevant to the supplementary noise study was Recommendation 10 which required the further assessment of noise impacts set out in mitigation measure MM-NV05 in Appendix G of the Inquiry and Advisory Committee's Report No. 2 (please refer to **Section 6.1.1** for MM-NV05).

This further assessment involved characterising the existing noise environment to enable recalculation of the regulatory noise limits, comparing pre-existing noise, project noise and combined pre-existing and project noise against the recalculated noise limits, and the development of project-specific noise criteria.

Background noise monitoring was undertaken at eight noise sensitive locations selected as being representative of Geelong Grammar School (GGS) and other noise sensitive areas surrounding the project and it was verified that background noise levels recorded at Avalon College (BG3 and BG4) and Norlane (BG5) are not influenced by intrusive noise from the refinery or other commercial, industrial or trade premises.

Background noise levels recorded at GGS (BG1 and BG2) are influenced by noise from the refinery and the surrounding port and industrial area, therefore BG4 was used as a representative background location to determine the noise limits at GGS.

Background noise levels recorded at 12 Myrtle Grove, North Shore (BG6) are influenced by intrusive noise from the surrounding port and industrial area (but not from the refinery), however background noise levels recorded at 36 Walker Street, Rippleside (BG7) are not. Therefore, BG7 was used as a representative background location to determine the noise limits at North Shore dwellings.

In accordance with the Noise Protocol (EPA Victoria Publication 1826.4: *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*), the background noise levels were used to re-calculate the regulatory noise limits.



Assessment of potential noise impacts was undertaken by comparing measurements of pre-existing industrial noise, modelled dredging, modelled project operational noise and cumulative noise from pre-existing industry and the project itself with the recalculated limits. Neutral weather conditions, with wind speeds up to 0.5 metres per second at a height of 10 metres, and noise enhancing weather conditions i.e. weather conditions favourable to sound propagation, with wind speeds up to 3 metres per second at a height of 10 metres, were considered as part of the assessment. The following conclusions were made:

- The measured, pre-existing industrial noise is at or below the recalculated noise limits under neutral weather conditions at all times and at all sensitive receiver locations. However pre-existing industrial noise exceeds the night period noise limit by up to 2dB at GGS and potentially by 1dB at Corio and North Shore dwellings under noise enhancing weather conditions.
- Predicted noise levels from dredging and project operation are at or below the recalculated noise limits at all sensitive receiver locations at all times, for both neutral and noise enhancing weather conditions.
- There are potential cumulative noise exceedances, from pre-existing industry and dredging activities, under noise enhancing weather conditions, at GGS for the evening and night periods and at Corio and North Shore dwellings during the night. Contingency measures would be implemented in accordance with mitigation measure MM-NV04 such that dredging operations would cease until the relevant period noise limits are met.
- Cumulative, i.e., combined pre-existing industrial and project operation, noise levels are at or below the recalculated noise limits at all sensitive receiver locations at all times, for neutral weather conditions. Cumulative noise levels are at or below the recalculated noise limits at all sensitive receiver locations during the day and evening under noise enhancing weather conditions. As

pre-existing industry noise currently exceeds night period noise limits under noise enhancing weather conditions at GGS and North Shore dwellings there are predicted cumulative exceedances of the night period noise limits at these locations in noise enhancing weather conditions. The potential cumulative exceedance is predicted to be up to 3dB (i.e., a just perceptible change in apparent loudness to the human ear, noting that changes in the character of the noise or its frequency spectrum may result in a more discernible change).

Project Noise Criteria have been proposed at 10dB below the noise limits which will ensure that project operational noise does not contribute to the effective noise level and consequently, does not contribute to cumulative noise. Continued implementation of mitigation measure MM-NV05 will ensure that noise emissions from project operational activities are managed such that Project Noise Criteria are met through iterative review and implementation of all reasonably practicable measures to reduce operational noise emissions.

## 6.1 Methodology

### 6.1.1 Minister's Directions

**Table 6-1** of the Minister's Directions consolidates the recommendations for further work to inform the Supplementary Statement. The Minister's Direction relevant to the supplementary noise impact assessment is presented in **Table 6-1** below.

**Table 6-1** Minister's Direction relevant to the supplementary noise study

Recommendation	Description	Section addressed
Recommendation 10	<p data-bbox="416 600 1195 685">Undertake the further assessment of noise impacts set out in mitigation measure MM-NV05 in Appendix G of the Inquiry and Advisory Committee's Report No. 2.</p> <p data-bbox="416 703 536 734"><b>MM-NV05</b></p> <p data-bbox="416 743 1038 775"><i>Establishing and implementing operational noise controls</i></p> <p data-bbox="416 784 1401 869">An operational noise management framework will be prepared that will inform, through all stages of the project, including design, equipment selection, construction, and installation, and operation, how actions will be taken to:</p> <ul data-bbox="416 891 1425 1182" style="list-style-type: none"> <li>• manage emissions of noise and vibration and minimise their impacts, so far as reasonably practicable, and</li> <li>• prevent the emission of unreasonable noise (as defined in the Environment Protection Act 2017), by               <ul style="list-style-type: none"> <li>– not exceeding the noise limits set in Part 5.3, Division 3 of the Environment Protection Regulations 2021; and</li> <li>– having regard to the factors in part (a) of the definition of unreasonable noise; and</li> <li>– managing low frequency noise, in accordance with the Noise guidelines: assessing low frequency noise (EPA Publication 1996) (as amended or replaced from time to time).</li> </ul> </li> </ul> <p data-bbox="416 1200 1241 1232"><i>Regulatory noise limits, pre-existing industry noise and Project Noise Criteria</i></p> <p data-bbox="416 1240 1107 1272">To inform the design, construction and operation of the project:</p> <ul data-bbox="416 1285 1433 1612" style="list-style-type: none"> <li>• Background noise levels shall be measured and verified without the inclusion of noise from Viva Refinery and from other commercial, industrial and trade premises, with noise limits of Part 5.3, Division 3 of the Environment Protection Regulations 2021 established accordingly.</li> <li>• Further assessment of the pre-existing noise from commercial, industrial and trade premises (from the Viva Refinery and from other commercial, industrial and trade premises) shall be carried out based on measurements taken over a period of at least 1-week to determine existing LAeq,30-min noise impacts and the likely cumulative noise impacts at Geelong Grammar School and at other noise sensitive areas. If background noise cannot be measured without impacts from Viva Refinery it will be measured during a period of plant shut down.</li> <li>• Establish and justify, supported by documented evidence, Project Noise Criteria to ensure that the noise from the Project, when combined to the pre-existing noise from commercial, industrial and trade premises will not lead to an exceedance of the regulatory noise limits.</li> </ul> <p data-bbox="416 1630 703 1662"><i>Plant design and selection</i></p> <ul data-bbox="416 1675 1409 2103" style="list-style-type: none"> <li>• Ensure, via iterative reviews, that all reasonably practicable opportunities to reduce the emission of operational noise have been considered across the design, construction and operation of the project.</li> <li>• Engage a suitably qualified acoustic consultant to review detailed plant designs and noise emission data for plant and vessels, and provide noise mitigation advice.</li> <li>• Operational plant selection process must ensure that manufacturers' data or noise measurement data to be verified for all operational equipment to ensure that tonality is not present.</li> <li>• Low frequency noise emissions from operational plants, including (but not limited to) from the following items, which must be assessed and managed in accordance with EPA Publication 1996 (as amended or replaced from time to time):               <ul style="list-style-type: none"> <li>– LNG carriers</li> <li>– FSRU vessels</li> <li>– Tugboat exhausts</li> <li>– Regasification boilers</li> </ul> </li> </ul>	Sections 6.3.1, 6.3.2 and 6.3.3

Recommendation	Description
	<p data-bbox="416 600 751 629"><i>Operational management plan</i></p> <ul data-bbox="416 647 1422 1160" style="list-style-type: none"> <li data-bbox="416 647 1422 757">• Noise from the Project will be managed in accordance with the Environment Protection Regulations 2021, EPA Publication 1826 (as amended or replaced from time to time) and the General Environmental Duty, including cumulative noise impacts from any other industry.</li> <li data-bbox="416 770 1422 999">• Prepare an operational management plan, supported by documented evidence that details the approach that will be taken to meet the Project Noise Criteria. This plan will include: <ul data-bbox="448 875 1422 999" style="list-style-type: none"> <li data-bbox="448 875 1187 904">– how the noise from LNG carriers will be taken into account and managed;</li> <li data-bbox="448 907 1163 936">– details of equipment selections and mitigation measures adopted; and</li> <li data-bbox="448 938 1422 999">– scheduling to ensure all activities minimise noise emissions. For example, during the night period, limit the number of activities operating concurrently.</li> </ul> </li> <li data-bbox="416 1023 1422 1099">• Review and update the operational management plan wherever necessary and relevant, including on the basis of any noise monitoring carried out to assess noise emissions from the Project, cumulative noise impacts or adverse noise character identified.</li> <li data-bbox="416 1111 1422 1160">• Additional cumulative impact management strategies will be developed in consultation with the relevant stakeholders.</li> </ul> <p data-bbox="416 1182 735 1211"><i>Operational noise monitoring</i></p> <p data-bbox="416 1223 1366 1279">Operational noise monitoring will be undertaken to confirm operational noise levels and verify cumulative noise impacts.</p> <ul data-bbox="416 1301 1422 2002" style="list-style-type: none"> <li data-bbox="416 1301 1422 1469">• Within the first 3 months of operation, conduct long-term noise monitoring (over a minimum of 1 month) in accordance with the Noise Protocol and the provisions of EPA Publication 1997 (as amended or replaced from time to time), to verify that the Project Noise Criteria and/or regulatory noise limits are not exceeded at Geelong Grammar School and other noise sensitive areas. The measurements shall be undertaken for all operating scenarios to verify the noise emissions.</li> <li data-bbox="416 1480 1422 1536">• Measurements will also be undertaken as part of the Environmental Management Plan in response to any community complaints.</li> <li data-bbox="416 1547 1422 1603">• Operational noise monitoring will inform ongoing updates to the operational management plan including potential scheduling of activities and mitigation measures if required.</li> <li data-bbox="416 1615 1422 1727">• Wherever the noise emissions from the Project are measured to exceed the Project Noise Criteria, or the cumulative Industry noise is measured to exceed the regulatory noise limits, additional attenuation and/or management controls shall be implemented and measurements repeated until compliance is demonstrated.</li> <li data-bbox="416 1738 1422 1816">• Further noise monitoring should be conducted to verify the effectiveness of the attenuation and/or management controls to prevent exceedances of the Project Noise Criteria and the regulatory noise limits.</li> <li data-bbox="416 1827 1422 1906">• Where management and scheduling for the operational activities is changed, the risk of exceedance of the Project Noise Criteria and the regulatory limits must be assessed, and wherever relevant further noise monitoring should also be conducted to verify compliance.</li> <li data-bbox="416 1917 1422 2002">• Where management and scheduling for the operational activities is changed, the risk of exceedance of the Project Noise Criteria and the regulatory limits must be assessed, and wherever relevant further noise monitoring should also be conducted to verify compliance.</li> </ul>



Specifically, Item 2 of mitigation measure MM-NV05, *Regulatory noise limits, pre-existing industry noise and Project Noise Criteria* addresses the further assessment of noise impacts set out in Recommendation 10, and the three points for further assessment work noted by the IAC, namely characterisation of the pre-existing noise environment, determination of appropriate noise limits and demonstration of compliance with those noise limits and the General Environmental Duty (GED).

A summary of the tasks that were undertaken to address the three items of further work are provided below:

- Methodology for Recommendation 10a: Carry out noise measurements to enable determination of background noise levels for Geelong Grammar School (GGS) and other noise sensitive areas without inclusion of intrusive noise from commercial, industrial or trade premises and recalculate the regulatory noise limits for GGS and other noise sensitive areas using these background noise levels.
- Methodology for Recommendation 10b: Carry out measurements of pre-existing noise at GGS and at other noise sensitive areas and undertake further assessment of pre-existing, project and cumulative (i.e., pre-existing noise combined with project noise) noise impacts informed by the results of the additional noise monitoring.
- Methodology for Recommendation 10c: Establish Project Noise Criteria.
- Identify any additional mitigation measures, if necessary.
- Confirm the significance level of noise impacts from dredging and project operation.

### 6.1.2 Study area

Consistent with the EES noise study the study area for the supplementary noise study extends up to 5km from the proposed location of the FSRU to include sensitive receivers that could be impacted by noise during the construction and operation phases of the project. These sensitive receivers are shown in **Figure 6-1**.

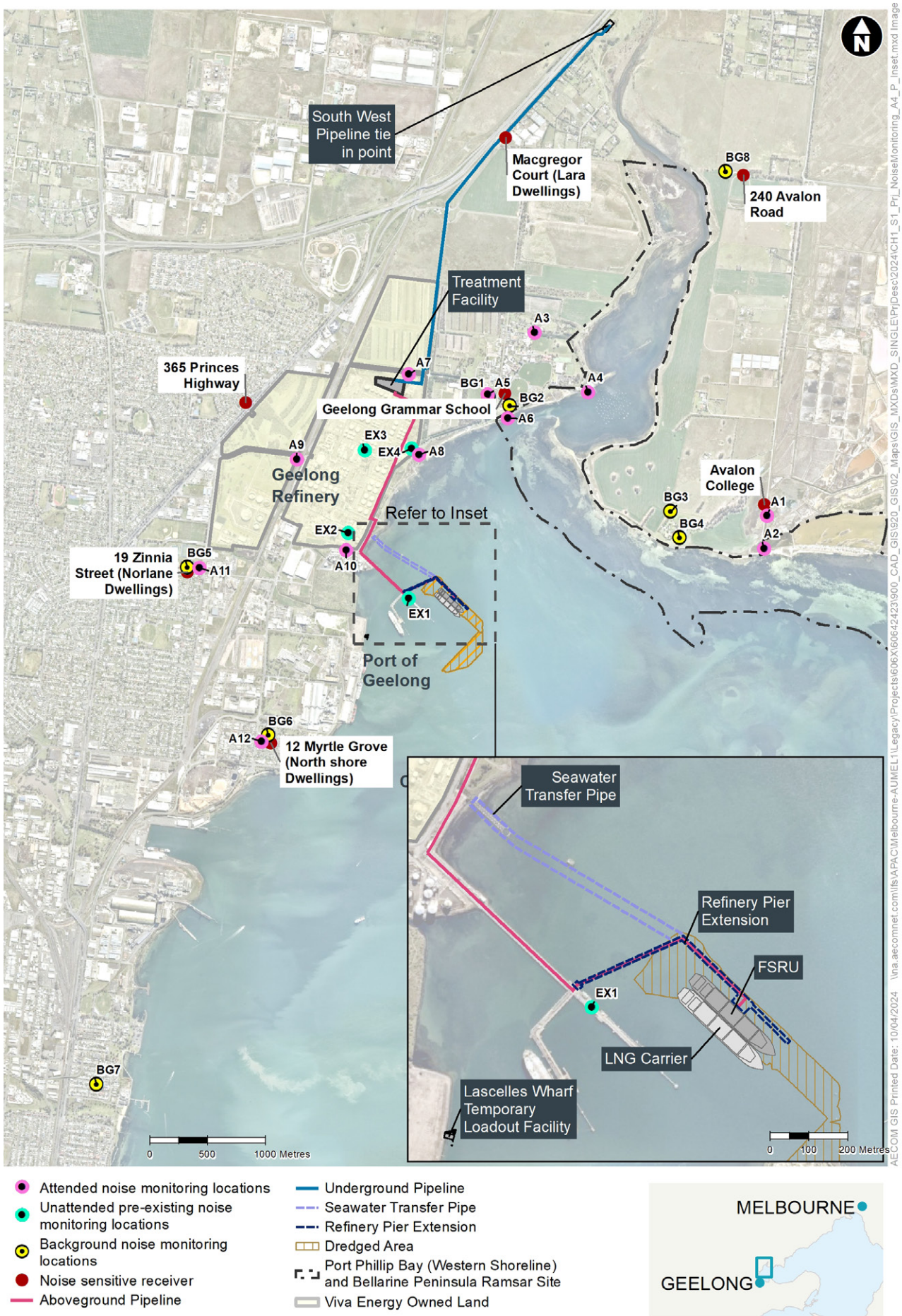


Figure 6-1 Noise sensitive receivers and monitoring locations

## 6.2 Summary of the original EES operational noise impact assessment

A full assessment of the potential impacts on noise from the project was conducted as part of the EES noise study. In accordance with Recommendation 10 in Table 1 of the Minister's Directions, the focus of the supplementary noise impact assessment was to further assess the operational noise impacts of the project.

The EES operational noise impact assessment consisted of noise modelling for five operational scenarios. All modelled scenarios in the original EES, except one, assumed closed loop operation of the FSRU as a conservative approach. The preferred mode of operation, open loop uses a continuous supply of seawater as a heat source to heat the liquified natural gas whereas closed loop operation uses gas-fired boilers and recirculating seawater to generate steam to heat the liquified natural gas. Closed loop mode would only be used in the unlikely event that the refinery is unable to accept discharge water from the FSRU (e.g., during unavailability of the seawater transfer pipe).

Furthermore, it was conservatively assumed that all equipment and facilities would operate 24 hours per day, seven days per week.

Each scenario was modelled with the application of 'worst case' weather conditions with the wind propagating from source to receiver. The EES noise study determined that predicted noise levels during operation of the project are expected to be within limits established in accordance with the Environment Protection Regulations 2021 at noise sensitive receivers.

The EES noise study identified the potential for cumulative noise impacts from the project and pre-existing industrial noise including the refinery to exceed the night period noise limit at GGS of 45dB by up to 3dB. However, it was considered highly unlikely that this exceedance would occur as it was only predicted for the 'worst case' operational scenario involving the FSRU operating at peak regasification in closed loop mode, LNG carrier berthing and nitrogen unloading at the treatment facility. The EES concluded that the concurrence of all these activities at night would be unlikely to

occur or be a rare event and would be managed through operational scheduling to ensure that these operational activities do not occur at the same time during the night period.

Noise from dredging activity during construction of the project was also assessed against established operational noise limits. Noise levels from dredging activity were not predicted to exceed the Environment Protection Regulations 2021 noise limits at any noise sensitive receiver during the day, evening or night. However, the EES proposed contingency measures to minimise potential noise impacts on the nearest sensitive receivers under noise enhancing weather conditions at night.

## 6.3 Outcomes of supplementary tasks

The following sections present the outcomes of the tasks undertaken in the supplementary noise impact assessment in response to Recommendation 10 of the Minister's Directions.

### 6.3.1 Establish regulatory noise limits

Background noise levels shall be measured and verified without the inclusion of noise from the refinery and from other commercial, industrial and trade premises, with noise limits of Part 5.3, Division 3 of the Environment Protection Regulations 2021 established accordingly.

#### 6.3.1.1 Background noise levels

Unattended noise monitoring was undertaken at background locations BG1 and BG2 (GGS) and BG3 and BG4 (Avalon College) for approximately 28 days between 18 October and 15 November 2023. Unattended noise monitoring was also undertaken at background locations BG5 to BG8 for approximately seven days between 25 October and 3 November 2023. These locations, shown in **Figure 6-1**, were selected as being representative of GGS and other noise sensitive areas.



**Table 6-2** Unattended noise monitoring locations

ID	Address / location	Details of site
BG1	Geelong Grammar School 11 Biddlecombe Avenue, Corio	Represents Geelong Grammar School sensitive receivers
BG2	Geelong Grammar School Heritage Tutors Flat, 4 Tower Road, Corio	Represents Geelong Grammar School sensitive receivers.
BG3	Avalon College North	Represents sensitive receivers at Avalon College and rural dwellings and a location without the presence of pre-existing industrial noise for comparison with Geelong Grammar School.
BG4	Avalon College South	Represents sensitive receivers at Avalon College and rural dwellings and a location without the presence of pre-existing industrial noise for comparison with Geelong Grammar School.
BG5	19 Zinnia Street, Norlane	Represents sensitive receivers in Norlane.
BG6	12 Myrtle Grove, North Shore	Represents sensitive receivers in North Shore.
BG7	36 Walker Street, Rippleside	Represents a location without the presence of pre-existing industrial noise for comparison with North Shore.
BG8	240 Avalon Road, Avalon	Represents a location without the presence of pre-existing industrial noise for comparison with Geelong Grammar School.

A summary of measured background noise levels is provided in **Table 6-3** below.

**Table 6-3** Measured background noise levels

ID	Background noise level, L90 dB(A)		
	Day	Evening	Night
BG1	44	44	44
BG2	42	41	41
BG3	41	37	39
BG4	39	39	38
BG5	47	43	43
BG6	42	37	37
BG7	43	40	35
BG8	39	38	35

Decibel Scale		
Threshold of hearing	0dB	The faintest sound we can hear
Almost silent	10dB	Human breathing
	20dB	
Generally quiet	30dB	Inside a car on a freeway
	40dB	Library
Moderately loud	50dB	Typical office space or ambience in the city at night
	60dB	CBD at lunch time
	70dB	The sound of a car passing on the street
Loud	80dB	Loud music played at home
	90dB	The sound of a truck passing on the street
Very loud	100dB	Indoor rock band concert
	110dB	Operating a chainsaw or jackhammer
Extremely loud	120dB	Jet plane take-off at 100m away
Threshold of pain	130dB	
	140dB	Military jet take-off at 25m away

Attended (handheld) noise monitoring for a duration of 15-minutes was undertaken at 12 locations (A1 – A12) on two separate occasions 3 and 15 November 2023 between 12:00 am and 3:15am to provide a better understanding of the surrounding environment, local noise sources and the potential noise impacts at sensitive receiver locations. These locations are shown in **Figure 6-1**.

Using the observations and measurements from the attended measurements, the unattended noise monitoring data was analysed and the following conclusions were made:

- Background noise levels recorded at Avalon College (BG3 and BG4) were verified as not including intrusive noise from the refinery or other commercial, industrial or trade premises.
- Although at times during the noise monitoring at 19 Zinnia Street, Norlane (BG5) industrial noise was audible background noise was dominated by road traffic and therefore verified as not being influenced by noise from the refinery or the surrounding port and industrial area.

- Background noise levels recorded at GGS (BG1 and BG2) are influenced by noise from the refinery and the surrounding port and industrial area. BG4 was used as a representative background location to determine the noise limits at Geelong Grammar School.
- Background noise levels recorded at 12 Myrtle Grove, North Shore (BG6) are influenced by intrusive noise from the surrounding port and industrial area (but not from the refinery) however. background noise levels recorded at 36 Walker Street, Rippleside (BG7) are not. Therefore, BG7 was used as a representative background location to determine the noise limits for North Shore dwellings.

**6.3.1.2 Recalculated noise limits**

In Part 6.3, Division 3 of the Regulations, noise limit means the maximum effective noise level allowed in a noise sensitive area, as determined in accordance with the Noise Protocol. The Noise Protocol sets out how to conduct noise-related assessments, including the urban and rural area methods for setting noise limits and assessing the noise.

Different levels of noise protection apply depending on the land use zoning and the amount of background noise at the noise sensitive area. The noise limits are primarily set according to the local land use zones surrounding the noise sensitive area. The influence of surrounding land uses is based on the purpose of the local land use zones in a Planning Scheme, including the degree of industrial use permitted. Higher noise levels are generally allowed close to industrial areas, and lower levels apply in residential or rural living areas.

If two or more commercial, industrial or trade premises contribute to the effective noise level, regulation 119 requires that a person in management or control of one or more of those premises must take all reasonable steps to ensure that the contribution from each of the premises, when combined, does not exceed the noise limit for the noise sensitive area.

The recalculated noise limits are presented in **Table 6-4** below.

**Table 6-4** Recalculated noise limits for noise sensitive receivers

Sensitive receiver location	Recalculated EPA 1826 – Noise Protocol limit, Leq dB(A)		
	Day	Evening	Night
Geelong Grammar School	54	50	45
Avalon College and rural dwellings	49	45	44
109 Macgregor Court, Lara (Lara dwellings) <sup>1</sup>	71	66	55
19 Zinnia Street, Norlane (Norlane dwellings)	54	348	46
12 Myrtle Grove, North Shore (North Shore dwellings)	51	45	40
65 Princes Highway, Corio (Corio dwellings) <sup>2</sup>	63	55	47

<sup>1</sup> Noise monitoring conducted in the EES noise study used to recalculate the noise limits (using the rural area method)

<sup>2</sup> Noise monitoring conducted in the EES noise study at 365 Princes Highway, Corio was found to be consistent with monitoring (at a location verified not to include intrusive industrial noise) conducted on a separate occasion for a separate project and therefore the limits remain the same as previously calculated.

### 6.3.2 Pre-existing and cumulative noise impacts

Further assessment of the pre-existing noise from commercial, industrial and trade premises shall be carried out based on measurements taken over a period of at least one week to determine existing noise impacts and the likely cumulative noise impacts at Geelong Grammar School and other noise sensitive areas.

#### 6.3.2.1 Pre-existing noise impacts

In addition to the noise monitoring described in **Section 6.3.1.1** unattended monitoring was undertaken at four locations (EX1 – EX4) at the refinery and Refinery Pier for approximately 28 days between 18 October and 15 November 2023 to enable a better understanding of pre-existing noise impacts. These locations are shown in **Figure 6-1**.

Results of the pre-existing noise monitoring are summarised in the table below.

**Table 6-5** Measured and estimated pre-existing industrial noise levels

Sensitive receiver location	Measured and estimated pre-existing industry noise Leq 30min dB(A) (and noise enhancing weather conditions shown in brackets)
Geelong Grammar School	43 (47) <sup>1</sup>
Avalon College and rural dwellings	Not audible
109 Macgregor Court, Lara (Lara dwellings)	29 (33) <sup>2</sup>
12 Myrtle Grove, North Shore (North Shore dwellings)	37 (41) <sup>3</sup>
19 Zinnia Street, Norlane (Norlane dwellings)	41 (45) <sup>3</sup>
365 Princes Highway, Corio (Corio dwellings)	44 <sup>4</sup> (48) <sup>3</sup>

1 Measured noise levels under noise enhancing weather conditions from attended monitoring and analysis of unattended monitoring.  
 2 Estimated noise levels for neutral and noise enhancing weather conditions based on measured levels at other locations and basic distance loss calculations.  
 3 Estimated noise levels for noise enhancing weather conditions based on comparable differences at other locations  
 4 Based on unattended noise monitoring from the EES noise study.

The pre-existing industry noise is within the recalculated noise limits under neutral weather conditions at all times and at all sensitive receiver locations. However, measured pre-existing industry noise exceeds the night period noise limit by 2dB at GGS under noise enhancing weather conditions. Estimated pre-existing industry noise potentially exceeds the night period noise limit by 1dB at Corio and North Shore dwellings under noise enhancing weather conditions, noting that noise from the refinery is not audible at North Shore.

**6.3.2.2 Dredging noise impacts**

Predicted noise levels from dredging are at or below the recalculated regulatory noise limits at all sensitive receiver locations at all times, for both neutral and noise enhancing weather conditions. There are potential cumulative noise exceedances, from pre-existing industry and dredging activities, under noise enhancing weather conditions, at GGS for the evening and night periods and at Corio and North Shore dwellings during the night. The potential cumulative exceedance is predicted to be up to 4dB.

Dredging is likely to occur during an eight-week period in autumn/winter. Technical Report D: Supplementary noise impact assessment contains a detailed analysis of weather data which has shown that this period coincides with a time of year when noise enhancing weather conditions generally occur less than during spring/summer. In the event that noise enhancing weather conditions did occur during the dredging campaign, the short duration of the campaign, the infrequent occurrence of the weather events and the small increase in noise level would mean potential cumulative noise impacts would be temporary in nature and limited in time.

However, contingency measures in accordance with mitigation measure MM-NV04 would be implemented to minimise the risk of unreasonable noise due to cumulative impacts. Where measurements undertaken at the commencement of dredging indicate cumulative noise levels will exceed the noise limits dredging operations would cease until the relevant period noise limits are met. Mitigation measure MM-NV04 was proposed in the EES, further refined during the EES inquiry process and recommended by the IAC in Appendix G of Report No. 2.

Engineering noise control - theory and practice 3rd edition (Bies&Hansen, 2006)	
Change in sound level (dB)	Change in apparent loudness
+3	Just perceptible
5	Clearly noticeable
10	Half or twice as loud
20	Much quieter or louder

### 6.3.2.3 Project noise impacts

To enable comparison of the project operational noise levels with the recalculated noise limits, seven operational scenarios were modelled. Peak regasification send-out from the FSRU was assessed for all scenarios which continued the conservative approach taken in the EES noise study, and in both the EES and supplementary noise studies all scenarios included nitrogen injection at the treatment facility.

The scenario naming convention used in the EES has been replaced with the most frequently occurring operating scenarios listed first. **Table 6-6** shows that Scenario 1, standard operation, would occur the most days per year and Scenarios 6 and 6a the least days.

Scenario 6a (the equivalent of EES noise study Scenario 1) represents the 'worst case' operating scenario. However as explained in the EES, closed loop is not the preferred FSRU operating mode and this scenario would only occur under 'emergency' conditions should the seawater transfer pipe from the FSRU to the refinery cooling water intake not be operational.

**Table 6-6** Operational scenarios and frequency/duration of occurrence

Scenario	Frequency and duration	Days per year scenario occurs <sup>1</sup>	% of days in a year scenario occurs
1	FSRU operation (open loop) only	Standard operation	254.779 69.80%
2	FSRU operation (open loop) with LNG carrier berthed	LNG carrier berthed 36 hours for up to 45 times per year (every 8 days during peak demand period)	58.174 15.94%
3	FSRU operation (open loop) and nitrogen offloading at the treatment facility	Anticipated that five nitrogen trucks per day would travel to site for 120 days of the year (winter months) and three nitrogen trucks per day would travel to site for a further 120 days of the year. There would be no nitrogen truck deliveries/unloading for the remaining days of the year. Unloading activities to take one hour and 15 minutes each delivery.	40.441 11.08%
4	FSRU operation (open loop) with LNG carrier berthed and nitrogen offloading at the treatment facility	LNG carrier berthed 36 hours for up to 45 times per year (every 8 days during peak demand period). Anticipated that five nitrogen trucks per day would travel to site for 120 days of the year (winter months) and three nitrogen trucks per day would travel to site for a further 120 days of the year. There would be no nitrogen truck deliveries/unloading for the remaining days of the year. Unloading activities to take one hour and 15 minutes each delivery.	9.234 2.53%
5	FSRU operation (open loop) and LNG carrier berthing	LNG carrier berthing for less than one hour up to 45 times per year (every 8 days during peak demand period).	1.616 0.44%

<sup>1</sup> Frequency calculated based on maximum duration of noise emitting activities

Scenario	Frequency and duration	Days per year scenario occurs <sup>1</sup>	% of days in a year scenario occurs
6	<p>FSRU operation (open loop), LNG carrier berthing and nitrogen unloading at the treatment facility</p> <p>LNG carrier berthing for less than one hour up to 45 times per year (every 8 days during peak demand period).</p> <p>Anticipated that five nitrogen trucks per day would travel to site for 120 days of the year (winter months) and three nitrogen trucks per day would travel to site for a further 120 days of the year. There would be no nitrogen truck deliveries/unloading for the remaining days of the year. Unloading activities to take one hour and 15 minutes each delivery.</p>	0.256	0.07%
6a	<p>FSRU operation (closed loop), LNG carrier berthing and nitrogen unloading at the treatment facility</p> <p>FSRU closed loop operation occurs only in an 'emergency' situation should the seawater transfer pipe not be operational.</p> <p>LNG carrier berthing for less than one hour up to 45 times per year (every 8 days during peak demand period).</p> <p>Anticipated that five nitrogen trucks per day would travel to site for 120 days of the year (winter months) and three nitrogen trucks per day would travel to site for a further 120 days of the year. There would be no nitrogen truck deliveries/unloading for the remaining days of the year. Unloading activities to take one hour and 15 minutes each delivery.</p>	0.0004	0.0001%

Throughout the design process undertaken to date Viva Energy has conducted iterative reviews to ensure that all reasonably practicable opportunities to minimise noise emissions from the project have been considered. Through continued design optimisation operational project noise emissions have been reduced.

All modelled scenarios, were predicted to be within the recalculated noise limits at all sensitive receiver locations, for both neutral and noise enhancing weather conditions during the day, evening and night.

**6.3.2.4 Cumulative noise impacts**

Under neutral weather conditions, cumulative noise levels, i.e., combined pre-existing industrial and modelled project noise levels (i.e., noise levels at noise sensitive receivers from the noise emissions of the project only), are at or below the recalculated noise limits at all sensitive receiver locations during the day, evening and night.

Under noise enhancing weather conditions, cumulative noise levels are at or below the recalculated noise limits at all sensitive receiver locations during the day and evening.

As pre-existing industry noise currently exceeds night period noise limits under noise enhancing weather conditions at GGS and North Shore dwellings there are predicted cumulative exceedances of the night period noise limits at these locations in noise enhancing weather conditions. . The potential cumulative exceedance is predicted to be up to 3dB (i.e., a just perceptible change in apparent loudness to the human ear, noting that changes in the character of the noise or its frequency spectrum may result in a more discernible change)..

A summary of the predicted cumulative night period noise levels at GGS and North Shore dwellings is presented in **Table 6-7**.

**Table 6-7** Comparison of predicted cumulative noise levels to the recalculated night period noise limits at GGS and North Shore dwellings

Predicted cumulative noise levels from pre-existing industry and project operation Leq,30min dB(A) (noise enhancing weather conditions shown in brackets) Complies (✓/~)								
Sensitive receiver location	Scenario 1 FSRU open loop operation only	Scenario 2 FSRU open loop operation with LNG carrier berthed	Scenario 3 FSRU open loop operation and nitrogen offloading at the treatment facility	Scenario 4 FSRU open loop operation with LNG carrier berthed and nitrogen offloading at the treatment facility	Scenario 5 FSRU open loop operation and LNG carrier berthing	Scenario 6 FSRU open loop operation, LNG carrier berthing and nitrogen unloading at the treatment facility	Scenario 6a FSRU closed loop operation LNG carrier berthing and nitrogen unloading at the treatment facility	Recalculated EPA 1826 – Noise Protocol night period limit, Leq dB(A)
Geelong Grammar School	44 (48) ✓ (~)	44 (48) ✓ (~)	44 (48) ✓ (~)	44 (48) ✓ (~)	44 (48) ✓ (~)	44 (48) ✓ (~)	44 (48) ✓ (~)	45
North Shore dwellings	37 (41) ✓ (~)	39 (42) ✓ (~)	37 (41) ✓ (~)	39 (42) ✓ (~)	39 (43) ✓ (~)	39 (43) ✓ (~)	39 (43) ✓ (~)	40

Further analysis of the potential cumulative exceedance predicted to occur at night and under noise enhancing weather conditions showed that, consistent with the conclusion of the EES noise study, it is very unlikely that project operations would contribute to the cumulative exceedance due primarily to the infrequent occurrence of the noisiest scenarios. However, Project Noise Criteria, which represent a level 10dB below the recalculated regulatory noise limit, have been proposed (refer to **Section 6.3.3**) to ensure that project operations do not contribute to an effective noise level which may exceed the noise limit.

Detailed analysis of noise attenuation and contingency measures consistent with the requirements of mitigation measure MM-NV05 is provided in the annexure to Technical Report D: *Supplementary noise impact assessment* which demonstrates that compliance with the Project Noise Criteria is able to be achieved. Continued implementation of mitigation measure MM-NV05 will ensure that noise emissions from project operational activities are managed such that Project Noise Criteria are met and the project does not contribute to cumulative noise impacts.

### 6.3.3 Project Noise Criteria

Establish and justify, supported by documented evidence, Project Noise Criteria to ensure that the noise from the Project, when combined with the pre-existing and approved noise from commercial, industrial and trade premises will not lead to an exceedance of the noise limits.

With consideration to the results of the supplementary noise impact assessment and the Environment Protection Regulations 2021 regulations 118 Unreasonable noise and 119 Cumulative noise the following Project Noise Criteria

have been proposed. The setting of Project Noise Criteria 10dB below the noise limit will ensure that project operational noise does not contribute to the effective noise level and consequently, does not contribute to cumulative noise impacts.

The annexure to Technical Report D: *Supplementary noise impact assessment* contains a detailed analysis of noise attenuation and contingency measures. Consistent with the requirements of mitigation measure MM-NV05 the annexure describes the iterative review (undertaken to date) of all reasonably practicable opportunities to reduce operational noise emissions and demonstrates that compliance with the proposed Project Noise Criteria is able to be achieved.

Table 6-8 Project Noise Criteria

Location / sensitive receiver location	Project noise criteria, Leq dB(A)		
	Day	Evening	Night
Geelong Grammar School	42	38	35
Avalon College and rural dwellings	37	37	33
109 Macgregor Court, Lara (Lara dwellings)	61	56	45
12 Myrtle Grove (North Shore dwellings)	41	35	30
19 Zinnia St (Norlane dwellings)	44	38	36
365 Princes Highway (Corio dwellings)	53	45	37

## 6.4 Integrated assessment

The purpose of this section is to integrate the findings of the supplementary noise study with the key outcomes of the EES noise study.

The original EES noise study undertook unattended noise measurements at six locations representative of surrounding noise sensitive areas in June and July 2021. Background noise measurements from these locations were used to calculate the regulatory noise limits in accordance with the Noise Protocol. The original EES noise study consisted of noise modelling for five operational scenarios. All modelled scenarios in the original EES, except one, assumed closed loop operation of the FSRU as a conservative approach. The preferred mode of operation, open loop uses a continuous supply of seawater as a heat source to heat the liquified

natural gas whereas closed loop operation uses gas-fired boilers and recirculating seawater to generate steam to heat the liquified natural gas. Although noise emissions from closed loop mode are potentially higher due to use of the boilers, closed loop would only be used in the unlikely event that the refinery is unable to accept discharge water from the FSRU (e.g., during unavailability of the seawater transfer pipe).

Furthermore, it was conservatively assumed that all equipment and facilities would operate 24 hours per day, seven days per week.

Each scenario was modelled with the application of 'worst case' weather conditions with the wind propagating from source to receiver.



The EES noise study concluded that:

- Predicted noise levels from all modelled operational scenarios would not exceed the established noise limits at surrounding noise sensitive areas during the day, evening or night.
- Predicted cumulative noise levels from existing industry and the modelled 'worst case' operational scenario could, under noise propagating conditions, exceed the established noise limits at some noise sensitive areas at night but cumulative noise impacts could be prevented through scheduling of operational activities to avoid the concurrence of all project activities at night.

Noise from dredging activity during construction of the project was also assessed against established operational noise limits. Noise levels from the dredging activity were not predicted to exceed the Environment Protection Regulations 2021 noise limits at any noise sensitive receiver during the day, evening or night. However, the EES proposed contingency measures to minimise potential noise impacts on the nearest sensitive receivers under noise enhancing weather conditions at night.

The IAC determined that operational noise modelling had been completed to an acceptable level in the EES noise study, however this finding was contingent on further assessment of background and cumulative noise.

Outcomes of the supplementary noise study were as follows:

- Noise limits were recalculated using the results from an extended noise monitoring campaign. Recalculated noise limits were generally consistent with those determined in the EES noise study.
- Measured pre-existing industry noise, including noise generated by the refinery, is at or below the recalculated noise limits at all sensitive receivers and at all times under neutral weather conditions. This is consistent with measurements obtained for the EES noise study.
- Measurements obtained for the supplementary noise study indicated that under noise enhancing weather conditions pre-existing noise from the refinery and surrounding port and industrial area exceeds the night period noise limit at GGS, and Corio and North Shore dwellings.
- Consistent with the conclusions of the EES noise study, modelled noise levels from dredging are at or below the recalculated noise limits at all sensitive receivers at all times.
- There are potential cumulative noise exceedances, from pre-existing industry and dredging activities, under noise enhancing weather conditions, at GGS for the evening

and night periods and at Corio and North Shore dwellings during the night. Consistent with measures proposed in the original EES, contingency measures would be implemented in accordance with mitigation measure MM-NV04 such that dredging operations would cease until the relevant period noise limits are met.

- Modelled scenarios were updated in the supplementary noise study to better reflect proposed operations and noise reduction obtained through design optimisation. The modelling still considered the 'worst case' FSRU closed loop scenario included in the EES noise study, noting that this scenario would only occur in the very unlikely event that the seawater transfer pipe is not operational. Predicted project operational noise levels for all scenarios under standard weather conditions are below the recalculated noise limits at all sensitive receivers at all times. This is consistent with the results of the modelling conducted in the original EES noise study.
- Under neutral weather conditions, cumulative noise levels do not exceed the recalculated noise limits.
- Under noise enhancing weather conditions, cumulative noise levels are at or below the recalculated noise limits at all sensitive receiver locations during the day and evening.
- Consistent with the findings of the EES noise study, there is potential for cumulative noise levels to exceed the night period noise limits at some sensitive receiver locations in noise enhancing weather conditions.
- Further analysis of the potential cumulative exceedances predicted to occur at night in noise enhancing weather conditions showed that, consistent with the conclusion of the EES noise study, it is very unlikely that the project would contribute to the exceedances due primarily to the infrequent occurrence of the noisiest scenarios. However, Project Noise Criteria, which represent a level 10dB below the noise limit, have been proposed to ensure that project operations do not contribute to the effective noise level. An annexure to Technical Report D: *Supplementary noise impact assessment* contains a detailed analysis of noise attenuation and contingency measures (including scheduling as proposed in the original EES) to minimise cumulative noise impacts.

## 6.5 Mitigation measures

The IAC considered that MM-NV05 provided a suitable framework for further assessment of noise impacts (IAC Report No. 1, section 12.4 (iv)). The supplementary noise study was subsequently undertaken in accordance with Item 2 of MM-NV05.

As mentioned above the annexure to Technical Report D: *Supplementary noise impact assessment* contains a detailed analysis of noise attenuation and contingency measures. Consistent with the requirements of mitigation measure MM-NV05 the annexure describes the iterative review (undertaken to date) of all reasonably practicable opportunities to reduce operational noise emissions and demonstrates that compliance with the proposed Project Noise Criteria is able to be achieved.

Continued implementation of mitigation measure MM-NV05 will ensure that noise emissions from project operational activities are managed such that Project Noise Criteria are met and the project does not contribute to cumulative noise impacts. MM-NV05 provides for iterative reviews to ensure all reasonably practicable opportunities to reduce operational noise emissions have been considered across the design, construction and operation of the project. At plant selection when manufacturer's data is available these reviews include verification of any noise characteristics, and assessment and management of low frequency noise emissions if present. Furthermore, an Operational Management Plan is required to detail the approach taken to meet the Project Noise Criteria including equipment selections and mitigation measures adopted, and contingency measures such as scheduling. Future operational monitoring of the actual FSRU and project components to confirm noise levels and verify cumulative impacts will also be undertaken in accordance with MM-NV05.

MM-NV01a provides for preparation of a dredging noise management plan and MM-NV04 includes contingency measures for dredging to prevent cumulative noise impacts resulting in exceedances of the noise limits.

Therefore, no additional mitigation measures have been proposed. The mitigation measures proposed in the original EES are still considered appropriate to manage project impacts noting that changes to MM-NV04 and MM-NV05 recommended by the IAC (Report No. 2 Appendix G) have also been adopted.

Refer to Chapter 9: *Environmental Management Framework* for a list of the mitigation measures relevant to the areas of further work covered by the Supplementary Statement.

## 6.6 Conclusion

Further work to assess project noise impacts has been undertaken as required by Recommendation 10 of the Minister's Directions.

Modelled noise emissions from dredging activities were at or below recalculated regulatory noise

limits. However, there were potential cumulative noise exceedances, from pre-existing industry and dredging activities, under noise enhancing weather conditions, at GGS for the evening and night periods and at Corio and North Shore dwellings during the night. Contingency measures will be implemented in accordance with mitigation measure MM-NV04 such that dredging operations would cease until the relevant period noise limits are met.

Modelled noise emissions from project operations were below recalculated regulatory noise limits. Cumulative noise levels were predicted to be at or below recalculated regulatory noise limits at all times in neutral weather conditions, and in noise enhancing weather conditions during the day and evening.

As pre-existing industry noise currently exceeds night period noise limits under noise enhancing weather conditions at GGS and North Shore dwellings there are predicted cumulative exceedances of the night period noise limits at these locations in noise enhancing weather conditions. The cumulative exceedance was predicted to be up to 3dB (i.e., a just perceptible change in apparent loudness to the human ear, noting that changes in the character of the noise or its frequency spectrum may result in a more discernible change).

With consideration to the results of the supplementary noise impact assessment and the Environment Protection Regulations 2021 regulations 118 Unreasonable noise and 119 Cumulative noise Project Noise Criteria have been proposed at 10dB below the noise limits which will ensure that project operational noise does not contribute to the effective noise level and consequently, does not contribute to cumulative noise.

The annexure to Technical Report D: *Supplementary noise impact assessment* contains a detailed analysis of noise attenuation and contingency measures. Consistent with the requirements of mitigation measure MM-NV05 the annexure describes the iterative review of all reasonably practicable opportunities to reduce operational noise emissions and demonstrates that compliance with the proposed Project Noise Criteria is able to be achieved.

Continued implementation of mitigation measure MM-NV05 will ensure that noise emissions from project operational activities are managed such that Project Noise Criteria are met and the project does not contribute to cumulative noise impacts.