Title:	**Environmental Noise Risk Assessment**
Project:	Esso South East Australia Carbon Capture and Storage Plant
Client:	Esso Australia Resources Pty Ltd

Wood Doc No	AU01293.01-FN01-Rev3	**Wood Job No.**	AU01293

Revision	Description	Prepared	Reviewed	Date
A	Issued for Review	P Mukesh	J McLoughlin	6 Feb 2023
0	Issued for Use	P Mukesh	J McLoughlin	8 Mar 2023
1	Issued for Use (editorial update)	P Mukesh	-	27 Mar 2023
2	Issued for Use (following comments)	P Mukesh	J McLoughlin	4 Sep 2023
3	Issued for Use (editorial update)	P Mukesh	-	13 Nov 2023

1. INTRODUCTION

Esso Australia Resources Pty Ltd (in its capacity as operator of the Gippsland Basin Joint Venture, the participants in which are Esso Australia Resources Pty Ltd and Woodside Energy (Bass Strait) Pty Ltd) (Esso) proposes to compress, dehydrate, transport and store carbon dioxide (CO2) in the depleted Bream oil and gas reservoir.

The CO2 stream available for injection as part of the Project is forecast to average ~0.5 million tonnes per annum (Mtpa) with a peak CO2 compression capacity of ~0.7 Mtpa and a cumulative injection of approximately 3 million tonnes (MT). This would be achieved by compressing the concentrated CO2 stream, which is already separated and vented at the existing licensed Longford Gas Conditioning Plant (GCP) (which is operated by Esso), into a dense phase for transportation to the Bream A platform where it will be injected and stored in the depleted Bream oil and gas reservoir. The Bream reservoir ceased production in September 2020 following more than 30 years of production including periods of gas injection and cycling.

The Project would provide a foundation for potential future expansion, including to allow for the injection and storage of CO2 from third party sources.

One component of the SEA CCS project is construction of new CO2 facilities at the existing Longford Gas Plants (from here referred to as the Project). The new facilities are expected to consist of two reciprocating compressors, dehydration facilities and associated equipment.

Wood was engaged by Esso to undertake a desktop risk assessment of any potential noise impacts to the environment from the proposed project.

1.1 Scope

This report focuses on the new facilities at the Longford Gas Plants described above (the Project) and the scope includes:

- Assign noise limits for the Project;
- Prepare a noise model and predict noise levels at noise sensitive areas;
- Comment on the potential for the Project to exceed noise limits;
- Provide recommendations for practical noise mitigation measures; and
- Provide recommendations for any future additional modelling or monitoring that may be required as part of Esso's submission of an Environmental Noise Impact Assessment (ENIA).

1.2 Site Locality

The Project will be constructed at a site adjoining the eastern end of Esso's Longford Gas Plants. Figure 1-1 displays the Project area in relation to the existing Longford facility.

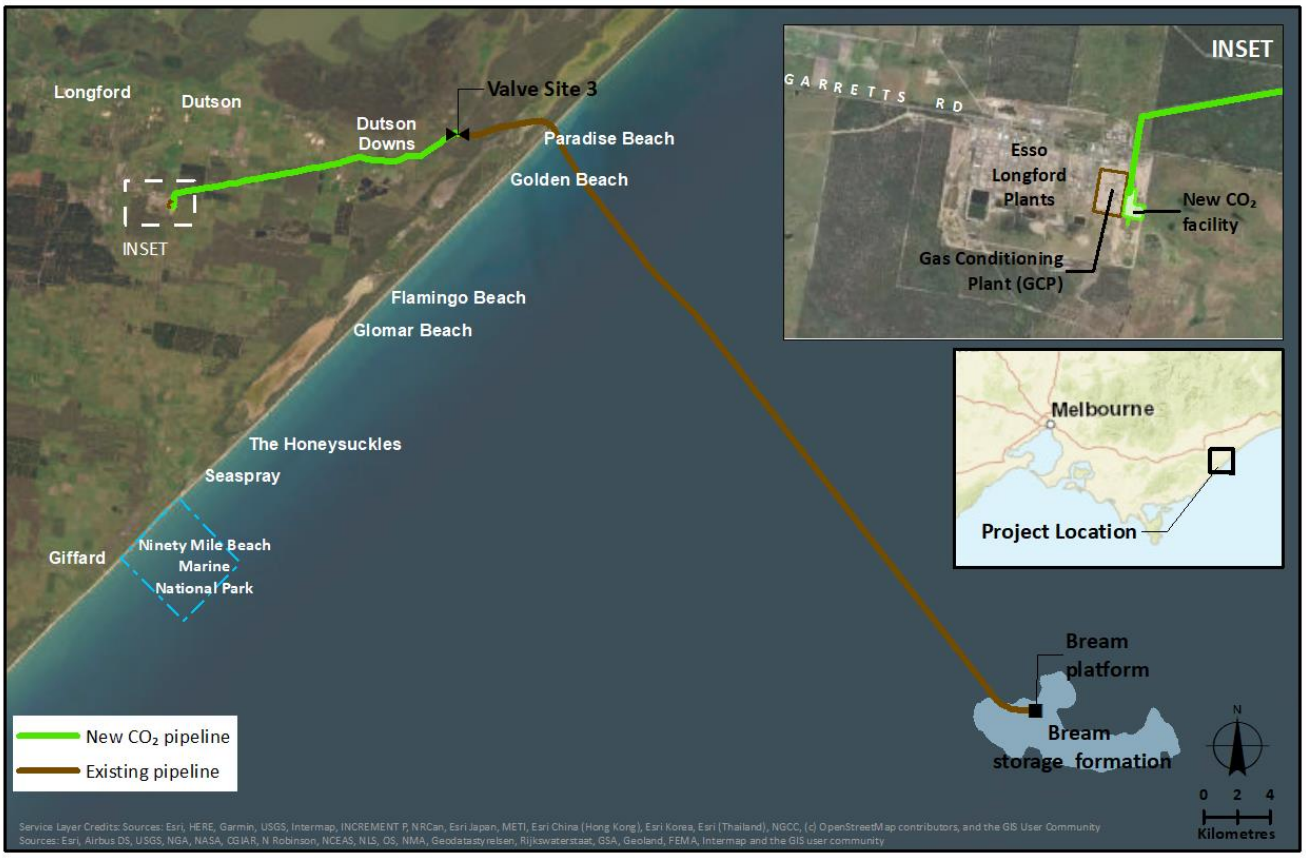

Figure 1-1 Project Area Image

2. PROJECT NOISE LIMITS

2.1 Noise Limits

Noise emissions from commercial, industrial, trade premises and entertainment venues in Victoria are regulated under the Noise Limit and Assessment Protocol (Noise Protocol). The Noise Protocol specifies the procedure for determining noise limits at noise sensitive areas near a proposed facility or activity.

The proposed facility is located in Longford, within the Gippsland region of Victoria, in the Wellington Shire, as shown in Figure 2-1. Therefore, noise limits have been determined using the Rural Area Method as defined by The Noise Protocol[1] Part 1, Section A, Subsection 2.

Figure 2-1 Location of Longford within the Melbourne Rural Area

[1] *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*, EPA Publication 1826.4 Part 1A

The following operational time periods (day, evening and night) outlined in Table 2-1 are defined in the Noise Protocol.

Table 2-1 Operating time periods

Period	Details
Day	0700-1800, Monday – Saturday (excluding public holidays)
Evening	1800-2200, Monday – Saturday
	0700-2200, Sunday and public holidays
Night	2200-0700

For the purposes of this Project, noise emissions have been assessed against night-time noise limits because the night-time limits are the most stringent and the facility will operate around the clock.

2.1.1 Noise Sensitive Areas

Thirty-three noise sensitive areas (NSAs) nearby the proposed facility were identified. The NSAs have all been identified as private residences/dwellings. Figure 2-2 shows an overview of the NSAs with reference to the proposed Project area.

Figure 2-2 Location of Project Area and Noise Sensitive Areas

2.1.2 Zone Level

The zone levels for the day, evening and night periods have been developed using Annex B of the Noise Protocol. The generating zone is the land use zone in which the premises being assessed is located and the receiving zone is the land use zone in which the noise sensitive area is located.

The generating zone for the Project is within an industrial zone (IN1Z) and the receiving zone is located within a farming zone (FZ). The applicable zone levels are summarised in Table 2-2.

Table 2-2 Zone Levels

Period	Zone Level dB(A)
Day	53
Evening	48
Night	43

In accordance with clause 20 of the Noise Protocol, the zone levels are adjusted to account for the distance between the zone and where the noise generator is located, and the location of the noise receiver in the noise sensitive area. The levels are adjusted by subtracting 1 dB for every 100 metres of the receiver distance from the generator with the maximum allowable subtraction being 9 dB, outlined by Table 2-3.

Table 2-3 Noise Limits for NSAs

Distance between the NSA and the boundary of the noise generating zone, m	Night-time noise limit, dB(A)
0	43
100	42
200	41
300	40
400	39
500	38
600	37
700	36
800	35
900 and >900	34

2.1.3 Project Noise Limits

The noise limit is the greater of the distance-adjusted level and base noise level in Regulation 118(2)(b)[2] outlined in Table 2-4, unless a background level assessment has been conducted. A background level assessment is made if the noise sensitive area is located within a background relevant area. A background relevant area is defined as a noise sensitive area within a rural area where background levels may be higher than usual[3]. This includes areas where freeway or highway traffic is a significant audible background noise source. For the Project, the noise sensitive areas are not considered to fall under a background relevant area and a background level assessment is not required.

Table 2-4 Base Noise Levels

Period	Base Noise Level dB(A)
Day	45
Evening	37
Night	32

Two of the noise sensitive areas fall within 900 m of the facility and an adjustment has been made to the zone levels. The remaining noise sensitive receivers are further than 900 m from the facility and the maximum subtraction of 9 dB has been applied to these receivers. Table 2-5 presents The Project noise limits for the noise sensitive areas, with those within 900 m bolded.

Table 2-5 Project Limits for Noise Sensitive Areas

Noise Sensitive Areas	Coordinates		Project Night-time Noise Limit, dB(A)
	x	y	
NSA-1	55511411	5767381	34
NSA-2	55512045	5767770	34
NSA-3	55511626	5767094	34
NSA-4	55513074	5766864	34
NSA-5	55512069	5767145	34
NSA-6	55513473	5766801	34

[2] Environment Protection Regulations 2021 S.R. No. 47/2021 Chapter 5, Part 5.3, (118)

[3] *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*, EPA Publication 1826.4 Part 1A Clause 21

Noise Sensitive Areas	Coordinates		Project Night-time Noise Limit, dB(A)
	x	y	
NSA-7	55515130	5766630	34
NSA-8	55512759	5765523	34
NSA-9	55514815	5766007	34
NSA-10	55512521	5765812	34
NSA-11	55515533	5765527	34
NSA-12	55512079	5766081	34
NSA-13	55512417	5766172	34
NSA-14	55511799	5766526	34
NSA-15	55519383	5769003	34
NSA-16	55517392	5764997	34
NSA-17	55519437	5769842	34
NSA-18	55517666	5764781	34
NSA-19	55510969	5770116	34
NSA-20	55517145	5764801	34
NSA-21	55510257	5769954	34
NSA-22	55512207	5771716	34
NSA-23	55514934	5772479	34
NSA-24	55514434	5773192	34
NSA-25	55512611	5770622	**35**
NSA-26	55517853	5772500	34
NSA-27	55517743	5771792	34
NSA-28	55517663	5771471	34
NSA-29	55517749	5771210	34
NSA-30	55517196	5767646	**42**
NSA-31	55511007	5768511	34
NSA-32	55511187	5767938	34

3. NOISE MODELLING

A predictive noise model of the Project (compressors and associated equipment) was constructed using the software package SoundPlan 8.2. This program calculates the sound pressure levels at nominated receiver locations or produces noise contours over a defined area of interest and the noise sources. The inputs in SoundPlan are noise source data, ground topographical data, meteorological data and receiver locations.

SoundPlan provides a range of prediction algorithms that can be selected by the user. The CONCAWE[4,5] prediction algorithms were selected for this assessment. The CONCAWE algorithm has been commonly used for noise modelling industrial proposals throughout Australia and is the preferred algorithm by the WA Department of Water and Environmental Regulation (DWER)[6]. The acoustic model has been used to generate a noise contour for the area surrounding the Project and to predict noise levels at the nearby existing receivers.

3.1 Noise Sources

Table 3-1 outlines the equipment and respective quantity used for the modelled scenario. For the purpose of this assessment, emergency scenarios and associated equipment have not been considered. Sound power levels have been based on Wood's experience with similar packages and are presented in Appendix A. The sound power levels assumed are commensurate with noise specifications (including industry standard noise controls) that are likely to be required in relation to the management of occupational noise exposure.

Table 3-1 Noise Sources

Equipment	No. of Units
Dresser-Rand HOS Compressor Package • Water return pump (A/B) • Air cooled exchanger • Compressors (motor driven)	2
SORBEAD Dehydration Package • Regen gas recovery vapour Sundyne unit (A/B) • Regen air cooler • Regen slip electric heater	1

[4] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[5] The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981

[6] *Assessment of Environmental Noise Emissions* May 2021 Draft Guideline

Equipment	No. of Units
Recovered water to LP column pump (A/B)	1
Metering Skid	1

3.2 Meteorological Conditions

The CONCAWE prediction algorithm includes consideration of the effect on noise propagation of defined meteorological conditions. The following variables are included that will affect the predicted noise level: temperature; Pasquill stability (temperature inversion); relative humidity; wind speed; and wind direction. Noise emissions have been predicted under adverse weather conditions favourable for noise propagation from the facility to the nearest residences, which is consistent with the guidance provided in section 3.2 of the Noise Protocol[7].

The noise model inputs are summarised in Table 3-2 below.

Table 3-2 Meteorological Conditions

Input	Adverse Conditions
Wind Speed (m/s)	3
Wind Direction	Source to Receiver
Pasquill-Gifford Stability Class (Atmospheric Stability)	F
Humidity (%)	50
Temperature (degrees Celsius)	15
Air Pressure (mbar)	1013.3

3.3 Ground Topography

Topographical information for the acoustic model has been imported from Google Earth. A moderately absorptive (ground factor 0.8) ground is assumed for forest, farmland surrounding the facility and a relatively reflective (ground factor 0.3) is assumed for the facility.

[7] Atmospheric conditions that increase noise at sensitive areas to make it above the noise limits (propagation conditions 'favourable to the propagation of sound') should be assumed for noise modelling and works programming, regardless of the actual conditions when the works occur. – *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*, EPA Publication 1826.4 Part 1A

4. NOISE ASSESSMENT

4.1 Predicted Noise Levels

The noise levels that would be generated at the noise sensitive area by operation of the SEA CCS Project were modelled under the adverse weather conditions set out in Section 3.2 which are representative of the conditions when noise impacts are greatest (and therefore more likely to elicit complaints). The predicted noise levels are presented in Table 4-1 below and a noise contour is presented in Appendix B.

Table 4-1 Predicted Noise Levels at NSAs

Noise Sensitive Areas	UTM Coordinates		Predicted Noise Level, dB(A)	Project Night-time Noise Limit, dB(A)
	Easting	Northing		
NSA-1	55511411	5767381	16.5	34
NSA-2	55512045	5767770	20.5	34
NSA-3	55511626	5767094	16.7	34
NSA-4	55513074	5766864	22.1	34
NSA-5	55512069	5767145	18.8	34
NSA-6	55513473	5766801	23.4	34
NSA-7	55515130	5766630	26.9	34
NSA-8	55512759	5765523	15.5	34
NSA-9	55514815	5766007	22.5	34
NSA-10	55512521	5765812	15.9	34
NSA-11	55515533	5765527	20.1	34
NSA-12	55512079	5766081	15.4	34
NSA-13	55512417	5766172	16.9	34
NSA-14	55511799	5766526	15.8	34
NSA-15	55519383	5769003	17.4	34
NSA-16	55517362	5765133	14.8	34
NSA-17	55519331	5769751	16.8	34
NSA-18	55517797	5764800	13.3	34
NSA-19	55510969	5770116	16.1	34
NSA-20	55517064	5764740	14.4	34

Noise Sensitive Areas	UTM Coordinates		Predicted Noise Level, dB(A)	Project Night-time Noise Limit, dB(A)
	Easting	Northing		
NSA-21	55510257	5769954	14.9	34
NSA-22	55512207	5771716	10.7	34
NSA-23	55514934	5772479	20.7	34
NSA-24	55514434	5773192	16.5	34
NSA-25	55512611	5770622	23.8	**35**
NSA-26	55517815	5772598	16.5	34
NSA-27	55517743	5771792	19.6	34
NSA-28	55517663	5771471	21.2	34
NSA-29	55517749	5771210	21.9	34
NSA-30	55517120	5767708	27.5	**42**
NSA-31	55511007	5768511	16.8	34
NSA-32	55511187	5767938	16.8	34

All predicted noise levels at the NSAs from the SEA CCS facility fall below the Project night-time noise limits.

4.2 Ambient Noise Monitoring

The existing ambient noise levels include noise from the Longford Gas Plants and any ambient noise, were measured by VIPAC Engineers & Scientists in 2018[8]. Noise surrounding the Longford Gas Plants at 6 locations, shown in Figure 4-1, along the boundary of the facility were measured.

[8] Vipac Engineers & Scientists *ESSO Australia Pty Ltd Longford Plants Noise survey and assessment* 30U-17-0170-TRP-645489-5.

Figure 4-1 Locations for ambient noise monitoring conducted in 2018 by VIPAC

The night-time noise levels at the loggers were corrected for wildlife noise due to the presence of cicadas and frogs. The correction procedure involved reducing the peaks in the 1.6 kHz to 4 kHz frequency range to derive the overall sound pressure level that is representative of the noise level in the absence of wildlife. The corrected noise levels are presented in Table 4-2.

Table 4-2 Night-time ambient noise levels

Logger Position	UTM Coordinates		Night-time	
	Easting	Northing	$L_{Aeq, corr}$	L_{AS90}
Logger 1	55515097	5770477	44	44
Logger 2	55517169	5769207	46	42
Logger 3	55516917	5767655	41	37
Logger 4	55514967	5766926	37	32
Logger 5	55512129	5767850	35	28
Logger 6	55511961	5770079	46	29

4.3 Impact of Project at NSAs

Predicted noise levels of the Project at NSAs closest to the ambient monitoring noise logger locations have been compared and presented in Table 4-3. At all three locations, the predicted noise level is at least 10 dB below the ambient levels, demonstrating that the risk of the Project to impact night-time noise limits is low and the predicted contributions at these locations would not result in any discernible change in the ambient noise level.

Table 4-3 Predicted and Ambient Noise Levels at Select NSAs

Noise Sensitive Areas	Closest Logger	Predicted Noise Level, dB(A)	Ambient Noise Level, L_{Aeq} dB(A)	Project Night-time Noise Limit, dB(A)
NSA-2	5	20.5	35	34
NSA-7	4	26.9	37	34
NSA-30	3	27.5	41	42

5. CONSTRUCTION NOISE

Victoria does not have regulatory limits for noise from construction works. Instead, EPA Victoria provides guidance to help operators reduce noise impacts from construction works through EPA Victoria's *Civil construction, building and demolition guide, Publication 1834, 2020 (replaces EPA Publication 480 and Publication 1254).*

The EPA's Publication 1834 states:

Under the general environmental duty, anyone who is engaging in an activity that poses risk of harm to human health and the environment, from pollution or waste, must manage that risk. You need to do this by ***eliminating or reducing your specific risks as far as reasonably practicable****. You can do this by putting appropriate controls in place.*

Key aspects to consider when you are planning include:

- *Identifying people and sensitive environments (sensitive receivers) that could be affected by your activities*
- *Carrying out appropriate engagement as early as possible*
- *Avoiding the generation of noise and vibration*
- *Facilitating construction during normal working hours, where possible (See* ***Error! Reference source not found.****)*
- *Reducing noise and vibration by using the most appropriate equipment and work practices for your activities*
- *Choosing alternative equipment or methods that generate less noise or vibration*
- *Maintaining equipment and vehicles according to manufacturer's instructions*
- *Attenuating noise by obstructing the path between noise source and receiver*
- *Mitigating offsite noise with measures such as respite offers and acoustic treatment*
- *Considering alternatives if noise and vibration cannot be reduced through avoidance, reduction or attenuation.*

The EPA's Publication 1834 provides recommended working hours for construction sites of major infrastructure works, including the development of power facilities, and guidelines for noise levels for works undertaken outside normal working hours. Esso will consider Publication 1834 when planning for construction.

6. DISCUSSION & RECOMMENDATIONS

6.1 Noise Assessment

Predicted noise levels from the Project at the NSAs are significantly below both night-time noise limits and measured ambient noise levels. Therefore, it is not anticipated that the Project will result in any discernible change to ambient noise levels.

Given the Project is in early stages of design, this preliminary assessment has been completed to provide an indication of noise impacts as part of early engineering and to inform future work. Following further engineering and selection of equipment, it is recommended that an Environmental Noise Impact Assessment for the Project is completed in accordance with EPA Victoria's Noise Limit and Assessment Protocol. It is recommended that this study includes a cumulative noise assessment taking into consideration a number of proposed changes to noise sources within and adjacent to Longford Gas Plants (removal of existing sources and addition of new sources).

6.2 Noise Sources

Since the Project noise levels fall well below ambient levels, no recommendations are required for the equipment, provided that vendor provided sound power levels are comparable to the representative noise levels used in this assessment. If noise levels deviate from levels used in the assessment, standard noise controls can be specified during the design phase, to ensure the Project does not significantly contribute to ambient noise levels at the noise sensitive areas.

6.3 Construction Noise

Whilst there are no applicable limits for noise emissions during construction activities, it is recommended that emissions are controlled or reduced where practicable for the project. The following best practices can be considered during the construction phase:

- Plan truck movements from and to the Project area to avoid manoeuvres and idling at locations nearby the NSAs.
- Consider quieter methods during construction activities. This may require considering:
    - avoiding metal-to-metal and metal-to-stone contact
    - reducing throttle and turning off equipment when not in use
- Maintain equipment by:
    - inspecting regularly and maintaining equipment to ensure good working order, this may include scheduled maintenance to equipment that are most likely to emit higher noise levels like trucks, graders, air compressors, and telehandlers.

- checking machines with enclosures such as generators, including doors and door seals and that the door closes properly against seals.

7. CONCLUSION

Noise impacts associated with the Project at the closest noise sensitive areas have been assessed based on noise modelling and ambient noise monitoring.

The predicted noise levels from The Project are significantly lower than both the existing ambient levels (measured in 2018) and applicable noise limits. Therefore, the noise associated with the Project is unlikely to contribute to any exceedances of noise limits or to be discernible above ambient noise. Following further definition of noise sources, it is recommended that an Environmental Noise Impact Assessment for the Project is completed in accordance with the Noise Protocol.

APPENDIX A : SOUND POWER LEVELS

Equipment Name	Octave Band Sound Power Level (dB)									SWL
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)
Recovered water to LP column pump (A/B)	72	73	74	76	76	79	76	72	66	82.7
Metering Skid	41	55	62	57	58	62	72	71	61	75.9
Dresser-Rand HOS Compressor Package										
Water return pump (A/B)	72	73	74	76	76	79	76	72	66	82.7
Air cooled exchanger	90	90	96	91	94	95	99	100	99	105.3
Compressors (motor driven)	-	95	96	96	97	98	98	95	91	103.3
SORBEAD Dehydration Package										
Regen gas recovery vapour Sundyne unit (A/B)	-	-	74	86	89	95	95	96	76	101.2
Regen air cooler	90	90	96	91	94	95	99	100	99	98.3
Regen slip electric heater	98	98	97	95	92	89	86	83	80	94.7

APPENDIX B : NOISE CONTOUR