Legend

- Non-stakeholder receiver
- Stakeholder receiver
- Project boundary
- Terminal station + BESS
- Wind turbine (Hexham)
- 15 km scale line
- Natural area
- Wind turbine (Hawkesdale)
- Wind turbine (Mortlake South)
- Wind turbine (Mt Fyans)
- Wind turbine (Salt Creek)
- Wind turbine (Woolsthorpe)
- Mortlake Power Station + BESS

Mortlake Energy Hub

- BESS and substation
- Solar Farm (site A)
- Solar Farm (site B)
- Solar Farm (site C)

Scale

0 2 4 6 8 km

Figure 17.3 Project site, surrounding identified natural areas and other projects

17.7 Impact assessment

17.7.1 Impact pathways

Key activities that have the potential to cause noise and vibration impacts from the construction and operation of the project are:

- Works within the project site associated with wind turbine construction, including civil works, excavation, foundation construction, cable trench digging, and turbine erection.
- Traffic movements on the surrounding road network from:
  - car movements associated with construction personnel
  - heavy vehicle movements associated with the transportation of construction plant, construction materials and components of the proposed turbines and related infrastructure. A significant component of the potential traffic movements relates to the sourcing of aggregate for construction.
- Works associated with the on-site quarry and concrete batching plant operation during project construction. This work would involve rock crushing, material handling operations and heavy goods vehicle movements. For the batching plants, the key sources of noise emissions are the fixed items of batching plant, pumps, and concrete mixing trucks.
- Wind turbine operation. This includes noise and vibration from wind turbine generators and movement of rotor blades.
- On-site substation, battery energy storage system and ancillary activities, which include noise-generating equipment such as transformers, inverters, batteries, and cooling management systems.

17.7.2 Design mitigation

The project's design has been refined to maximise separation distances between noise-producing infrastructure and dwellings, and to minimise noise from construction works and operational activities.

The quarry has been located as far away from occupied dwellings as possible, while still being able to provide enough aggregate at sufficient quality. The closest occupied dwelling, owned by a project stakeholder, is 1,400 metres from the quarry boundary.

The seven temporary concrete batching plants have been located to provide convenient access to all wind turbines, with consideration of setback distances from dwellings. The closest stakeholder dwelling (sensitive receptor) to a proposed concrete batching plant is approximately 1,100 metres. The closest non-stakeholder dwelling is approximately 1,800 metres to a proposed concrete batching plant.

17.7.3 Environmental management measures

Wind farm projects often undergo a degree of micro-siting of infrastructure (including wind turbines) during detailed design, and so preparation of a 'pre-construction noise assessment' will be required for the final project layout and equipment selection. Wind turbine noise predictions for the final layout will be included in that assessment, as well as equipment selection for wind turbines and battery energy storage system, which would ensure that the noise criteria are achieved at all non-stakeholder dwellings under all wind speeds prior to construction commencing.

Management measures, outlined in Table 17.6, are recommended to minimise potential noise and vibration impacts and include community consultation, scheduling of works, and engineered noise reduction measures for plant and equipment.

Table 17.6 Noise and vibration management measures

Noise and vibration impact	Project phase	Management measures	Number
All construction activity noise (including the quarry)	Construction	**Construction Noise and Vibration Management Plan** 1. Prior to the commencement of construction, a Construction Noise and Vibration Management Plan (CNVMP) will be prepared as a sub-plan to the Construction Environmental Management Plan (EMM01) to address the effects of construction noise related to on-site activities and off-site traffic movements, and construction vibration associated with any activities expected to occur at less than 100 m from a receiver. 2. The CNVMP will include the following: a. a clear description of the proposed construction program including the expected timing and duration of key elements of the works b. details of all reasonably practicable measures proposed to fulfil the general environmental duty under the *Environment Protection Act 2017* (EP Act), accounting for guidance under EPA Publication 1834.2: Civil construction, building and demolition guide. The measures will include (but not be limited to): i. restriction of construction activities to normal working hours wherever practical ii. selection of major construction plant to achieve low noise emissions and minimise any distinctive undesirable characteristics iii. maintenance of site equipment and infrastructure to minimise noise emissions iv. planning for the most efficient way to complete the works and minimise duration of the noise v. processes and governance for addressing the general environmental duty (GED), with particular reference to any out of hours work. c. a schedule of noise emission data for the major plant items to be used for construction of the project, including the source reference for this data. d. definitions and justifications for all anticipated unavoidable works, low-noise works and managed- impact works which may occur outside of normal working hours, such as out of hours deliveries or wind turbine installation activities that are subject to weather constraints. e. details relating to proposed routing and timing of construction traffic, including protocols to minimise noise along local roads and within Mortlake to the extent reasonably practicable. This will establish a restriction to avoid heavy vehicle movements related to construction aggregate sourcing from local quarries (if required) prior to 7am on the local road network around the project or within local townships. f. management measures relating to off-site vehicle movements including education of drivers about the general environmental duty under the EP Act and considerate driving practices. g. details of the measures to be implemented to address noise characteristics such as tonality, impulsive noise and low frequency noise, including consideration of residential receivers and noise levels in natural areas. h. the proposed scheduling of any out of hours works, and provide evidence to support that low-noise or managed-impact works meet the criteria defined in EPA Publication 1834.2. i. identify specific activities which warrant notification of neighbouring residents in advance of the work occurring, including unavoidable works outside of normal working hours, peak periods of off-site construction traffic, and activities with potential to cause perceptible vibration. j. details of the complaints management procedure as part of the Complaints and Grievance Mechanism (SE02) k. requirements for periodic reviews and updates, as necessary, including those informed by complaints and any remedial actions taken in response to the Complaints and Grievance Mechanism (SE02). 3. The CNVMP will be prepared in consultation with relevant stakeholders.	NV01

Noise and vibration impact	Project phase	Management measures	Number
	Construction	**Quarry Work Plan - Quarry Noise Management Plan** 1. Prior to the commencement of construction, a Quarry Noise Management Plan will be prepared in consultation with relevant authorities and endorsed as part of the Quarry Work Plan (EMM07). 2. The Quarry Noise Management Plan will document measures to: a. minimise the risk of harm from operational noise so far as reasonably practicable, in accordance with the general environmental duty under the *Environment Protection Act 2017* (EP Act). b. prevent prescribed unreasonable noise by complying with noise limits determined in accordance with EPA Publication 1826.5: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (Noise Protocol). c. prevent unreasonable noise according to the factors defined in part (a) of the definition of unreasonable noise in section 3(1) of the EP Act, accounting for the low frequency guidance of EPA Publication 1996: Noise guidelines: assessing low frequency noise (as amended or replaced from time to time).	NV02
	Construction	**Concrete Batching Plants - Noise management** 1. All temporary concrete batching plants will be designed and operated in accordance with the general management measures in EPA Publication 1806: Reducing risk in the premixed concrete industry. The design and operation of the batching plants would implement measures to: a. minimise the risk of harm from operational noise so far as reasonably practicable, in accordance with the general environmental duty under the *Environment Protection Act 2017* b. prevent prescribed unreasonable noise by complying with noise limits determined in accordance with EPA Publication 1826.5*: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol). c. prevent unreasonable noise according to the factors defined in part (a) of the definition of unreasonable noise in section 3(1) of the *Environment Protection Act 2017,* accounting for the low frequency guidance of EPA Publication 1996: Noise guidelines: assessing low frequency noise (as amended or replaced from time to time).	NV03
Wind turbine noise	Pre-construction	**Pre-construction noise assessment - Wind turbines** 1. Prior to the installation of wind turbines, a pre-construction noise assessment will be completed. This assessment will be undertaken to assess the final project layout and equipment selection to ensure that the noise criteria are achieved at all assessable receivers for all wind speeds. 2. The pre-construction noise assessment will: d. be based on the final wind turbine layout, representative noise emission data for the final selected wind turbine model and the location of all receivers surrounding the wind farm (existing or approved noise sensitive receivers at the time of project approval) e. identify all stakeholder receivers where noise agreements have been established f. be prepared in accordance with the assessment and documentation requirements of NZS 6808:2010 Acoustics – Wind farm noise g. be verified by an EPA Victoria appointed Independent Environmental Auditor in accordance with regulation 52.32-4 of the Moyne Planning Scheme h. be documented in the Operational Noise Management Plan prepared under EMM NV06.	NV04

Noise and vibration impact	Project phase	Management measures	Number
	Operation	**Wind turbine sound power level testing** 1. Prior to the commencement of wind turbine operations, a schedule of sound power level testing will be prepared. This will be undertaken to verify that the noise emissions of a representative selection of installed wind turbines are consistent with the noise emissions presented in the pre-construction noise assessment prepared under EMM NV04. 2. An EPA Victoria appointed Independent Environmental Auditor will be engaged to prepare a report verifying the schedule of sound power level testing. 3. The schedule of sound power level testing and the Independent Environmental Auditor's verification report will be provided to EPA Victoria upon request. Sound power level testing and reporting would subsequently be undertaken in accordance with the schedule.	NV05
	Operation	**Operational Noise Management Plan** 1. Prior to the commencement of wind turbine operations, an Operational Noise Management Plan would be prepared for operational wind turbine noise in accordance with the requirements of regulation 131E of the Environment Protection Regulations 2021 (EP Regulations), as a sub-plan to the Operations Environmental Management Plan (EMM08). 2. In accordance with the EP Regulations, the Operational Noise Management Plan will include requirements for an annual statement detailing the actions undertaken to ensure compliance, and noise monitoring to be undertaken every five years (or as otherwise specified in the EP Regulations) to verify compliance with the applicable noise limits). 3. In addition to the requirements of the EP Regulations, the Operational Noise Management Plan would: a. document the pre-construction noise assessment conducted under EMM NV04 b. account for the guidance of EPA Victoria webpage Wind Energy Facility Turbine Noise Regulation Guidelines and EPA/Department of Transport and Planning Publication 3011: Wind Energy Facility Turbine Noise – Technical Guideline c. stipulate that the post-construction noise monitoring report and the accompanying auditor's verification report would, where practicable, be submitted to EPA Victoria within 10 days of the auditor's verification report being completed d. include requirements for periodic reviews and updates, as necessary, including those informed by complaints and any remedial actions taken in response to the Complaints and Grievance Mechanism (SE02). 4. An EPA Victoria appointed Independent Environmental Auditor (IEA) would be engaged to prepare a report verifying the Operational Noise Management Plan. 5. Both the Operational Noise Management Plan and the IEA's verification report would be provided to EPA Victoria upon request.	NV06

Noise and vibration impact	Project phase	Management measures	Number
	Pre-construction	**Pre-construction noise assessment – On-site terminal station and battery energy storage system** 1. Prior to the commencement of construction, a pre-construction noise assessment is to be submitted to the Responsible Authority demonstrating that the design and operation of the on-site terminal station and battery energy storage system (BESS) include measures to: a. minimise the risk of harm from operational noise so far as reasonably practicable, in accordance with the general environmental duty under the *Environment Protection Act 2017* (EP Act). b. prevent prescribed unreasonable noise by complying with noise limits determined in accordance with EPA Publication 1826.5: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (Noise Protocol). c. prevent unreasonable noise according to the factors defined in part (a) of the definition of unreasonable noise in section 3(1) of the EP Act, accounting for the low frequency guidance of EPA Publication 1996: Noise guidelines: assessing low frequency noise (as amended or replaced from time to time).	NV07
	Decommissioning	**Decommissioning Noise and Vibration Management Plan** 1. A Decommissioning Noise and Vibration Management Plan will be prepared and submitted to the Responsible Authority for endorsement. This would be a sub-plan to the Decommissioning Management Plan (EMM10) and would: a. provide a detailed assessment of decommissioning noise and vibration from project activities b. outline proposed measures to minimise potential impacts.	NV08

17.7.4 Residual impacts

Construction noise

The following obligations apply under the *Environment Protection Act 2017* for construction noise and vibration:

- construction activities must not cause unreasonable noise in accordance with the factors set out in the *Environment Protection Act 2017*
- operation of the on-site quarry and batching plants must not cause noise that is prescribed to be unreasonable or assessed to be unreasonable according to the listed factors set out in the *Environment Protection Act 2017*
- the risk of harm from construction noise and vibration must be minimised, so far as reasonably practicable, in accordance with the general environmental duty.

On-site activities

Sensitive receivers

Noise levels from construction of wind turbines, the terminal station and battery energy storage system, access tracks, cable trench digging and site compounds were predicted at the nearest receivers to provide an indication of the upper range of noise levels. The predicted noise levels for each key construction activity, in relation to the nearest sensitive receiver, are presented in Table 17.7. As the precise equipment selections and working methods would be determined during the development of a construction plan, and that noise associated with construction plant and activity varies significantly, an indicative range of predicted noise levels that may occur in practice are provided.

For most construction activities the predicted noise levels are above the ERS daytime objective of 40 dB $L_{AEQ,16hr}$ for areas surrounding the project site. The highest noise levels are expected occur during the construction of access roads near a non-stakeholder receiver (i.e., D482, with a predicted level range of 55-60 dB L_{Aeq}). These activities will progress quickly and therefore these levels would only be expected to be reached for a short period of time (typically significantly less than three to four weeks for the construction of access roads and less than one week for cable trench digging).

Table 17.7 Indicative range of construction noise predictions

Construction activity	Non-stakeholder			Stakeholder		
	Nearest receiver	Distance to nearest receiver, m	Predicted level range, dB L_{Aeq}	Nearest receiver	Distance to nearest receiver, m	Predicted level range, dB L_{Aeq}
Access track construction	D482	322	55-60	D418 (S)	142	65-70
Battery energy storage system and on-site terminal station	D413	2,584	30-35	D356 (S)	937	40-45
Cable trench digging	D620	788	45-50	D380 (S)	379	55-60
Permanent met mast	D205	909	40-45	D418 (S)	667	45-50
Powerline pole	D299	728	45-50	D355 (S)	401	50-55
Powerline stringing	D299	727	40-45	D355 (S)	400	45-50
Site compound Site operation and maintenance facility and carpark Staging areas Temporary construction site office Wind turbine hardstands	D482	379	50-55	D418 (S)	233	55-60
Turbine assembly	D622	1,041	45-50	D438 (S)	494	50-55
Turbine foundations	D622	1,041	40-45	D438 (S)	494	45-50

Out of hours work, if required, would be limited to low-impact noise works or managed impact works (such as maintenance activities) or unavoidable works that must occur outside normal working hours for safety reasons and/or to reduce traffic disruptions. Prior to construction, measures to be implemented to minimise the risk of harm from construction noise and vibration would be outlined in the Construction Noise and Vibration Management Plan [EMM NV01]. As brief periods of noise above the ERS daytime objective are predicted from some construction activities, the Construction Noise and Vibration Management Plan would include provisions to notify neighbouring residents in advance of noisy works occurring. With the implementation of recommended management measures, the residual impact is considered low.

Natural areas

For the closest natural areas to the project site (i.e., Hexham School Historic Reserve and Lake Connewarren) construction noise levels are estimated to be up to 30-35 dB L_{Aeq} at both areas due to access track construction and cable trench digging. For most construction activities, the predicted construction noise levels at these natural areas are less than 35 dB L_{Aeq}. These noise levels represent the worst case predicted noise levels, assuming that all equipment associated with the activity is operating continuously and under conditions that favour sound propagation. Actual noise levels would be lower and change as construction works move to other areas of the project.

While the predicted noise levels are low for natural areas, construction noise would be distinct from that of the natural sound environment in terms of the frequency and temporal characteristics of the noise. As such, noise from construction would temporarily impact the value of the soundscape in these natural areas when the works are occurring. Measures incorporated into the Construction Noise and Vibration Management Plan [EMM NV01], such as the selection of low noise emission plant and restriction of construction activities to normal working hours (where practical), would minimise the extent and duration of noise impacts to natural areas.

Off-site traffic

The predicted noise levels for key traffic routes and aggregate sourcing scenarios (i.e., on-site and off-site material sourcing) are shown in Table 17.8.

Table 17.8 **Predicted off-site traffic noise levels during the peak period of construction, dB $L_{Aeq,1h}$**

Route	Existing dB	Proposed dB [a]	Change dB
On-site material sourcing			
Hamilton Highway/Dunlop St	55	57	+2
Connewarren Lane	39-40 [b]	46	+6
Off-site material sourcing			
Hamilton Highway/Dunlop St	55	60	+5
Connewarren Lane	39-40 [b]	50	+10

a Combined existing and construction traffic volumes

b Range based on assumed heavy vehicle percentages for Connewarren Lane

The results indicate that construction traffic is likely to result in clearly discernible increases in total road traffic noise levels for both the on-site and off-site material sourcing scenarios, with the increases expected to be most pronounced for the off-site sourcing due to the higher number of heavy vehicle movements. In particular, the noise modelling predicts that noise levels would be above the ERS objectives (i.e., 40 dB $L_{Aeq,16h}$ during the day and 35 dB $L_{Aeq,8h}$ at night) along both traffic routes, particularly for off-site material sourcing and the receivers adjacent the Hamilton Highway in Mortlake.

In accordance with the Construction Noise and Vibration Management Plan [EMM NV01], heavy vehicle movements, on the local road network around the project or within local townships would not occur prior to 7am, other than for over-size and over-mass deliveries. The Construction Noise and Vibration Management Plan would also include measures for informing local communities and other relevant stakeholders (e.g. local council) about the peak periods of construction traffic and the measures that will be implemented to minimise the noise, so far as reasonably practicable. With the implementation of recommended management measures, the residual impact is considered medium.

On-site quarry and concrete batching plant

Predicted noise levels from the proposed on-site quarry and concrete batching plants at all sensitive receivers within three kilometres from this site are outlined in Table 17.9 and Table 17.10, respectively.

The results indicate that noise levels at all dwellings within three kilometres of the quarry site and concrete batching plants are predicted to be lower than the daytime noise limit of 46 dB ENL (refer to Table 17.3 in Section 17.3.2). For the nearest non-stakeholder dwelling (D299, located approximately 3.9 kilometres from the quarry site), quarry noise levels are predicted to be 9 dB below the applicable daytime noise limit. As such, noise from the proposed on-site quarry and concrete batching plants are not likely to be a project design constraint provided that the operations are limited to the daytime.

The Quarry Noise Management Plan, prepared as part of the Quarry Work Plan [EMM NV02], and the Construction Noise and Vibration Management Plan [EMM NV01] would include details of all reasonably practicable mitigation measures to be implemented to fulfil the general environmental duty under the *Environment Protection Act 2017* and achieve the noise limits in accordance with the Noise Protocol. With these management measures in place, residual impacts associated with noise from the on-site quarry and concrete batching plants is anticipated to be low.

Table 17.9 **Estimated noise levels from on-site quarry at dwellings within three kilometres of the quarry site**

Receiver	Separation distance (m)	Estimated noise level, dB Effective Noise Level (ENL)
Stakeholder receivers within project site boundary		
D40 (S)	2,957	41
D197 (S)	2,873	36
D298 (S)	2,914	41
D397 (S)	2,646	42
D441 (S)	2,763	37
D442 (S)	2,609	42

Table 17.10 Estimated noise levels from concrete batching plants at dwellings within three kilometres a concrete batching plant

Receiver	Separation distance (m)	Estimated noise level, dB Effective Noise Level (ENL)
Non-stakeholder receivers		
D36	2,357	28
D413	1,758	37
D482	2,813	30
D620	2,451	29
Stakeholder receiver outside project site boundary		
D362 (S)	1,600	24
Stakeholder receivers within project site boundary		
D34 (S)	2,377	16
D35 (S)	1,734	19
D40 (S)	2,818	42
D197 (S)	1,239	32
D298 (S)	2,481	28
D355 (S)	2,455	18
D356 (S)	1,204	19
D357 (S)	1,409	14
D359 (S)	2,936	12
D361 (S)	2,070	25
D366 (S)	2,137	19
D378 (S)	1,415	28
D379 (S)	1,794	25
D380 (S)	1,392	27
D395 (S)	2,398	32
D396 (S)	1,751	22
D397 (S)	2,418	31
D398 (S)	2,944	25
D417 (S)	1,858	26
D418 (S)	2,654	13
D422 (S)	2,138	19
D423 (S)	2,049	19
D428 (S)	1,221	43
D429 (S)	1,107	40
D430 (S)	1,104	43
D438 (S)	2,198	16
D441 (S)	2,359	41
D442 (S)	2,484	31
D444 (S)	2,974	25

As a conservative assessment, potential noise impacts of the on-site quarry and all concrete batching plants operating simultaneously was considered. These results indicate that cumulative estimated noise levels are below the applicable noise limit (46 dB ENL) at all receivers by at least 2 dB.

A noise contour map of the cumulative estimated noise levels from the proposed on-site quarry and concrete batching plants is shown in Figure 17.4.

The cumulative noise level from these activities is predicted to be below 20 dB L_{Aeq} at the nearest natural areas (i.e., Hexham School Historic Reserve and Lake Connewarren). As such, noise from the on-site quarry and concrete batching plants during the proposed operational daytime period in accordance with the EP Regulations is not expected to be audible at these sites.

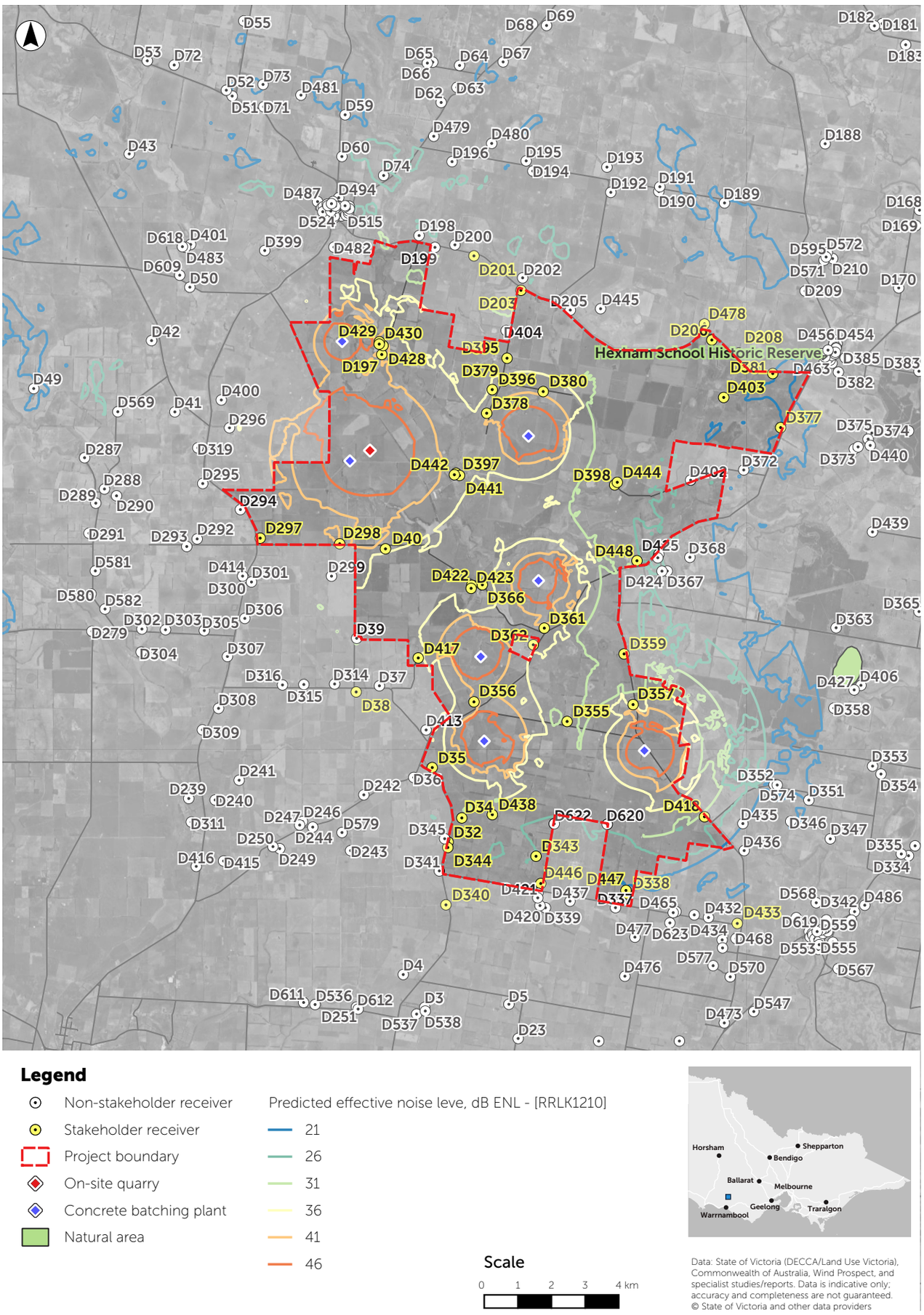

Figure 17.4 Cumulative estimated operational noise levels from the on-site quarry and concrete batching plants

Construction vibration

The nearest receiver to construction activities is a stakeholder receiver (D361) located approximately 140 metres from the proposed access tracks. The nearest non-stakeholder receiver (D482) is located approximately 320 metres from the proposed access tracks.

The distance from proposed access tracks to the nearest sensitive receivers is at least 140 metres, which is greater than the minimum working distances for cosmetic damage (25 metres) and human comfort (100 metres) as specified in the New South Wales Roads and Maritime Services Construction Noise & Vibration Guidelines. As construction activities are beyond the safe working distances for both cosmetic damage and human response, vibration impacts are considered a low risk for the project and vibration monitoring is not expected to be required.

Operational noise

Wind turbine noise

The noise level at stakeholder and non-stakeholder dwellings is provided in the ***Environmental Noise and Vibration Impact Assessment*** (Appendix E1) in tabulated form for wind turbine operation. The results indicate that wind turbine noise levels are predicted to comply with the noise limits for all receivers. Specifically, the predicted wind turbine noise levels are:

- below the applicable base noise limit of 40 dB L_{A90} by at least 0.4 dB at all non-stakeholder receivers
- below the applicable base noise limit of 45 dB L_{A90}, by at least 8.4 dB at all stakeholder receivers outside the project site boundary where a noise agreement is proposed. As the predicted noise levels are at least 3.4 dB below the base noise limit of 40 dB L_{A90} applicable to non-stakeholders, a noise agreement is not required to achieve compliance with the Environmental Performance Regulations.
- below the reference base noise level of 45 dB L_{A90} by at least 1.6 dB at all stakeholder receivers within the project site boundary.

The locations of the predicted 30, 35, 40 and 45 dB L_{A90} noise contours are shown in Figure 17.5 corresponding to the hub height wind speed which results in the highest predicted noise levels.

The highest predicted noise level at Lake Connewarren, the closest natural area to the project site, is 26 dB L_{A90}. While wind turbine noise may be audible at times, this would be influenced by wind conditions and the specific characteristics of the background environment. On the limited occasions when wind turbine noise may be audible, it is likely to be difficult to distinguish from other ambient noise sources, particularly in the presence of any wind disturbance of vegetation in the area.

With the implementation of management measures (NV04, NV05, NV06) the residual impact would be low.