

Technical Report 16

# Assessment of Construction Noise Effects

## Revision History

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## Document Acceptance

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## Executive summary

This report provides an assessment of construction noise effects for the proposed MacKays to Peka Peka Expressway Project on noise sensitive buildings in the vicinity.

It contains a discussion of appropriate criteria and assessment methodologies and details of predicted noise levels and potential areas of risk. Construction noise criteria are based on those contained in NZS6803:1999, with the aim of achieving compliance with these criteria where practicable. The Standard acknowledges the requirement of Section 16 of the Resource Management Act that the best practicable option be adopted to ensure that noise emissions from any site do not exceed a reasonable level. The methodology used for this assessment takes account of, and discusses, the practicability of mitigation options.

Through the prediction of noise levels from proposed construction activities, and a review of potential noise mitigation and management measures, areas of risk have been identified where full compliance with the criteria may not be able to be achieved. These include areas where night-time works are required in order to avoid disruption to local traffic due to road closures, e.g. for the installation of Expressway bridges over local main roads.

Construction noise has been predicted using noise sources measured as part of previous projects and from information contained in NZS6803:1999 and BS5228-1:2009. Tables are provided that show potential noise emissions from the construction activities proposed. These predictions are based on assumptions provided by the Project team<sup>1</sup> and contain some uncertainty about actual equipment to be used and duration of activities.

General noise management and mitigation measures have been recommended that should be implemented throughout the Project construction as a best practice provision, e.g. the maintenance of equipment to a high level and the avoidance of unnecessary noise such as the use of horns. In addition, where there is a risk that the construction noise standards would be exceeded, recommendations for specific noise mitigation and management methodologies are provided. These recommendations are site specific and involve additional measures such as the installation of temporary construction noise barriers or the timing of construction activities to avoid effects on receivers, e.g. summer holidays.

The construction noise criteria are likely to be exceeded during some activities. While the intention is to meet the criteria as far as practicable, there will be times when construction cannot be undertaken within the noise limits, and alternative management will need to be implemented. This

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<sup>1</sup> This Technical Report refers to the Project team as carrying out works on behalf of and as contracted by the NZTA. The NZTA is the requiring authority and the consent holder.

may involve one-on-one discussions with affected residents, and may, in some instances, require temporary relocation of residents.

The effects of construction noise will require active noise management throughout construction to avoid, remedy or mitigate such effects. This would be undertaken through the implementation of the Construction Noise and Vibration Management Plan (CNVMP – Appendix F of the CEMP, Volume 4) which will be formulated and updated as appropriate to reflect the actual activities occurring. The CNVMP forms the basis of all construction noise management and mitigation and contains detailed information regarding communication, training, maintenance, mitigation and other aspects of construction that affect the noise generation.

Overall, the construction of the Project is predicted to result in noise levels that are generally within the construction noise criteria in accordance with the New Zealand Standard NZS6806:1999, with some exceptions. While construction noise levels are higher than ongoing operational noise levels, it is commonly accepted that for any construction to occur, noise criteria must be less stringent, with the understanding that construction is a temporary activity with a finite duration.

It is considered that this Project can be constructed within reasonable noise criteria, provided that the best practicable option of mitigation is implemented throughout and contractors are committed to managing construction noise on an ongoing basis.

## 1. Introduction

The purpose of this report is to provide an assessment of the NZTA's proposed MacKays to Peka Peka Expressway in relation to construction noise effects. Where this assessment identifies potential adverse construction noise effects on occupiers in the vicinity, the report provides recommendations for noise mitigation and management methodologies.

This noise report relates closely to reports pertaining to operational (traffic) noise<sup>2</sup> and construction and operational vibration.<sup>3</sup> It is based on the proposed construction methodology provided to Marshall Day Acoustics (MDA) by the Project team. The results of the construction noise assessment, specifically the management and mitigation measures, form part of the Environmental Management Plans.

A glossary of technical terms is contained in Appendix 16.A.

## 2. Existing noise environment

As set out in the Pre Construction Noise Level Survey (Technical Report 17, Volume 3), the ambient noise environment in the vicinity of the proposed Expressway is relatively low due to the absence of major local roads and industry. Exceptions are the northern and southern connections of the proposed Expressway with the existing SH1 affecting ambient noise levels at Leinster Avenue and Peka Peka Road.

Ambient noise measurements showed a range of noise levels from 40 dB to 68 dB  $L_{Aeq(24h)}$  demonstrating the varying effect of relative proximity to existing roads, with noise levels at the lower end representing positions located away from the existing roading network and at the higher end representing positions close to existing major roads (such as the existing SH1, Kāpiti and Te Moana Roads). Background  $L_{A90}$  levels for the majority of the route are also low; during the night-time  $L_{A90}$  noise levels are typically below 35 dB.

The existing ambient noise levels for the majority of the Alignment are not controlled by current road traffic noise but by natural environmental noise.

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<sup>2</sup> Technical Report 15, Volume 3 of the AEE

<sup>3</sup> Technical Report 18, Volume 3 of the AEE

### 3. Project description

A full Project description is contained in Part D, Chapter 7, Volume 2, of the Assessment of Environmental Effects. The following sections contain a brief overview of each Project sector in relation to features that may affect noise generation.

#### 3.1. Sector 1 – MacKays Crossing to Raumati Road

Sector 1 is extended from south of Poplar Avenue to the north of Raumati Road (Chainage 900 to 4500).

Following is an overview of the proposed Expressway Alignment, bridges, interchange and local road connections as they may have an effect on construction noise generation:

- The proposed Expressway crosses over Poplar Avenue. Poplar Avenue itself will remain at grade but will be realigned to the north at its existing location.
- A partial interchange will be located at Poplar Avenue with on and off ramps.
- The proposed Expressway crosses the eastern end of Leinster Avenue. Leinster Avenue will be closed at this location to form a cul-de-sac. A separate access way will be provided for properties north of Leinster Avenue.
- The Expressway will cross over Raumati Road (with twin bridges). Raumati Road will remain at grade.

#### 3.2. Sector 2 – Raumati Road to Mazengarb Road

Sector 2 commences north of Raumati Road and extends to north of Mazengarb Road.

Following is a general overview of the proposed Expressway Alignment, bridges, interchange and local road connections as they may affect construction noise generation:

- The proposed Expressway will cross over Kāpiti Road (twin bridges).
- A full diamond interchange will be constructed at Kāpiti Road. This will consist of north and south facing on and off ramps connecting to Kāpiti Road.
- Kāpiti Road will remain at grade with improvements made to the local road to allow the network to manage the Expressway traffic. These improvements will generally include widening Kāpiti Road to 6 lanes and generally two traffic lanes in each direction. In addition, the intersection of the on and off ramps will be signalised to control traffic exiting the proposed Expressway onto Kāpiti Road and vice versa.
- The proposed Expressway will cross over Mazengarb Road on twin bridges. Mazengarb Road will be slightly lowered to reduce the height of the proposed Expressway.

#### 3.3. Sector 3 – Mazengarb Road to North of Te Moana Interchange

Sector 3 extends from north of Mazengarb Road to the north of Te Moana Road.



The following paragraphs provide a general overview of the proposed Expressway Alignment, bridges, interchange and local road connections as they may affect construction noise generation:

- The proposed Expressway will cross over Otaihanga Road. Otaihanga Road will remain at grade in its current location. A new accessway will be provided for those properties on the eastern side of the proposed Expressway to the north of Otaihanga Road.
- The proposed Expressway will cross over the Waikanae River and a new access road to the Waikanae Christian Holiday Camp (El Rancho).
- The proposed Expressway will cross over Te Moana Road. A full diamond interchange will be located at Te Moana Road consisting of north and south facing on and off ramps connecting to Te Moana Road.
- Two roundabouts on Te Moana Road will be built to the east and the west of the proposed Expressway to provide access onto and off the proposed Expressway, without the need for signals.
- Near the bridge, Te Moana Road will need to be widened. Te Moana Road will remain at grade in its current location.

### **3.4. Sector 4 – North of Te Moana Interchange to Peka Peka Road**

Sector 4 commences north of Te Moana Road and ends to the north of Peka Peka Road.

A general overview of the proposed Expressway Alignment, bridges, interchange and local road connections, as they affect construction noise generation, is provided below:

- The proposed Expressway passes under Ngarara Road. Ngarara Road will be bridged over the proposed Expressway and requires a minor realignment.
- A new local road will be bridged over the proposed Expressway to provide access to properties currently serviced by Smithfield Road and the Nga Manu nature reserve on the eastern side of the Alignment.
- On the western side of the proposed Expressway, existing Smithfield Road will be retained up to the edge of the proposed Designation boundary. On the eastern side of the proposed Expressway, existing Smithfield Road will be retained up to the edge of the proposed Designation boundary and a local road connection made between the new Smithfield Road and the existing Smithfield Road for the purposes of continued access to properties.
- A partial interchange will be located at Peka Peka Road with on and off ramps.
- A local connection from existing SH1 heading north passes over the proposed Expressway south of Peka Peka Road and connects to a roundabout at grade at Peka Peka Road. A new roundabout will provide a local connection onto Peka Peka Road, a local connection northward as well as a northern on ramp to the proposed Expressway.

### **3.5. Duration of construction activities**

The overall construction timeframe for the entire Project is expected to be four years. This will comprise of the following activities:

- Preload and surcharge of peat areas (Sectors 1, 3 & 4): 3 years
- Kāpiti Road to Te Moana Road (Sectors 2 and 3): 3 years
- Southern Tie-in at MacKays Crossing (Sectors 1 and 2): 2 years
- Northern Tie-in at Peka Peka Beach Road (Sector 4): 2 years

More details on the duration of each activity are given in Tables 9-6 to 9-9.

#### 4. Construction methodology

This assessment addresses the noise effects from the construction of the Project. Construction in each sector involves different noise sources, sensitivities and effects.

The construction of the Project will involve noisy machinery operating in relatively close proximity to noise sensitive receivers. Night-time construction may be required in certain areas. Noise effects will need to be carefully managed throughout construction through the use of management systems and plans (refer Section 8).

The main activities generating construction noise are as follows:

- Bulk earthworks will likely be the most significant activity in the Project. This will involve large numbers of earthmoving machinery. There is likely to be a significant volume of earth which will need to be moved and/or processed.
- Fill haulage will generally occur along the Project Alignment rather than State Highway 1. For this reason, the haul route has been considered as part of the bulk earthworks operation. Notwithstanding this, fill will be brought to site via Ihakara Street (through an industrial area) and Poplar Avenue. Noise from fill haulage is expected to be insignificant when this occurs during daytime.
- There are several bridges along the route. It is likely that the bridges crossing major roads will need to be constructed during the night-period under road closures. It is likely that only bridge beam placement will need to occur during the night-period in order to minimise night-time works, with the remainder of works being undertaken during daytime under temporary traffic management procedures. Vibroreplacement and rammed piles during foundation works have the potential to cause high noise levels during daytime period.
- Sealing and road finishing would be completed once bulk earthworks are completed. Noise levels from these activities would typically only exceed the construction noise criteria at interchanges with local roads where dwellings are in very close proximity.
- The construction of traffic noise barriers may exceed the construction noise criteria where they are placed along the residential property boundaries. However, once constructed these barriers would also provide shielding from construction noise and would therefore be beneficial if constructed early during the construction process.
- Construction yards are intended to be located along the Alignment to accommodate and service the works. Eleven yards are proposed in total. Some of these yards (“bridge” yards

and “intersection” yards) are likely to operate for a period that is shorter than the total Project duration and would have limited activity. The main yard (“Project” yard) at Otaihanga Road is likely to operate for the entire duration of works.

- The activities which have the highest risk of adverse construction noise effects in each Project Sector are outlined in the following Table 3-1, and described in detail in Section 9.

**Table 4-1: Key construction noise issues**

Sector	Noise generating activities
1	Fill delivery for preload construction Excavation and fill Road base course and sealing works Bridge construction, including piling & vibroreplacement Local road realignment and resurfacing
2	Fill delivery for preload construction Excavation and fill Off-road earthworks transport Road base course and sealing works Bridge construction, including piling & vibroreplacement Construction of traffic noise barriers Local road realignment and resurfacing
3	Fill delivery for preload construction Excavation and fill Off-road earthworks transport Road base course and sealing works Bridge construction, including piling & vibroreplacement Local road realignment and resurfacing

Sector	Noise generating activities
4	Fill delivery for preload construction Excavation and fill Off-road earthworks transport Road base course and sealing works Bridge construction, including piling & vibroreplacement Local road realignment and resurfacing

## 5. Assessment methodology

The following methodology has been used for the construction noise assessment:

1. Acoustic considerations were one factor in determining the preferred route option: the selection of the proposed Expressway corridor has been instrumental in reducing the adverse effects of construction noise of an Expressway between MacKays Crossing and Peka Peka. This included the choice of an alignment that avoided low noise environments, such as at Raumati South by not following the existing WLR designation through a currently quiet environment and instead aligning the proposed Expressway with the existing SH1, and by choosing the location of construction yards to avoid close proximity to dwellings.
2. A review of the preferred Alignment has been undertaken and nearby receivers considered.
3. A review of noise emission data for each construction task / process has been undertaken. Data previously obtained by Marshall Day Acoustics has informed this process. In addition, data from appropriate noise standards has also been considered, where relevant.
4. Ambient noise measurements along the proposed route have been undertaken as part of the operational noise assessment (Technical Report 17, Volume 3). This information has been considered in determining reasonable night-time noise criteria for the construction activity.
5. A review of relevant noise assessment criteria was undertaken: these criteria are set out in this report and Project noise limits based on the criteria in NZS6803:1999 have been recommended.
6. Predictions of noise levels from each construction process have been undertaken and dwellings that are likely to receive noise levels above the construction noise criteria identified.

7. Where potential exceedances are identified, the best practicable option (BPO) for reducing noise effects has been identified. These have been included in the draft Construction Noise and Vibration Management Plan (CNVMP).<sup>4</sup> Any modified construction methodology would need to be taken into consideration and included in, and by regular updating of, the CNVMP.

## 6. Noise performance criteria

### 6.1. District Plan

The Project will be constructed under a Designation, therefore, the District Plan noise rules do not strictly apply. However, review of the relevant rules provides a suitable basis of assessment as it sets out the expectations of residents in the District.

The Project (Sectors 1 to 4) is located within the jurisdiction of the Kāpiti Coast District Council. The Kāpiti Coast District Plan Section *D.2 Rural Zone Controlled Activity Standards Construction Noise from New Roads* specifies noise for construction associated with any new road shall comply with the limits prescribed in New Zealand Standard NZS 6803P:1984 “The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work”. Noise criteria for construction in the residential zone are set out in the District Plan Section D1-22 and also reference NZS6803P:1983.

The 1984 version of NZS 6803 is a 26-year old provisional Standard. It has been replaced by the 1999 version of the Standard (refer Section 7.2.1). However, there is no significant difference between the two versions of NZS 6803; compliance with the 1999 version of the standard will typically mean that compliance with the 1984P standard is achieved. The current 1999 version is the most up-to-date Standard, which integrates with the newest versions of associated Standards such as NZS 6801:2008<sup>5</sup> and NZS 6802:2008<sup>6</sup>, specifically including technical refinements such as the use of the  $L_{Aeq(T)}$  parameter rather than that of  $L_{A10}$ .

The NZS6803:1999 standard is widely acknowledged as being appropriate for construction noise management and is recommended in place of the 1984P standard. The 1999 standard is discussed below.

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<sup>4</sup> Refer to Appendix F of the CEMP, Volume 4.

<sup>5</sup> NZS6801:2008 Acoustics – Measurement of Environmental Sound

<sup>6</sup> NZS6802:2008 Acoustics – Environmental Noise

## 6.2. NZS6803:1999 “Acoustics – Construction Noise”

The New Zealand Construction Noise Standard NZS 6803:1999 “Acoustics – Construction Noise” contains recommended noise criteria that are specifically intended for the control of noise from construction activities.

The criteria apply at a distance of 1 metre from closest occupied building façades. Noise levels ( $L_{Aeq}$ ) are time-based. All criteria and levels quoted in this report are referenced to (T) with T being a representative assessment duration between 10 and 60 minutes.

### 6.2.1. Construction noise criteria

The recommended noise criteria of NZS 6803:1999 are summarised in Tables 7-1 and 7-2 below.

**Table 6-1: Recommended upper limits for construction noise received in residential zones<sup>7</sup>**

Time of week	Time period	Duration of work	
		Long-term duration (dB)	
		$L_{Aeq(T)}$	$L_{AFmax}$
Weekdays	0630-0730	55	75
	0730-1800	70	85
	1800-2000	65	80
	2000-0630	45	75
Saturdays	0630-0730	45	75
	0730-1800	70	85
	1800-2000	45	75
	2000-0630	45	75
Sundays and public holidays	0630-0730	45	75
	0730-1800	55	85
	1800-2000	45	75
	2000-0630	45	75

<sup>7</sup> NZS 6803:1999 Acoustics – Construction Noise, Section 7.2.3 Table 2

**Table 6-2: Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year<sup>8</sup>**

Time period	Duration of work
All days of the year	Long-term duration
	$L_{Aeq(T)}$ (dB)
0730-1800	70
1800-0730	75

The Standard provides for higher noise criteria during normal working hours for construction noise received in residential areas to enable construction activity to take place. For commercial and industrial areas, less stringent noise criteria are specified during night-time when it is less likely that persons or business activities would be affected by construction noise.

The Standard specifies more stringent noise criteria for construction activity in residential areas that occurs during Sundays (refer Table 7-1 above). It is generally accepted that the lower Sunday noise criteria are intended to provide a day of rest from noise, as the 55 dB  $L_{Aeq(T)}$  limit is such that only quieter operation would be possible. This approach is considered reasonable for the Project given the long duration of the construction programme and the low ambient noise levels in the vicinity.

### **6.2.2. Night-time and Sunday Background Noise Level**

Construction is not generally proposed over a 24 hour period for this Project as it can practicably be completed without significant night-works. However, some bridges are likely to require night-time construction to reduce the impacts on traffic on major local roads. This would likely be confined to activities relating to bridge beam placement in order to minimise the duration of night-time construction. Furthermore, it is possible that some other unforeseen construction activities may be required during night-time.

NZS 6803:1999 provides a recommended criterion of 45 dB  $L_{Aeq(T)}$  for night-time and Sunday construction noise received at residential dwellings. Section 7.2.6 of NZS 6803:1999 recognises that such criterion may not be appropriate in all circumstances, e.g. where existing noise levels are already elevated due to other noise sources in the vicinity. The Standard allows for the determination of an alternative noise criterion using the “background plus” approach, for circumstances where high background noise levels exist. This approach allows the determination

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<sup>8</sup> NZS 6803:1999 Acoustics – Construction Noise, Section 7.2.4 Table 3

of an alternative  $L_{Aeq(T)}$  noise criterion by adding 10 decibels to the measured background noise level ( $L_{A90}$ ) noise levels.

The background noise levels have been measured at representative locations along the Project Alignment.<sup>9</sup> During night-time, average  $L_{A90}$  noise levels are typically below 35 dB, at most receivers. Therefore, based on the noise survey results, no increase to the night-time noise limit is considered justified and night-time and Sunday construction noise criteria are recommended to be those of NZS 6803:1999, without alteration.

However, during night-time works these criteria will be exceeded for a limited duration, and mitigation measures such as alternative equipment or construction noise barriers will not be sufficient to achieve compliance with the 45 dB  $L_{Aeq}$  noise criterion. In this instance, it is recommended that the best practicable option for mitigation and management of noise levels is implemented which may include measures such as communication and consultation with affected residents and, where night-time operations extend over several consecutive nights, temporary relocation of residents. Such measures would be determined through a Site Specific Noise Management Plan, which is further explained in Section 8.2 below.<sup>10</sup>

### 6.3. NZTA Environmental Plan

The NZTA has developed an 'Environmental Plan' (June 2008). The Environmental Plan is intended to support environmental sustainability of the NZTA's projects and contains sections on several issues, including construction noise. The Environmental Plan discusses a number of approaches designed to reduce construction noise effects on sensitive receiver positions.

The methods outlined in the Environmental Plan to manage construction noise include the following:

- Monitoring and reporting requirements, including results of risk assessments and noise measurements
- Identifying appropriate noise mitigation measures to be implemented and
- Procedures for maintaining contact with stakeholders and managing noise complaints

The Environmental Plan also refers to situations where it is necessary and justified to undertake construction at night. It states that any night-time noise criteria should be reasonable and practicable.

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<sup>9</sup> Refer Technical Report 17, Volume 3, Pre Construction Noise Level Survey

<sup>10</sup> Refer also to section 13 of Appendix F of the CEMP, Volume 4.



The NZTA has developed a set of tools and standard procedures for addressing construction noise to give effect to the Environmental Plan. These are contained within the website:  
<http://acoustics.nzta.govt.nz/>.

These tools can be used for the Project, and have been incorporated into the CNVMP for the Project.

#### **6.4. Resource Management Act**

Under the provisions of the Resource Management Act (RMA) there is a duty to adopt the best practicable option to ensure that the noise from any development does not exceed a reasonable level. Specifically, Sections 16 and 17 reference noise effects as follows.

Section 16 states that *“every occupier of land (including any coastal marine area), and every person carrying out an activity, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level”*.

Section 17 states that *“every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity, whether or not the activity is in accordance with a rule in a plan, a resource consent or relevant sections of the RMA”*.

#### **6.5. Assessment of construction noise effects**

##### **6.5.1. Assessment standard**

For this Project, construction noise levels should be managed to comply with the requirements of NZS6803:1999 noise criteria where practicable.

NZS6806 provides for construction noise criteria that are higher than criteria for ongoing operational noise levels. This is because it is commonly accepted that for any construction to occur, noise criteria must be less stringent, with the understanding that construction is a temporary activity with a finite duration. The Standard states in the Foreword:

*“The generally acceptable level of intrusive noise in the community is assessed under the provisions of NZS6802:1999. However, construction noise is outside the scope of NZS6802:1999 because it usually cannot be kept within the specified limits. Although this may mean that the noise is undesirable, it is not necessarily unreasonable when all the relevant factors are taken into consideration. Construction noise is an inherent part of the progress of society. “*

##### **6.5.2. Change in noise level**

The ambient noise levels in the area under consideration are generally low. Therefore, even when achieving compliance with the daytime construction noise criteria, there will be a significant increase in overall noise level during the construction phase. This is, as set out by the Standard, an expected and inevitable result of large construction projects in the vicinity of receivers.

The tables in Section 9.6 contain predicted worst case construction noise levels which are based on reasonable assumptions as to the construction methodology, timing and equipment to be implemented. While information provided by the construction contractor is reasonably detailed, it is noted that no final decision has been made as to the specific equipment and timing. Therefore, the noise level predictions provided should be understood to be flexible as construction methodologies may change prior to, and even throughout, construction. In order to take account of this potential for change, this assessment relies on the formulation, update and implementation of the Construction Noise and Vibration Management Plan.<sup>11</sup> The management plan is the appropriate location for actual and detailed information relating to construction noise predictions, mitigation and management.

### **6.5.3. Timing of construction**

The tables in Section 9.6 also show a “total duration” of construction activities. It is important to bear in mind that these durations relate to the entire activity. For instance, bridge construction at Te Moana Road is expected to take approximately 8 months, with 12 nights of bridge beam placements. This does not, however, mean that the predicted noise levels in excess of the criteria would occur for the entire time, at all closest receivers. Certain activities will occur over limited times (e.g. the beam placement over 12 nights) and at varying distances to dwellings. Therefore, each dwelling would receive varying noise levels throughout the construction of the bridge which would range from just audible (e.g. for dwellings more distant and for low noise activities such as road marking) to very loud (e.g. for dwellings very close to construction and for vibroplacing of piles).

This effect of varying noise levels is even more pronounced for straight road sections where the construction activities will vary in timing and distance. For instance, large sections of the proposed Expressway Alignment are proposed to be pre-loaded and be left to settle for several months prior to further construction activities occurring. During the road construction, equipment will move along the Alignment and therefore be in close proximity to individual dwellings for short times only, e.g. for half a day, before moving on.

### **6.5.4. Potential adverse effects**

Keeping the above points in mind, even when achieving compliance with the daytime construction noise limit of 70 dB L<sub>Aeq</sub>, resulting noise levels will be above those desirable for noise sensitive activities such as watching TV or conversations. (Generally, external noise levels above 65 dB L<sub>Aeq</sub> can cause annoyance and disruption to noise sensitive activities.)

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<sup>11</sup> Refer to Appendix F of the CEMP, Volume 4.

The following figure shows approximate noise levels that can be related to everyday and construction noise levels expected:

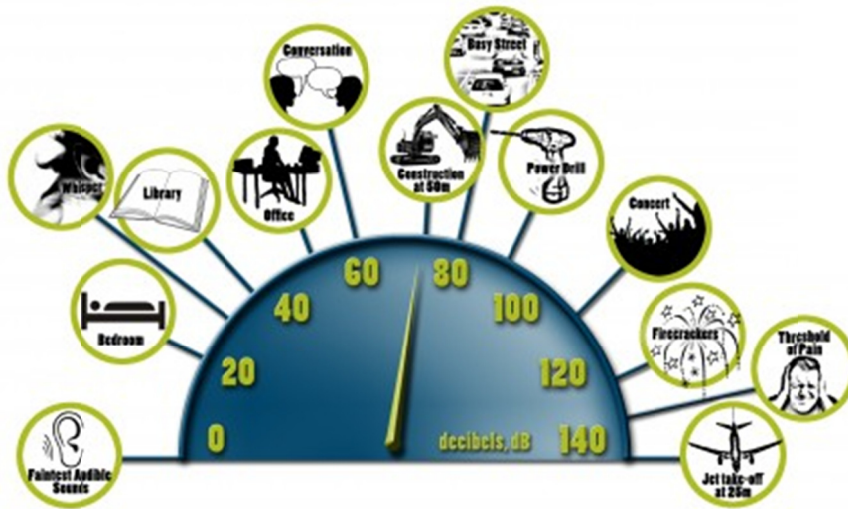


Figure 7-1: Typical noise levels for various activities<sup>12</sup>

#### 6.5.5. Exceedance of criteria

Construction would occur in close proximity to receivers. In some instances, noise emissions have the potential to exceed the recommended construction noise criteria. For most large scale construction projects, minor exceedances of the construction noise criteria for brief periods of time are common. Provided these exceedances are temporary and of limited duration, this may not be unreasonable.

The duration of a construction activity exceeding criteria that could be considered to be reasonable, may vary from site to site and activity to activity. The circumstances in which an exceedance may occur, affect their effects on neighbouring dwellings. For instance, where daytime noise criteria are exceeded for several days, but neighbouring residents are not at home, no one would be affected and therefore mitigation may not be required beyond communication with the residents.

In the event that night-time works occur for one or two nights, this may be acceptable provided that residents have been informed and a clear time frame provided. However, should night-time works be ongoing for several consecutive nights, and at a noise level that affects residents' ability to sleep, then alternatives should be found such as the temporary relocation for the most affected residents.

<sup>12</sup> <http://acoustics.nzta.govt.nz/basics/acoustics-principles>

### **6.5.6. Management of construction noise**

Construction noise is inherently loud and therefore disruptive, but is generally accepted by the community as an inevitable requirement in society. Therefore, the construction noise criteria, while high, are considered to be an acceptable compromise between amenity and progress.

The focus of a construction noise assessment is on managing the noise levels and resulting effects, rather than meeting a specific criterion. Such management and mitigation measures would be found in the CNVMP that provides detail as to the methodology for pro-actively avoiding, or responding to, any issues.<sup>13</sup>

For instance, for potential exceedances of long duration or great magnitude, measures should be implemented to manage or mitigate noise generation as far as practicable. Where exceedances are still likely, a Site Specific Noise Management Plan (SSNMP) should be produced that sets out alternative mitigation measures that should be implemented in order to achieve suitable outcomes for all parties affected. This may include mitigation and management measures such as temporary relocation of residents. This would be determined on a case-by-case basis throughout the construction process when construction equipment, methodologies and timing has been ascertained.

It is considered that this Project can be constructed within reasonable noise criteria, provided that the best practicable option of mitigation is implemented throughout and contractors are committed to managing construction noise on an ongoing basis.

## **7. Construction noise mitigation and management**

### **7.1. General noise management and mitigation measures**

The following general noise mitigation measures should be implemented throughout the construction of the Project as a matter of good practice, and are considered to be the baseline mitigation for most circumstances. Where the implementation of the 'general mitigation measures' described below is dependent of a best practicable approach, this is noted in the appropriate section of the assessment.

Where a potential exceedance of the Project construction noise criteria of the tables in Section 7.2.1 is identified due to a specific activity or in a specific area, the general mitigation measures may not be sufficient to achieve full compliance, and further mitigation should be investigated and implemented where practicable.

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<sup>13</sup> Refer to section 10.5 and Appendix F.B of Appendix F of the CEMP, Volume 4.

### **7.1.1. Training of personnel**

All personnel on site should be made aware of the importance of operating in the quietest practicable manner and be familiar with the CNVMP. All personnel working on the Project, including Contractor employees and subcontractors, have the responsibility of following the requirements of the CNVMP at all times while on site or on the way to or from the site.

### **7.1.2. Maintenance of equipment**

Construction equipment noise levels correlate to the degree of maintenance of such equipment. Potential unnecessary noise sources include squeaking excavator or bulldozer chains, noisy engines and grinding conveyors.

All plant should be maintained to ensure that noise emissions remain as low as practicable.

### **7.1.3. Temporary construction noise barriers**

Where noisy equipment is operating in close proximity to sensitive receivers and noise levels are predicted to exceed the Project noise criteria, consideration should be given as to whether it is practicable to screen the noise source from sensitive receivers using acoustic barriers.

Where practicable and effective, permanent (traffic) noise barriers required for operational noise mitigation following completion of the Project should be erected early during construction. Traffic noise barriers can be constructed in their final form utilising the proposed final materials, or final supports can be constructed and temporary materials utilised throughout construction to avoid damage of final barrier panels. Suitable materials are those described below for temporary barriers.

Temporary noise barriers should be utilised for those areas where no permanent (traffic) noise barriers are required or where these cannot be practicably implemented early during construction. Temporary barriers are typically constructed from plywood and need to be of sufficient height to screen acoustic line-of-sight between the receiver and the noise source. Solid plywood site hoarding can often be effective as a temporary noise barrier.

Construction noise barriers should be installed where effective and practicable, and be completed prior to the commencement of the construction activity that is predicted to cause an exceedance of the noise criteria.

### **7.1.4. Enclosures**

Noisy stationary equipment, e.g. generators, can benefit from enclosures. Any enclosure should be designed by a suitably qualified and experienced acoustic specialist. Enclosures should be utilised if effective and practicable. This would be decided on a case-by-case basis.

### **7.1.5. Selection of low noise plant**

Low noise plant should be selected and used wherever practicable. Where plant is identified as being particularly noisy, action should be taken to reduce noise emissions. This may involve the

fitting of noise mitigation devices, such as silencers or enclosures. In specific areas, noise and vibration emissions may be significantly reduced through the judicious selection and implementation of plant. It is noted that earthmoving equipment from certain manufacturers is markedly quieter than some other manufacturer's products. Preference should be given to procuring lower noise generating equipment for the Project.

#### **7.1.6. Night-time operation**

For the majority of construction activities for this Project, it is intended to schedule noisy activities for daytime where practicable. Noisy activities should be avoided during night-time. Where night-time operation is required for reasons of traffic management, only the critical tasks should be undertaken during night-time with all other tasks scheduled to occur during normal daytime hours.

For the contractor yard located at Otaihanga Road the layout of the yard should take account of noise sensitive receivers in the vicinity. All noisy activities should be located as far as practicable from nearby receivers. Truck routes and site entrance locations should be chosen so as to minimise disruption to sensitive receiver positions.

#### **7.1.7. Reversing alarms**

Equipment operating during night-time should be fitted with alternatives to tonal reversing alarms. Those alarms may include, but not be limited to, broad band auditory devices or visual (rather than audible) alarms.

#### **7.1.8. Temporary resident relocation**

Where all practicable noise mitigation measures, including specific mitigation measures, have been implemented, and noise levels are predicted to be above the Project noise criteria (refer Section 7.2.1) for a significant duration or by a significant margin, temporary relocation of affected residents may need to be considered.

Such a measure should be considered only as a last resort. Before this management measure is considered, the advice of a suitably qualified and experienced acoustic specialist should be sought.

It is unlikely that such measure would be required for this Project, it should be considered where no alternatives exist.

#### **7.1.9. Noise level monitoring**

Monitoring of construction noise levels provide valuable information for the construction team and form the basis of site specific construction noise predictions for future operations on the site. Such monitoring generally involves two distinct parts: the monitoring of individual equipment noise levels in order to enable predictions of future construction noise levels, and the monitoring of construction site noise at assessment positions close to dwellings in order to ensure compliance with relevant criteria.

Such compliance monitoring and proactive noise level monitoring at the onset of known noisy construction activities is set out in the Construction noise and vibration management plan (CNVMP) (refer Section 8.2 below).

Construction noise levels should be monitored and assessed generally in accordance with the requirements of NZS 6801:2008 *“Acoustics - Measurement of Environmental Sound”*, NZS 6802:2008 *“Acoustics - Assessment of Noise”* and NZS 6803:1999 *“Acoustics - Construction Noise”*.

Monitoring should involve the following as set out in the CNVMP:

- at monthly intervals throughout construction, but not at pre-arranged times or locations;
- as and when required during critical phases of construction, i.e. when possible exceedance of the Project criteria is anticipated;
- in response to reasonable complaints being received;
- at locations representative of sensitive receivers in the vicinity;
- by a suitably qualified and experienced acoustic specialist.

In the event that measurement shows non-compliance with the Project criteria, the following procedures should be implemented:

- Further measurement should be undertaken where necessary to determine the extent of non-compliance and the specific equipment causing the exceedance. Potential (further) mitigation and management measures should be developed at this stage.
- Upon implementation of any additional mitigation measures, further measurements should be undertaken to confirm the effectiveness of those mitigation measures.

Any noise survey should be summarised in a report and monitoring records kept at the site office.

#### **7.1.10. Reporting**

It is generally recommended that a register of noise complaints and all monitoring records are held at the site office, and made available upon request to Council and other relevant parties.

Any communication with Council should be undertaken in accordance with the communication strategy set out in the Stakeholder and Communication Management Plan (CEMP Appendix S, Volume 4).

#### **7.1.11. Public liaison and communication**

The Project teams' Environmental Manager, or appointed representative, should be available on site at all times when construction is being undertaken, and should be contactable by affected parties regarding noise. This can be undertaken through the provision of a 0800 number which is clearly notified at entrance points to the construction site and in printed communication with residents.

The contact details of this person should be prominently displayed at the entrance to each contractor's yard and at relevant positions around the construction site. These contact details should also be included in any written documentation, particularly for those potentially most affected (refer Section 9).

#### **7.1.12. Consultation with affected sensitive receivers**

Consultation with potentially affected sensitive receivers should be carried out prior to commencement of construction activities affecting such receivers. The level of consultation depends on the distance of the sensitive receiver from the construction site. As a general rule, the following distances and involvement is recommended.

##### **a. Sensitive receivers within 300 metres**

Where night-time works are proposed at bridges along the Alignment, written notification and a Project description should be provided to all receivers within 300 metres of the construction area to raise awareness of the Project, its expected activities and duration in the vicinity.

It should be recommended to residents that they sleep with their windows closed during the night time construction works, where practicable.

##### **b. Sensitive receivers within 100 metres**

Written notification and a Project description should be provided to all receivers within 100 metres of the entire construction area to raise awareness of the Project, its expected activities and duration in the vicinity.

The construction contractor should maintain a tight timeframe and keep the construction time in the vicinity of any residential and other noise sensitive areas to a minimum. Construction equipment needs to be well maintained in order to reduce noise/vibration resulting from the deterioration of equipment.

As a matter of good practice, all general mitigation measures noted above should be implemented throughout the entire construction phase.

##### **c. Sensitive receivers within 50 metres**

For sensitive receivers within 50 metres of the construction area, notification should be provided and opportunity made available for discussions on a case-by-case basis, if required by the occupiers/owners.

In addition to the general mitigation measures above, a working relationship should be established with the receivers in order to keep them well informed on the proposed activities and to provide them with an opportunity to express their concerns.



Where practicable, construction of additional temporary acoustic screens specifically targeted for an individual or a group of sensitive receivers (barriers could be erected on specific residents' properties) as required throughout the construction activity should be considered, and specific activities managed or scheduled so that it suits affected parties.

Consideration shall also be given to other measures requested by the affected occupiers/owners where they can be reasonably met, e.g. managing or scheduling specific activities in a way which reduces their effect on affected parties or providing alternative accommodation for long duration localised operations.

#### **d. Sensitive Receivers within 20 metres**

For sensitive receivers within 20 metres of the construction area, discussions with individual occupiers/owners should be held and, if required, suitable alternatives and/or mitigation options explored which are acceptable to both parties. Ongoing consultation should be carried out throughout the construction duration.

It is noted that receivers within 20 metres of the construction site are likely to be strongly adversely affected by construction noise during activities in close proximity of the dwellings, and an ongoing close working relationship with these occupiers will be required.

### **7.2. Construction noise management**

The most effective way to control construction noise is through good on-site management. A Draft CNVMP has been produced for the Project and is contained in the Environmental Management Plan. This management plan includes information required by NZS 6803:1999 in Section 8 and Annex E such as:

- Summary of Project noise criteria contained within this assessment
- Summary of assessments/predictions contained within this assessment;
- General construction practices, management and mitigation;
- Noise management and mitigation measures specific to activities and/or receiving environments;
- Monitoring and reporting requirements;
- Procedures for handling complaints and;
- Procedures for review of the CNVMP throughout the Project.

The CNVMP will need to be implemented on site for each specific area of work. Construction noise management schedules would be prepared for each area of work once details of construction equipment and locations have been confirmed.

Where compliance with the noise criteria cannot be achieved with the implementation of practicable management and mitigation, a Site Specific Noise Management Plan (SSNMP) should be

developed in communication with the affected residents and Council. This plan would set out specific conditions relating to a defined activity in a pre-determined location and be relevant for this activity only. Generally, SSNMPs are developed for activities that have been identified as likely to exceed the Project noise criteria, prior to commencement, and mitigation is not practicable. This may apply to activities such as the bridge beam placement which is proposed to occur during night-time in order to avoid daytime road closures of local main roads. The equipment used for the bridge beam placements is impracticable to be shielded due to the height of the cranes required and the location of dwellings in the vicinity.

A flow chart setting out the procedures to be followed in the event of predicted or measured exceedance of construction noise criteria is shown in the CNVMP in Appendix 16.A.

In addition to the CNVMP, the NZTA standard procedures for the management of noise should be implemented. These can be reviewed at <http://acoustics.nzta.govt.nz/>. Section 8.1 'General Noise Mitigation Measures' above discusses mitigation and management measures appropriate for the Project. These are also detailed in the CNVMP.

## **8. Assessment of Noise Effects and Specific Mitigation**

The construction of the Project will result in temporary noise which are likely to have some impact on occupiers in the vicinity of the required works. In the following sections, the key construction activities are described for each Sector and dwellings that potentially receive noise levels above the noise criteria of NZS6803:1999 are identified.

In Appendix 16.B, sound power levels ( $L_{AW}$ ) are provided for each item of construction equipment for specific activities that are likely to occur along the Project Alignment. These sound power levels have been determined with reference to Marshall Day Acoustics' noise source database. Cross-reference has also been made to data contained in NZS 6803:1999 where necessary.

### **8.1. Sector 1 – South of Poplar Avenue to Raumati Road**

#### **8.1.1. Construction activity overview**

Sector 1 includes the reconstruction and widening of the existing SH1 between MacKays Crossing and Poplar Avenue. A new intersection would be formed to Poplar Avenue, with a bridge constructed to take the proposed Expressway over the existing SH1. The proposed Expressway would then be routed through residential areas to Raumati Road.

For construction noise level predictions for Sector 1 refer to Table 9-6 in Section 9.6 below.

#### **8.1.2. Poplar Avenue realignment**

The realignment of Poplar Avenue would be undertaken in two phases. The first phase will involve the placement of a preload fill. Imported fill loaded on truck & trailer units would be placed using

bulldozers and compactors. This is proposed to be undertaken during daytime working hours only. Following the preload settlement period, the new Alignment would be constructed using standard road construction plant and equipment during daytime only.

The realignment of Poplar Avenue is likely to result in noise levels that are above 70 dB  $L_{Aeq(T)}$  at a small number of dwellings on Leinster Avenue.

### **8.1.3. Bridge construction – Poplar Avenue**

Construction of the bridge at Poplar Avenue is likely to involve piling operations, vibroreplacement and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site and placed in position. With Poplar Avenue traffic running on a temporary diversion during this process, construction would be able to proceed during daytime hours only, thus reducing the impact on neighbouring residents.

The bridge construction would be sufficiently remote from dwellings to ensure that noise levels are below the NZS6803 daytime guideline (70 dB  $L_{Aeq(T)}$ ) even where vibroreplacement is occurring.

### **8.1.4. Poplar Avenue – Raumati Road**

Initially, preload fill would be brought into this section and allowed to settle for up to two years. Imported fill loaded on truck & trailer units would be placed using bulldozers and compactors. This is intended to be undertaken during daytime working hours only. Following the preload settlement period, the new Alignment would be constructed using earthmoving and road construction plant and equipment during daytime.

This is a long (approximately 1.7 km) extent of road requiring significant earthworks. This activity has the potential to exceed the NZS6803 daytime criterion (70 dB  $L_{Aeq(T)}$ ) at several dwellings. Refer to Table 9-1 for details of potentially affected dwellings.

### **8.1.5. Stormwater wetland ponds**

Stormwater wetland ponds would be constructed either side of the proposed Expressway at approximate chainage 3800. This would require excavation, which is expected to occur during daytime only.

The stormwater wetland pond does not require significant numbers of equipment and is sufficiently remote from dwellings to ensure that noise levels will be well below the NZS6803 daytime criterion (70 dB  $L_{Aeq(T)}$ ) at all surrounding dwellings.

### **8.1.6. Intersection construction yards**

An intersection construction yard is proposed to be located at the Poplar Avenue Interchange. This yard would house the administrative centre for the works in this areas as well as storage of plant for local works.

This yard is some distance from the nearest dwellings to the north-west and about 100 metres from the Te Ra Waldorf School. Noise levels from this yard are predicted to be low; the only activity that could generate any significant noise is equipment mobilisation. However, the yard is generally further from dwellings than the actual works occurring at the intersection, and hence noise levels from the yard are likely to be insignificant in the context of the overall works in the area. The school would be at a sufficient distance to not be affected by noise from the construction yard, and the management measures recommended below are sufficient to address any potential noise effects on the school.

As with all construction yards, the following management procedures should generally be followed:

- Ensure that any generators required have sufficient noise control to the exhaust, cooling intake and cooling discharge louvres.
- Avoid mobilising equipment en-masse during sensitive periods unless access is sufficiently far from dwellings to ensure noise levels are reasonable.
- Where fencing is required, consider how solid plywood (or similar) hoarding can be used to reduce noise from heavy equipment access and egress points.

#### **8.1.7. Potentially affected dwellings**

The following table summarises dwellings and commercial buildings where there is the potential for the Project noise criteria to be exceeded.

**Table 8-1: Sector 1 Buildings where daytime/night-time construction noise criteria are potentially exceeded**

Activity	Dwellings or Commercial Buildings	Activity
MacKays Crossing – Poplar Avenue	None	n/a
Poplar Avenue realignment	1, 3, 5A and 5B, 7 Leinster Avenue	Earthworks north of Poplar Avenue, sealing
Bridge construction	None	n/a
Poplar Avenue – Raumati Road	101, 103, 105, 106B, 107, 108, 109, 112, 115 Leinster Avenue 4, 6, 8, 9, 10, 11, 12 Conifer Court 72, 75, 76, 77, 78, 79, 86, 88, 90, 110, 116, 118 Raumati Road 218 A, 218B, 236 Matai Road 22,23,25 (both), 27 Fincham Road 200, 256, 260 SH1 42, 44 Gavin Road	Bulk earthworks
Stormwater wetland ponds	None	n/a
Poplar Avenue zone yard	None	n/a

## 8.2. Sector 2 – Raumati Road to Mazengarb Road

### 8.2.1. Construction activity overview

Sector 2 includes the construction of the proposed Expressway from Raumati Road to 300 m north of Mazengarb Road, through the mostly urban environment of Paraparaumu. Bridges are proposed to be constructed over local roads at Raumati Road and Mazengarb Road, along with a bridge spanning the Wharemauku Stream. Vertical realignment of Mazengarb Road would be required to accommodate the proposed Expressway bridge. Kāpiti Road would undergo widening to enable the construction of the new full diamond interchange. A bridge would be constructed over Kāpiti Road to carry the proposed Expressway, with on- and off-ramps in each direction.

Construction is proposed to proceed in a north to south direction from Sector 3. This will enable the progressive completion of the bridges and earthworks to enable a haul route to be established along the new Alignment to transport materials, thus largely avoiding construction traffic on the local roading network.

Noise level predictions for construction activities in Sector 2, and recommendation relating to noise management and mitigation are contained in Table 9-7 in Section 9.6 below.

### **8.2.2. Bridge construction – Raumati Road**

Construction of the bridge at Raumati Road involves piling operations, vibroreplacement, reinforced concrete column and crosshead construction.

Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site and placed in position. Due to Raumati Road being a major arterial road and the requirement to close the road during the placement of bridge beams, this operation is proposed to proceed during night time.

Night-time construction of the Raumati Road bridge has the potential to exceed the NZS6803 night-time noise criterion of 45 dB  $L_{Aeq(T)}$  at a large number of dwellings. For this construction activity, noise management will be required. Refer to Table 9-2 for details of dwellings potentially affected.

### **8.2.3. Raumati Road – Wharemauku Stream**

Initially, preload fill would be brought into this section via a temporary haul road constructed from the end of Ihakara Street and allowed to settle for up to two years. Imported fill loaded on truck & trailer units will be placed using bulldozers and compactors. This would be undertaken during daytime only. Following the preload settlement period, the new Alignment would be constructed using earthmoving and road construction plant and equipment during daytime hours. Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery. All work are proposed to be carried out during daytime hours.

Bulk earthworks in this section of the Alignment are predicted to generate noise levels that may be above daytime construction noise criterion of 70 dB  $L_{Aeq(T)}$  at dwellings close to the Alignment, even with the implementation of mitigation options such as barriers. Good communication is recommended in order to arrive at a reasonable outcome for affected parties. (refer Table 9-6 for further information)

Noise from haul road operations is assessed separately (refer to Section 9.5)

### **8.2.4. Bridge construction – Wharemauku Stream**

Construction of the bridge across the Wharemauku Stream is proposed to involve piling operations, vibroreplacement, and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga construction yard and then transported to site and placed in position. The access to the bridge site would be via a temporary access track constructed from the end of the existing Ihakara Street. Construction is anticipated to proceed during daytime only.

This activity is relatively remote from any buildings and noise levels predicted comply with the relevant construction noise criteria at all times.

### **8.2.5. Wharemauku Stream – Kāpiti Road**

Initially, preload fill would be brought into this section via Kāpiti Road and allowed to settle for up to two years. Imported fill loaded on truck & trailer units would be placed using bulldozers and compactors. These activities would be undertaken during daytime working hours only. Following the preload settlement period, the new Alignment is anticipated to be constructed using earthmoving and road construction plant and equipment during daytime.

Upon completion of the earthworks activity, the proposed Expressway pavement will be completed using standard road construction machinery. All work would be carried out during daytime only.

Earthworks in this area are predicted to result in noise levels above 70 dB  $L_{Aeq(T)}$  at some dwellings.

### **8.2.6. Widening of Kāpiti Road**

The widening of Kāpiti Road will be carried out using standard road construction machinery. It is anticipated that the works will proceed under temporary traffic management arrangements during daytime. However, some operations may be required at night due in order to avoid traffic disruptions.

The widening of Kāpiti Road has the potential to cause exceedances of the construction noise criteria during both day and night time. Night works are likely to affect a large number of dwellings although the exact number would depend on the actual works undertaken. For this reason, it is recommended that night works be restricted to low noise operations and/or the minimum works where practicable as required by traffic.

### **8.2.7. Bridge Construction – Kāpiti Road**

Construction of the proposed Expressway bridge over Kāpiti Road is proposed to involve piling operations, vibroreplacement and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site and placed in position. Due to the high traffic volumes using Kāpiti Road, bridge beam placement would be undertaken during night time in order to avoid traffic disruption during daytime.

During daytime, vibropiling and/or rammed pile operations are predicted to exceed the Project noise criteria at dwellings near the operation. During night-time, bridge beam placement also has the potential to exceed the criteria. These operations, along with any other noisy works, will require noise monitoring, management and mitigation.<sup>14</sup>

### **8.2.8. Kāpiti Road – Mazengarb Road**

The earthworks phase of this section would involve scrapers moving material along the Alignment between Kāpiti Road and Mazengarb Road. Upon completion of the earthworks activity, the

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<sup>14</sup> Refer Section 8 of the report.

proposed Expressway pavement would be completed using standard road construction machinery. The southbound carriageway is proposed to only be completed to sub-base level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 2, the haul route would then be paved and surfaced. All work are anticipated to be carried out during daytime.

This activity occurs in close proximity to a significant number of dwellings and has the potential to exceed daytime Project criteria. Noise management measures and monitoring will be required to reduce noise effects.

#### **8.2.9. Vertical realignment of Mazengarb Road**

The vertical realignment of Mazengarb Road would be carried out using standard road construction machinery. To enable the realignment, a driven H-pile retaining wall would be constructed either side of Mazengarb Road. It is anticipated that the work would proceed under temporary traffic management arrangements during daytime. Some operations may be required at night in order to avoid disruption to traffic flows, however, these operations would be of limited duration only.

During daytime, the construction of the driven pile retaining wall has the potential to exceed the Project noise criteria at nearby dwellings. During night-time, a significant number of dwellings may be exposed to noise levels above the 45 dB  $L_{Aeq(T)}$  night time construction criterion. Noise management will be required for these works and night-time construction will need to be minimised as far as practicable. It is noted that no piling would be undertaken at night-time.

#### **8.2.10. Bridge construction – Mazengarb Road**

Construction of the bridge at Mazengarb Road would involve piling operations, vibroreplacement and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site and placed in position. Due to the traffic volumes on Mazengarb Road, bridge beam placement may be undertaken during night-time in order to avoid disruption to traffic flows.

During daytime, vibropiling is predicted to exceed the Project criteria at three dwellings near to the operation. During night-time construction works, bridge beam placement also has the potential to exceed the criteria within around 250 metres of the works. These operations, along with any other noisy works, will require noise monitoring, management and mitigation.

#### **8.2.11. North of Mazengarb Road**

Initially, preload fill would be brought into this section via the Otaihanga Yard and allowed to settle. Imported fill loaded on truck & trailer units would be placed using bulldozers and compactors. This is proposed to be undertaken during daytime only. Following the preload settlement period, the new Alignment would be constructed using earthmoving and road construction plant and equipment, during daytime only.



Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery, with all work being carried out during daytime only.

While this is a short segment of works, there is the potential for daytime Project noise criteria to be exceeded at five dwellings and at the Paraparaumu waste water treatment plant. Noise management of the bulk earthworks operation will be required.

#### **8.2.12. Stormwater wetland ponds**

A stormwater wetland pond would be constructed either side of the proposed Expressway at Wharemauku Stream and at Kāpiti and Mazengarb Roads. This will require excavation, which would occur during daytime.

Where excavation takes place immediately adjacent to dwellings, daytime Project noise criteria may potentially be exceeded. Given the limited duration of works, this is not expected to cause a significant effect, however, good communication with adjacent residents is recommended.

#### **8.2.13. Construction yards**

Construction yards are proposed to be located at:

- **Raumati Road Bridge Yard** for the Raumati Bridge works

This yard would be located between the Raumati Bridge and dwellings at 110 and 114 Raumati Road. Daytime operations (i.e. equipment mobilisation) from the yard are predicted to comply with the Project criteria. During the night-time bridge beam launching, equipment mobilised from the site has the potential to exceed the night-time Project noise criterion at these dwellings. Provision of solid site hoarding and careful management of vehicle movements during the night-period would reduce noise effects on these dwellings.

- **Wharemauku Stream Bridge Yard** for the Wharemauku Stream Bridge works,

This yard is well removed from dwellings and activity is predicted to readily comply with daytime noise criteria. Night-time activity is not expected in this yard.

- **Kāpiti Road Intersection Yard** for the intersection works at this location,

This yard would be in two parts, located north and south of Kāpiti Road. The part closest to dwellings would be located on the northern side of the road. It is recommended that plant and equipment used for night-time works be stored on the southern side of Kāpiti Road or in the commercial area to the north of the interchange as these locations are more distant from dwellings. Provision of solid site hoarding and careful management of vehicle movements during the night-period is likely to reduce noise effects on these dwellings.

- **Mazengarb Road Bridge Yard** for the Mazengarb Road realignment and bridge works.

This is located some distance from the nearest dwellings and activities will generally comply with the daytime noise criteria. During the night-period frequent access to and from the site by heavy vehicles has the potential to exceed the night-time Project noise criteria. However, overall noise levels are likely to be lower than operation at the Mazengarb Road bridge. Provision of solid site hoarding and careful management of vehicle movements during the night-period is predicted to reduce noise effects on these dwellings.

As with all construction yards, noise should be managed in accordance with the noise management plan and the relevant points set out in Section 9.1.6.

**Table 8-2: Sector 2 Buildings at which daytime/night-time construction noise criteria are potentially exceeded**

Activity	Dwellings or Commercial Buildings	Activity
Raumati bridge construction	<b>Day</b>	<b>Day</b>
	218B Matai Road	Vibroreplacement
	82, 86, 88, 90, 116 Raumati Road	
	4, 6, 8, 10, 12, 14 Rata Road	<b>Night</b>
	<b>Night</b>	Night-time bridge beam placement
	Dwellings north of Fincham and east of Matai Road	
	Dwellings west of Rimu Road and east of Rata Road (south of Moss Lane properties)	
Dwellings immediately west of Conifer Court (north of 10 Conifer Court)		
	NOTE: within this zone some dwellings may receive levels below 45 dB $L_{Aeq(T)}$ depending on screening provided by topography	
Raumati Road-Wharemauku Stream	72, 75, 76, 77, 78, 79, 82, 86 Raumati Road	Bulk earthworks
	236 Matai Road	
	46, 48, 65 Rata Road	
Bridge construction Wharemauku Stream	None	None
Wharemauku Stream-Kāpiti Road	25, 27, 29, 31, 33, 37, 39, 41, 43, 45, 47, 49, 57 Quadrant Heights	Bulk earthworks
	11, 15, 17 Datum Way	
	7, 11, 15, 16, 20, 21, 23, 24, 28, 27 Observation Way	
	23, 27, 31, 44, 48, 51, 52, 55, 56, 59 Milne Drive	

Activity	Dwellings or Commercial Buildings	Activity
Kāpiti Road widening	<p><b>Day</b></p> <p>9 , 11, 19A to 19E, 23, 27, 31 Milne Drive (commercial)</p> <p>3, 4, 5, 11 Kodex Place (commercial)</p> <p>74, 80, 82, 84, 86, 88, 90, 92, 94, 102, 112, 118, 122 Kāpiti Road</p> <p><b>Night</b></p> <p>Depending on the activities occurring at night, noise emissions will vary. However, a conservative assessment suggests that all dwellings within 250 metres of the widening operations will potentially be exposed to levels above 45 dB L<sub>Aeq (T)</sub>. This includes:</p> <ul style="list-style-type: none"> <li>all dwellings north of Arawhata Rd, West of Elder Grove accessway</li> <li>2, 6,10,14 Bearing West Court</li> <li>44, 48 Milne Drive</li> <li>74 Kāpiti Road</li> </ul> <p>Noise levels at commercial buildings are unlikely to exceed 80 dB L<sub>Aeq (T)</sub></p>	Earthwork and sealing operations
	<p><b>Day</b></p> <p>90, 92/94, 96, 98, 102, 104 Kāpiti Road</p> <p>4, 5,11 Kodex Place</p> <p>19 A – 19E, 23, 27, 31 Milne Drive</p> <p><b>Night</b></p> <p>All dwellings within 250 metres of the beam placement. This includes:</p> <ul style="list-style-type: none"> <li>all dwellings in the area between Kāpiti Road, Greenwood Place and Arawhata Road</li> <li>All dwellings between 1 to 16 Makarini Drive</li> <li>4 , 6, 8, 10, 15, 17, 19, 21, 23, 25 Arawhata Road</li> <li>2, 6,10,14 Bearing West Court</li> <li>All dwellings on Greenwood Place</li> <li>44, 48 Milne Drive</li> <li>74, 76 Kāpiti Road</li> </ul> <p>Noise levels at commercial buildings are unlikely to exceed 80 dB L<sub>Aeq (T)</sub></p>	<p><b>Day</b></p> <p>Vibroreplacement</p> <p><b>Night</b></p> <p>Beam Placement</p>

Activity	Dwellings or Commercial Buildings	Activity
Kāpiti Road -	12, 13, 14, 16, 15A, 15B, 16, 17 Greenwood Place	Bulk Earthworks
Mazengarb Road	3, 4, 5, 6, 7, 8, 9 Elder Grove	Bund construction
	14, 15A, 15B, 16, 17A, 17 B, 18, 20A, 20B, 22, 24, 26, 28A, 28B Cypress Grove	
	11, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37A, 37B, 39 Spackman Crescent	
	59A, 59B, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97B, 99A, 99B, 103, 105, 107 Makarini Street	
	2, 4, 6, 7, 10, 12, 14, 15, 16, 17, 18 Palmer Court	
	3, 5, 7, 9, 11, 15, 20A, 20B, 22, 24 St James Court	
	12, 14, 16, 18, 20, 22, 35, 37, 39, 41, 45 Chilton Drive	
	353 Mazengarb Road	
	1, 2, 3, 4 Lincoln Court	
	19, 20, 21, 22, 23, 25, 26, 28, 30, 32, 34, 42, 44, 46, 48 Cheltenham Drive	
	14 Arundel Drive	
	28 Malvern Way	
	2, 4, 6, 8, 10 Oxford Court	
Vertical realignment of Mazengarb Road	<p><b>Day</b></p> <p>323, 345, 353, 372, 374, 376, 378, 380 Mazengarb Road</p> <p>2 Soldiers Way</p> <p>20, 22 Chilton Drive</p> <p><b>Night</b></p> <p>All dwellings within 350 metres of works on Mazengarb Road. This generally includes:</p> <ul style="list-style-type: none"> <li>Dwellings on St James Court, Chilton Drive, Fytfield Place, Oxford Court, Crown Mews, Crown Hill, Sovereign Way, Soldiers Way, Service Lane, Harvest court</li> <li>Realm Drive between Sovereign Way and Mazengarb Road</li> <li>Mazengarb Road between Pukeko Street and Mazengarb Pharmacy</li> </ul>	<p><b>Day</b></p> <p>Bore piling</p> <p><b>Night</b></p> <p>Bore piling</p> <p>Earthworks</p>

Activity	Dwellings or Commercial Buildings	Activity
Bridge construction – Mazengarb Road	<b>Day</b> 20, 22, 18 Chilton Drive	<b>Day</b> Vibroreplacement  Piling
	<b>Night</b> All dwellings within 250 metres of works on the bridge. This generally includes: <ul style="list-style-type: none"> <li>Mazengarb Road between Realm Drive and Makarini Street</li> <li>Dwellings on St James Court, Chilton Drive, Fytfield Place</li> </ul>	<b>Night</b> Beam placement
North of Mazengarb Road	333, 339, 345 Mazengarb Road 60A, 60 Ratanui Road  Paraparumu Waste Water Treatment Plant	Bulk earthworks
Stormwater wetland ponds	61 Killalea Road 2, 4, 6, 8, 10 Oxford Court  44, 46, 48, 52 Cheltenham Drive	Excavation (only where directly adjacent to dwellings)
Construction yards	<b>Raumati Road (night)</b> 90, 116, 118 Raumati Road  4, 6 Rata Road  <b>Ihakara Road (night)</b> None  <b>Kāpiti Road (night)</b> 90, 92, 94 Kāpiti Road  <b>Mazengarb Road (night)</b> 319, 323, 331, 345 Mazengarb Road	Equipment mobilisation (several vehicles entering or existing the site over a short period of time)

### 8.3. Sector 3 – Mazengarb Road to north of Te Moana Road

#### 8.3.1. Construction activity overview

Sector 3 involves the construction of the proposed Expressway from 300 m north of Mazengarb Road to 600 m north of Te Moana Road in proximity to the mainly urban area of Waikanae Beach. A bridge for the proposed Expressway is proposed to be constructed to carry it over Otaihanga Road, along with a new local property access road. A 170 m bridge spanning the Waikanae River would also be constructed in this Sector. At Te Moana Road, the existing road would be realigned to incorporate two new roundabouts that will form the intersection with the proposed Expressway. A

bridge is proposed to be constructed to carry the proposed Expressway over the full diamond interchange, with on- and off-ramps in each direction.

The main construction yard and Project office would be established at the Otaihanga Landfill site on Otaihanga Road. This is intended to become the main access onto and off the Alignment for delivery of materials and movement of plant and vehicles. Construction is likely to be staged to enable movement of construction traffic along the route from this main access point.

Noise level predictions and recommendations relating to management and mitigation are contained in Table 9-8 in Section 9.6 below.

### **8.3.2. North of Mazengarb Road – Otaihanga Road**

Initially, preload fill would be brought into this section and allowed to settle. Imported fill loaded on truck & trailer units would be placed using bulldozers and compactors. These activities are proposed to occur during daytime only. Following the preload settlement period, the new Alignment would be constructed using earthmoving and road construction plant and equipment. The southbound carriageway is intended to only be completed to sub-base level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 3, the haul route would then be paved and surfaced. All work is intended to be carried out during daytime only.

There are few dwellings adjacent to this section of works and noise levels are predicted to comply with the Project criteria without mitigation.

### **8.3.3. Bridge construction – Otaihanga Road**

Construction of the proposed Expressway bridge at Otaihanga Road is proposed to involve piling operations, vibroreplacement and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the precast concrete construction yard (Otaihanga Road Project Yard) and then transported to site and placed in position. It is proposed to place the bridge beams during night-time to avoid traffic disruption on Otaihanga Road.

Daytime construction is predicted to comply with the Project criteria, however, night-time bridge beam placement is likely to exceed the Project criteria at seven dwellings. Good communication with affected residents and noise management for this activity will be required. Night-time construction should be minimised as far as practicable.

### **8.3.4. New road link to Otaihanga Road**

The new local road link to Otaihanga Road would be constructed using standard road construction machinery. It is anticipated that the work would proceed under temporary traffic management arrangements during daytime.

Only one dwelling is expected to be exposed to noise levels above 70 dB  $L_{Aeq(T)}$ . As this activity is anticipated to be of relatively short duration near to this dwelling, effects are likely to be insignificant.

### **8.3.5. Otaihanga Road – Waikanae River**

The earthworks phase of this section would involve scrapers moving material along the Alignment between Otaihanga Road and the Waikanae River. Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery. The southbound carriageway is proposed to only be completed to sub-base level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 3, the haul route would then be paved and surfaced. All work are anticipated to be carried out during daytime.

There are few dwellings in proximity to these works, and as such there are only four dwellings which may experience noise levels above 70 dB  $L_{Aeq(T)}$  during earthworks. Noise at these dwellings will need to be managed and noise levels reduced where practicable e.g. by installing temporary construction noise barriers, timing construction to avoid noise sensitive times and keeping residents fully informed about time frames and expected operations.

### **8.3.6. Waikanae River Bridge**

Construction of the proposed Expressway bridge at Waikanae River is anticipated to involve piling operations, vibroreplacement, and reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site along the Alignment, accessing from Otaihanga Road, and placed in position.

The construction of this bridge is not in close proximity to dwellings. The activity is predicted to potentially generate noise levels above 70 dB  $L_{Aeq(T)}$  at the eastern end of El Rancho Christian Holiday Park for a limited time.

Generally, noise effects from this activity are likely to be insignificant, nonetheless, noise management of this activity and communication with the Holiday Park owners and the owner of 68 Tiekoo Street is recommended. It is also recommended that the above construction activities are timed so that they occur off season for the Holiday Park.

### **8.3.7. Waikanae River – Te Moana Road**

The earthworks phase of this section would involve scrapers moving material along the Alignment between the Waikanae River and Te Moana Road. Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery. The southbound carriageway is proposed to only be completed to sub-base level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 3, the haul route would then be paved and surfaced. All work are anticipated to be carried out during daytime.

Noise from bulk earthworks on this section of the Project has the potential to exceed the Project criterion at around ten dwellings and the Holiday Park. Noise management and mitigation of this activity will be required in accordance with the recommendations in Table 9-7.

### **8.3.8. Te Moana Road interchange**

The formation of the new full diamond interchange at Te Moana Road would be carried out using standard road construction machinery. It is anticipated that the work would proceed under temporary traffic management arrangements during daytime. However, some operations may be required at night in order to avoid disruption to traffic on Te Moana Road.

This activity is predicted to cause noise levels that exceed the Project criteria at dwellings adjacent to Te Moana Road during both daytime and night-time. Night works are also likely to cause exceedances of the Project criteria at some dwellings along Park Avenue and Alexander Street. Noise management and minimisation of night works will be required.

### **8.3.9. Bridge construction – Te Moana Road**

Construction of the proposed Expressway bridge at Te Moana Road is understood to involve piling operations, vibroreplacement, reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site and placed in position. In order to avoid traffic disruption on Te Moana Road, bridge beam placement is proposed to proceed under night-time closures.

As with the construction of the Te Moana Road interchange, this activity has the potential to exceed the Project criteria at a number of dwellings. Noise management and minimisation of night works will be required as recommended in Table 9-7.

### **8.3.10. North of Te Moana Road interchange**

The earthworks phase of this section would involve scrapers moving material along the Alignment between Te Moana Road Interchange and the northern end of Sector 3. Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery. The southbound carriageway is proposed to only be completed to sub-base level at first to provide the earthworks haul route. Following completion of all earthworks in Sector 3, the haul route would then be paved and surfaced. All work are proposed to be carried out during daytime.

These works are generally in a cutting (i.e. well shielded) and are sufficiently far from dwellings for compliance with the Project criteria to be achieved.

### **8.3.11. Stormwater wetland ponds**

Stormwater wetland ponds are proposed to be constructed either side of the proposed Expressway between Mazengarb and Otaihanga Roads, south of the Waikanae River and in the vicinity of Puriri Road. This is understood to require excavation, which would occur during daytime.

Activities immediately adjacent to dwellings on Puriri Road have the potential to exceed the Project criteria during daytime. However, the duration of any such activity is limited so that noise effects are



expected to have insignificant noise impact on neighbouring dwellings. Notwithstanding this, good communication with residents on Puriri Road is recommended.

### **8.3.12. Construction yards**

Construction yards are proposed to be located at:

- **Otaihanga Road Project Yard** for the main Project works

The main Project construction yard is proposed at the Otaihanga Landfill site on Otaihanga Road. This location is situated adjacent to the proposed Expressway Alignment and will incorporate the main Project offices and yard area for general machinery and material storage. It would also be the site of the precast concrete yard for the fabrication of all structural elements and disposal site for waste peat. The main access to construction would be through this yard. The operation of the site at night is understood to involve only equipment mobilisation for night-works; concrete precast sections would not be manufactured during the night-time although they may be loaded on to trucks for transport.

The formation of the yard area would involve earthmoving equipment, road construction machinery and piling operations.

The site is sufficiently far from residential and commercial buildings that noise levels are predicted to comply with the daytime and night-time Project noise criteria. Notwithstanding this, there is a small risk of exceedance of the night-time Project noise criteria at one dwelling on Otaihanga Road.

- **Te Moana Road Intersection Yard** for the Te Moana Interchange and Waikanae Bridge works

An Intersection Yard is proposed at Te Moana Road for works occurring at Te Moana Interchange and Waikanae River Bridge. The yard is some distance from dwellings and daytime activity is predicted to comply with daytime Project noise criteria.

Night-time works on the Te Moana Interchange and bridge are likely to generate noise levels at nearby dwellings that are above the Project night-time noise criteria. As part of this operation, activity may occur in the construction yard during the night period, although noise from the construction yard is predicted to be insignificant in the context of the night-time intersection works.

As with all construction yards, noise should be managed in accordance with the noise management plan and the points discussed in Section 8.1.10.

**Table 8-3: Sector 3 Buildings at which daytime/night time construction noise criteria are potentially exceeded**

Activity	Dwellings or Commercial Buildings	Activity
North of Mazengarb Road -Otaihanga Road	None	n/a
Bridge construction – Otaihanga Road	<p><b>Day</b></p> <p>None</p> <p><b>Night</b></p> <p>140, 150, 155, 165 Otaihanga Road</p> <p>43, 39 Killalea Place</p> <p>23 Grand Poppa Way</p>	<p><b>Day</b></p> <p>n/a</p> <p><b>Night</b></p> <p>Bridge beam placement</p>
New road link to Otaihanga Road	Dwelling to south of 126 Otaihanga Road (no data available for allotment)	Earthworks
Otaihanga Road-Waikanae River	<p>117, 165 Otaihanga Road</p> <p>24 Grand Poppa Way</p> <p>68 Tieko Street (end) – possible shed</p>	Bulk earthworks
Waikanae River bridge	<p>68 Tieko Street (end) – possible shed</p> <p>East of El Rancho Christian Holiday Park</p>	Vibroreplacement
Waikanae River-Te Moana Road	<p>East of El Rancho Christian Holiday Park</p> <p>39, 59, 61, 63 Puriri Road</p> <p>8 Greenway Road</p> <p>164, 172, 174, 178, 190A Te Moana Road</p>	Bulk earthworks
Te Moana Road interchange	<p><b>Day</b></p> <p>145, 145A, 151, 153, 159, 161, 167A,169A, 175,177, 180, 182,181,187A, 189, 192, 194, 196, 197 Te Moana Road</p> <p><b>Night</b></p> <p>145, 145A,149, 151, 153, 155, 157, 159, 161, 163, 165, 167A, 167B, 169A, 169B, 171, 173, 173A, 175, 177, 179, 180, 181, 182, 183, 185, 187A, 187B, 189, , 190A, 190B, 191, 192, 193, 194, 195, 196, 197, 199, 201, 203, 208, 210, Te Moana Road</p> <p>2, 4, 6, 8, 10,12 Park Avenue</p> <p>7, 13, 15, 21 Alexander Street</p>	Road sealing and construction

Activity	Dwellings or Commercial Buildings	Activity
Bridge construction – Te Moana Road	<b>Day</b> 145 / 145A, 151 Te Moana Road	<b>Day</b> Vibroreplacement
	<b>Night</b> 145, 145A, 149, 151, 153, 155, 157, 159, 161, 163, 165, 167A, 169A, 169B, 175, 177, 179, 180, 181, 182, 185, 187A, 189, 192, 194, 196, 197 Te Moana Road	<b>Night</b> Bridge beam placement
North of Te Moana Road	None	n/a
Stormwater wetland ponds	59, 61, 63 Puriri Road	Excavation
Construction yards	<b>Otaihanga Road</b> None	Equipment mobilisation (several vehicles entering or exiting the site over a short period of time)
	<b>Te Moana Road (night)</b> 145, 151 Te Moana Road	

## 8.4. Sector 4 – Te Moana Interchange to Peka Peka Road

### Construction activity overview

Sector 4 involves construction of the proposed Expressway through a mainly rural area to link back with the existing SH1 at Peka Peka. Ngarara Road would be realigned, and a bridge to carry Ngarara Road over the proposed Expressway be built. Smithfield Road would be relocated to the south of its existing position, with a bridge constructed to carry the new Alignment over the proposed Expressway. At the Peka Peka end, an interchange is proposed to be constructed linking Peka Peka Road to the proposed Expressway and to the existing SH1.

#### 8.4.1. North of Te Moana Road – Ngarara Road

The earthworks phase of this section would involve scrapers moving material along the Alignment. This section is also the main source of fill material for the northern part of the Alignment, so in addition, 50 t excavators will be loading 40 t off-road dump trucks for transport along the haul route to the Peka Peka Road end. Upon completion of the earthworks activity, the proposed Expressway pavement would be completed using standard road construction machinery. All work is anticipated to be carried out during daytime.

This activity is sufficiently far from dwellings, therefore, compliance with Project daytime noise criteria has been predicted.

#### **8.4.2.Ngarara Road realignment**

The realignment of Ngarara Road would be carried out using standard road construction machinery. It is anticipated that the work would proceed under temporary traffic management arrangements during daytime thus avoiding the need for night-time construction.

This activity is sufficiently far from dwellings to ensure compliance of noise levels with the Project daytime noise criteria.

#### **8.4.3.Bridge construction – Ngarara Road**

Construction of the bridge to carry Ngarara Road over the proposed Expressway would involve piling operations, vibroreplacement, reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site along the existing Ngarara Road. They would be lifted into position from the new Alignment, enabling work to proceed during daytime.

Due to the large distance from dwellings, noise levels are predicted to comply with the Project daytime noise criteria.

#### **8.4.4.Smithfield Road realignment**

The formation of the new Smithfield Road alignment would be carried out using standard earthworks and road construction machinery. As the new alignment is distant from existing roads, work is proposed to proceed during daytime.

One dwelling only is expected to receive noise levels that may exceed daytime Project noise criteria: the dwelling at 283 Ngarara Road. Good communication and noise management is recommended when operating in proximity to this dwelling.

#### **8.4.5.Bridge construction – Smithfield Road area**

Within the Smithfield Road area are three bridge structures: (1) bridge to take the new Smithfield Road over the proposed Expressway; (2) bridge to take the new Smithfield Road over the Kakariki Stream; and (3) bridge to take the proposed Expressway over the Kakariki Stream. Each bridge structure would involve piling operations, vibroreplacement, reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site along the existing Ngarara Road. They are proposed to be lifted into position from the new alignment thus enabling work to proceed during daytime only.

Given the distance between these bridges and nearby dwellings, noise levels are predicted to comply with the Project criteria at all surrounding dwellings.

#### **8.4.6.Ngarara Road – Peka Peka**

Initially, preload fill would be brought into this section and allowed to settle. Imported fill loaded on truck and trailer units would be placed using bulldozers and compactors during daytime working

hours. Following the preload settlement period, the new alignment would be constructed using earthmoving and road construction plant and equipment. The southbound carriageway is proposed to only be completed to subbase level at first to provide an earthworks haul route to the Peka Peka Interchange. Following completion of all earthworks, this haul route would then be paved and surfaced. All work is proposed to be carried out during daytime. Access will be directly from the existing SH1 at Peka Peka Road.

Although this section of the alignment covers a significant distance, there are very few dwellings in proximity. Noise levels at all dwellings are predicted to comply with the Project criteria.

#### **8.4.7. Peka Peka interchange**

The formation of the new interchange at Peka Peka Road and the realignment of Peka Peka Road is anticipated to be carried out using standard earthmoving and road construction machinery. It is proposed that the work would proceed under temporary traffic management arrangements during daytime. However, some operations may be required during night-time due to high traffic volumes on the existing SH1.

The intersection at Peka Peka is located near to dwellings on large sections. Both daytime and night-time operations are likely to cause noise levels above the Project criteria. It is recommended that night-time operations be restricted as far as practicable and all involve active noise management.

#### **8.4.8. Bridge construction - Peka Peka Road**

Construction of the bridge to carry the realigned Peka Peka Road across the proposed Expressway is anticipated to involve piling operations, vibroreplacement, reinforced concrete column and crosshead construction. Bridge beams would be cast off-site in the Otaihanga Yard and then transported to site. They would be lifted into position from the new alignment enabling work to proceed during daytime hours thus reducing effects on neighbouring residents and avoiding night-time works.

#### **8.4.9. Construction Yards**

Construction yards are proposed to be located at:

- **Ngarara Road Bridge Yard** for the construction of the Ngarara Road and Smithfield Road bridges

A bridge construction yard would be located at Ngarara Road for bridge works occurring on Ngarara Road and Smithfield Road bridges. These bridges would be constructed during daytime and the construction yard is therefore anticipated to operate only during daytime. Noise from the yard is predicted to comply with the Project daytime criteria at all times.

- **Peka Peka Road Intersection Yard** for works occurring at Peka Peka interchange

An Intersection construction yard would be located at Peka Peka Road for works occurring at Peka Peka interchange, including bridge construction. There are few dwellings in proximity of the construction yard. It is predicted that noise from the yard may exceed the night-time Project noise criteria, however, it is unlikely that noise from the construction yard will be significant in the context of the night-time intersection works.

As with all construction yards, noise should be managed in accordance with the noise management plan and the points discussed in Section 8.2.

**Table 8-4: Sector 4 Buildings at which daytime/night-time construction noise criteria are potentially exceeded**

Activity	Dwellings or Commercial Buildings	Activity
North of Te Moana Road - Ngarara Road	None	n/a
Ngarara Road realignment	None	n/a
Bridge construction – Ngarara Road	None	n/a
Smithfield Road realignment	283 Ngarara Road	Earthworks
Bridge construction – Smithfield Road area	None	n/a
Ngarara Road-Peka Peka	269 Ngarara Road 37 End Farm Road	Bulk earthworks

Activity	Dwellings or Commercial Buildings	Activity
Peka Peka interchange	<b>Day</b> 29 Te Kowhai Road  20, 23, 31, 32, 34, 37, 42 Peka Peka Road	<b>Day</b>  Earthworks
	<b>Night</b>  Will vary depending on activity. A provisional (conservative) assessment is given below, however it is recommended that each activity be considered on a case-by-case basis during construction.  <ul style="list-style-type: none"> <li>• 22, 32, 38, 44 Octavius Road</li> <li>• 401 SH1</li> <li>• 20, 23, 31, 32, 34, 37, 42 Peka Peka Road</li> <li>• 11, 21 Kensington Drive</li> </ul>	<b>Night</b>  Earthworks, sealing, etc.
Bridge construction - Peka Peka Road	<b>Day</b>  None	<b>Day</b>  n/a
	<b>Night</b>  None	<b>Night</b>  Potentially bridge beam placement
Construction yards	<b>Ngarara Road</b>  None	Equipment mobilisation (several vehicles entering or existing the site over a short period of time)
	<b>Peka Peka Interchange</b>  None	

### 8.5. Construction traffic

Construction traffic would generally involve the use of the Project Alignment rather than the main highway or existing local roads in order to avoid adverse effects from heavy vehicles on local roads.

Any off site traffic importing preload fill and pavement material is proposed to travel on State Highway 1 and enter the Project site at locations as required for the phase of the Project.<sup>15</sup> As the existing SH1 already carries a high traffic volume, the addition of a relatively small number of trucks is unlikely to cause any adverse effects on neighbouring residents.

The effects of construction traffic noise on local roads and State highways are considered in detail in the following Table 9-5. It is noted that traffic noise level predictions generally have an accuracy of  $\pm 2$  decibels and are therefore not generally stated to within a decimal point. However, due to the

<sup>15</sup> Refer to Technical Report 33, Volume 3 of the AEE

very minor changes in noise level predicted, the following table states where noise levels are calculated to result in changes of less than 1 decibel.

**Table 8-5: Construction traffic noise summary**

Road	Activity	Truck movements per day (approx)	Description of noise effects
SH1	Import preload fill	34- 74	The existing traffic volume on the SH 1 is in the order of 25,000 vehicles per day with approx 1,750 commercial vehicles (inclusive). The additional vehicles using the State highway are predicted to result in no change to the existing noise level and would therefore have no noise effects. The additional trucks will be generally unnoticeable.
	Pavements	24	
Poplar Avenue	New Poplar Avenue	24	Poplar Avenue carries approximately 3200 vehicles per day with around 7 -12 % HCVs (c. 220- 380 HCVs). The increase in heavy vehicles would result in less than a 0.5 dB increase in the average noise level and be generally unnoticeable.
	Bridge construction	60	
Raumati Road	Bridge construction	60	<p>The existing traffic volumes on Raumati Road are between 5,000 and 13,000 vehicles per day with 5 – 10% heavy vehicles. The increase in heavy vehicles would result in less than a 0.5 dB increase in the average noise level and be generally unnoticeable.</p> <p>Night-time deliveries of beams to site are likely to involve only a few additional truck movements. Whilst the noise of delivery trucks would be audible (as is the noise from existing truck movements) the additional noise is considered to have an insignificant effect. Notwithstanding this, night-time truck movements should be minimised where practicable.</p>
Ihakara Road	Temporary road	24	Ihakara Road is predominantly industrial in use and additional truck movements are unlikely to be of concern.
	Bridge construction	60	
Kāpiti Road	Bridge construction	60	Kāpiti Road carries between 16,000 and 25,000 vehicles per day with around 5% heavy vehicles (c. 800 to 1,250 HCVs). Given the significant traffic volumes on this road the additional truck movements would have no effect on the existing traffic noise level and therefore be unnoticeable.
	Road realignment	Est <100	



Road	Activity	Truck movements per day (approx)	Description of noise effects																								
Mazengarb Road	Vertical realignment	24	<p>Mazengarb Road carries 5,000 to 7,000 vehicles per day with around 8% heavy commercial vehicles. The increase in heavy vehicles would result in less than a 0.5 dB increase in the average noise level, in insignificant change.</p> <p>Night-time deliveries of beams to site are likely to involve only a few additional truck movements. Whilst the noise of delivery trucks would be audible (as the noise from existing truck movements already is) the additional noise is not considered to have a significant effect. Notwithstanding this, night-time truck movements should be minimised where practicable.</p>																								
	Bridge construction	60		Otaihanga Road	Project administration cars	200 (cars)	<p>Otaihanga Road carries approximately 6,500 vehicles per day with around 9% heavy commercial vehicles. This road leads to the main construction yard and is predicted to experience the highest increase in traffic volumes during the construction. Notwithstanding this, average noise levels are expected to increase by less than 0.5 decibels which will have an insignificant, and generally unnoticeable, noise effect.</p> <p>As part of general noise management for the Project, night – time truck movements should be minimised as far as practicable.</p>	Import preload	37	Bridge construction	60	Pavements	24	Te Moana Road	Road realignment	Est < 100	<p>Te Moana Road carries more than 10,000 vehicles per day with around 8 – 9% heavy commercial vehicles. The increase in average noise level due to construction traffic would be less than 0.5 decibels which would be an insignificant, and generally unnoticeable, noise effect.</p>	Bridge construction	60	Ngarara Road	Bridge construction (SMI)	60	<p>Ngarara Road carries between 600 – 5,000 vehicles per day with around 6% heavy vehicles. The additional truck movements on this road are likely to result in an increase in average noise levels of around 3 decibels. This would be a perceptible but not significant increase in traffic noise.</p> <p>It is recommended that noise from truck movements along Ngarara Road is managed through the CNMP and any issues addressed accordingly. Residents along Ngarara Road should be communicated with throughout the construction period.</p>	Pavements	24	Bridge construction	60
Otaihanga Road	Project administration cars	200 (cars)	<p>Otaihanga Road carries approximately 6,500 vehicles per day with around 9% heavy commercial vehicles. This road leads to the main construction yard and is predicted to experience the highest increase in traffic volumes during the construction. Notwithstanding this, average noise levels are expected to increase by less than 0.5 decibels which will have an insignificant, and generally unnoticeable, noise effect.</p> <p>As part of general noise management for the Project, night – time truck movements should be minimised as far as practicable.</p>																								
	Import preload	37																									
	Bridge construction	60																									
	Pavements	24																									
Te Moana Road	Road realignment	Est < 100	<p>Te Moana Road carries more than 10,000 vehicles per day with around 8 – 9% heavy commercial vehicles. The increase in average noise level due to construction traffic would be less than 0.5 decibels which would be an insignificant, and generally unnoticeable, noise effect.</p>																								
	Bridge construction	60																									
Ngarara Road	Bridge construction (SMI)	60	<p>Ngarara Road carries between 600 – 5,000 vehicles per day with around 6% heavy vehicles. The additional truck movements on this road are likely to result in an increase in average noise levels of around 3 decibels. This would be a perceptible but not significant increase in traffic noise.</p> <p>It is recommended that noise from truck movements along Ngarara Road is managed through the CNMP and any issues addressed accordingly. Residents along Ngarara Road should be communicated with throughout the construction period.</p>																								
	Pavements	24																									
	Bridge construction	60																									
	Pavements	24																									

Road	Activity	Truck movements per day (approx)	Description of noise effects
Peka Peka Road	Import preload	74	Trucks entering Peka Peka Road from SH 1 would not cause noise effects beyond what has been considered in the noise assessment for Sector 4. This area is already subject to noise from the State highway. Additional heavy vehicle movements along the State highway would not increase noise emissions to a noticeable degree.
	Pavements (NGA-PP)	24	
	Bridge construction (NGA)	60	
	Pavements (NGA)	24	
	Bridge construction (PP)	60	
	Pavements (PP)	24	

In summary, truck movements associated with the construction of the Project are predicted to result in insignificant, and often unnoticeable, noise effects.

### 8.6. Construction Noise Emission Summary

The following tables provide a summary of activities that are likely to exceed the Project construction noise criteria and state generally the highest noise levels at the closest receivers to each activity. Predictions of noise levels are also given, although it should be noted that these represent the worst case level of noise likely to be received where construction activity is occurring in close proximity to that receiver, which would be for a limited time only and not extend for the total duration for each activity set out in the tables.

The mitigation measures listed are also indicative of noise mitigation measures which may be required for other dwellings affected by construction noise in the vicinity of each activity.

Appendix 16.C<sup>16</sup> shows indicative areas where the construction noise criteria may be exceeded.

<sup>16</sup> Appendix 16.C is contained in Technical Report Appendices, Report 16, Volume 5

**Table 8-6: Sector 1 Predicted noise levels and recommended management and mitigation procedures**

Activity	Noisiest equipment	Est. total duration <sup>17</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>18</sup>	
								Daytime	Night time
Poplar Ave realignment – earthworks and sealing	Graders Excavators Trucks	~4 months	1 Leinster Avenue	78	Yes	n/a	<ul style="list-style-type: none"> <li>○ temporary construction noise barriers</li> <li>○ choice of low noise equipment</li> <li>○ operation at north end of site during least sensitive times</li> <li>○ good communication and case-by-case mitigation</li> </ul>	No	n/a
Earthworks on Poplar Ave to Raumati Road	Graders Excavators Trucks	~ 9 months	107 Leinster Avenue	85	Yes	n/a	<ul style="list-style-type: none"> <li>○ installation of traffic noise barriers early during construction, if practicable</li> <li>○ temporary construction noise barriers</li> <li>○ operation in proximity to dwellings during least sensitive times</li> <li>○ good communication and case-by-case mitigation</li> </ul>	Yes	n/a

<sup>17</sup> It is important to note that the duration of construction activity affecting specific dwellings will be much shorter than the total estimated time period for the activity

<sup>18</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance

**Table 8-7: Sector 2 Predicted noise levels and recommended management and mitigation procedures**

Activity	Noisiest equipment	Est. total duration <sup>19</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>20</sup>	
								Daytime	Night-time
Raumati Bridge Construction	Vibroreplacement Vibro hammer Bridge beam placement (concrete breakers, trucks)	~10 months Beam placement 4 nights	90 Raumati Road	71 (vibroreplacement) 78 <sup>21</sup> (Vibro hammer) 65 (beam placement)	Yes	Yes	<ul style="list-style-type: none"> <li>○ piling during at least sensitive times</li> <li>○ resident relocation during night works</li> <li>○ temporary noise barriers</li> <li>○ good communication and case-by-case mitigation</li> <li>○ schedule noisy activities for daytime period</li> </ul>	Yes (Vibro hammer / vibro-replacement only)	Yes
Earthworks between Raumati Rd and Wharemauku Stream	Graders Excavators Trucks Scrapers	~7 months	79 Raumati Road	82	Yes	n/a	<ul style="list-style-type: none"> <li>○ installation of traffic noise barriers early during construction, if practicable temporary construction noise barriers</li> <li>○ operation in proximity to dwellings during least sensitive times</li> <li>○ good communication and case-by-case mitigation</li> </ul>	Yes	n/a

<sup>19</sup> It is important to note that the duration of construction activity affecting specific dwellings will generally be much shorter than the total estimated time period for the activity

<sup>20</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance

<sup>21</sup> Some limited acoustic screening through the topography has been assumed as piling will occur close to ground level

Earthworks between Wharemauku Stream and Kāpiti Road	Graders Excavators Trucks Scrapers	~6 months	Observation Place dwellings	90	Yes	n/a	<ul style="list-style-type: none"> <li>o As above</li> </ul>	Yes	n/a
Earthworks and sealing Kāpiti Road Widening	Graders Excavators Trucks	~6 months	Kāpiti Road dwellings south of intersection	80	Yes	Yes	<ul style="list-style-type: none"> <li>o noisy activities during daytime only where practicable</li> <li>o temporary construction noise barriers</li> <li>o resident relocation during night works</li> <li>o good communication and case-by-case mitigation</li> </ul>	Yes	Yes
Kāpiti Road bridge construction	Vibroreplacement Vibro hammer	~10 months Beam placement over 12 nights	94 Kāpiti Road	73 <sup>22</sup> (vibroreplacement) 80 (Vibro hammer) 67 (beam placement)	Yes	Yes	<ul style="list-style-type: none"> <li>o piling to occur at least sensitive times</li> <li>o resident relocation during night works</li> <li>o temporary noise barriers</li> <li>o good communication and case-by-case mitigation</li> <li>o schedule noisy activities for daytime period</li> </ul>	Yes (Vibro hammer and vibro-replacement only)	Yes
Earthworks between Kāpiti Road and Mazengarb Road	Graders Excavators Trucks Scrapers	~ 3 months	24 Cypress Grove	90	Yes	n/a	<ul style="list-style-type: none"> <li>o installation of traffic noise barriers early during construction, if practicable temporary construction noise barriers</li> <li>o operation in proximity to dwellings during least sensitive times</li> <li>o good communication and case-by-case mitigation</li> </ul>	Yes	n/a

<sup>22</sup> Some limited acoustic screening through topography has been assumed as piling will occur close to ground level

Vertical realignment of Kāpiti Road	Piling Graders Trucks Excavators	~ 4 months	171 Greenwood place	70	Yes	Yes	<ul style="list-style-type: none"> <li>○ conduct piling operations during daytime</li> <li>○ limit night-time operations where practicable</li> <li>○ choose quiet piling methods where practicable (i.e, avoid Vibro hammer piling)</li> <li>○ temporary construction noise barriers</li> </ul>	No	No
Piling and beam launching for Mazengarb Road	Vibroreplacement Piling Concrete breakers Large plant	~ 4 months Beam placement over 12 nights	20 Chilton Drive	71 (vibroreplacement) 79 (Vibro hammer) 65 (beam placement)	Yes	Yes	<ul style="list-style-type: none"> <li>○ piling to occur at least sensitive times</li> <li>○ resident relocation during night works</li> <li>○ temporary noise barriers</li> <li>○ good communication and case-by-case mitigation</li> <li>○ schedule noisy activities for daytime period</li> </ul>	Yes (Vibro hammer /vibro-replacement only)	Yes
Earthworks on Mazengarb road	Graders Excavators Trucks Scrapers	~4 months	345 Mazengarb Road	90	Yes	n/a	<ul style="list-style-type: none"> <li>○ installation of traffic noise barriers early during construction, if practicable temporary construction noise barriers</li> <li>○ operation in proximity to dwellings during least sensitive times</li> <li>○ good communication and case-by-case mitigation</li> </ul>	Yes	n/a
Excavation of stormwater wetland ponds	Excavators Off road trucks	~1 month	Oxford Court dwellings	72	Yes	n/a	<ul style="list-style-type: none"> <li>○ good communication and case-by-case mitigation</li> </ul>	No	n/a
Construction Yard (Raumati Road)	Equipment Mobilisation	~10 months	90 Raumati Road	50	No	Yes	<ul style="list-style-type: none"> <li>○ Noise control to generators</li> <li>○ Avoid mobilising equipment en-masse during sensitive periods</li> <li>○ Solid site hoarding</li> </ul>	No	No

Construction Yard (Kāpiti Road)	Equipment Mobilisation	~24 months	94 Kāpiti Road	53	No	Yes	○ As above	No	No
Construction Yard (Mazengarb Road)	Equipment Mobilisation	~10 months	331 Mazengarb Road	50	No	Yes	○ As above	No	No

**Table 8-8: Sector 3 Predicted noise levels and recommended management and mitigation procedures**

Activity	Noisiest equipment	Est. total duration <sup>23</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>24</sup>	
								Daytime	Night-time
Bridge beam placement on Otaihanga Road	Cranes Hand tools	~2 months Beam placement over 4 nights	150 and 155 Otaihanga Road	60	No	Yes	<ul style="list-style-type: none"> <li>○ limit night-time construction where practicable</li> <li>○ good communication and case-by-case mitigation</li> </ul>	No	Yes
Earthworks for new road link to Otaihanga Road	Excavators Trucks Graders	~4 months	Dwelling to south of 126 Otaihanga Road (no data available for allotment)	73	Yes	n/a	<ul style="list-style-type: none"> <li>○ good communication and case-by-case mitigation</li> </ul>	No	n/a
Earthworks between Otaihanga Road and Waikanae River	Excavators Trucks Graders Scrapers	~3 months	165 Otaihanga Road	71	Yes	n/a	<ul style="list-style-type: none"> <li>○ good communication and case-by-case mitigation</li> </ul>	No	n/a
Bridge construction for Waikanae River Bridge	Vibroreplacement Vibro Hammer	~12 months	East of El Rancho Christian Holiday Park	70	Yes	n/a	<ul style="list-style-type: none"> <li>○ good communication and case-by-case mitigation</li> </ul>	No	n/a

<sup>23</sup> It is important to note that the duration of construction activity affecting specific dwellings will be much shorter than the total estimated time period for the activity

<sup>24</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance



Activity	Noisiest equipment	Est. total duration <sup>25</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>26</sup>	
								No	n/a
Earthworks between Waikanae River and Te Moana Road	Excavators Trucks Graders Scrapers	~6 months	65 Puriri Street	73	Yes	n/a	<ul style="list-style-type: none"> <li>good communication and case-by-case mitigation</li> </ul>	No	n/a
Road sealing Te Moana Road Intersection	Excavators Trucks Graders	~4 months	Te Moana Road south of intersections	76	Yes	n/a	<ul style="list-style-type: none"> <li>temporary noise barriers</li> <li>good communication and case-by-case mitigation</li> </ul>	No	n/a
Bridge Construction at Te Moana Road	Vibroreplacement Vibro hammer Bridge beam placement	~8 months  Beam placement over 12 nights	145 Te Moana Road	70 (vibroreplacement) 78 (Vibro hammer) 61 (beam placement)	Yes	Yes	<ul style="list-style-type: none"> <li>piling to occur at least sensitive times</li> <li>resident relocation during night works</li> <li>temporary noise barriers</li> <li>good communication and case-by-case mitigation</li> <li>schedule noisy activities for daytime period</li> </ul>	Yes (Vibro hammer / vibro-replacement only)	Yes

<sup>25</sup> It is important to note that the duration of construction activity affecting specific dwellings will be much shorter than the total estimated time period for the activity

<sup>26</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance

Activity	Noisiest equipment	Est. total duration <sup>27</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>28</sup>	
								No	No
Construction yard (Otaihanga Road)	Concrete casting Truck deliveries Site mobilisation	Entire Project duration 4 years	150 Otaihanga Road	Potentially >45	No	Potentially	<ul style="list-style-type: none"> <li>○ locate plant and access roads away from nearby receivers</li> <li>○ operate during daytime where practicable</li> <li>○</li> </ul>	No	No
Construction yard (Te Moana Road)	Concrete casting Truck deliveries Site mobilisation	~ 24 months	145 Te Moana Road	47	No	Yes	<ul style="list-style-type: none"> <li>○ Noise control to generators</li> <li>○ Avoid mobilising equipment en-masse during sensitive periods</li> <li>○ Solid site hoarding</li> </ul>	No	No

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<sup>27</sup> It is important to note that the duration of construction activity affecting specific dwellings will be much shorter than the total estimated time period for the activity

<sup>28</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance

Table 8-9: Sector 4 Predicted noise levels and recommended management and mitigation procedures

Activity	Noisiest equipment	Est. total duration <sup>29</sup>	Closest dwelling(s)	Maximum noise level at closest receiver w/o mitigation L <sub>Aeq(t)</sub> dB	Exceeds daytime criterion 70 dB L <sub>Aeq</sub>	Exceeds night-time criterion 45 dB L <sub>Aeq</sub>	Potential mitigation option	Potential exceedance with mitigation <sup>30</sup>	
								Daytime	Night-time
Earthworks for Smithfield Road Realignment	Excavators Trucks Graders	~6 months	283 Ngarara Road	71	Yes	n/a	o good communication and case-by-case mitigation	No	n/a
Earthworks between Ngarara Road and Peka Peka	Excavators Trucks Graders Scrapers	~ 6 months	269 Ngarara Road	72	Yes	n/a	o good communication and case-by-case mitigation	No	n/a
Earthworks and sealing for Peka Peka Interchange	Excavators Trucks Graders	~6 months	32 Peka Peka Road	75 (earthworks) 68 (sealing)	Yes	Yes	o resident relocation during night works o temporary noise barriers o good communication and case-by-case mitigation o schedule noisy activities for daytime period where practicable	No	Yes

<sup>29</sup> It is important to note that the duration of construction activity affecting specific dwellings will be much shorter than the total estimated time period for the activity

<sup>30</sup> Refer to Figures in Appendix 16.B showing areas of potential exceedance

## 9. Conclusions

An assessment of construction noise effects for the proposed MacKays to Peka Peka Expressway Project has been completed.

Relevant construction noise criteria for the construction of the Project have been reviewed and it has been concluded that NZS6803:1999 “Acoustics – Construction Noise” is the most appropriate standard for the assessment and management of proposed Expressway construction noise. If the noise criteria of this standard are predicted to be exceeded, noise management and mitigation measures will be required to be implemented.

Away from State Highway 1, existing ambient noise levels in the vicinity of the Project are relatively low and an increase in the residential night-time noise criterion above 45 dB  $L_{Aeq(T)}$  is not considered to be appropriate for this Project.

Noise from all proposed construction activities has been considered and noise levels have been predicted at surrounding dwellings. Several construction activities are likely to generate noise levels in excess of daytime Project construction noise criterion (70 dB  $L_{Aeq(T)}$ ). Construction activities occurring at night are likely to be confined to bridge beam placement and intersection works; these activities are predicted to generate noise levels in excess of the night-time Project construction noise criterion (45 dB  $L_{Aeq(T)}$ ).

Noise from construction truck movements on the State highway and on local roads has been considered. In most cases, because of the existing volumes of heavy traffic, the increase in noise level is unlikely to be perceptible and at most would be just perceptible. Overall noise effects from construction traffic is predicted to be small and in many instances insignificant or unnoticeable.

This assessment contains detailed summary tables of the activities likely to exceed the Project construction noise criteria. These tables also identify buildings where these exceedances are likely to occur.

For the above activities, active noise management and mitigation measures are recommended to be undertaken to reduce, avoid and mitigate noise emissions as far as practicable. These measures are detailed in the construction noise and vibration management plan (CNVMP).

It is considered that the best practicable option for this Project is to ensure that construction noise effects are managed with the aim of meeting the Project construction noise criteria set out in Section 7.2 of this report and any exceedances are addressed through noise management and mitigation.

## 10. References

Wood, B. Pre-Construction Noise Level Survey: Technical Report 17, Volume 3 of the MacKays to Peka Peka Expressway Project AEE.

Whitlock, J. & Wilkening, S. Construction Noise and Vibration Management Plan: CEMP Appendix F, Volume 4 of the MacKays to Peka Peka Expressway Project AEE.

Stakeholder and Communication Management Plan: CEMP Appendix S, Volume 4 of the MacKays to Peka Peka Expressway Project AEE.

## Appendix 16.A: Glossary of technical terms

<b>Frequency</b>	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
<b>Noise</b>	A sound that is unwanted by, or distracting to, the receiver.
<b>Ambient</b>	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
<b>SPL or L<sub>p</sub></b>	<u>Sound Pressure Level</u> A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
<b>SWL or L<sub>w</sub></b>	<u>Sound Power Level</u> A logarithmic ratio of the acoustic power output of a source relative to 10 <sup>-12</sup> watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
<b>dB</b>	<u>Decibel</u> The unit of sound level.  Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. $dB = 20 \times \log(P/Pr)$
<b>dBA</b>	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
<b>A-weighting</b>	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.

<b><math>L_{Aeq}(t)</math></b>	<p>The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.</p> <p>The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.</p>
<b><math>L_{Amax}</math></b>	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
<b>NZS 6801:2008</b>	New Zealand Standard NZS 6801:2008 <i>"Acoustics – Measurement of environmental sound"</i>
<b>NZS 6802:2008</b>	New Zealand Standard NZS 6802:2008 <i>"Acoustics – Environmental Noise"</i>
<b>NZS 6803P:1984</b>	New Zealand Standard NZS 6803P:1984 <i>"The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work"</i> .
<b>NZS 6803:1999</b>	New Zealand Standard NZS 6803: 1999 <i>"Acoustics - Construction Noise"</i>

## Appendix 16.B: Activity sound power levels

An overall sound power “Group L<sub>AW</sub>” for each activity has been determined from the following data. This takes into account the overall operation time of each item of equipment within the group. The overall “Group L<sub>AW</sub>” may be lower than the sound power level of the loudest item in the group where this item does not operate continuously. For instance in “span finishing and barrier installation” the Group L<sub>AW</sub> is stated at 110 dB despite grinders and jack hammers contained in the group have sound power levels of around 120 dB L<sub>AW</sub>. This is because these items of equipment would be used intermittently only.

The following activities are representative of activities throughout the entire Project. In some areas, the plant that will likely be used differs from that contained in the following tables, but generally not significantly.

**Table A-1:** State highway reconstruction

Activity	Day/Night	Equipment (add. equipment may be used)	Avg. Sound Power Level per unit (dB)
Preload fill	Day	On-road trucks Compactors Hydraulic excavator (c. 20 Tonne) <b>Group Lw</b>	95-105 106 109-115 <b>113</b>
Road Construction and surfacing	Day	Graders (100kw) Rollers (vib.& non-vib.) On-road trucks Water carts Wirtgen KMA200 Stabiliser Bitumen sprayers Loaders Pavers Wirtgen Rotomill <b>Group Lw</b>	110 102-105 95-105 105-110 112 105 104 110 – 114 114 <b>110</b>



**Table A-2: Road Realignment / widening**

Activity	Day/Night	Equipment (add. equipment may be used)	Avg. Sound Power Level per unit (dB)
Road construction and surfacing	Day	Excavators	109-115
		Trucks	98-110
		Kerbing machine	114
		Concrete trucks	99-104
		Concrete pump	100-106
		Graders (100kw)	110
		Rollers (vib.& non-vib.)	102-105
		On-road trucks	95-105
		Water carts	105-110
		Wirtgen KMA200 Stabiliser	112
		Bitumen sprayers	105
		Loaders	104
		Pavers	110 – 114
		Wirtgen Rotomill	114
		<b>Group Lw</b>	<b>115</b>

**Table A-3: Bridge Construction**

Activity	Day/Night	Equipment (add. equipment may be used)	Avg. Sound Power Level per unit (dB)
Bore piling  Stone columns	Day	Diesel Generators Petrol Generators Air Compressors (trailer mounted) General light vehicles Concrete breakers (hand held or attached to excavator) Crawler crane (40t – 100t) Piling drill rig Vibro hammer Excavators (5-30t) Concrete trucks Concrete pump Delivery trucks (articulated) Earthmoving trucks Water trucks Sucker trucks Water blaster Welder and gas set Bentonite or Polymer system (complete with tanks and filtration systems) <b>Group Lw</b>	110-120 110-120 75-85 95-110 122 103 107-110 111 109-115 106 102 100-106 109 98-110 107 90 93-96 <100 <b>110</b>
Pile cap construction  Column/crosshead construction  Super-structure construction (pre-cast beams)	Day  Pre-cast beam placement during night-period	Diesel Generators Petrol Generators Air Compressors (trailer mounted) General light vehicles Concrete breakers (hand held) Crawler crane (40t – 100t) Excavators (5-30t) Concrete trucks Concrete pump Delivery trucks (articulated) Earthmoving trucks Sucker trucks Water trucks Water blaster Welder and gas set Mobile cranes (25t-300t) Grout pump Elevated work platforms (knuckle boom, straight boom, scissor lift, cherry pickers) Water pump with spears Submersible water pumps	110-120 110-120 75-85 95-110 122 103 109-115 106 102 109 109 98-110 107 90 93-96 95-105 108 <95 97-109 90

		Telehandler	99-105
		Forklift	95
		Petrol powered concrete saws	107-113
		Core drills	113
		<b>Group Lw</b>	<b>110</b>

**Table A-4: Expressway Construction**

Activity	Day/Night	Equipment (add. equipment may be used)	Avg. Sound Power Level per unit (dB)
Preload fill	Day	On-road trucks	95-105
		Compactors	106
		Excavators (20T)	97-110
		<b>Group Lw</b>	<b>113</b>
Earthworks	Day	On-road trucks	105
		Compactors	106
		Excavators (50T)	110-115
		Excavators (20T)	97-110
		MT31 Dumpers	100-110
		Twin Scrapers	118-123
		Single elevator Scrapers	115-120
<b>Group Lw</b>	<b>118</b>		
Road pavement construction	Day  Potential night works at interchanges	Excavators	109-115
		Trucks	98-110
		Kerbing machine	114
		Concrete trucks	99-104
		Concrete pump	100-106
		Graders (100kw)	110
		Rollers (vib.& non-vib.)	102-105
		On-road trucks	95-105
		Water carts	105-110
		Wirtgen KMA200 Stabiliser	112
		Bitumen sprayers	105
		Loaders	104
		Pavers	110 – 114
		Wirtgen Rotomill	114
<b>Group Lw</b>	<b>115</b>		

**Table A-5: Wetland Ponds**

Activity	Day/Night	Equipment (add. equipment may be used)	Avg. Sound Power Level per unit (dB)
Excavation and finishing	Day	Hydraulic excavator	109-115 95-
		On Road Trucks	105

of stormwater wetland pond		<b>Group Lw</b>	<b>110</b>
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## Appendix 16.C: Areas where construction noise criteria are potentially exceeded

Refer Appendix 16.C, Technical Report Appendices, Report 16, Volume 5