A review of variability in environmental regulatory requirements for roading construction projects across New Zealand

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- David Greig, Principal Environmental Specialist, Waka Kotahi – *Research Owner and Chair*
- Haobo Wang, Senior Scientist, Ministry of Transport
- Sue-Ellen Fenelon, Senior Analyst, Ministry for the Environment
- Jon Cunliffe, Resource Management Advisor, Marlborough District Council.

Additionally, the critique and commentary provided by the two independent peer reviewers was very useful in finalising this report. The peer reviewers were:

- Hugh Leersnyder (Independent Hearing Commissioner)
- Rod Albertyn (Senior Planner, Waka Kotahi).

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Abbreviations and acronyms

AEE	assessment of environmental effects
AEP	annual exceedance probability
CEMP	construction environmental management plan
CESCP	construction erosion and sediment control plan
CMP	construction management plan
CNVMP	construction noise and vibration management plan
CSM2	Christchurch Southern Motorway Stage 2
DOC	Department of Conservation
EMRP	ecological management and restoration plan
ESC	erosion and sediment control
ESCP	erosion and sediment control plan
ESR	environmental and social responsibility
GPS	Government Policy Statement
GWRC	Greater Wellington Regional Council
KCDC	Kāpiti Coast District Council
M2PP	Mackays to Peka Peka Expressway
MfE	Ministry for the Environment
NOR	Notice of Requirement
NTU	nephelometric turbidity units
OGPA	open-graded porous asphalt
PMO	preferred mitigation option
PPFs	protected premises and facilities
SEV	stream ecological value
SH58 Interchange	SH2/SH58 Haywards Interchange
SQEAS	suitably qualified and experienced acoustics specialist
TP90	Auckland Regional Council Technical Publication No. 90
TSS	total suspended solids
WEX:H	Waikato Expressway – Hamilton Section
WHO	World Health Organization

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Executive summary

Waka Kotahi NZ Transport Agency is one of New Zealand's largest infrastructure providers and is responsible for commissioning capital works projects in every region of the country. In recent years, anecdotal observations made by Waka Kotahi staff and project delivery partners have identified variability in the treatment and management of environmental aspects relating to Waka Kotahi construction projects both within regions and across New Zealand.

The scope of this review was to understand whether there is variability in treatment and approach to resource management processes and consenting outcomes between projects. This relates specifically to conditions/obligations that come about through the Resource Management Act (RMA) process, not the environmental outcomes after project delivery.

The reasons behind any variability identified and the resultant influence on environmental outcomes sought by the resource management process were investigated. Understanding this variability will help with future consenting processes for applicants, regulators, partners and stakeholders alike. In this context, partners may include tangata whenua as a Treaty partner and other transport infrastructure providers such as Auckland Transport or KiwiRail.

The scope was agreed by the Project Steering Group following an initial assessment of two case-study projects, where four key environmental risk areas were identified to analyse the variability of RMA conditions[1] and environmental management requirements:

- ecology
- erosion and sediment control
- stormwater management
- noise and vibration.

Eight capital works road transport projects were selected as case studies for the analysis. These projects were a mix of small- and large-scale projects and represent a variety of regions with different receiving environment systems. A review of the RMA approval process and consent and designation conditions was undertaken for each of the key environmental risks for each case study. The RMA conditions and management controls between case studies were analysed to understand whether the variability observed could be attributed to several factors, including:

- size of the project
- RMA approval process
- local government district and region
- sensitivity or types of receiving environment
- urban/rural/natural-state project environment.

An environmental risk matrix was then developed to measure the effectiveness of the management controls with respect to each of the four environmental risks.

[1] References to RMA conditions or conditions throughout the assessment cover both designation conditions and resource consent conditions.

Identifying factors that can contribute to variability of the RMA requirements and outcomes is complex due to the number of stages, parties involved and various pieces of legislation and regulations that need to be considered. Notwithstanding this, the analysis in this report sought to understand where variability in resource management decision making exists so that lessons learned from these case studies may inform more consistent decision making and a streamlined resource management process in the future – with a particular focus on RMA conditions, purpose and outcomes sought.

As the focus of the analysis was to evaluate resource consent and designation conditions, there has been a focus on capital works projects. This research is not a detailed scientific study as there are inherent biases associated with the case-study selection process. It is noted that as the requiring authority, Waka Kotahi dictates or has significant influence over the designation conditions, so any matters of inconsistency can be better addressed by Waka Kotahi (as they can propose applicable conditions), as opposed to regional and district RMA conditions and the outcome of a Board of Inquiry process, which are imposed by external decision makers.

It is also recognised that local authorities establish district and regional policy and manage resources at these levels specific to the local environments and communities. In this context, variability between projects is an essential component to support and protect local values and circumstances and reflects the environmental variability of New Zealand.

The analysis shows that the specificity of consent requirements increases where there is potential for significant effects and where there is keen interest from council officers and submitters. Conditions with a high degree of specificity imply a high level of certainty for regulators, who can be more confident that adverse effects will be managed appropriately. Countering this approach, however, is that when conditions are very specific, this may limit the ability of the contractor to deliver an outcome-focused approach to managing the effect in question.

There are several steps within the business case and consenting process where factors contributing to inconsistency between consent requirements may be introduced. These factors can be cumulative, leading to potentially dissimilar sets of conditions being applied across projects.

Our assessment is that the most impactful stage for an environmental screening assessment is the point of entry stage of a business case process. This is the stage where investment decisions are made and there is the ability to shape the project directly. The Waka Kotahi point of entry guidance and templates could be amended to recommend application of the environmental screening tool as part of the information considered at this stage.

The review included assessing how effective the management controls were in addressing environmental risks. We have not achieved this definitively. We note that more stringent requirements were applied to more sensitive environmental aspects, overall. However, further work, including interviewing regulatory staff, reviewing compliance reports, and post-construction monitoring, would be required to ascertain this more fully, likely alongside ‘outcomes monitoring’ and collation of data that has been collected as part of construction-phase requirements, coupled with post-construction monitoring that may or may not be an obligation of resource consent frameworks currently.

Key impacts on environmental values considered are as follows:

- **Ecological values** – Ecology was the most complex aspect considered. The ability to avoid or minimise impacts on sensitive ecological values is best undertaken at the route selection (business case) phase. Thereafter, typically a standard process is applied of understanding the base line (monitoring), then developing strategies to mitigate impacts where these can’t be avoided.

- **Water and air quality from the discharge of sediment** – The management of risks associated with sediment-laden runoff is the most consistent across the case studies, and in our experience, across New Zealand. Good practical guidance material has been developed over the past 28 years, and there is a reasonable level of understanding and acceptance of these requirements by regulators and the construction industry. The exception to this is the lack of guidance around water quality standards for sediment discharge, and this was an area where more variability was observed in RMA condition requirements between projects.
- **Water quality and quantity from the discharge of stormwater** – There was relatively significant variability in the approach to managing stormwater quality and quantity across the case studies. Larger, more complex projects where new infrastructure was constructed generally addressed stormwater impacts comprehensively. The smaller projects, some of which were upgrading or retrofitting existing infrastructure, generally offered less opportunities to manage the risks of stormwater discharge, and the consent requirements reflected this.
- **Amenity values and the effects on the built environment from noise and vibration** – There was variability in the approach to managing noise and vibration. All projects were expected to generate some level of noise and vibration effects in both the construction and operation phases. However, management controls were strongly dependent on the size of the project and the proximity to urban areas or other receptors.

The location of the projects had some impact on the conditions for some of the environmental aspects reviewed, generally in response to the degree of risk. There was no apparent correlation between the rural–urban continuum and adverse effects on ecological values, as projects in urban, rural, and natural-state environments all have potential for adverse effects, and management requirements were applied accordingly. For erosion and sediment control and stormwater effects, the scale of the project had more of an influence on the conditions applied rather than whether the project was in an urban or rural environment. Noise and vibration aspects were more significant in urban areas, and stringent conditions and management requirements were applied accordingly.

One of the matters investigated was whether environmental outcomes sought through RMA approval processes are being achieved in transport projects under current consenting regimes. Understanding effective means of mitigating impacts on natural values (associated with habitat modification, and water quality associated with sediment and stormwater contaminant discharges) and on amenity and the built environment (noise and vibration) will allow the ongoing development of mitigation guidelines and certainty of outcomes for applicants, regulators, partners and stakeholders alike.

Other recommendations that seek to deliver better environmental outcomes and value for money across capital works transport projects include:

1. **Strategic business case project screen:** a visual screening tool to inform key project decisions, such as route selection, and visually communicate an indication of the level of effort and cost required to adequately address adverse effects at the point of entry stage of a business case process.
2. **Developing project feedback loops**: potential to consider RMA conditions that require monitoring results to be reported back to the local authorities and the road-controlling authority so that the project success at achieving specific environmental outcomes can be measured and quantified. This could also be adopted directly by Waka Kotahi (rather than via condition).
3. **Understanding what drives good environmental outcomes**: recommendation towards further research as to whether more prescriptive RMA conditions generate better environmental outcomes compared to less prescriptive requirements.

4. **Management plan framework**: a national guidance document to standardise the terminology and structure of the management plans required for capital works transport projects.

These findings have application wider than Waka Kotahi projects; they also apply to consenting processes and projects in general. Applying systematic or routine approaches to managing the potential effects of construction on environmental aspects provides certainty and streamlines these processes.

Abstract

Waka Kotahi NZ Transport Agency staff and project delivery partners have identified variability in the treatment and management of environmental aspects relating to state highway construction projects across New Zealand. The scope of this research (undertaken between 2018 and 2020) was to seek to understand this variability better through a review of eight case-study projects. The scope of this research relates specifically to conditions/obligations that come about through the Resource Management Act (RMA) process, not the environmental outcomes after project delivery. The reasons behind any variability identified and the resultant influence on environmental outcomes sought by the resource management process were investigated. We identified several steps within the business case and consenting process where factors contributing to inconsistency between consent requirements may be introduced, for reasons ranging from regional planning rules to public participation in the RMA process. Understanding this variability will help with future consenting processes for applicants, regulators, partners and stakeholders alike. Based on this research, we provide recommendations that seek to streamline and improve consistency in decision making to deliver better environmental outcomes and value for money across capital works transport projects.

1 Introduction

1.1 Purpose

Waka Kotahi NZ Transport Agency is one of New Zealand's largest infrastructure providers and is responsible for commissioning capital works projects in every region of the country. With the scale and breadth of the work it undertakes, Waka Kotahi is in a unique position to provide insights into how infrastructure resource and environmental management is undertaken nationally and from project to project.

In recent years, anecdotal observations made by Waka Kotahi staff and project delivery partners have identified variability in the treatment and management of environmental matters relating to Waka Kotahi construction, operation, and maintenance projects both within regions and across New Zealand.

There are two types of Resource Management Act (RMA) approvals that Waka Kotahi obtains for capital projects – resource consents and designations. As the requiring authority, Waka Kotahi determines the designation conditions in consultation with district councils, so any matters of inconsistency may be addressed directly by Waka Kotahi. Regional and district resource consent conditions and the outcome of Board of Inquiry processes are imposed by external decision makers.

This review seeks to identify high-level themes and causes of consistency, or inconsistency, of RMA conditions across New Zealand road transport projects as they relate to environmental management aspects.

Learnings from this review will help to better understand:

- whether environmental risk management practices required via RMA conditions are routinely and consistently applied across New Zealand
- whether environmental outcomes sought through RMA processes are being achieved in transport projects under current consenting regimes
- whether there are areas where more consistency could be achieved (across RMA conditions or outcomes/management)
- how and where improvements could be made by developing stronger guiding principles for transport projects.

If stronger guiding principles would be appreciated by the various parties involved in RMA approval processes, then those processes may be streamlined and provide more certainty for all.

Recommendations are included where any further assessment is considered useful and to maximise the value of the findings from this evaluation.

1.2 Scope

Following detailed discussions with Waka Kotahi, the scope of this research was determined to be a high-level review of eight Waka Kotahi roading projects, seeking to explore the following questions.

1. Is there variability in treatment and approach to resource management processes and consenting outcomes between projects,[2] and why?

[2] The scope of this study does not include conditions/management processes imposed through non-RMA processes such as wildlife permits and archaeological authorities.

2. If there is variability, how does this influence the environmental outcomes sought by the resource management approach?
3. What lessons can be applied to streamline future projects while maintaining environmental values?

RMA conditions and the range of management controls between case studies were analysed to determine whether the variability across the projects is a function of the:

- size of the project
- consent process (eg, fully notified/limited notification/Board of Inquiry/direct referral to Environment Court)
- local government region
- types of receiving environment
- project setting (urban/rural split).

For the purposes of this assessment, the term 'management control' is defined as an instrument or tool utilised to avoid, remedy or mitigate the potential effects on the environment as a result of the activity. For example, this may include the use of site selection (and avoiding sensitive areas by route selection), management plans, monitoring activities, use of methodologies to mitigate effects on air, land and water, defining areas that need to be avoided, or mitigation activities such as those to replicate habitat.

Further qualitative analysis has been undertaken to establish the relative effectiveness of the range of controls employed on each project to manage and mitigate effects.

The review of these eight projects is considered sufficient to provide information on the key environmental management issues for application to future road transport projects.

1.3 Drivers

RMA approval processes associated with Waka Kotahi construction projects are time consuming and costly. Anecdotal evidence from recent transport projects suggests that RMA approval processes and resulting environmental requirements can vary from project to project, including those of a similar scale. Variability between projects may be a consequence of the site parameters as well as the applicable district and regional plan objectives, policies and rules pursuant to which an RMA approval is granted.[3] Further variability may be introduced through the:

- environmental management practices (controls) utilised to manage and/or mitigate those effects
- scale of the project
- RMA process under which consents and designations are obtained.

The RMA establishes a largely decentralised policy and decision-making framework under which regional and territorial authorities have agency over resource management issues that affect them. This supports variability in how environmental risks are addressed on projects. Local authorities establish district and regional policy and manage resources at these levels specific to the environments and communities they operate in. In this context, variability between projects is an essential component to support and protect local

[3] Acknowledging that national environmental standards and policy statements may help to deliver a degree of consistency between regional plans.

values and circumstances and reflects the environmental variability of New Zealand. For the purposes of this assessment, the term ‘environment’ comprises the four matters covered by section 2 of the RMA.[4]

Identifying factors that can contribute to variability of resource consent requirements and outcomes can be complex due to the number of stages, parties involved and various pieces of legislation and regulations that need to be considered. Figure 1.1 examines each stage of a typical project, noting that a further series of steps can occur through an appeal process following decisions.

Notwithstanding the variability that can arise from the resource management processes, there are some themes that should be relatively consistent irrespective of the specifics of a project. These include the:

- scale of a project, both spatially and cost (not including land, which can vary significantly)
- RMA approval process (Board of Inquiry, direct referral, district and regional designation and consenting processes, appeal)
- range of environmental risk management controls utilised
- land use characteristics (urban or rural, greenfield or brownfield)
- community acceptance or resistance to a project.

These aspects are considered in detail in the following sections.

[4] *environment includes—*

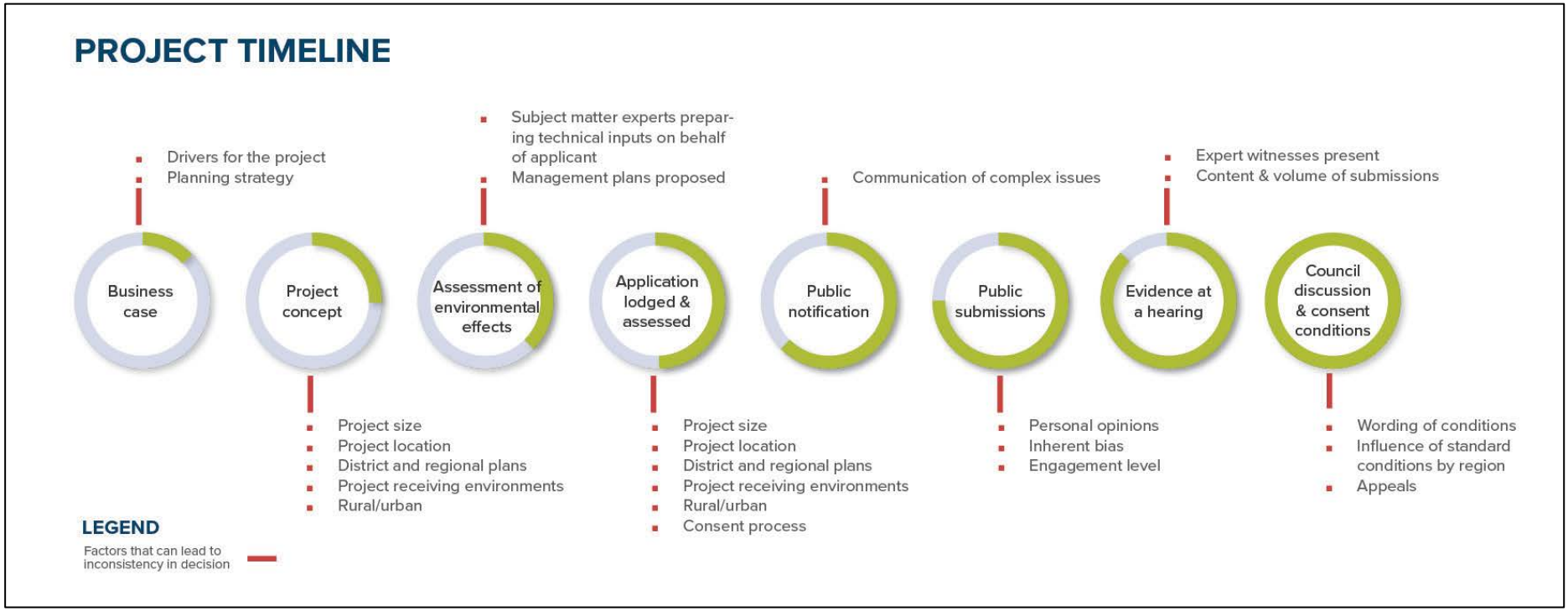
(a) ecosystems and their constituent parts, including people and communities; and

(b) all natural and physical resources; and

(c) amenity values; and

(d) the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters

Figure 1.1 Factors that can introduce variability in the environmental management requirements for a project



2 Methodology

The methodology was developed in an iterative process with input from the Project Steering Group (details below). A summary of the project methodology is presented in Figure 2.1.

2.1 Research process steps

The research process for this project was undertaken in the following steps.

2.1.1 Initialisation

At the beginning of the project, key drivers for the research were assessed and an initial scope of research formulated in line with the identified drivers (section 1.3). The project scope was originally set as:

> *A high-level survey of selected transport projects to provide some insight into the drivers and consistency of environmental management requirements.*

The Steering Group provided input and direction during the scoping exercise. The Steering Group consisted of:

- David Greig, Principal Environmental Specialist, Waka Kotahi – Research Owner and Chair
- Haobo Wang, Senior Scientist, Ministry of Transport
- Sue-Ellen Fenelon, Senior Analyst, Ministry for the Environment
- Jon Cunliffe, Resource Management Advisor, Marlborough District Council.

2.1.2 Develop research process

Some initial work was completed to develop the research process prior to the kick-off meeting with the Steering Group. Two recent roading projects – Mackays to Peka Peka Expressway (M2PP) and Waterview Connection, located in the Wellington and Auckland regions respectively – were used as case studies to conduct an initial comparison and develop a process for analysis.

Using information sourced from the application documentation and RMA conditions for both projects, four topics were analysed:

- ecology
- cultural/heritage
- erosion and sediment control (ESC)
- construction and operational noise and vibration.

Differences in the prescriptiveness of conditions and the environmental management requirements applied in each of the topic areas were assessed. This initial analysis was presented to the Steering Group, and the approach was then expanded to include a wider range of case studies.

Figure 2.1 Summary of the project methodology

2.1.3 Case study selection

A long list of potential projects was developed. For each, the following information was assessed to aid in the selection of a short list:

- local government region
- size (scale)
- primary surrounding land use
- receiving environment type
- types of RMA approvals obtained.

Eight capital works road transport projects were selected that reflected small- and large-scale projects. They represent a variety of regions with different receiving environment systems.

This research is not a detailed scientific study as there are inherent biases associated with the case-study selection process. As the focus of the project was to evaluate resource consent and designation conditions, there has been a focus on capital works projects.

Half of the projects selected were large-scale projects, consisting of capital works of greater than $50 million, while the remainder of the projects were considered small-scale (capital works of less than $50 million). Summaries of the selected case studies are presented in section 3.1, with more detail set out in Appendix A and Appendix B.

2.1.4 Source evidence

The information pertaining to each project, including applications, Notice of Requirement and decision documentation, including the RMA conditions for each case study, were obtained from a range of sources, including Waka Kotahi and relevant local authorities.

2.1.5 Determine environmental aspects

Following the initial assessment of the M2PP and Waterview projects, four key areas or environmental risks were selected to analyse the variability of RMA conditions and environmental management requirements. These are impacts on:

- ecological values
- water and air quality from the discharge of sediment
- water quality and quantity from the discharge of stormwater
- amenity values and the effects on the built environment from noise and vibration.

The consideration of cultural/heritage aspects was originally analysed when first developing the research process (section 2.1.2). However, this aspect was not pursued further because the effects and conditions vary widely, depending on the local tangata whenua and local history. Therefore, it was difficult to make valid comparisons between projects.

2.1.5.1 Environmental risk analysis methodology

A review of the decision-making process and RMA conditions (Appendices B and C) was undertaken for each of the key environmental risk aspects for each case study.

Summary tables were developed and used to compare each of the case studies by the four environmental risk aspects (Appendix D). The variability of RMA conditions and management controls between case studies was analysed to understand whether the variability observed could be attributed to the:

- size of the project
- RMA approval process
- local government region
- sensitivity or types of receiving environment
- urban/rural/natural-state project environment.

2.1.5.2 Effects diagrams

To simplify and consolidate the information collected, the components analysed were summarised visually by environmental risk aspect (Figures 3.2–3.7) using Venn diagrams to illustrate consistency.

The scale of potential environmental effect of each of the four key environmental risk aspects (ecological values, water and air quality from the discharge of sediment, water quality and quantity from the discharge of stormwater, and amenity values and the effects on the built environment from noise and vibration) was assessed on a 5-point scale as being less than minor, minor, moderate, high, or significant.

This high-level judgement was based on an assessment of the:

- application documentation (assessment of environmental effects, notice of requirement, etc)
- decision documentation (hearing reports, RMA conditions, etc)
- receiving environment.

The reasoning behind each judgement on the scale of effect for each case study is set out in Tables 3.1–3.4.

The projects were also placed on a spectrum of rural to urban receiving environments using a 5-point scale, where:

- 1 = natural-state environment
- 2 = rural countryside
- 3 = mixture of rural and urban receiving environments
- 4 = the outskirts of an urban area
- 5 = an urban city centre.

In this report, a ‘natural-state’ environment refers to a receiving environment that is ‘towards the pristine end of the artificial/polluted to pristine continuum’ (*Rangitata South Irrigation Ltd v Fish and Game* (Environment Court C109/2004 5 August 2004) pp. 11–12). The rural compared to urban determination for each case study is set out in Table 3.1.

2.1.6 Develop environmental risk matrix

An environmental risk matrix was developed to assess the effectiveness of the management controls for each of the four environmental risk aspects (Table 4.1) in general accordance with the Waka Kotahi *Risk Management Practice Guide* (NZ Transport Agency, 2018).

In line with standard practice, risk ratings were developed by comparing the likelihood of occurrence (probability) compared to the potential environmental consequence. The definitions for the likelihood of an event occurring are set out in Table 4.3 on a scale from rare (1) to almost certain (5).

The definitions for environmental consequence are set out in Table 4.2 and have been expanded from Table 4.4 of the Waka Kotahi *Risk Management Practice Guide* to highlight the difference between construction and operational phase environmental risks.

2.1.7 Assessment of environmental risk aspects

Table 2.1 below sets out the factors that may impact the potential scale of an environmental effect arising for each of the four environmental risks.

Table 2.1 Matters contributing to the level of environmental risk

Environmental risk aspect	Factors influencing risk
Ecological values	• Sensitivity of nearby receiving environments • Ecological value of the receiving environments • Presence/abundance of indigenous flora and fauna • Presence/abundance of threatened or at-risk species • Presence of, or proximity to, significant ecological areas and habitat • Amount of habitat loss • Cumulative impacts arising from other projects/disturbance locally
Water and air quality from the discharge of sediment	• Sensitivity of nearby receiving environments • Duration and season of the construction phase of the project • Surface geology and the associated ease of mobilisation of soil particles • Construction methodology and staging • Contours/grade across the project alignment • Local climatic conditions, including rainfall depth and intensity and wind
Water quality and quantity from the discharge of stormwater	• Sensitivity of nearby receiving environments • Ecological value of nearby receiving environments • Scale of the project, including increases in impervious surfaces • Contours/grade across the project alignment • Areas of historical or modelled flooding • Cumulative impacts arising from other projects • Climate change • Traffic volume as a determinant of the level of stormwater contamination
Amenity values and effects on the built environment from noise and vibration	• Existing background/ambient noise levels • Proximity of nearby residential dwellings and/or commercial or industrial premises • Proximity of other noise-sensitive premises (eg, schools) • Construction hours • Type and scale of construction (construction methodology) • Geology of area (can impact vibration levels) • Duration of the construction phase of the project • Expected operational traffic volume and vehicle type • Traffic speed limit • Final road surface treatment/pavement type

The environmental risks for each project were assessed against the risk matrix and given a risk rating of low, moderate, high, or critical.

The *inherent risk* was assessed as the risk without any management controls in place. The inherent risk rating should be interpreted as a worst-case scenario. Where sensitive receiving environments were present, the potential consequence of a risk being realised was higher, leading to higher inherent risk ratings.

The *residual risk* refers to the risk remaining after accounting for the management controls required by RMA conditions. This research was constrained to assessing management controls required by RMA conditions, but in practice many effects are controlled through additional factors, including design, route selection, construction methodology, iwi or stakeholder involvement, or even through the contractor installing additional environmental controls over and above what they are required to do by consent condition.

By further comparing the inherent risk to the residual risk, a measure of the effectiveness of the consenting process at reducing environmental risks was developed. The risk reduction from inherent to residual risk was plotted by case study in four categories, as listed below.

- **Inherent risk already low –** There was no need to reduce the risk as the inherent risk was already low to begin with. The fact that a risk is low does not necessarily mean that there is no opportunity to reduce or eliminate that risk.
- **No risk reduction –** There is no difference between the inherent and residual risk.
- **Risk category reduced by one level of severity –** The residual risk is one risk category lower than the inherent risk (ie, a 'high' inherent risk reduces to a 'moderate' residual risk when the controls required by RMA conditions are considered).
- **Risk category reduced by two levels of severity –** The residual risk is two risk categories lower than the inherent risk (ie, a 'high' inherent risk reduces to a 'low' residual risk when the controls required by RMA conditions are considered).

Overall sources of variability or inconsistent approaches between environmental risks associated with the case studies were highlighted.

2.1.8 Evaluate findings

The findings of the risk analysis were evaluated to identify key themes and reasons for consistency, or inconsistency, of conditions and environmental management requirements across the projects. This evaluation provided some insight into the decision-making process at the RMA decision-making phase.

Learnings from this review will help with understanding how environmental outcomes are being achieved in transport projects under current consenting regimes, whether there are areas where greater consistency could be achieved, and how improvements could be made by developing stronger guiding principles.

A number of recommendations were developed based on these findings and the Government Policy Statement (GPS) on Land Transport (New Zealand Government, 2018). The GPS sets out the Government's priorities for expenditure from the National Land Transport Fund. Key strategic priorities include:

- **Environment** – a land transport system that reduces greenhouse gas emissions, as well as adverse effects on the local environment and public health
- **Value for money** – a land transport system that delivers the right infrastructure and services to the right level at the best cost.

Several recommendations are included that seek to deliver better environment outcomes and value for money.

2.1.9 Review process

A copy of the draft report was submitted to Waka Kotahi for review. Feedback received from the review process was reflected in the report submitted for peer review.

Two independent peer reviewers with appropriate expertise were engaged to certify that the draft report was technically sound. The peer reviewers were:

- Hugh Leersnyder (Independent Hearing Commissioner)
- Rod Albertyn (Senior Planner, Waka Kotahi).

The research report and recommendations were then finalised for distribution.

2.2 Limitations of this approach

It is important to note that the analysis of risk is undertaken in the context of the RMA conditions that focus on managing the risk of environmental effects for each project. While the focus of the assessment is to evaluate the potential variability of RMA conditions and the drivers of variability, it is important to note that RMA conditions may not identify, quantify and seek to manage all known environmental risks.

As our analysis of the issue developed, it became clearer that certain aspects are, for example, avoided entirely – and hence not necessarily subject to management from an RMA condition sense. Other aspects may be subject to a lot of focus in terms of management of their effects. Some may even go over and above minimum baseline expectations set in RMA conditions as a result of scrutiny or particular interest from external parties. These point to the fact that there are various tools to manage effects and risks and only some are addressed directly through RMA conditions. Other methods can include avoiding high-value habitat areas, or utilising noise attenuation techniques near residential areas.

There may also be a discrepancy (we explore some of the reasons for this in section 6) in what may be identified as management issues for resource consents and designations, and what may take more focus during construction or operational phases. As an example, we understand that on many construction projects, noise effects and their management are key areas of focus for environmental teams. Management effort (stakeholder liaison, complaints management, pre-emptive notification of potentially noisy work) around managing these effects is anecdotally a significant focus of these projects, potentially more so than other similarly noteworthy environmental effects issues such as sediment discharges to the environment.

As a result of this method, the term ‘risk’ and the derivation of key focus areas in the context of this report is not consistent with the more typical approach that is based around a holistic review of practice and how this is managed in the construction or operational phases of a road transport project.

The RMA provides a process that expects that actual and potential adverse effects are adequately identified and quantified, and that management measures are put in place. There is also a reasonable expectation that an overarching objective is set – that is, the acceptable level of *effect* of a proposal.

Hence, the uncertainties in being able to achieve the expected objectives are typically then down to the drafting of the conditions to meet the outcome of the objective and the compliance with the RMA conditions by the requiring authority/consent holder and their contractor(s). The *likelihood* of a risk eventuating is the controlling factor.

3 Case studies

3.1 Case study summaries

Eight road transport capital works projects were selected from across New Zealand. Project summary information is set out below. Project locations are shown on Figure 3.1.

- **Waterview Connection** (Waterview): a new 4.5 km motorway section that tunnels under central/west Auckland from Mt Roskill to Waterview, connecting SH16 and SH20 and forming part of the Western Ring Route. Waterview was a significant (>$50M) urban project near the high-value coastal environment (Waterview Estuary and Waitematā Harbour). Waterview was authorised via a Board of Inquiry process.
- **Mackays to Peka Peka Expressway** (M2PP): a new 18 km four-lane expressway through the Kāpiti Coast from Mackays Crossing to Peka Peka, forming part of the Kāpiti Expressway (SH1). M2PP was a large-scale (>$50M) project extending through both urban and rural areas, including high-value, regionally rare and significant wetlands and other valuable waterways in the Wellington region. M2PP was also authorised through a Board of Inquiry process.
- **Christchurch Southern Motorway – Stage 2** (CSM2): a new four-lane median separated motorway from Halswell to SH1 near Robinsons Road and an upgrade of the existing SH1 from north of Robinsons Road to Rolleston, with a combined length of 16 km. CSM2 was a large-scale (>$50M) project passing through rural farmland south of Christchurch with relatively few sensitive receivers in close proximity. CSM2 was authorised through a Board of Inquiry process.
- **Waikato Expressway – Hamilton Section** (WEX:H): a new 22 km four-lane expressway that bypasses Hamilton on the eastern side and forms part of the SH1 Waikato Expressway. It connects the existing Tamahere Interchange in the south to the Ngāruawāhia Section (Lake Road interchange) of the Waikato Expressway in the north. WEX:H is a large-scale (>$50M) project traversing rural farmland and is adjacent to built-up areas as well as passing through ecologically high-value gully systems. It was consented through the various local authorities.
- **SH1 Barters Road/Pound Road Improvements** (Barters Road): road upgrades near the Waterloo Business Park located on the outskirts of Christchurch, including a new intersection with traffic lights installed at Waterloo Road and Pound Road, the closure of the existing Barters Road railway crossing, and a new T-intersection at Pound Road via a new railway crossing. Barters Road is a small-scale (<$50M) project extending through largely rural farmland with some dwellings and commercial/industrial receivers and was consented through the local authorities.
- **SH73 Arthur's Pass Mingha Bluff Realignment** (Mingha Bluff): a road realignment and reconstruction to improve safety and reliability of a 5 km section of SH73 near Arthur's Pass village within Arthur's Pass National Park. Mingha Bluff is a small-scale (<$50M) project within an undeveloped national park with very high ecological values and was consented through the local authorities.
- **SH2/SH58 Haywards Interchange** (SH58 Interchange): a new interchange at the SH2 and SH58 intersection located near the northern outskirts of Lower Hutt. This is a small-scale (<$50M) project located on the urban fringe, near Belmont Regional Park and the Hutt River, and was consented through the local authorities.
- **Welcome Bay Road and Te Puke Highway Intersection** (Welcome Bay): replacing the existing T-intersection with a single-lane roundabout at the Welcome Bay Road and Te Puke Highway intersection, located south of Papamoa Beach. Welcome Bay is a small-scale (<$50M) rural project with few sensitive receivers and was consented through the local authorities.

An overview and location map for each case study is provided in Appendix A.

An in-depth discussion of the consenting and decision-making process for each case study is included in Appendix B. Tables outlining the RMA conditions for each case study are presented in Appendix C. High-level comparison summary tables of the RMA conditions for the case studies are provided in Appendix D.

Figure 3.1 Case study locations

3.2 Variability analysis

Eight case studies were selected to analyse, based on the factors set out below:

- size of the project
- RMA process
- local government region
- types of receiving environment
- project setting (urban/rural split).

As previously noted, these are known variables considered to have a potential impact on variability of RMA requirements. The variability of RMA conditions between case studies was assessed across the four environmental aspects outlined in section 2.1.5.

The following sections outline the various environmental aspects considered and provide commentary on the variability observed between case studies (refer to Appendix B for a more detailed discussion).

3.2.1 Ecology

Ecology is one discipline where a wide degree of variability could be anticipated due to the natural geographic and environmental conditions specific to each region of New Zealand and the degree of modification from the natural state of the project areas.

This makes it challenging to assess in the context of this research, but it does present more opportunities to understand the consistency in the approach to managing environmental risk. Management controls are typically governed by ecological best practice in response to the species and habitats that may be impacted.

To aid effective comparison between projects, only ecological matters that had a degree of commonality between projects have been considered.

In addition to the extent and detail contained in the RMA conditions, ecological aspects often require very detailed management plans to be submitted prior to construction commencing. In some instances (often for large projects), this requires consultation with third parties (including iwi and the Department of Conservation (DOC)) and the outcome of that consultation being reflected in the associated management plan.

This may be further complicated by the need for Wildlife Act 1953 and Conservation Act 1987 permits applied for from DOC and the Ministry for Primary Industries where specific ecological aspects and means of mitigating impacts are addressed in a parallel process, albeit not necessarily at the same time.

3.2.1.1 Freshwater ecosystems

Of the eight projects examined, seven had actual or potential interactions with freshwater ecosystems. Only one, Barters Road, did not. Of the seven projects that did interact with freshwater ecosystems:

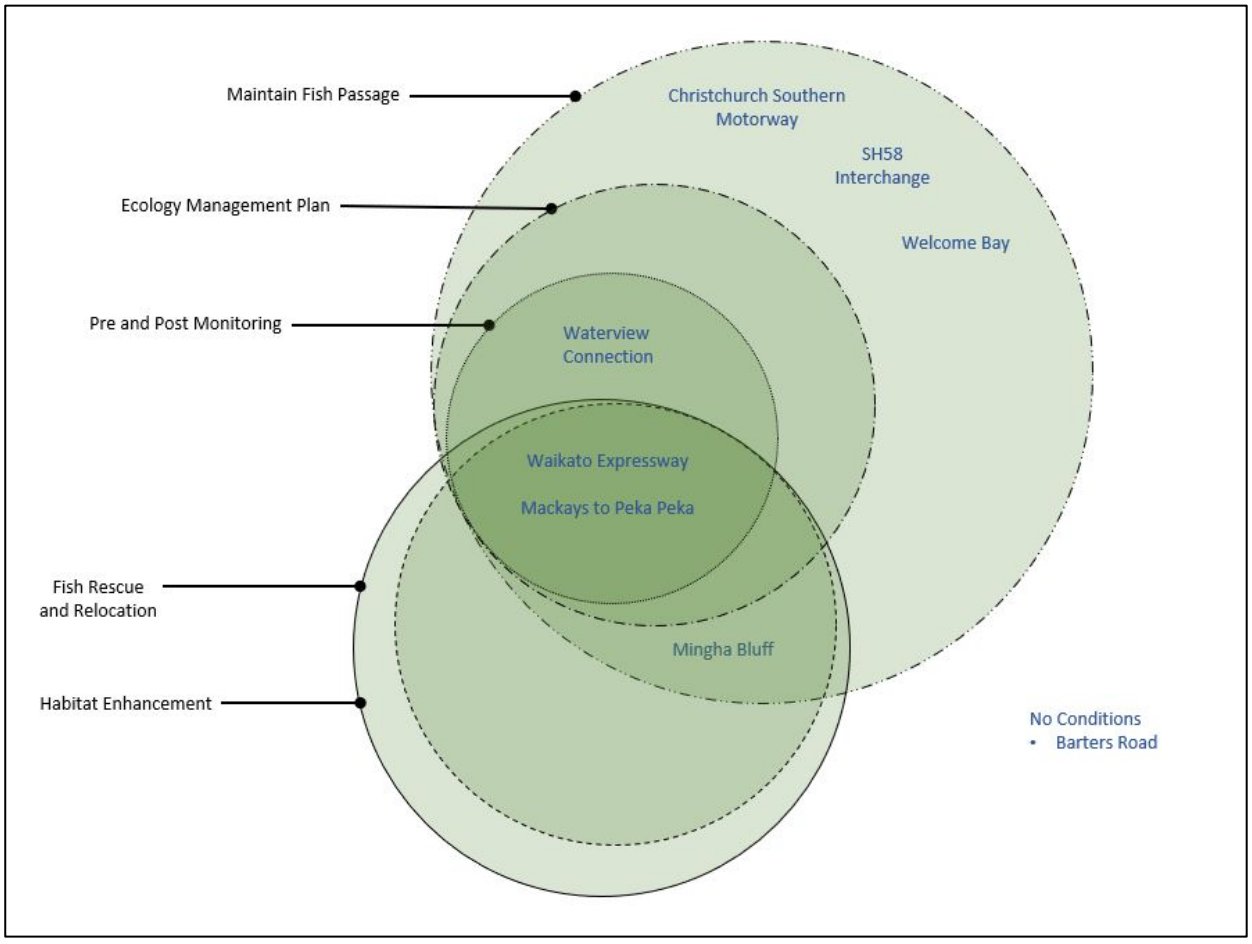
- all included measures to manage fish passage through diversion and structures
- three included fish rescue and relocation provisions
- three required a specific ecological management plan to include freshwater ecological matters, and one provided for it in a wider environmental management plan
- three included pre- and/or post-structure survey (monitoring) provisions
- four included mitigation or habitat enhancement measures.

It is noted that mitigation or enhancement of ecological aspects associated with construction projects is often included in the design of the final project, but not reflected in the RMA conditions.

Figure 3.2 illustrates the overlapping or consistent requirements and highlights the differences between each of the case studies relating to freshwater ecosystem management requirements detailed through RMA conditions.[5]

There appears to be some variability in RMA conditions, particularly relating to project size, with the larger projects typically having more consent requirements. Due to the potential scope of impact, freshwater ecology was considered to have greater importance for three large-scale and one small-scale project. This importance was demonstrated in the extent of RMA conditions, in terms of both the number and scope of these. Three of the large-scale projects required pre- and post-construction ecological monitoring. Such monitoring was not required on the smaller projects.

Figure 3.2 Freshwater ecosystem management controls



3.2.1.2 Avifauna and bats

There is a potential impact on avifauna and bats where projects involve the removal of vegetation. Variability in RMA conditions is expected across the case-study projects as conditions will be specific to the avifauna,

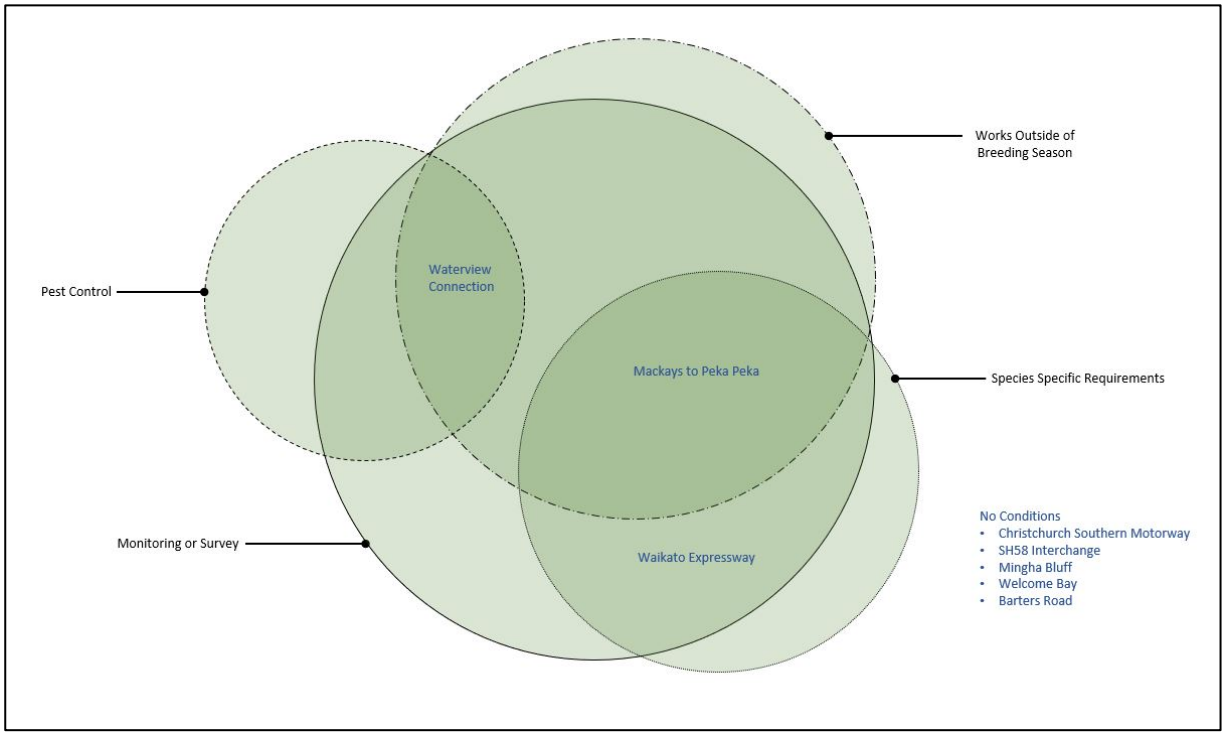
[5] Guide to interpreting Figures 3.2 to 3.7: The overlapping rings of the Venn diagrams represent the various RMA condition requirements. Case studies are situated within the rings depending on what requirements applied to individual projects.

bats and habitats present within each project area. Of the projects reviewed, two are in rural settings and low risk to avifauna and bats, with no related RMA condition requirements. Due to the extent and potential impact on avifauna habitat, three of the large-scale projects have specific avifauna-related conditions. Of these:

- two outlined species-specific provisions
- one did not specify species but did include requirements for roosting structures and pest control
- three included monitoring or surveying requirements
- three had bat-specific RMA conditions
- two had provisions for avoiding disturbance to birds in breeding season.

Figure 3.3 illustrates the differences between each of the case studies, and the requirements outlined in RMA conditions. RMA conditions around avifauna and bats were imposed on the majority of case studies. Of the three projects that did have avifauna and bat RMA conditions, there is some overlap between requirements.

Figure 3.3 Avifauna and bat ecological management controls



The avifauna and bat conditions were site specific and focused on specific at-risk or threatened species present in most instances, except one case study where the conditions were not species specific. Variability in conditions at a species level is expected. We understand that there is still some debate amongst ecologists on appropriate management methods for avifauna and bats. Consequently, variability in RMA conditions is likely as the scientific knowledge associated with monitoring and mitigating impacts on these species matures.

3.2.1.3 Herpetofauna (reptiles and frogs)

Management measures for herpetofauna are required when it has been determined that herpetofauna are present within a project area. All four large-scale projects required development of a lizard management plan and/or lizard management measures. There appears to be limited variability across regions, urban/rural, or decision-making processes. The small-scale projects had no consideration of herpetofauna, so there is variability across scale.

Management plans often include pre-construction/baseline monitoring followed by searches immediately prior to construction as well as accidental discovery protocols that are implemented if herpetofauna species are located during construction.

There may also be a requirement to have an agreed site for any lizards to be relocated to. This relocation requires a Wildlife Act permit. Mitigating the loss of lizard habitat can include animal pest control programmes and habitat establishment or enhancement.

3.2.1.4 Terrestrial ecosystems

Terrestrial ecology was considered for the four large-scale projects and for two of the small-scale projects. There was significant variation within the RMA conditions and management controls across the projects due to specific terrestrial ecology and associated habitats identified within the project areas.

3.2.1.5 Summary

There was significant variability across the various ecological disciplines assessed. The larger projects often interacted with more high-value habitats and freshwater systems, and the consent requirements associated with these projects reflected that. In addition, very detailed ecological management plans, often including standalone species-specific plans, were required and involved significant time and effort with third parties to agree mitigation actions to address the risks that the project works posed.

Only one of the smaller projects had detailed ecological requirements, reflecting the work in close vicinity to a valued forest ecosystem (Mingha Bluff). Overall, significant variability was observed between case studies for ecological RMA conditions, mostly influenced by the sensitivity of the receiving environment and to a lesser extent the project size.

3.2.2 Erosion and sediment control

Erosion and sediment control (ESC) best practice is well-defined and applied across New Zealand. Therefore, we would expect to see limited variability across regions. The application of ESC requirements generally reflects best practice construction methods, rather than being driven by region or submission process. This is reflected in the similarity of ESC guidelines published by councils across New Zealand, where variability in application of control measures primarily reflects the age of the guidance document.

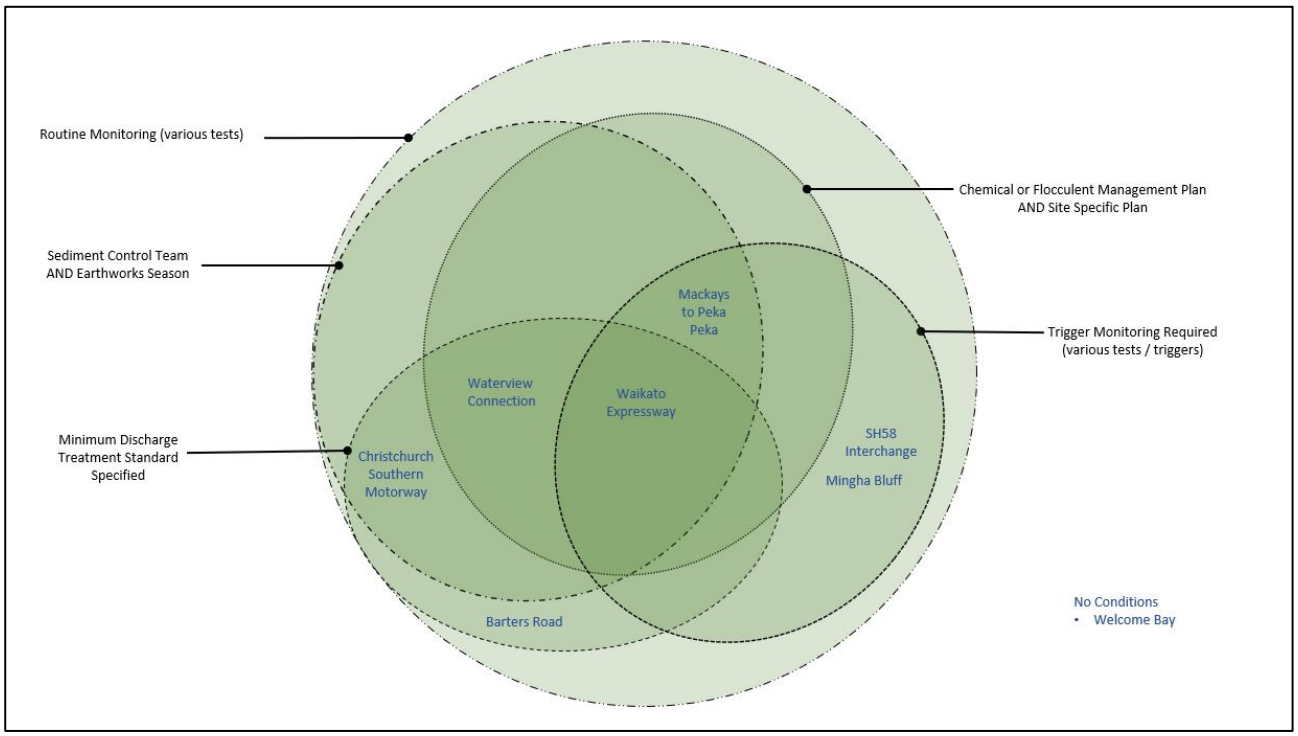
All eight case studies involved earthworks and included ESC methodologies. ESC was a key focus area for the four large-scale projects, where the extent of earthworks was significant, and one small-scale project (Mingha Bluff) due to the sensitivity of the receiving environment. Of the case-study projects:

- All the projects were required to develop an erosion and sediment control plan (ESCP) for certification by the relevant council, with two also requiring site-specific ESCPs.
- The ESCPs all required compliance with relevant guidelines:
  - two with Auckland Regional Council's Technical Publication 90 (TP90), *Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region* (Auckland Regional Council, 1999)

  - one with Wellington Regional Council's *Erosion and Sediment Control Guidelines for the Wellington Region* (Greater Wellington – The Regional Council, 2002)
  - one with Waikato Regional Council's *Erosion and Sediment Control: Guidelines for Soil Disturbing Activities* (Environment Waikato, 2009)
  - one with Bay of Plenty Regional Council's *Erosion and Sediment Control Guidelines for Land Disturbing Activities* (Environment Bay of Plenty, 2010)
  - three with Canterbury Regional Council's *Erosion and Sediment Control Guideline 2007* (Environment Canterbury, 2007)
  - two also required compliance with the Waka Kotahi *Erosion and Sediment Control Guidelines for State Highway Infrastructure* (NZ Transport Agency, 2014a).
- Three of the large-scale projects required a flocculation or chemical treatment management plan.
- All eight required routine monitoring. Three left the specifics of this monitoring to the detail within the ESCP, while the other five included specific conditions (as well as requiring the ESCP to set out monitoring requirements).
- ESCP monitoring requirements are not consistent. Three projects required water quality monitoring (turbidity monitoring, pH monitoring, total suspended solids monitoring, visual clarity monitoring) and one required weekly checks of erosion sediment control structures.
- Treatment discharge standards were applied to some but were generally not consistent. Standards included:
  - turbidity <30–55 nephelometric turbidity units (NTU)
  - change in turbidity <20%
  - pH <7.5 or 5.5–8.5
  - total suspended solids <50–100 mg/L
  - dissolved aluminium <0.2 g/m^3
  - reduction in visual clarity not to exceed 20% absolute.
- Two had earthworks season requirements (ie, winter works periods) set out in conditions.
- All projects required routine monitoring, which was either stated in the RMA conditions or the project ESCP. In all cases, the management practice 'toolbox' typically remains similar (outlined in various guidelines referred to above), but the actual controls implemented, the discharge triggers set, and the monitoring required was not consistent.

Figure 3.4 illustrates the differences in management expectations that were issued through RMA conditions for each of the case studies. There is variability in RMA conditions relating to ESC, with different projects focusing on different aspects of controls and monitoring.

Figure 3.4 ESC monitoring requirements



3.2.2.1 Summary

Limited variability was observed between case studies for ESC conditions, mostly influenced by the size of the project. An exception to this was the significant variability encountered in RMA conditions related to treatment discharge standards, as no national guidance document is currently available to inform this, and they are often routinely applied in consent documents. Discharge standards should reflect the value/quality of the receiving environment. For example, if such a risk-based approach was taken, we could expect the works at Mingha Bluff to have higher water quality standards than for Barters Road.

3.2.3 Stormwater

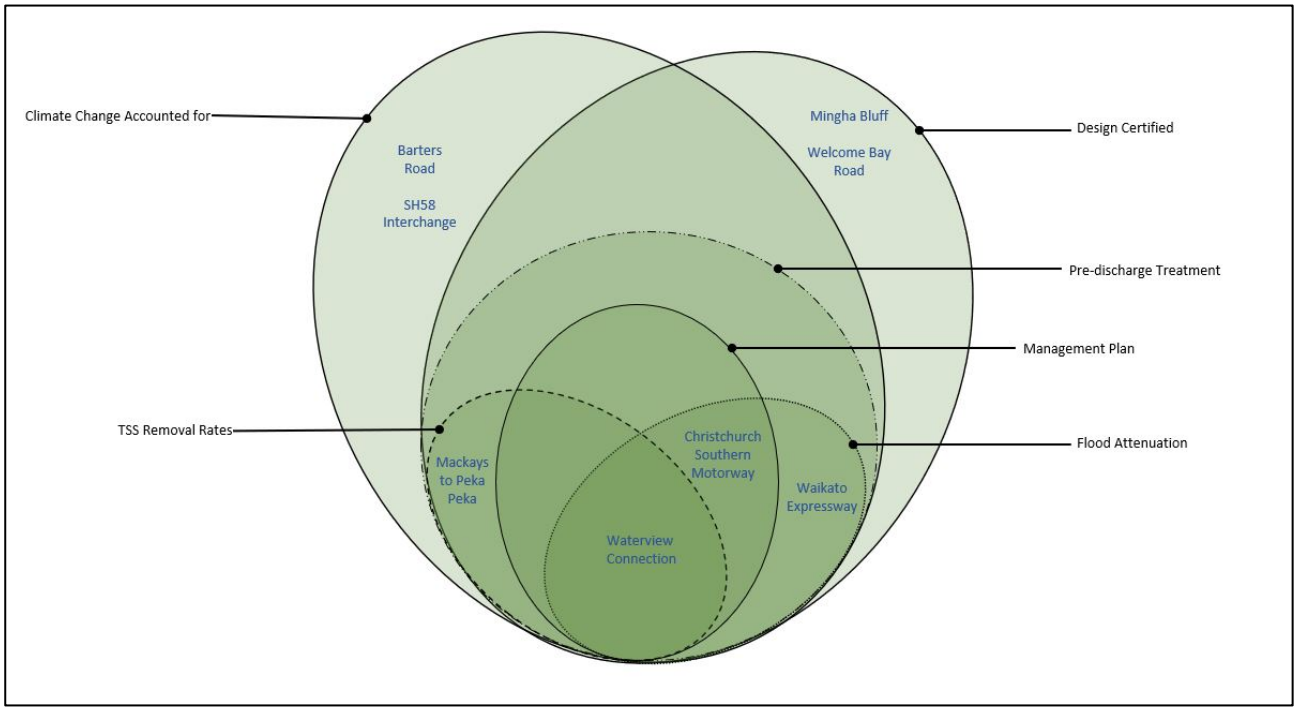
Of the eight case studies, seven had stormwater-related conditions. The scale and scope of these conditions varied significantly.

- Four of the projects had conditions referencing the Waka Kotahi guidance document *Stormwater Treatment Standard for State Highway Infrastructure* (NZ Transport Agency, 2010a).
- One did not have specific guidance referenced in the conditions, but an associated report submitted with the application referenced several Australian, New Zealand, and Auckland-specific guidelines.
- One referenced the Bay of Plenty Regional Council (2012) *Hydrological and Hydraulic Guidelines*.
- Two did not include reference to any stormwater design guidance documents.
- Two required preparation of stormwater management plans.
- One had a specific climate change assessment requirement in the conditions.
- Four included climate change allowance in the application.
- Two required flood attenuation.

- Five required stormwater treatment (the four large-scale projects and Mingha Bluff).
- Three had specified operational total suspended solids (TSS) discharge requirements (either 75–80% TSS removal or discharge not exceeding a concentration of 100 mg/L).

Figure 3.5 illustrates the differences in management expectations that were issued through RMA conditions for each of the case studies.

Figure 3.5 Stormwater management controls



From our assessment, the number of RMA conditions cannot be used as a gauge of potential environmental effect arising from stormwater discharges. The M2PP project had only three stormwater-related conditions but had the potential to have significant flooding effects on a large number of properties and significant water quality effects if stormwater was not adequately managed. In contrast, the Mingha Bluff project had six stormwater conditions and, although that project had potential for local effects, the overall scale of effect would appear to be much less.

This can reflect where further design work is undertaken between consenting and construction, particularly for large, complex projects. Secondary approvals or certification of the detailed design to confirm that the stormwater management system meets the standards outlined in the RMA conditions is often where the main compliance effort is expended.

3.2.3.1 Summary

Moderate variability was observed between case studies for stormwater conditions, mostly influenced by the size of the project and the local government region.

3.2.4 Noise and vibration

We expected to see some variability of noise and vibration management across the projects, with large-scale projects typically impacting on more people or ‘receptors’ and therefore having a higher degree of control

sought. The relatively low degree of variability expected should reflect the standards that exist for construction and operational noise.

3.2.4.1 Construction noise

All the projects reviewed generate noise as a result of construction. However, only the four large-scale projects and one small-scale project included conditions managing construction noise. The remaining three small-scale projects were in largely rural environments with few sensitive receivers, and the absence of construction noise control is considered appropriate. Despite the lack of specific RMA conditions, most district plans defer to the construction noise standard as the permitted activity levels, so while these may not be required per se, the standards still apply. Of the five projects that included conditions:

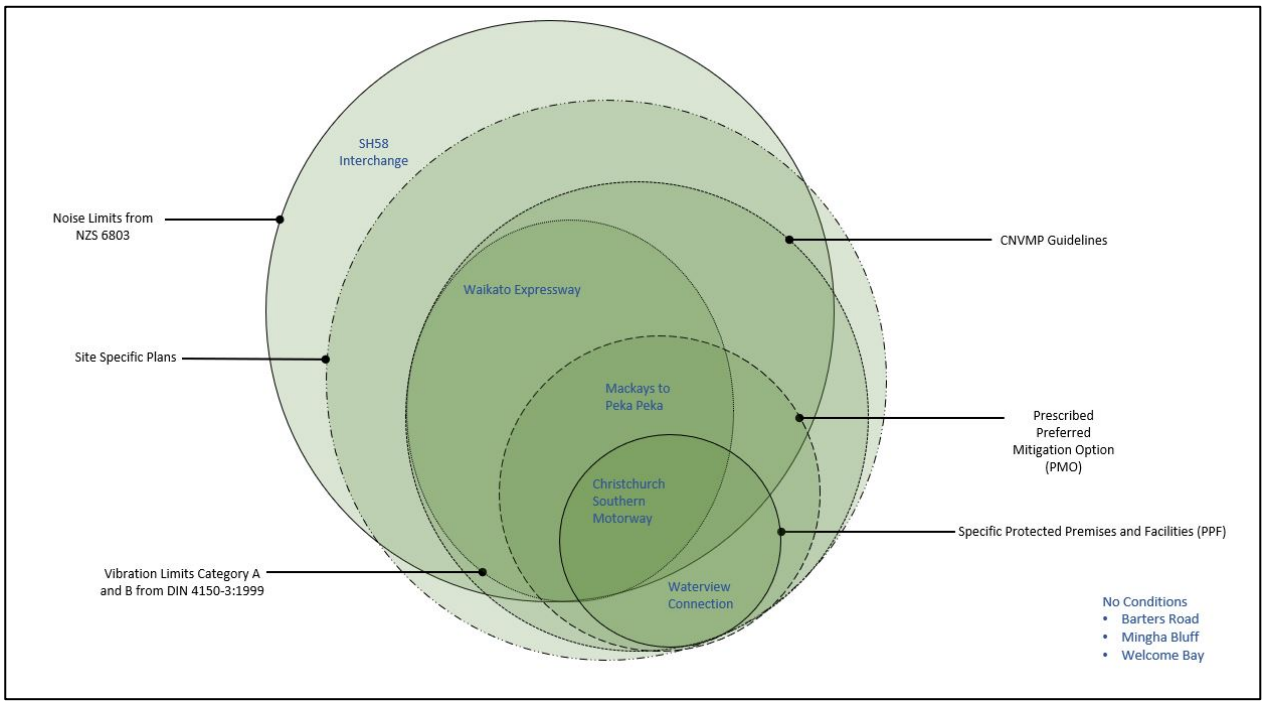
- Four required construction noise to be assessed and measured in accordance with New Zealand Standard (NZS) 6803:1999 *Acoustics – Construction Noise* (New Zealand Standards, 1999), with three using the construction noise limits set out in that standard and one (Waterview) prescribing alternative construction noise limits.
- Three required that, where practicable, permanent noise mitigation structures were implemented early to provide for construction noise mitigation.
- Four required the preparation of a construction noise and vibration management plan (CNVMP) and site-specific or activity-specific CNVMPs where the relevant limits could not be met.

NZS 6803:1999 has been specifically developed for construction noise and is referenced in many district plans. Therefore, compliance with this standard could be reasonably assumed to represent best practice.

Of the five projects with construction noise conditions, three of the projects used the construction noise levels within the standard. The Waterview project derived site-specific noise limits; however, these were in the same format as the NZS 6803:1999 limits.

NZS 6803:1999 does not provide specific guidance relating to the management of construction noise or set definite noise limits; rather, it sets out noise levels that are considered appropriate, with higher noise levels requiring additional management – in particular, notification and communication with potentially affected receptors. This regime allows the management actions to be scaled up with project size and the number of affected dwellings or sensitivity of the affected receptors. On that basis, there should be limited variation across project size or receiving environment, consistent with what we see in the case studies (Figure 3.6).

Figure 3.6 Construction noise and vibration management controls



3.2.4.2 Construction vibration

Only the four large-scale projects attracted RMA conditions relating to construction vibration. The SH58 Interchange project had construction noise conditions but did not have any conditions relating to vibration. Due to scale, the four smaller projects have lower construction vibration risk profiles, and the lack of conditions are not considered significant. Of the four large-scale projects:

- Two required construction vibration be assessed and measured in accordance with the German Standard DIN 4150-3:1999 *Structural Vibration Part 3: Effects of Vibration on Structures* (German Institute for Standardization, 1999) and used the vibration limits set out in that standard.
- One (WEX:H) was required to meet the vibration limits set out in DIN 4150-3:1999 but with additional limits for transient and continuous vibration for underground services (as per the British Standard BS 5228-2:2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration* (British Standards Institution, 2009)).
- One required construction vibration be assessed and measured in accordance with DIN 4150-3:1999 but prescribed different vibration limits.

With the absence of a New Zealand standard for construction vibration, we could expect to observe variability in the treatment and management of vibration. However, DIN 4150-3:1999 appears to have generally been adopted for Waka Kotahi projects, providing a level of consistency. BS 5228-2:2009 is also referred to by some district councils within designation requirements.

Similar to construction noise, the Waterview project set its own construction vibration limits, in part due to the specific project requirements relating to tunnel boring and blasting.

3.2.4.3 Operational noise

In a similar vein to construction noise, while all the projects will have some level of operational noise effect, only the four large-scale projects and one smaller-scale project included conditions managing operational

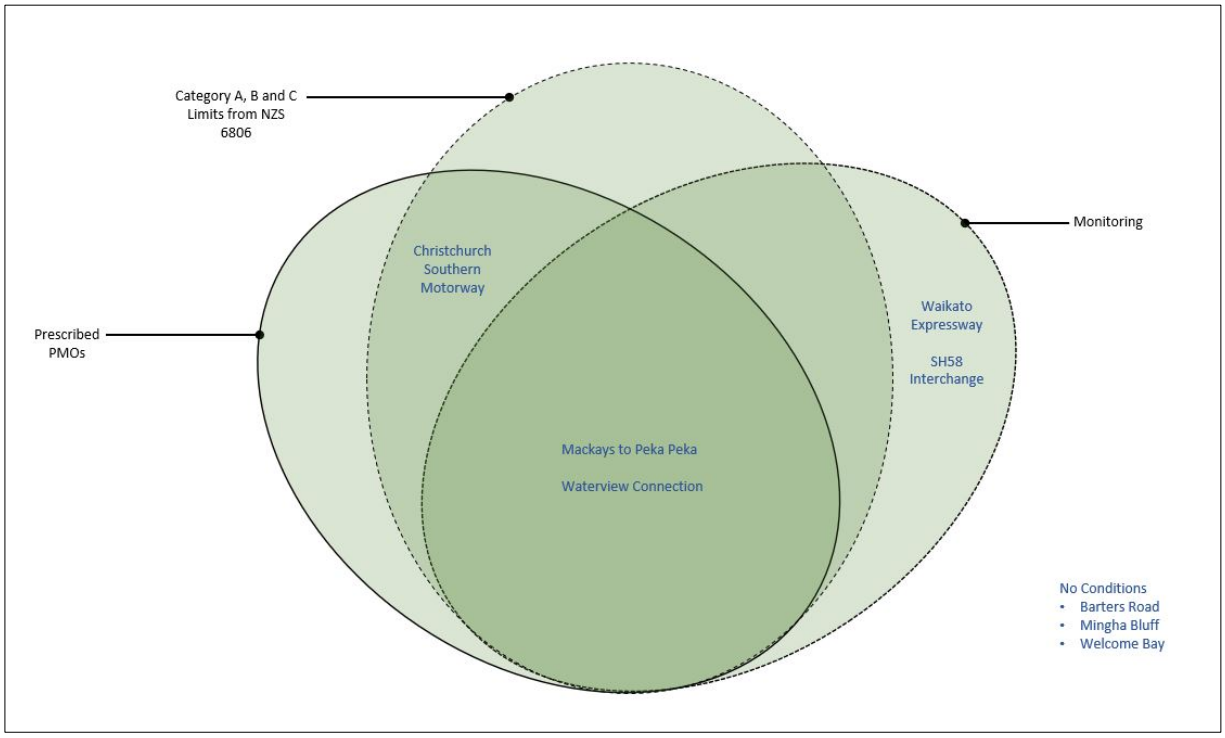
noise. The remaining three small-scale projects are located in rural environments with few sensitive receivers, and the absence of operational noise control is considered appropriate. Of the five projects that had operational noise requirements (refer Figure 3.7):

- One required operational noise to be in accordance with NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads.*
- Two required operational noise to be in accordance with NZS 6806:2010 but added a more stringent requirement for internal noise.
- Two required operational noise to be in accordance with *Transit New Zealand's Guidelines for Management of Road Traffic Noise – State Highway Improvement* (Transit New Zealand, 1999).
- Three had preferred mitigation options (PMOs) set out in the conditions including specified areas of low-noise road surfacing.
- Four projects required monitoring of operational noise; however, the timeframes to complete the monitoring varied. Christchurch Southern Motorway did not require operational noise monitoring but did require management and maintenance of the PMOs.

Like the construction noise standard, NZS 6806:2010 has been specifically developed to manage operational road traffic noise, and therefore compliance with this standard could be reasonably assumed to represent best practice. On that basis, there should be limited variation across regions or across scale of project. Where we would expect to see some variation is project environment (ie, rural vs urban).

Three of the projects used construction noise limits from NZS 6806:2010, whereas two projects (WEX:H and SH48 Interchange) used *Transit New Zealand's Guidelines for Management of Road Traffic Noise*. This reflects timing of consenting with the projects approved earlier needing to comply with Transit New Zealand's guidelines, and the latter projects required to meet NZS 6806:2010, which supersedes these guidelines.

Figure 3.7 Operational noise management controls



3.2.4.4 Summary

Some variability was observed between case studies for noise and vibration conditions, primarily influenced by the project setting (urban/rural) and the scale of the project. Note that those projects that didn't attract conditions relating to noise and vibration still have standards set out in the relevant district plan to meet, providing a level of overall consistency.

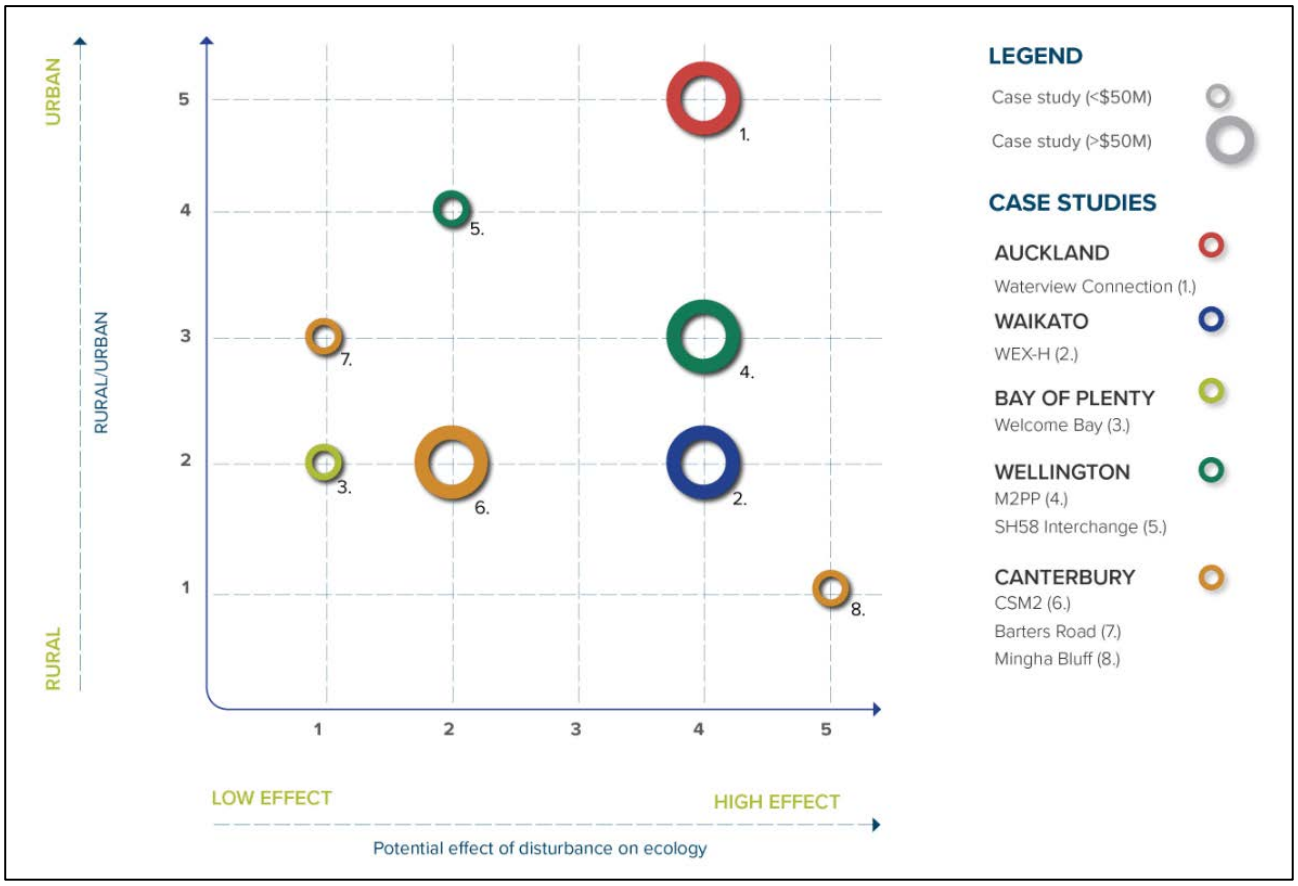
3.3 Environmental aspect assessment

This section includes a more detailed assessment of the four environmental aspects reviewed. Diagrams have been utilised to illustrate the scale of the potential effect of the works on receiving environments at a project level against other key factors identified as likely to contribute towards variability in RMA conditions (size of the project, project setting (urban/rural split), local government region etc). While it is acknowledged that there are many factors at play, this assessment simplifies and consolidates some of the case-study information set out in Appendix B.

3.3.1 Ecology

The potential effect of the project on the ecology of the receiving environments is summarised in Figure 3.8 below.

Figure 3.8 Visual representation of the potential ecological effects of each case study



The scale of ecological effects was assessed on a 5-point scale as being less than minor, minor, moderate, high, or significant based on the reasoning set out in Table 3.1 below.

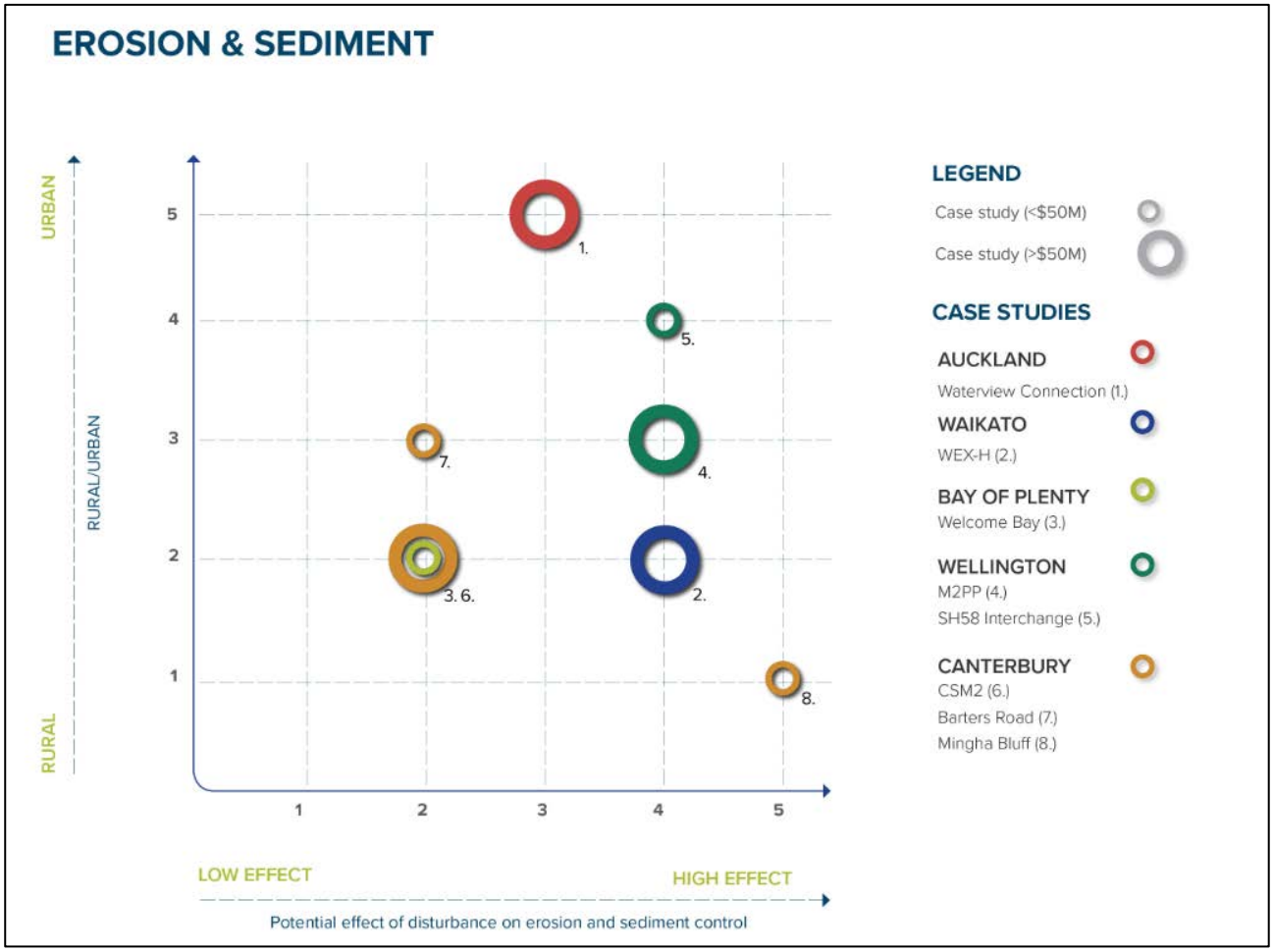
Table 3.1 Significance of potential ecological effects for each case study

Case study	Rural/urban ranking	Reason
Waterview	4	Waterview is located in a highly modified urban area of Auckland; however, some significant receiving environments exist within the alignment. Oakley Creek ran parallel to the project site and discharged into the Moto Manawa Marine Reserve, with expected water quality effects to range from minor to moderate. Terrestrial ecological effects were expected to be significant in relation to the eco-tone sequences at Traherne Island. Numerous monitoring and mitigation requirements were imposed to address the high potential effect of the project on the ecology of the receiving environments.
M2PP	4	The M2PP alignment is located in a mixture of receiving environments ranging from regionally rare and significant habitats to heavily modified urban landscapes. The Waikanae River has high ecological values. Effects on avifaunal values were also assessed as high for the fernbird. An area of kānuka forest remnant was also identified as a sensitive receiving environment. The project could have had a significant effect on this remnant. Numerous monitoring and mitigation requirements were imposed to address the high potential effect of the project on the ecology of the receiving environments.
CSM2	2	The CSM2 alignment passed through rural farmland with low ecological value. Effects on aquatic ecology, terrestrial vegetation, and herpetofaunal values were expected to be low, and relatively few conditions were imposed to manage these effects.
WEX:H	4	The WEX:H alignment is situated mostly within rural farmland with pockets of significant receiving environments. Effects on aquatic ecological values were assessed as potentially significant due to disturbance of habitat of the at-risk black mudfish. Effects on long-tailed bats also had potential to be significant, although there was limited knowledge on the bat populations within the project area. Effects on terrestrial ecological values were related to the Mangaonua and Mangaone gully systems, which had been substantially impacted by human activities but still include kahikatea swamp forest remnants. Numerous monitoring and mitigation requirements were imposed to address the high potential effect of the project on the ecology of the receiving environments.
Barters Road	1	The Barters Road receiving environments were highly modified with low ecological value. No ecology conditions were included in the consent.
Mingha Bluff	5	Mingha Bluff is located within the pristine Arthur's Pass National Park receiving environment. Effects on aquatic and terrestrial ecological values were assessed as very high. In particular, the removal of mature beech trees was an unavoidable effect with the potential to result in the loss of populations and habitat of the critically endangered beech mistletoe. Numerous ecology conditions were imposed to manage these potentially significant effects.
SH58 Interchange	2	There were few ecology conditions related to SH58 Interchange as potential effects on ecological values were expected to be low. Conditions covered revegetation plans and fish passage.
Welcome Bay	1	The Welcome Bay receiving environments are modified rural environments with low ecological value. The potential effects on ecological values of the roundabout construction were expected to be no more than minor.

3.3.2 Erosion and sediment control

The potential effect of the project on the receiving environments from an ESC perspective is summarised in Figure 3.9 below.

Figure 3.9 Visual representation of the potential ESC effects of each case study



The scale of effects from sediment discharges was assessed on a 5-point scale as being less than minor, minor, moderate, high, or significant based on the reasoning set out in Table 3.2.

Table 3.2 Significance of potential effects from sediment discharges for each case study

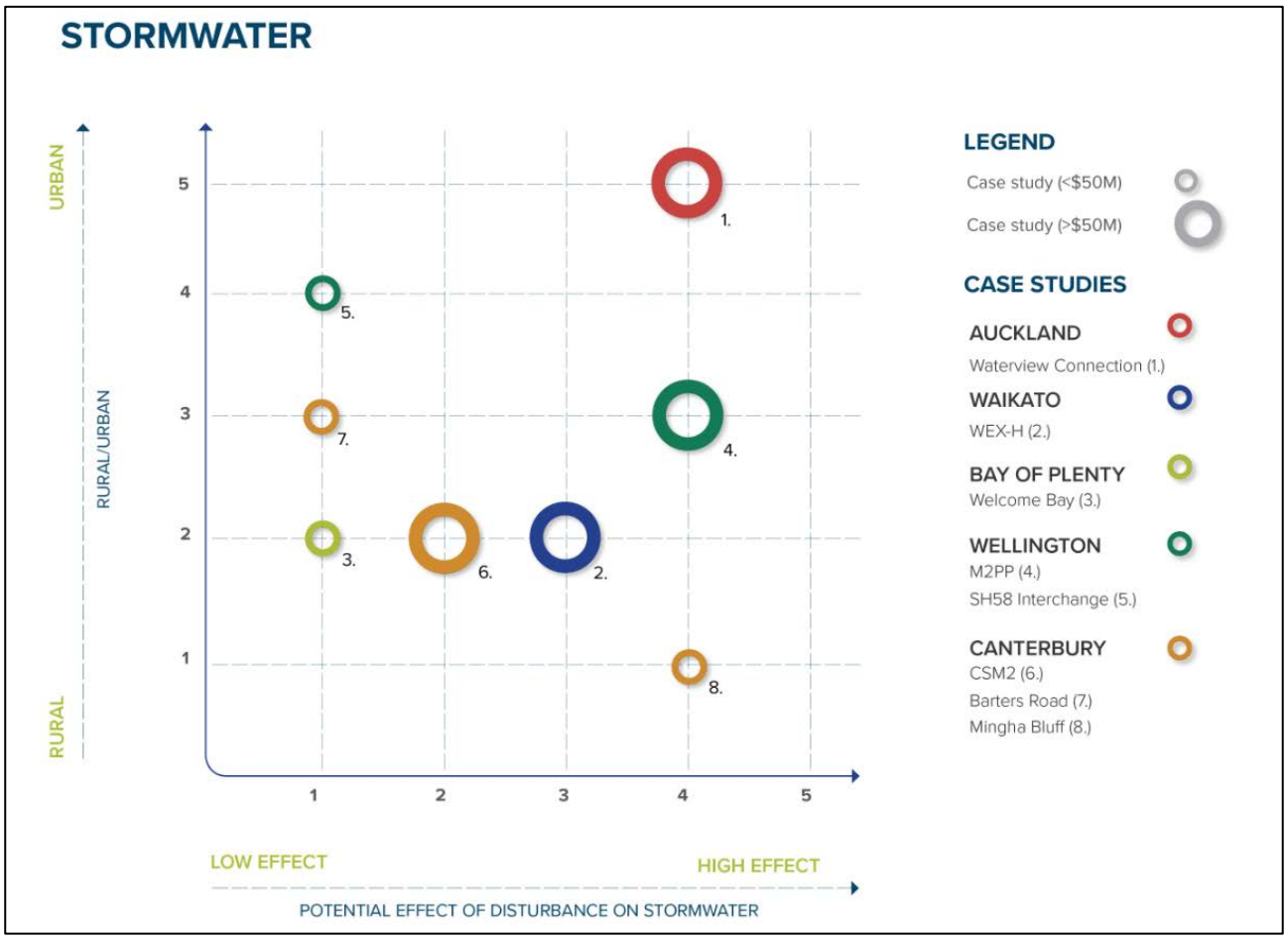
Case study	Rural/urban ranking	Reason
Waterview	3	Oakley Creek, which is characterised by poor water quality and low species diversity, was the main receiving environment for sediment discharges. The more sensitive Waitematā Harbour and Moto Manawa Marine Reserve were also receiving environments in the coastal marine area. Given the extent of earthworks, the large number of earthworks conditions, and some potentially sensitive receiving environments, effects from sediment discharges were deemed moderate.
M2PP	4	The majority of watercourses in the M2PP alignment were characterised by moderate to low water quality, except for the Waikanae River, which has high ecological values. Stringent turbidity monitoring conditions were applied to the consent. Effects from sediment discharges were deemed high.
CSM2	2	For CSM2, there were potential sediment discharges into surface water and low-value stockwater races in a rural environment. Some general ESC conditions were attached to the consent. Effects of sediment discharges were deemed minor.
WEX:H	4	While most watercourses along the proposed alignment were significantly modified by farming, some drains and gullies provided habitat for the at-risk black mudfish and other threatened species. As such, high sediment discharges had potential for high effects on the receiving environment.
Barters Road	2	A number of ESC conditions were attached to the Barters Road consent to address effects from sediment discharges on the Barters Road drain receiving environment. Due to the scale of earthworks, this effect was deemed minor.
Mingha Bluff	5	Mingha Bluff is located within the pristine Arthur's Pass National Park receiving environment. Effects of sediment discharges on aquatic ecological values were assessed as very high.
SH58 Interchange	4	For SH58 Interchange, the Haywards Stream receiving environment had very high habitat quality and macroinvertebrate assemblages that were sensitive to sediment loadings. As such, the effects of sedimentation in Haywards Stream was discussed in detail at the project hearing. Overall, effects of sediment discharges were expected to be high.
Welcome Bay	2	ESC conditions were attached to the Welcome Bay consent to address earthworks effects on nearby watercourses. Due to the scale of earthworks and rural nature of the receiving environment, these effects were deemed minor.

3.3.3 Stormwater

The potential effect of the project on the receiving environments from a stormwater perspective[6] is summarised in Figure 3.10.

[6] Stormwater discharges have potential impacts on both water quantity and water quality.

Figure 3.10 Visual representation of the potential stormwater effects of each case study



The scale of effects from stormwater discharges was assessed on a 5-point scale as being less than minor, minor, moderate, high, or significant based on the reasoning set out in Table 3.3.

Table 3.3 Significance of potential effects from stormwater discharges for each case study

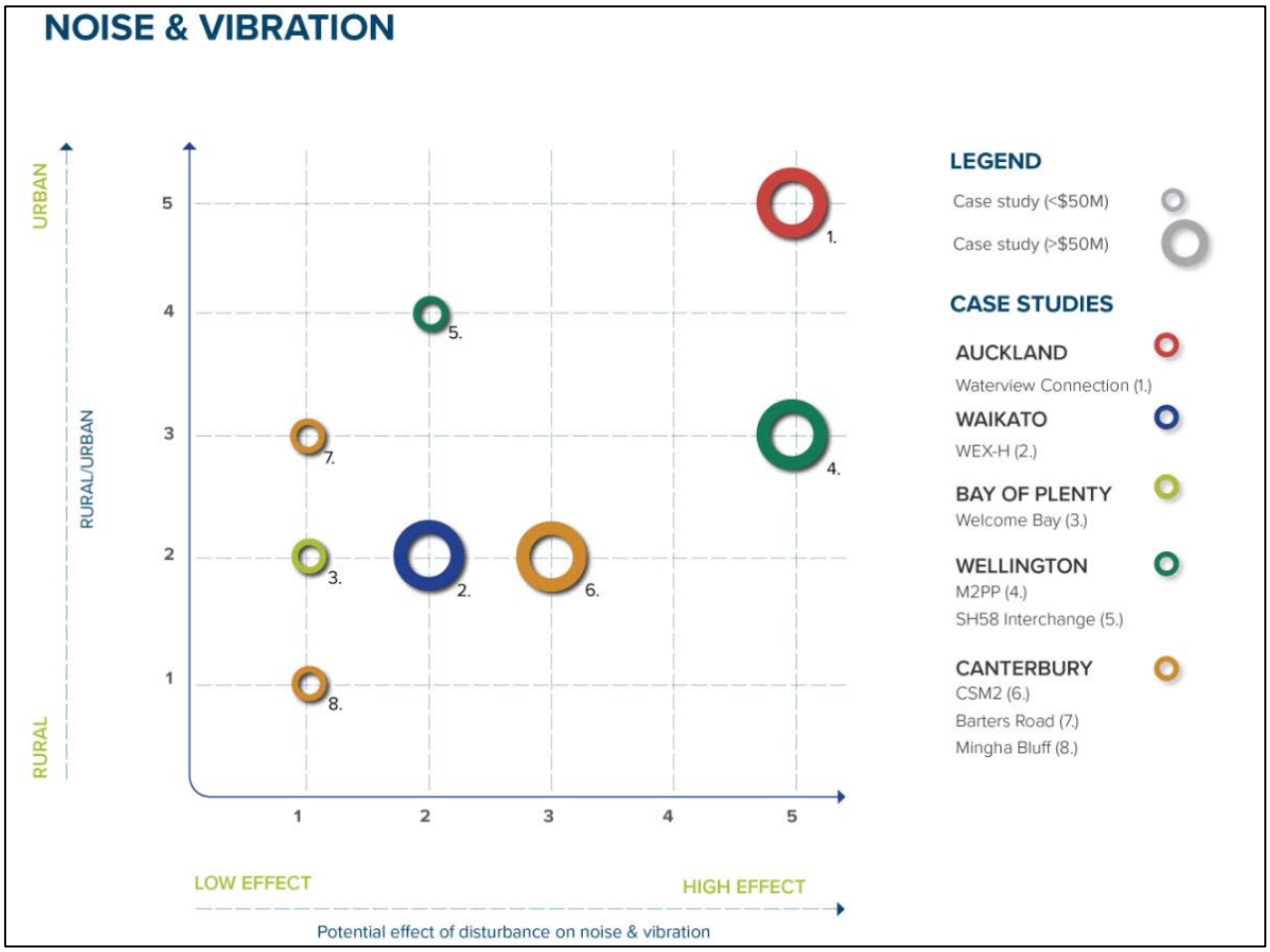
Case study	Rural/urban ranking	Reason
Waterview	4	The effects of stormwater discharges were a contentious matter for submitters as there was potential for increased flooding to an area of private land where flooding was already a problem. Stormwater quality treatment was also a focus of the application. Overall, stormwater effects were potentially high.
M2PP	4	Significant parts of the project traversed low-lying land that was prone to flooding. A key design principle was to achieve hydraulic neutrality. Stormwater quality treatment was also a focus of the application to mitigate effects on sensitive receiving environments. Climate change effects were discussed in detail in the hearing. Overall, effects of stormwater discharges were potentially high.
CSM2	2	The CSM2 application proposed to dispose of stormwater to land, stating that it had the potential to reduce downstream flooding due to improved management and control of drainage. Stormwater quality treatment was also a focus, but due to the modified rural environment, nearby aquatic receiving environments were of low ecological value. Overall, effects of stormwater discharges were minor.

WEX:H	3	Ecological effects of stormwater discharges and potential flooding effects were key issues addressed in the application, hearing, and RMA conditions. Due to the presence of some sensitive aquatic receiving environments, overall effects of stormwater discharges were assessed as moderate.
Barters Road	1	The stormwater design for the project included numerous treatment options prior to discharge to land. Overall effects of stormwater discharges were expected to be less than minor.
Mingha Bluff	4	Due to the increase in road pavement area, the project was expected to lead to an increase in stormwater runoff and associated contaminants into the pristine aquatic receiving environment. Prescriptive stormwater conditions were included in the decision. Overall, effects from stormwater discharges were assessed as high.
SH58 Interchange	1	Stormwater was not a key issue in this application, and no stormwater conditions were imposed. Effects from stormwater discharges were assessed as less than minor.
Welcome Bay	1	The project was expected to decrease the overall impervious area, and therefore effects from stormwater discharges were assessed as less than minor.

3.3.4 Noise and vibration

The potential effects on the receiving environments from noise and vibration of the projects are summarised in Figure 3.11 below.

Figure 3.11 Visual representation of the potential noise and vibration effects of each case study



The scale of noise and vibration effects was assessed on a 5-point scale as being less than minor, minor, moderate, high, or significant based on the reasoning set out in Table 3.4.

Table 3.4 Significance of potential noise and vibration effects for each case study

Case study	Rural/urban ranking	Reason
Waterview	5	Significant noise and vibration effects were expected during the project, with 24-hour tunnelling and construction yard operations close to residential areas and other noise-sensitive premises.
M2PP	5	Concerns around noise and vibration related issues were recorded in 362 of 725 submissions. The scale of effects was expected to be significant in some areas, with noise limits predicted to be exceeded even with mitigation measures in place.
CSM2	3	Temporary construction noise and vibration had potential to cause disturbance to residents and occupiers of commercial properties near the project. The hearing discussion included extensive debate over the expected noise effects on a nearby wedding venue, but the expected noise levels were deemed fit for purpose. The overall noise and vibration effects were moderate.
WEX:H	2	WEX:H is primarily located in a rural environment, but some submissions were received on the topic of noise and vibration. Overall, the application and decision documentation considered that any adverse effects would be no more than minor.
Barters Road	1	For Barters Road, noise and vibration effects were not considered in the application documents or decision, and no noise and vibration conditions were applied.
Mingha Bluff	1	For Mingha Bluff, no sensitive noise receivers were identified near the site, and no noise and vibration conditions were applied.
SH58 Interchange	2	A number of submissions were received on the topic of noise and vibration. Prescriptive consultation conditions were included to address the concerns of nearby residents and ensure mitigation options were satisfactory. Due to the location and nature of works, and hours of construction, noise and vibration effects were expected to be minor.
Welcome Bay	1	No noise and vibration RMA conditions were applied to Welcome Bay. As there was no major change in alignment or the surface of the road, operational noise was not expected to increase.

3.4 Summary of findings

The following key findings were evident from the assessment of the RMA condition requirements associated with ecology, ESC, stormwater management and noise and vibration.

- The size of the project doesn't necessarily reflect the number of conditions imposed, or the complexity of those conditions.
- The location of the project (rural or urban) influences the potential effects on amenity values and the built environment. Projects in an urban location are likely to attract more onerous controls on the generation of noise and vibration.
- Ecological values vary throughout the environment, and the science associated with conservation is also developing. Three of the larger projects and Mingha Bluff presented risks to high-value habitat, and the RMA conditions were reflective of this. The remainder of the smaller projects and CSM2 presented less risk to ecological values, and this was reflected in consent requirements.

- Those projects that posed risks to avifauna or lizards, for example, required specific controls and/or management plans to address these risks.
- Stormwater management requirements across the projects differ significantly, with some being relatively onerous and others less so (especially where less new infrastructure is being constructed). Some smaller projects had more conditions relating to stormwater management and drainage than the larger ones. Stormwater management is often approved via a secondary design approval process. There is a lack of consistency regarding standards (water quality and quantity) to be met where standards are dictated. This is also the case for considering the impacts of climate change on rainfall and runoff.
- ESC requirements are generally applied consistently by consent authorities. In addition, the guidance information that consent holders need to comply with (outlining associated management practices) is typically similar in scope and content.
- All the projects generate construction noise, but only five of the eight case studies included conditions managing construction noise. This reflects to some degree the receiving environments in which the projects are located. In addition, where applicants state that construction will comply with district plan limits, they may not attract conditions.
- There was also variability in the standards applied to operational noise. Noise monitoring requirements were not consistent.
- The large, linear projects reviewed typically have more detailed compliance requirements. These may not be set out in detail in the RMA conditions, but rather are the subject of secondary approvals through management plan processes often involving time for negotiating outcomes with subject matter experts. These processes provide uncertainty to the consent applicant and are often time consuming. Further to this, management plans may also provide uncertainty for consent authorities, who would likely prefer to have the information contained in the management plans available at the time of decision making.

4 Environmental risk analysis

One way of contextualising the efficacy of management measures sought by RMA conditions was conceived to be the use of an environmental risk assessment. A semi-quantitative review of how effective the RMA conditions might be in mitigating effects was undertaken in order to evaluate the efficacy of measures in decreasing environmental risk.

Environmental risks are threats that have potential to adversely affect the health of the environment. The RMA approvals process attempts to identify and define environmental objectives that are acceptable and to control the threats to achieving those objectives.

4.1 Environmental risk matrix

An environmental risk matrix was developed to categorise the risks associated with selected topics (ecology, ESC, stormwater, noise and vibration) for each case-study project. For each risk identified, the inherent risk and the residual risk were categorised using the risk matrix set out in Table 4.1.

Inherent risk refers to the risk before any management controls are put in place; *residual risk* refers to the risk remaining after management controls required by RMA conditions are implemented. The environmental risk matrix is adapted from Table 4.6 of the Waka Kotahi *Risk Management Practice Guide* (NZ Transport Agency, 2018, p. 16).

Table 4.1 Environmental risk matrix for inherent and residual risks

Likelihood	Consequence				
	1 Insignificant	2 Minor	3 Moderate	4 Severe	5 Extreme
1 Rare	Low	Low	Low	Low	High
2 Unlikely	Low	Low	Moderate	Moderate	High
3 Possible	Low	Moderate	Moderate	High	Critical
4 Likely	Moderate	Moderate	High	Critical	Critical
5 Almost Certain	Moderate	Moderate	High	Critical	Critical

The environmental risk matrix set out in Table 4.1 ranks the consequence of an environmental risk on a scale from low (1) to critical (5). The definitions of these consequences are set out in Table 4.2 and have been expanded from Table 4.4 of the Waka Kotahi *Risk Management Practice Guide* (NZ Transport Agency, 2018, p. 14) to highlight the difference between construction and operation phase risks. Environmental risks identified in the case studies were ranked by environmental consequence; however, it was also recognised that there are other consequences, including reputational and health and safety, associated with environmental risks.

Table 4.2 Consequence scale for environmental risks

Consequence	Effect on the environment
1 Insignificant	**Event resulting in small-scale, localised pollution or other environmental damage, with no resultant adverse effects** During construction, this type of event is unlikely to require a remedial response. During operations, this type of event would not require any rework. The impact is managed at a local level.
2 Minor	**Event resulting in minimum pollution or other environmental damage, with short-term effects only** During construction, this type of event will require a minor localised remedial response. During operations, this type of event will require a minor site-specific mitigation response. The impact may result in a letter from authority requesting action.
3 Moderate	**Event resulting in pollution or other environmental damage at a localised level, with medium-term effects** During construction, this type of event will require a localised remedial response. During operations, this type of event will require a site-specific mitigation response. The impact may result in regulator enforcement action (legal rebuke/abatement notice/restrictions).
4 Severe	**Event resulting in significant and widespread pollution or other environmental damage, with long-term effects** During construction, this type of event will require a significant remedial response. During operations, this type of event may require significant rework to achieve the expected outcome. The impact may result in formal enforcement action, including prosecution.
5 Extreme	**Event resulting in permanent pollution damage or other environmental damage** During construction, this type of event will require a significant and long-term remedial response and restitution. During operations, this type of event may require significant redesign and rework to achieve the expected outcome. The impact may result in high-profile prosecution(s) with potential for custodial sentence.

The environmental risk matrix set out in Table 4.1 ranks the likelihood of an environmental risk occurring on a scale from rare (1) to almost certain (5). The definitions of these likelihoods are set out in Table 4.3, in accordance with the Waka Kotahi *Risk Management Practice Guide* (NZ Transport Agency, 2018).

Table 4.3 Environmental risk likelihood criteria

Likelihood criteria	
1 Rare	Unlikely to ever occur (≤5% probability)
2 Unlikely	Not likely to occur in normal circumstances (>5%–30% probability)
3 Possible	May occur at some time (>30%–55% probability)
4 Likely	Expected to occur at some time (>55%–85% probability)
5 Almost Certain	Expected to occur regularly (>85% probability)

4.2 Subsequent application of analysis

It was considered that a quantification of the mitigation provided through implementing the RMA conditions or, conversely, the residual risk that remains after the mitigation is in place could be used to aid a determination of which conditions might be most effective. However, on reflection and further analysis (as set out in sections 5 and 6) of the factors influencing the variability of RMA conditions and outcomes, a number of more critical factors are important to determining the effectiveness of the conditions. While it may be useful to consider the potential 'residual' environmental risk that arises following implementation of the

conditions, these risks have been assessed through an RMA approval process and deemed to be acceptable by the regulatory authority. Any variability in terms of RMA conditions drafting or number of conditions would hence be a result of the local environment and be a response to the assessed value of the environment.

We have set out the details of the semi-quantitative analysis in Appendix E for future reference but have limited our analysis of the findings of that analysis for the reasons noted above.

5 Discussion

5.1 Variability of consenting requirements

5.1.1 Overview

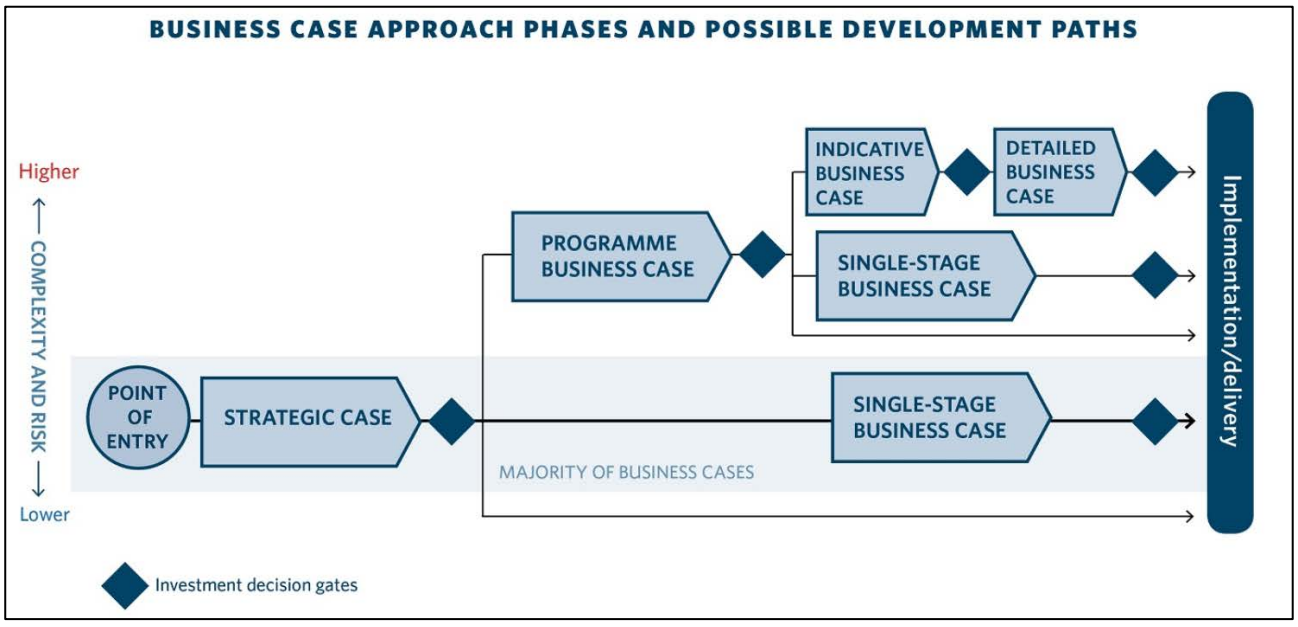
There are many factors that can lead to inconsistency in the environmental management requirements for a project. These factors include the project size, project location, the relevant district and regional plans, previous projects and the skills and experience of the applicant, submitters, regulatory assessor and decision makers. The approvals process (ie, limited notified, publicly notified, Board of Inquiry, consent and/or designation, etc) may also be a factor in introducing variability in RMA conditions through the level of public engagement, scrutiny and input to the application.

Factors that may lead to variability in RMA conditions can be introduced at each step in the project timeline and be cumulative from the business case, through concept design, assessment of effects and approval process (Figure 1.1). These are examined in more detail below.

5.1.2 Business case

The business case stage identifies the drivers for a project and the key strategic decisions to solve identified problems. Optioneering assessments during this phase narrow down a range of potential outcomes (or in the case of state highways, preferred alignments) to a select number of preferred options. Most opportunities to avoid disturbing sensitive environments must be taken during this phase of the project before a final route is selected. The phases of business case development for Waka Kotahi projects are set out in Figure 5.1.

Figure 5.1 Waka Kotahi business case approach phases



Currently, Waka Kotahi uses an environmental and social responsibility (ESR) screen (NZ Transport Agency, 2016; reprinted in Appendix F of this report) to identify opportunities and risks for state highway projects based on several broad categories, including natural environment; cultural and historic heritage; human health; social; and urban and landscape design.

The ESR screen is intended to be used at the indicative business case phase of a project. The strategic case is about identifying the need for the project and assessing whether the benefits obtained will be of an order that justifies investment. Depending on the cost and the risk associated with the project, the strategic case may be refined into options in a programme business case or fast-tracked into a single-stage business case.

Some projects proceed directly from the strategic case to implementation. The indicative business case identifies and assesses high-level options, while the detailed business case includes a more detailed analysis of a refined number of project options. Where projects are fast-tracked through the business case stages, the ESR screen may be undertaken relatively late in the process, not maximising its full benefit, potentially reducing opportunities to avoid sensitive receiving environments. Currently, the ESR screen is not usually adopted at the strategic business case level and therefore does not drive the pre-implementation process.

During the planning stage of a project, mitigation options for adverse effects are often proposed, and opportunities to avoid these effects altogether are diminished. This is because route selection at the beginning of a project is a large determinant of the types of receiving environments within the project alignment.

There may be limited opportunity during the planning and consenting stage to change the alignment to such a degree as to *avoid* significant receiving environments and related adverse effects. Project decisions made during the business case phase to avoid impacts on significant receiving environments are not always communicated in the consent application documents.

It is understood that the point of entry assessment is required at the commencement of each stage of a business case. Our assessment is that the most impactful stage for a screening tool is the point of entry (Waka Kotahi, 2019). This is the stage where investment decisions are made and where Waka Kotahi can shape the project directly, document expectations, and ensure that the scope from the previous phase is not lost. It is worth noting that this is also the point in the project life cycle where the greatest impact can be had on sustainability. Adding a sustainability lens to this process may well lead to better environmental outcomes.

Ideally, environmental experts would contribute at this point. The point of entry guidance and templates could be revised to recommend application of the ESR screening tool as part of the information submitted at the point of entry stage and to more explicitly apply principles of sustainability.

5.1.3 Project concept

The case-by-case approach to approvals under the RMA means that the environmental impacts of projects are assessed and managed on a discrete basis. At the concept design phase, more details are known about the route alignment, scale of the project, and specific receiving environments that may be disturbed during construction or operation of the project. All of these factors drive the planning and consenting strategy, and by default have a bearing on the consistency of environmental outcomes.

5.1.3.1 Project scale

In general, larger projects (in terms of cost and area affected) impact larger areas and generate more comprehensive management requirements. This is apparent in the high-level summary tables of consenting requirements presented in Appendix D. The themes of ecological value and effects from noise and vibration have particularly noticeable differences in the number of requirements between large- and small-scale projects.

In relation to noise and vibration effects, the majority of the small-scale case studies did not attract RMA conditions but still need to meet district plan permitted activity requirements.[7] However, several prescriptive conditions were applied to the SH58 Interchange decision due to its more sensitive urban receiving environment. Even so, the smaller scale of disturbance meant that fewer RMA requirements were applied to this project compared to the large-scale projects.

A large number of RMA conditions and ecological management requirements were attached to the four large-scale projects, while the smaller projects attracted minimal ecological requirements. Mingha Bluff was the only exception, with a number of freshwater and terrestrial ecological RMA conditions imposed due to the significant ecological value of the receiving environment located in Arthur's Pass National Park. Overall, this is an adequate reflection of risk to ecological values represented by the four large-scale projects as well as the Mingha Bluff project.

Management of operational stormwater consent requirements were also generally consistent with this trend. The large-scale projects had RMA conditions specifying management plans, certification of design, flood attenuation, consideration of climate change and discharge treatment standards. This was in contrast to the stormwater conditions on the small-scale projects where minimal/no stormwater conditions were applied.

Overall, the trend observed within the domains of ecological values, stormwater discharges, and noise and vibration effects is that large-scale projects generate broader RMA conditions and management plan requirements. This seems intuitive but does not necessarily mean better environmental outcomes or value for money.

It is appropriate that more stringent management controls are utilised where projects threaten sensitive receiving environments or the built environment (such as flooding, noise and vibration effects) but debatable whether the same approach should be applied simply because a project is 'large'. Conversely, a small-scale project that is situated near sensitive receiving environments should have substantive controls in place. The level of management control stipulated in the RMA requirements should be proportional to the potential risk to the receiving environments.

ESC conditions were an exception to this trend. The specific detail and number of ESC RMA conditions varied between case studies, irrespective of the scale of the project. Waterview had the most comprehensive ESC consent condition requirements, while M2PP had some of the least, as almost all details were deferred to management plans. Nevertheless, the general intent behind the ESC conditions were the same, and every case study was required to develop an ESCP in line with the relevant regional ESC guideline document, leading to consistency in the expected outcomes across projects of all sizes.

5.1.3.2 Potential effect on receiving environments

The specificity of RMA conditions increases where there is potential for significant adverse effects. This trend was observed both *within* case studies and *between* case studies. Conditions with a high degree of specificity imply a high level of certainty for regulators, who can be more confident that adverse effects will be managed appropriately.

The specificity of conditions may also relate to the adversarial process, where disagreement during the consent phase can lead to specific conditions to address certain groups' concerns. However, when conditions are very specific, this may limit the ability of the contractor to deliver an outcome-focused approach to managing the effect in question.

[7] Notwithstanding section 16 of the RMA, which requires a duty to avoid unreasonable noise.

The balance between specificity and flexibility of conditions needs further consideration. It is very helpful if the context and rationale for conditions is explicitly articulated in either the application, decision report, or is supported by an advice note. There needs to be a clear rational nexus between the condition and the effect it is designed to manage so that consent holders and consent authorities can interpret conditions in the way they were anticipated.

The specificity of conditions varied within individual projects depending on the significance of the effects expected. In the M2PP case study, avifauna effects were assessed as potentially high for the fernbird and low for other species. This is reflected in the specificity of the fernbird requirements set out in the RMA conditions. In addition, there was a more general condition that required avoidance of breeding habitat of nationally endangered or at-risk bird species. This addressed risks for pipit and grey duck, with the risk management measures outlined in the ecological management plan rather than specific conditions. In contrast, herpetofaunal effects were assessed as low, and the few conditions addressing these effects are likely to be sufficient. This is an appropriate way of prioritising management areas, while ensuring that the RMA conditions are not too cumbersome and do not duplicate the requirements of other legislation, such as the Wildlife Act.

Across projects, the monitoring and mitigation requirements are significantly higher where the overall potential effect on the receiving environment is high. For ecological values, the potential effects of Waterview, M2PP, WEX:H and Mingha Bluff on the receiving environments were expected to be within the high to significant range, before management considerations were taken into account. The entire Mingha Bluff alignment was located within the sensitive environment of Arthur's Pass National Park, but the high-value ecological areas within Waterview, M2PP and WEX:H were located in isolated pockets of their respective alignments.

The ecology conditions for each of these case studies were very prescriptive. Some of these requirements included pre-construction surveys of flora and fauna, relocation of indigenous species, mitigation planting, and intensive construction and post-construction monitoring (Table 5.1). Monitoring and mitigation conditions add significant time and cost elements to the projects, but this may be appropriate if high-value ecological areas are preserved and protected or otherwise mitigated.

Monitoring can also be required where the baseline is not adequately documented – for example, at-risk lizard species may have been documented in the wider area over the past 25 years but not seen since or during baseline assessments, but requirements are still included to minimise the risk of harming them. This relies on the judgement of environmental professionals, who may influence consent decisions due to the reluctance of decision makers to override this advice.

Table 5.1 Ecological monitoring and mitigation requirements by project case study

Case study	Monitoring requirements	Mitigation requirements
Waterview	• Freshwater: Two baseline surveys pre-construction, twice annual during construction (fish and macroinvertebrates), annually for (up to) 3 years post-construction, additional monitoring in the event of a trigger event • Oakley Creek water quality: monthly water quality survey, four event-based surveys, two sediment quality surveys per annum • Marine: 6-monthly monitoring starting at least 12 months prior to commencement of construction and continuing for (up to) 3 years post-construction, additional monitoring in the event of a trigger event	• 343 m of stream offset mitigation
M2PP	• 1 year of baseline pre-construction monitoring – vegetation, freshwater and marine ecology, fernbird • 2 years of post-construction vegetation and freshwater and marine ecology monitoring • 5 years of post-construction wetland monitoring • 2 years of post-construction fernbird monitoring • 4 years of post-construction fish passage monitoring	• Minimum total 40.7 ha of planting • Minimum 7.6 ha indigenous terrestrial habitat to reflect loss of 3.8 ha • Minimum 5.4 ha wetland habitat to reflect loss of 1.8 ha • Minimum 5,240 m stream mitigation, including naturalisation and 17.7 ha riparian planting at 20 m either side (unless otherwise agreed) • Creation of at least 1.4 km of new stream channel and 10 ha of wetland and riparian planning in flood storage areas • Mitigation to be implemented within 1 year of completion of bulk earthworks in each stage/area • Mitigation areas to be legally protected (covenant or other encumbrance)
WEX:H	• Kahikatea monitoring (Mangaonua Gully) for 3 years post-construction • Pre-construction monitoring, including minimum of two bat surveys • Annual bat monitoring reported annually for 5 years, then 5-yearly until 15 years post-commencement of works • Little shag nesting activity monitoring for 3 years post-construction	• 10.2 ha ecological restoration within or contiguous with Mangaonua and Mangaone gullies, including 4 ha gully swamp forest • Buffer planting of kahikatea tree stands • Habitat suitable for mudfish to be provided
Mingha Bluff	• Mistletoe inventory to be undertaken pre-construction • Monitoring details for mistletoe, *Coprosma acerosa*, and riparian planting to be included in the required remediation plan	• Mitigation planting details for mistletoe, *Coprosma acerosa*, and riparian planting to be included in the required remediation plan

In contrast to the Waterview, M2PP, WEX:H and Mingha Bluff projects, the potential effects on ecological values of CSM2, Barters Road, SH58 Interchange, and Welcome Bay were assessed as minor or less than

minor. Accordingly, significantly fewer ecological requirements were included in the conditions of these consents.

It is appropriate for ecological management requirements to be proportional to the potential scale of effect. For new capital transport projects, there is value in investing more into the scoping and optioneering phase of the route planning to maximise avoidance of sensitive receiving environments, where practical and cost-effective alternative routes exist. This has the dual benefit of saving time and cost during the construction and operation phase of a project while also delivering better environmental outcomes and avoiding potential reputational risk. Such decisions (in the future or previously), would not be expected to be captured by this review as it is limited to assessing RMA conditions and the potential impacts.

5.1.3.3 Rural/Urban effects

The potential effects of disturbance varied depending on where the project was situated on the rural–urban continuum (Table 3.1). The correlation between the rural–urban continuum and the potential effect of disturbance is presented by theme in Figures 3.8–3.11.

There was no apparent correlation between the rural–urban continuum and adverse effects on ecological values. This trend reflects that some projects in highly modified urban environments have pockets of potential impact within their alignments where there were important ecological values to consider.

Projects in urban, rural, and natural-state environments all had the potential to have significant adverse effects, and strict management requirements were applied accordingly. Conversely, other projects, also in urban and rural areas, were expected to have minor adverse effects, and limited conditions were applied.

Similarly, for ESC and stormwater effects, the scale of the project had more of an influence on the conditions applied rather than whether the project was in an urban or rural environment.

Noise and vibration effects were more significant in urban areas, and stringent conditions and management requirements were applied accordingly. The large-scale projects that were built through urban areas (Waterview and M2PP) were expected to potentially lead to significant adverse noise and vibration effects due to the proximity of the project to sensitive receivers.

Public interest in noise and vibration issues for these projects was very high and resulted in rigorous management requirements within the conditions. In contrast, the rural large-scale projects (CSM2 and WEX:H) were expected to have minor to moderate adverse noise and vibration effects as there were fewer sensitive receivers near the project alignment. Interestingly, similarly rigorous conditions and management controls were required for both the rural and urban large-scale projects even though the degree of potential adverse effect was significant due to the number of sensitive receptors. The conditions reflect that the potential effect can be similar for each receptor, rather than the number of them.

Noise and vibration effects were expected to be higher for the urban SH58 Interchange project compared to the other more rural small-scale projects. Even so, the adverse SH58 Interchange noise and vibration effects were only expected to be minor due to the scale of the project. Prescriptive conditions around consultation and management of effects were applied to SH58 Interchange, while no noise and vibration conditions were applied to the other small-scale projects (Barters Road, Mingha Bluff, and Welcome Bay). Having said that, most district plans defer to the construction noise standard as the permitted activity levels, so while these may not be outlined specifically in consent requirements, the standards still apply.

Overall, it is considered that the controls imposed through the RMA conditions outlined for the eight case-study projects reasonably reflect the environmental risks on the environment (rural, urban or semi-urban) in which they occur.

5.1.3.4 Regional requirements

Under the RMA, decision making has largely been decentralised to the regional and local levels. This allows local authorities to make decisions based on a high level of understanding of the local receiving environments and key environmental concerns in their jurisdiction. While national planning standards have been introduced (as part of the 2017 amendments to the RMA) to improve consistency in plan and policy statement structure, many councils are yet to adopt these standards. There may also be particular approaches and methods that are favoured by certain regulators, potentially leading to inter-regional variability in decision making between different local authorities for similar issues.

Some specific management requirements were identified as quirks of the local authorities. For example, relating to ESC, Waterview and WEX:H both had earthworks season requirements (earthworks not permitted during winter, defined as 1 May to 30 September).

Both of these projects also had a specific requirement for a Sediment Control Team to be in place for the duration of construction, whose function was to oversee on-site ESC and meet on a weekly basis with the regional council.

Earthwork season requirements are applied routinely across a number of regions in New Zealand. No specific advice for these requirements was given in the decision documentation. For the Auckland Region, the earthworks season is not included in the *Auckland Unitary Plan Operative in Part* (Auckland Council, 2020), but it is mentioned in the ESC guideline document for the Auckland Region (Leersnyder et al., 2016). We understand that a seasonal earthworks requirement is a risk management tool, implemented as the ability to complete earthworks (obtain compaction requirements) and temporarily stabilise sites (the lower ground temperatures can limit grass strike and growth) is compromised throughout winter. Taking a seasonal approach to managing earthworks enables the local authority to have greater control over managing this risk.

5.1.4 Project application

5.1.4.1 Management plans

A suite of management plans is often required for large-scale projects, including those in the case studies, (Figure 5.2). In contrast, certified ESCPs were the only management plans required for the small-scale projects.

Where management plans are stipulated in the RMA conditions, there is often the additional requirement for certification of the management plan by the relevant territorial authority or, in some cases, a suitably qualified independent person. In some cases, there is also third-party involvement in reviewing management plans (including DOC and iwi) and a need to consider the third-party feedback in the final draft plan (eg, WEX:H ecological management plans).

The full suite of management plans required for M2PP, Waterview, and WEX:H were all required to be submitted to the relevant local authority for certification. All management plans required for CSM2 were required to be certified by an independent suitably qualified and experienced person approved by the territorial authority. Provisions for certification of management plans give local authorities more confidence that the intent behind the decision and subsequent RMA conditions will be met.

A wide variety of management plans were observed in the case studies investigated in this research (Table 5.2). Management plan terminology was not consistent (including naming of management plans), which can introduce uncertainty for contractors and regulatory authorities as to the scope of certain plans and where to look to find specific management requirements. Standardising the terminology at a national level would help to solve this problem. In addition, having a comprehensive template could provide consistency and streamline approvals, providing support from regulators and any key stakeholders.

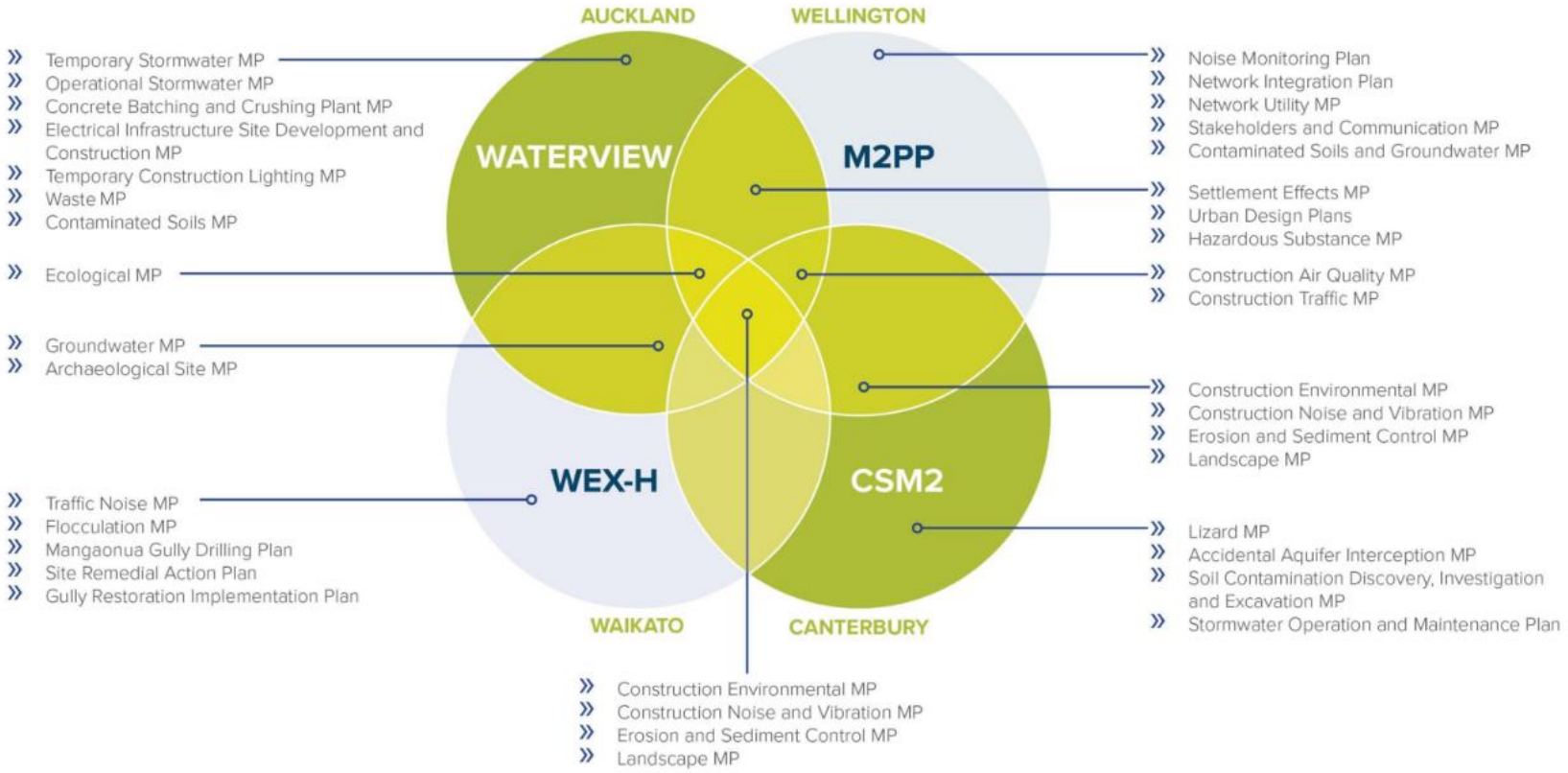
RMA conditions defer environmental management requirements to environmental management plans. Therefore, the quality of management plans and the effectiveness of their implementation determine the final scope of mitigation of adverse effects. Sometimes the outcomes required by a management plan are well-defined within the RMA conditions, while other times the content of management plans is approved by subject matter experts or council officers. Management plans are prepared by a range of contractors, consultants, or applicants, adding to the potential inconsistency of environmental controls applied.

A management plan approach does not necessarily promote consistency between projects, but it does provide flexibility within an outcomes-focused framework. It would be useful if consistency of *what should be achieved* in terms of outcomes managed within a plan was defined.

Table 5.2 Costs and benefits of a management plan approach

Costs	Benefits	Other comments
• High cost to prepare • Prepared during design phase and often requires re-work or adaptation in practice • Ongoing reviews often dictated in management plan requirements • Can be perceived by submitters as a way to avoid public input into resource management decisions as they are typically assessed by council officers under delegation	• Sets clear guidelines for the contractor • Monitoring requirements are acknowledged • Presents risks • Delegates responsibility to ensure outcomes are met • Management plans are easier to change/adapt than RMA conditions	• No guideline standards for preparing environmental management plans • Potential for inconsistency between similar management plans • Requirements for certification by council are cumbersome • Often many management plans per project

Figure 5.2 Management plans required by RMA conditions for the four large-scale case studies



MP = Management Plan

5.1.5 Public participation

Facilitating public participation in decision-making is an important premise of the RMA.

If public concern for a particular issue is considerable, this can result in more stringent requirements set during the consenting phase of a project than might otherwise be imposed. Often, effects associated with amenity values are most contentious with the public. For example, significant public concern existed in relation to potential operational noise and vibration effects for Waterview and M2PP.

Waka Kotahi maintained that the mitigation measures proposed would provide the best practicable option even though the noise effects may still be more than minor for some but would 'not be unreasonable'. The Board of Inquiry accepted that it was not feasible to mitigate outdoor noise levels any further than proposed.

In addition to this, and departing from the limits set out in NZS 6806:2010, a lower internal noise criterion was set. The Board of Inquiry also directed amendments to the designation conditions to ensure appropriate mitigation was carried out by Waka Kotahi in consultation with the affected property owners.

The quantity and nature of submissions for any consent application can lead to a disproportionate amount of time spent on an issue that has drawn public notice. It does not always follow that the area of greatest environmental risk (or effect) attracts the greatest management response in terms of conditions imposed. For M2PP, concern around noise and vibration related issues were recorded in 362 of 725 submissions for the project. Given the high levels of concern, the Board carried out an extensive review of the proposed noise and vibration limits to further confirm that the effects would be mitigated to acceptable levels.

As a result of the extensive conferencing and debate during the Board of Inquiry hearing process, prescriptive noise and vibration conditions were applied to the M2PP consent, with designation conditions detailing specific criteria to be met and processes to follow if exceedances occurred. The M2PP Board also adopted the lower internal noise limit that was first introduced in the Waterview decision.

In contrast, the topic of ESC did not receive the same level of interest and discussion by the M2PP Board of Inquiry, and no submissions on this matter were acknowledged in the hearing report. The conditions applied for this topic included standard conditions indicating what was to be addressed in the ESCP, and a number of specific conditions addressing water quality turbidity requirements. There was general agreement between the council and Waka Kotahi experts regarding appropriate requirements, lessening areas of contention.

However, for both topics – noise and vibration, and ESC – it was determined that there was potential for significant adverse effects. In both cases, the conditions were deemed by the Board of Inquiry to be sufficient and appropriate to manage effects, yet the difference in oversight and prescriptiveness of conditions between topics illustrates how public participation can influence outcomes.

The level of public participation is not just confined to the decision process. Many large-scale projects (including Waterview, M2PP, and CSM2) establish community liaison groups, technical advisory groups or reference groups to provide an avenue for input during the construction and operational phases of projects. These may have varying roles and responsibilities, including input to management plans. It is important that there are clear terms of reference for these groups and ideally an escalation path.

5.1.6 Assessment of the application

5.1.6.1 Consent process

The decision-making process occurred at the local and regional authority level for the small-scale projects, and WEX:H, M2PP, Waterview, and CSM2 consents were all granted through the Board of Inquiry decision-making process. Generally, it was not observed that the process itself had any significant bearing on the

RMA conditions and complexity of environmental risk management requirements. For example, WEX:H had similar RMA consent condition requirements when compared to the other large-scale projects. Further discussion on the influence of the decision-making process on the RMA conditions by case study is included in Appendix B.

5.1.6.2 Expert witness

Expert witnesses are called upon to present evidence in support or opposition of the proposal at project hearings. Expert witnesses are required to adhere to the Environment Court's Code of Conduct, which limits them to provide their professional opinion and not be advocates for or against a project. As a part of this process, there can be a conflict of opinion that must be negotiated and resolved between people with expertise in the same subject area. For M2PP, potential terrestrial ecology effects varied from low to moderate in most places, except for an area of kānuka forest remnant which the project was expected to have a high effect on.

There was some disagreement during the hearing process over appropriate ecological compensation ration for terrestrial and wetland vegetation. The Board of Inquiry accepted that there are no standards or mandatory tools in New Zealand and therefore it must be considered on a case-by-case basis. Agreement was eventually reached between the experts after extensive conferencing.

In cases like this, agreement on appropriate mitigation or management requirements may be based on the expert witnesses present. This raises the question of whether different outcomes would be reached depending on the experts involved. This may lead to variability in decision-making and reduce certainty for the parties involved.

Another source of conflict between experts can be generated when different environmental models produce varying results. ESC issues were prominent in the SH58 Interchange hearing because at the time reliance on the relatively new Auckland ESC guideline was untested in the Wellington region. Waka Kotahi and the local authority used different models to predict the additional annual sediment load from the project into a nearby stream, and results varied by an order of magnitude.

While the disparate predictions were never resolved, it was generally agreed that there were potentially significant adverse effects from sedimentation that needed to be addressed. The final conditions applied were potentially more conservative than needed to meet the precautionary approach.

This example also demonstrates the usefulness of having established standards that have been proven to work on other projects, as they give expert witnesses confidence when proposing environmental management actions. This project may also have benefitted from inclusion of a condition requiring an adaptive monitoring plan, where the results of the monitoring could have been fed back into the model for calibration and verification.

Sometimes the evidence used to support consent applications is limited in nature, making it difficult for experts to appropriately assess potential effects. For WEX:H, the effects on the long-tailed bat, a threatened endemic species classified as 'nationally vulnerable', were considered to be potentially significant. However, there was some disagreement between the applicant, reporting officers and DOC in relation to the limited knowledge on long-tailed bat populations within the project area during the hearing. Overall, the general consensus was reached that the specific requirements were to be included in a bat management plan.

The regulator needs confidence that the effects are appropriately and adequately described and introduces caution where this test is not met. The decision needs to balance uncertainty with availability of information and the ability to collect that information.

WEX:H stormwater-related erosion and flooding issues were also a particular concern for many submitters. The hearing commissioner accepted expert evidence that adverse erosion and flooding effects could be adequately managed but, due to inadequate information in the proposal, implemented conditions that explicitly stated that works would avoid creating new, or exacerbating existing, flooding effects. In these circumstances, often the RMA conditions applied could be deemed to be more conservative to manage the associated risk. It is beholden on the applicant to be able to demonstrate otherwise or accept conservative outcomes.

5.1.6.3 Standards

Some topics have consistent nationwide standards to reference, while other topics rely on regional guideline documents. For example, there are New Zealand standards for construction and operational noise. In contrast, ESC conditions rely heavily upon regional ESC guideline documents, irrespective of the scale of the project. These guideline documents may vary between regions, although they are reasonably consistent. The relevant ESC guideline documents were referenced in the RMA conditions of each case study and appear to be accepted by consenting authorities as sufficient to manage the effects of sediment discharges.

However, decision makers do not necessarily need to accept that works in accordance with a prescribed standard are adequate. Where project decisions result in a departure from the previously accepted standards, these decisions may set a precedent. The Waterview decision adopted a more onerous noise limit than the limit set out in NZS 6806:2010, as the Board of Inquiry did not agree that NZS 6806:2010 adequately embodied the requirements of the RMA. The Board for M2PP decided to adopt the same operational internal noise criteria as Waterview. These types of decisions indicate that decision makers are not always confident that existing standards suitably address the requirements of the RMA. It is up to the applicant to make sure all RMA obligations are adequately addressed in the application documentation, rather than relying on meeting the relevant standard.

The Board of Inquiry for CSM2 did not adopt the new noise limits set for Waterview but commissioned an independent report on construction and operational noise relating to the project. This report included the background to NZS 6806:2010, how the standard has been applied to other roading projects, how the standard was derived, how it works, and how it deals with mitigation.

If a standard was developed that satisfactorily embodied the requirements of the RMA, then this would streamline the consenting process and provide certainty for all parties. This issue has been consistent for noise and vibration effects for M2PP, Waterview and CSM2.

5.1.6.4 Climate change

Governments are attempting to address the significant environmental threat climate change poses. The New Zealand Ministry of Health (2018) states:

> *Climate change is already affecting our climate. It is likely to impact our agriculture and other climate-sensitive industries, our native ecosystems, infrastructure, health and biosecurity, as well as having broader social and economic impacts.*
>
> *New Zealand can expect to see changes in wind and sea current patterns, storm tracks, the occurrence of droughts and frosts and the frequency of heavy rainfall events, as well as rising temperatures. The impacts of climate change in New Zealand will become more pronounced as time goes on.*

Climate change considerations varied widely between case studies. M2PP had the most comprehensive assessment of potential climate change effects and mitigation. Flood risk for M2PP was required by consent condition to be assessed against the 1% annual exceedance probability (AEP) storm, with climate change to

2115 accounted for and sensitivity evaluations required. CSM2 also had a consent condition that required the effects of climate change to be accounted for to 2080. The Waterview RMA conditions mentioned making 'allowances for climate change' but did not specify a scenario year. However, the Waterview application and decision documents accounted for climate change to 2090, and sea-level rise to 2100.

Similarly, no consideration of climate change was specified in the RMA conditions for WEX:H, Barters Road, Mingha Bluff, SH58 Interchange, or Welcome Bay. Allowances for increased rainfall intensity due to climate change were, however, specified in the applications for WEX:H (for a 2090 scenario), Barters Road (for a 2100 scenario) and SH58 Interchange (no scenario-year identified).

The potential effects of climate change were a major subject of debate in the M2PP Board of Inquiry hearing. Professor Martin Manning, a leading New Zealand expert on climate change, gave evidence at the hearing expressing serious reservations about the location of the expressway in a coastal area subject to sea-level rise, and the need to be conservative and risk averse when calculating potential climate change effects. This had an influence on the resultant prescriptive climate change conditions.

Addressing consistency between approaches to climate change across capital works projects would provide more certainty for applicants, regulators and stakeholders alike.

5.1.7 RMA conditions

Ambiguous wording used in RMA conditions has implications for the ability of the regulatory authority to enforce compliance (or a project to determine what is an appropriate management measure) and leads to uncertainty for both the consent holder/requiring authority and affected parties. A key area of concern for submitters on the Waterview project, for example, was the potential for increased flooding to an area of private land where flooding was already an existing issue. Auckland Council appeared to accept the stormwater mitigation provided in the application, but the Board of Inquiry 'had residual concerns'. Changes were made to include a consent condition that required the operational stormwater system to mimic the existing hydrologic system. However, after the applicant questioned its ability to comply with the condition, the wording was changed to 'best practicably mimic'.

'Practicable' is a concept that is enshrined in RMA case law and in the Act itself.[8] However, the actual determination of what is 'practicable' is not supported by an exacting process, and the amount of information provided to support such determinations is variable.

A significant amount of expert advice was considered to develop the Waterview construction noise criteria, including works at night. During conferencing, the use of the term 'as far as practicable' (referring to mitigation measures) was removed from the draft conditions, and instead processes suggested where noise and vibration criteria could not be met. In this instance, how 'practicability' would be measured in the context of the project was discussed in the hearing, which does allow more certainty for the parties involved, but removes some flexibility for the consent holder/requiring authority in implementing the conditions.

[8] For example, the 'best practicable option' as it relates to discharge of a contaminant or an emission of noise is defined in section 2 of the RMA as follows:

> ***best practicable option**, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
>
> *a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
>
> *b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
>
> c) *the current state of technical knowledge and the likelihood that the option can be successfully applied*

An alternative to adopting a 'practicable' approach to meeting compliance requirements is to propose a requirement to be consistent with draft management plans. Draft plans are sometimes included in applications and provide a higher level of detail and certainty for decision makers and submitters alike. These management plans may require peer review in addition to certification by council. It may not be appropriate, efficient or useful for members of the public to have an opportunity to input to a highly technical management plan, so a balance needs to be applied. Such an approach may be suitable for large-scale projects and where effects on sensitive environmental values need to be avoided, remedied or mitigated and where full mitigation/management measures are known at the consent phase.

5.1.8 Cumulative factors

Overall, there are many stages within the RMA approval process where factors contributing to variability or inconsistency between decisions can be introduced. These factors can be cumulative, leading to potentially dissimilar sets of conditions being applied across projects.

This case-by-case approach to RMA approvals is likely to lead to better environmental outcomes as the unique circumstances and receiving environments are assessed in detail and, where scale and risk necessitates, management plans prepared prior to construction starting. Nevertheless, this approach can be lengthy and cumbersome on an individual project basis, and there would be benefit in developing a more streamlined approach for projects of a similar nature (ie, small-scale rural capital-works road transport projects).

Having more guidance material (setting out best management practices, or similar) for those aspects not currently covered (effects on ecological values, for instance) would also assist with streamlining processes where applicants, stakeholders and regulators could be confident that by applying industry standard practices, potential environmental effects would be adequately addressed.

Recommendations are stated in section 6 regarding how this process may be further streamlined.

5.2 Risk analysis

Environmental risks are threats that have potential to adversely affect environmental values. The risks associated with the case studies were analysed by theme (see Appendix E).

This section outlines the four key environmental risks by topic, and outlines whether there are standard practices that reduce risk, variability in practices to respond to the risks, and certainty for the parties involved in the RMA approvals for state highway network construction projects. We also consider whether the practices required reduced the risk to a state that was adequate, or whether uncertainty in outcome directed conditions (and possibly consequential outcomes) that were overly conservative.

As the applicant, Waka Kotahi wants to ensure that reputational risks are adequately considered in terms of both the environmental outcomes and the expectations of the community interested in or affected by the construction and operation of the state highway network.

5.2.1 Ecological risks

The ecological residual risk profiles (Appendix E, Figure E.1) generally corresponded with the expected ecological effects for each case study. Waterview, M2PP, WEX:H, and Mingha Bluff all had higher residual risks due to the associated sensitive receiving environments.

This reflects that projects within natural-state environments generally present a higher risk to ecological values. Projects that have large footprints (in terms of length and area) are also more likely to be high risk where there is a greater opportunity that the alignment will encounter isolated areas with ecologically

sensitive receiving environments. The scale of earthworks and extensive pavement areas associated with large-scale projects also means that runoff during and after construction can discharge to sensitive freshwater and coastal systems.

Waterview, M2PP, WEX:H, and Mingha Bluff also had the most effective ecological management controls (Appendix E, Figure E.5). For example, a critical inherent risk was associated with freshwater ecological values for M2PP, but this was effectively reduced to a moderate residual risk through a combination of management controls, monitoring conditions and offsetting mitigation (in this instance comprising 5,240 m of stream mitigation).

Mitigation and offsetting were particularly effective ways to reduce ecological project risks. Standard management controls reduce the likelihood of the adverse effects occurring and include:

- provision for fish passage
- capture and relocate conditions
- restoration activities (such as gully restoration, pest control and planting).

Mitigation and offsetting[9] conditions provide for the creation or rehabilitation of similar local habitats, which aims to offset the consequence of the loss of habitat due to project disturbance in a holistic sense. When standard management controls and provision for mitigation are both utilised to address the same project risk, this produces effective results, as both the likelihood and consequence of the risk are reduced.

5.2.2 Erosion and sediment control risks

The sediment discharge residual risk profiles (Appendix E, Figure E.2) generally corresponded with the possible effects of sediment discharges for each case study (Appendix E, Figure E.6). CSM2, Barters Road, SH58 Interchange and Welcome Bay had the lowest risk profiles, but overall, the risk profiles across all case studies were generally consistent.

The effectiveness of the environmental controls applied to each study were also consistent across all case studies. This reflects that all projects were required to develop an ESCP, regardless of the size of the project, in accordance with the relevant regional ESC guidelines. There is also a reasonable level of consistency across the regional ESC guidelines, with standard controls including perimeter controls, installation of ESC devices, staged earthworks, progressive stabilisation, and stabilised entranceway and access tracks.

5.2.3 Stormwater risks

The stormwater residual risk profiles (Appendix E, Figure E.3) did not correspond with the potential effects of stormwater discharges for each case study (Appendix E, Figure E.7). The large-scale projects and Mingha Bluff were assessed in the consent application documentation as having a higher stormwater risk profile due to either the sensitivity of the receiving environment or the creation of large amounts of impervious surface area.

In contrast, the residual stormwater risk profiles for all case studies were reasonably consistent and included a number of high risks associated with flooding and climate change events. It is noted that there is more opportunity to address stormwater risk (water quality and quantity) for standalone or new projects compared to those that are upgrading existing transport infrastructure.

[9] Maseyk et al. (2018) provide guidance on offsetting that is relied upon across New Zealand.

5.2.4 Noise and vibration risks

The noise and vibration residual risk profiles (Appendix E, Figure E.4) largely consisted of moderate and low risks, which does not reflect the expected noise and vibration effects for each case study (Appendix E, Figure E.8). Noise and vibration is an emotive issue that can attract significant interest during consenting by parties living adjacent to state highway corridors. This was particularly the case for Waterview and M2PP, which attracted non-standard construction noise conditions.

5.3 Environmental outcomes

This assessment has looked primarily at the consenting processes and requirements for the eight case studies. While this has assisted with understanding the variability of RMA conditions, further value would come from understanding the effectiveness of the RMA conditions; in particular, as it applies to the larger projects where responding to environmental risks presents a significant cost. Understanding what the value of that investment has been would be useful for application to future projects.

Understanding effective means of mitigating impacts on natural values (associated with habitat modification, and water quality associated with sediment and stormwater contaminant discharges) and on the amenity and built environment (noise, vibration and flooding) will allow the ongoing development of mitigation guidelines and certainty of outcomes for applicants, regulators and stakeholders alike.

6 Key findings and recommendations

6.1 Summary of findings

The purpose of this research was to undertake a high-level survey of selected transport projects. This was to determine the drivers and consistency of environmental management requirements relating to capital works projects across the transport sector.

Learnings from this review indicate how environmental outcomes are being addressed in transport projects under the current RMA approval regime and identified areas where greater consistency could be achieved across RMA conditions or management requirements.

Key findings from the assessment are listed below.

- Overall, there is reasonable consistency between projects, especially in the areas of the application of technical methodologies to address the effects from stormwater and sediment discharges. The RMA consent requirements for these aspects were reasonably consistent.
- There are inconsistencies elsewhere, such as in the wording of ecology conditions, and in terms of how conditions seek to manage effects.
- Inconsistencies in RMA conditions were due to a variety of reasons (as discussed in this report), ranging from regional planning rules to public participation in the RMA process.
- The best opportunity to address significant environmental impacts occurs in the business case stage (ie, pre-consenting). This relates particularly to avoiding sensitive ecological values and built-up areas or heritage features (that may be impacted by vibration, for example). Once this initial screening process is complete, consenting steps are more focused on remedying and mitigating rather than avoiding.
- Some decisions consider future management plans for certification to be appropriate, whilst other approaches are to set out prescriptive requirements within the conditions themselves.
- The RMA approvals process (Board of Inquiry, district/regional approvals process) did not have any significant bearing on the RMA conditions and complexity of environmental risk management requirements.
- RMA conditions generally reflected risk – this is particularly applicable to ecology conditions for the four large-scale projects, as well as Mingha Bluff. Comprehensive ecological evaluations were completed as part of the assessment of environmental effects, and comprehensive conditions were applied. The risk mitigation strategies and mitigation programmes were further outlined in detailed management plans.
- Assessing the potential impacts and developing ESC methodologies is a relatively mature discipline. Comprehensive guidance material has been developed in New Zealand over the past 28 years, and while there may be some minor variability within regional earthworks guidelines, the principles upon which they have been developed apply to all. There is also widespread acceptance of these requirements across industry and regulators, so while there may be some inconsistencies across consent requirements (terminology), the outcomes are similar. Larger projects may attract more requirements (such as staging or flocculation requirements). These aspects are also well entrenched.
- Noise and vibration requirements were addressed relatively consistently. Two projects adopted *Transit New Zealand's Guidelines for Management of Road Traffic Noise* for operational noise, and three adopted NZS 6806:2010. There is reasonable consistency in imposition of NZS 6803:1999 where there

are construction noise conditions. Having a consistent approach for these requirements assists in the RMA approval process.

- Consistency in RMA conditions or management requirements would assist with certainty for applicants, regulators and stakeholders. The de-centralised nature of the New Zealand environment and planning regime means that some variability is inherent. Our assessment has shown that this variability in application and outcome is further exacerbated by:
  - business case process
  - project size, scale and location
  - stakeholder interest and concern
  - previous project experience regionally
  - applicant drivers regarding reputational aspects.
- The project scope included assessing how effective the management controls required by the conditions were. We have not achieved this definitively. We note that more stringent requirements were applied to more sensitive environmental risks, on the whole. However, further work, including interviewing regulatory staff and reviewing compliance reports and post-construction monitoring, would be required to ascertain this more fully. It is noted that at least one project is still under construction at the time of writing.
- Understanding the effective means of mitigating impacts on the natural and built environment will allow the ongoing development of mitigation guidelines across the various environmental disciplines.
- Environmental science continues to develop. This introduces uncertainty into consenting processes (eg, managing the impacts of construction and operation of highways on bats has developed rapidly over the past decade and continues to develop), and regulators will continue to adopt the precautionary approach where uncertainty exists.

6.2 Recommendations

A number of recommendations fall out of this research that are aligned with the GPS on Land Transport (New Zealand Government, 2018) (refer section 2.1.8). The GPS sets out the Government's priorities for expenditure from the National Land Transport Fund. Key strategic priorities include:

- **Environment** – a land transport system that reduces greenhouse gas emissions, as well as adverse effects on the local environment and public health
- **Value for money** – a land transport system that delivers the right infrastructure and services to the right level at the best cost.

A number of recommendations that seek to deliver better environmental outcomes and value for money across capital works transport projects are set as key recommendations or more general recommendations below.

6.2.1 Key recommendation 1: strategic business case project screen

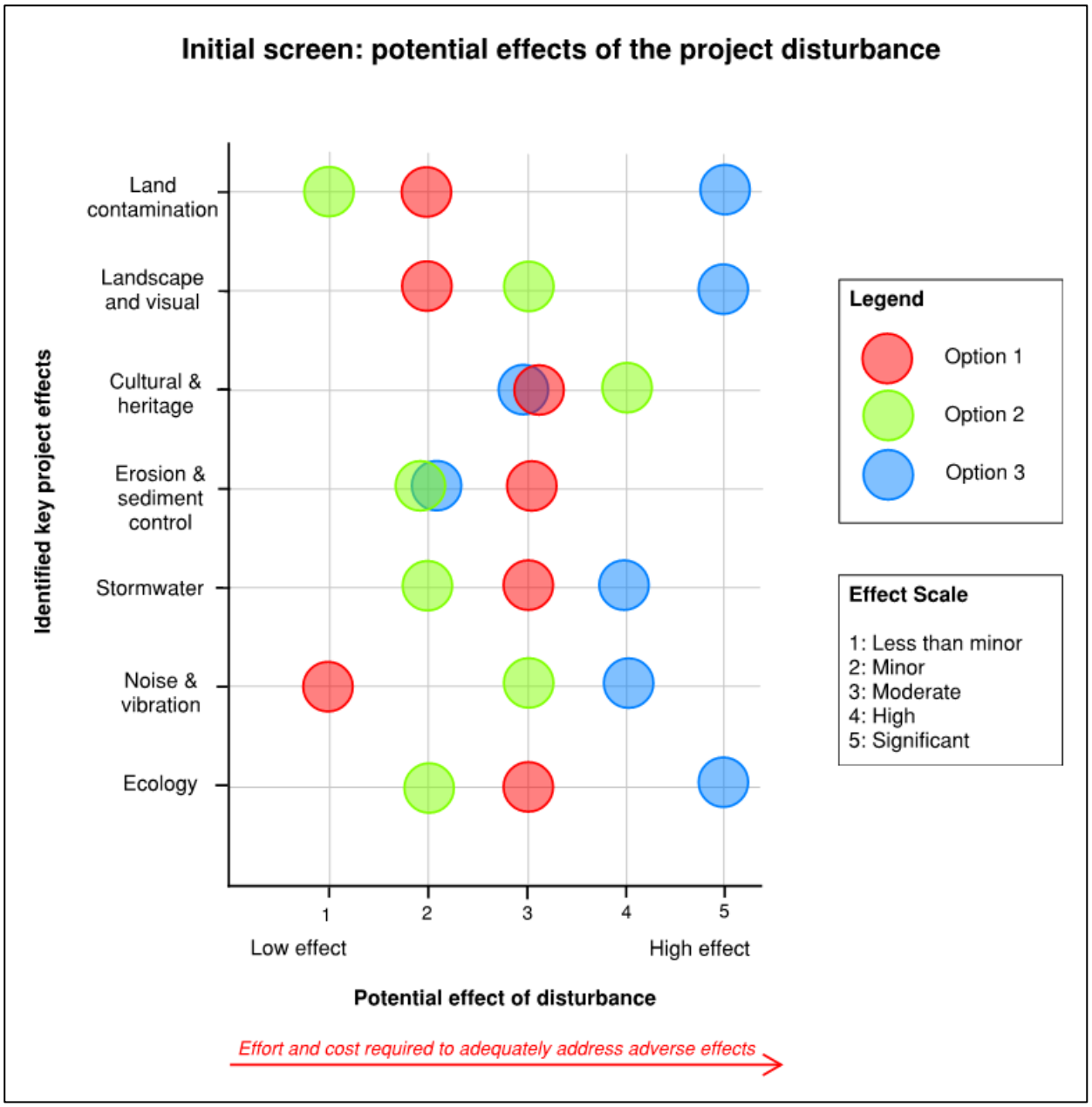
The type and significance of project receiving environments have a bearing on the scale of environmental effects that must be avoided, remedied or mitigated under the RMA. Our assessment is that there are inherent differences between scale of effect across different themes for discrete projects.

There is value in developing a screening tool that visually presents a high-level assessment of environmental effects for key areas where it has been identified that the project is likely to have adverse effects.

An example of the type of tool that could be utilised is shown in Figure 6.1. The proposed screening tool will help inform key project decisions, such as route selection, and visually communicate an indication of the level of effort and cost required to adequately address adverse effects. This screening tool may be utilised at the point of entry stage of a project business case prior to route selection to ensure optimum benefits.

Based on the high-level information known, several potential key project effects could be identified, and a broad judgement made on the scale of the adverse effect. When this information is presented visually, quick comparisons can be drawn between different options, including an indication of the level of effort and cost required to adequately address adverse effects under the RMA.

Figure 6.1 Visual screening tool example (showing key project areas where significant effort may be needed to mitigate adverse environmental effects)



It is proposed that the existing ESR screen questions be used to help inform judgements made on the scale of the adverse effect. For example, if the answer is 'yes' to the question 'Will the option affect areas of the conservation estate, or areas of known significance for biodiversity or known habitats of uncommon or threatened species?' then the anticipated adverse ecological effects are likely to be high.

Effectively, the screening tool proposed in Figure 6.1 is a visualisation of the information collected through the ESR screen. The initial categorisation of adverse effects is based on the judgement of environmental professionals, and this process is not intended to replace or influence the formal assessment of environmental effects that takes place during the consenting process.

Employing a screening tool at the point of entry business case stage would be useful to ensure that due consideration is given to project obligations under the RMA, and opportunities to avoid effects are identified while there is still scope to implement avoidance mechanisms. This tool could also provide an opportunity for an initial consideration of sustainability principles, noting that adding a sustainability lens may well lead to better environmental outcomes as well. It is noted that options for assessment aren't necessarily developed in detail at the point of entry, and further consideration is needed of how this can be adopted specifically.

The project screen also enables informed judgements to be made on the type and scale of environmental management controls and plans required. Effort can then be focused accordingly to ensure that environmental outcomes are met and value for money is considered.

Presenting a visualisation of the options screening process in the formal assessment of environmental effects will also assist with communicating that a range of options were considered in the early stages of the project. This is useful because sometimes the value of the decisions made in the early project development stages are not adequately covered in the RMA approval process. It is beneficial to show that while the project may still generate some significant potential adverse effects that need addressing, other project alternatives may have presented greater environmental risks.

This research has also shown that the specificity and prescriptiveness of RMA conditions and environmental management requirements increase where there is potential for significant adverse effects. Therefore, it follows that the more that significant project effects are avoided, the less likely that prescriptive conditions will be imposed. It is expected that the screening tool will improve the consistency of conditions and environmental management requirements across different projects.

6.2.2 Key recommendation 2: feedback loop

Currently there are limited conditions that require monitoring of environmental outcomes after the completion of a project. There may be value for Waka Kotahi considering RMA conditions that require monitoring results to be reported so that the project success at achieving specific environmental outcomes can be measured and quantified. This may be easier to implement for designation conditions rather than resource consent conditions because of the role of Waka Kotahi as a requiring authority. This is undertaken occasionally to assess ecological mitigation measures, as well as confirm operational noise levels for larger projects. More targeted monitoring (such as stream system ecology following construction and longer term to assess stormwater impacts, for example) would provide certainty for future projects. As an alternative to being required by RMA conditions, Waka Kotahi could look to undertake this work directly (and possibly in partnership with local government).

A better understanding of cause and effect in relation to environmental effects offers benefits for Waka Kotahi (for future projects) and more broadly in terms of contribution to science around effects management and outcomes. A better understanding of the effectiveness of mitigation strategies and methodologies will reduce the reliance on the precautionary approach to consenting. There are a number of projects from the early 1990s to 2000s with 15–20 years of possible outcomes being achieved that could be reviewed.

The feedback loop created by 'report back' conditions will enable regulators and consent holders to understand the efficacy of the conditions. This is potentially costly work with the outputs benefiting more broadly than Waka Kotahi, so options for funding should be investigated if this recommendation is advanced. This work may be able to be shared with local authorities as part of their State of the Environment reporting responsibilities.

6.2.3 Key recommendation 3: environmental outcomes

Another key point to consider more fully is whether the outcomes generated as a result of more stringent or prescriptive approaches (as observed for larger projects) generate better environmental outcomes in comparison to less prescriptive requirements. Future analysis in terms of outcome monitoring (as described in the key recommendation 2) may be useful to review what best-practice processes relating to conditions on RMA processes could drive. Undertaking further assessment of efficacy of the conditions implemented via feedback from regulatory staff, the construction industry, and reviewing compliance reports and post-construction monitoring would also assist.

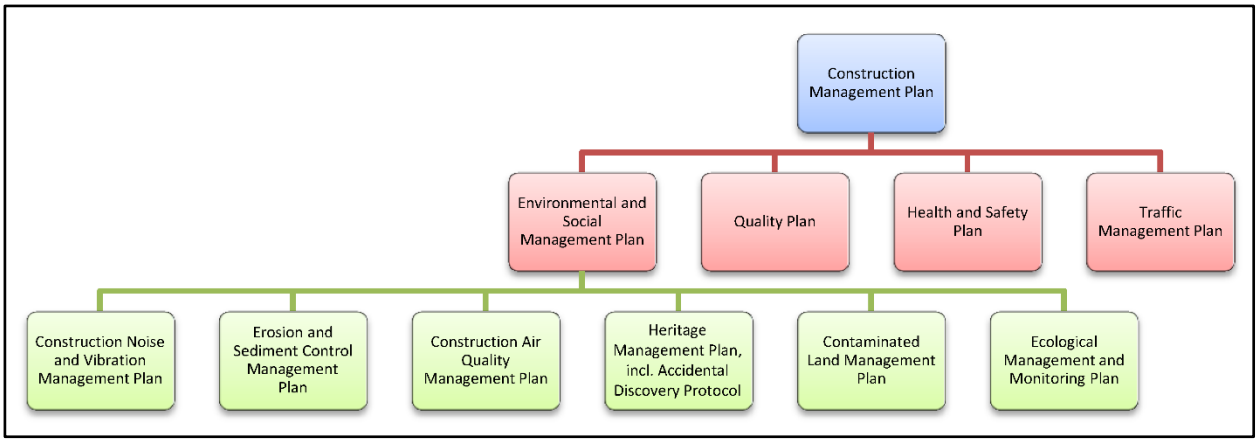
6.2.4 Key recommendation 4: management plan framework

Standardising the terminology and structure of environmental management plans may improve the consistency of environmental management requirements across projects. Management plans form a useful way of establishing environmental management requirements, setting out accountability, and demonstrating how compliance will be achieved.

A wide variety of management plans were observed in the case studies investigated in this research (Figure 6.2). Inconsistent management plan titles, for example, contribute to confusion for contractors as to what information is contained within certain plans and where to look to find specific management requirements.

The Waka Kotahi *Guideline for Preparing an Environmental and Social Management Plan* (NZ Transport Agency, 2014b) sets out the requirements of an environmental and social management plan and provides guidance for its use, including integrating an environmental management system with the multitude of associated management plans (Figure 6.2). Internal policy requires that an environmental and social management plan is submitted to Waka Kotahi for approval for all construction projects and maintenance/operation contracts.

Figure 6.2 Exemplar schematic showing the key documents in the management of environmental and social effects for a typical capital project, as identified in the Waka Kotahi *Guideline for Preparing an Environmental and Social Management Plan* (NZ Transport Agency, 2014b, p. 8)



Other common names for management plans with similar content to an environmental and social management plan include construction environmental management plan (CEMP), environmental management plan, or construction management plan (CMP). Additionally, there is no standardised protocol available for road-controlling authorities concerning the terminology or content of associated management plans.

We recommend that a national guidance document for environmental management plans for capital works projects is prepared in consultation with road-controlling authorities, regional and territorial authorities, key contractors from the infrastructure industry, and iwi. Involving iwi in the development of the guidelines from the inception is important to understand a mātauranga Māori perspective.

The guidance document should set out standard terminology protocols and clear expectations of what must be included in each type of management plan. It should also give guidance to management plan authors around avoiding adding constraints to activities beyond what is anticipated by an RMA condition. It would also be helpful to set out the level of detail required at various stages in the project lifecycle – for example, starting with a set of principles and adapting this into a draft management plan for consenting purposes, and then developing a site-specific plan for construction.

Consistent RMA conditions could then be developed that reference the relevant guidance document and clearly set out the outcomes that need to be achieved by the management plan. This approach will ensure that both regulators and contractors clearly understand where to find information within large suites of management plans, and their roles, responsibilities and accountabilities for compliance.

A standardised approach to preparing management plans will also give local authorities and their communities more confidence that positive environmental outcomes will be achieved. This should speed up the RMA approval processing time and improve the consistency of conditions across capital works transport projects.

Involving the infrastructure industry in the development of these guidelines would be useful – firstly, to give an industry perspective, and secondly, to get buy-in. It would also be useful to couple the guideline development with a roadshow or series of training sessions with industry practitioners to help facilitate implementation.

6.3 Other recommendations

Other matters that may be considered to assist with the development of RMA approval information that would assist with consistency of requirements, providing certainty to parties involved in RMA approvals, and streamlining processes, are listed below.

- Review and where necessary further develop the Waka Kotahi project environmental reference database. Information to be contained in the database could include (generally captured in CS VUE):
  - RMA applications, council reports (decisions) and condition archive
  - environmental compliance database
  - environmental management plans
  - outline plan of works
  - wildlife permits and applications
  - archaeological authorities/permits.

- Consider developing construction project environmental monitoring guidance covering aspects of potential environmental effects to reduce variability and encourage standardisation, where appropriate. This could include:
  - developing ecology mitigation guidelines. These could include means to calculate the areas needed to offset habitat impacted by project works and monitoring post-construction to review effectiveness. These would outline a more diverse range of mitigation measures than biodiversity offsetting alone and could incorporate and refer to the work already done in the existing biodiversity offsetting guidelines (Maseyk et al., 2018)
  - developing guidelines on the preparation and implementation of adaptive monitoring plans in areas such as ESC
  - developing a metadata base for data collected for compliance purposes that might be useful to assist in understanding best practice, which will then feed into updating best practice guidelines
  - reviewing in more detail the various water quality standards set for sediment discharge on the case-study projects (or other identified projects) to see how effective the setting of the standard was and whether it led to an improved outcome. Use these findings to develop a national guideline on sediment discharge standards and triggers, or for supporting proposed RMA conditions in resource consent applications.
- It should be noted that Waka Kotahi (and other requiring authorities) can help shape national consistency of regional plan provisions by actively engaging in plan change processes. Undertaking a systematic assessment of how existing rules and planning documents vary between regions and comparing these to the RMA conditions for the case-study projects would also be useful to aid this thinking. Similarly, pro-actively proposing regional RMA conditions in regional consent applications (as opposed to relying on councils to do so) may help to deliver more consistency in RMA conditions.
- Review the compliance management system – the detail within CS VUE often doesn't address specific consenting commitments and obligations (including those obligations agreed to via management plans). A more detailed RMA compliance system could assist Waka Kotahi, the regulator (if so desired), other stakeholders (if so desired for transparency purposes), and the contractor to deliver on all obligations. This could link to the Waka Kotahi incident management system as well.
- While outside of the scope of this report, it would also be worth considering the alignment between RMA processes and other processes required under related legislation (such as the Wildlife Act 1953, the Conservation Act 1987 and the Public Works Act 1981) to aid in streamlining the entire approvals process. In our experience, this lack of alignment of legislation is in the outcomes sought, the application processes and the conditions or controls applied. The lack of alignment can add considerable risk and delay to projects for no beneficial environmental outcome. Further investigation into this issue will help to identify any change in practice or broader legislative change that may be beneficial.
- Organise a local and regional council RMA approvals panel discussion of findings of this report.

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Appendix A: Case study summaries

Figure A.1 Case study profile: Waterview Connection

WATERVIEW CONNECTION

REGION:	SCALE:	ESTIMATED PROJECT COST:
AUCKLAND	**LARGE (>$50M)**	**$1.4 BILLION**

PROJECT OVERVIEW:
A NEW 4.5KM MOTORWAY SECTION THAT TUNNELS UNDER CENTRAL/WEST AUCKLAND FROM MT ROSKILL TO WATERVIEW, CONNECTING SH16 AND SH20 AND FORMING PART OF THE WESTERN RING ROUTE.

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
LARGELY RESIDENTIAL URBAN LAND. OAKLEY CREEK RUNS THROUGH THE PROJECT SITE FROM SOUTH TO NORTH DISCHARGING INTO THE WATERVIEW ESTUARY (MOTO MANAWA MARINE RESERVE) AND WAITEMATĀ HARBOUR. OAKLEY CREEK IS CHARACTERISED BY LOW WATER QUALITY AND LOW SPECIES DIVERSITY.

GEOLOGY:
WAITEMATĀ GROUP ROCK, CONSISTING OF SANDSTONE, SILTSTONE OR MUDSTONE, PRESENT IN THE WESTERN PORTION OF THE SITE. AUCKLAND BASALTS (KERIKERI VOLCANIC GROUP) OF THE AUCKLAND VOLCANIC FIELD, CONSISTING OF IGNEOUS ROCKS BASALT AND TUFF, PRESENT IN THE EASTERN PORTION OF THE SITE. [1]

1. Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKER:
BOARD OF INQUIRY

KEY SUBMITTER CONCERNS:
- EFFECTS ON OPEN SPACES
- COASTAL PROCESSES
- MARINE ECOLOGY
- STORMWATER, GROUNDWATER AND GROUND SETTLEMENT
- NOISE AND VIBRATION

Figure A.2 Case study profile: Mackays to Peka Peka Expressway

MACKAYS TO PEKA PEKA EXPRESSWAY

REGION:	SCALE:	ESTIMATED PROJECT COST:
WELLINGTON	**LARGE (>$50M)**	**$630 MILLION**

PROJECT OVERVIEW:
A NEW 18KM FOUR-LANE EXPRESSWAY THROUGH THE KĀPITI COAST FROM MACKAYS CROSSING TO PEKA PEKA, FORMING PART OF THE KĀPITI EXPRESSWAY (SH1).

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
A MIXTURE OF RURAL AND URBAN LAND. URBAN AREAS INCLUDE PARAPARAUMU AND WAIKANAE. THE WAIKANAE RIVER AND WHAREMAUKU STREAM INTERSECT THE PROJECT AND FEED INTO THE TASMAN SEA COASTAL ENVIRONMENT. TERRESTRIAL ECOLOGY ENVIRONMENTS VARY FROM REGIONALLY RARE AND SIGNIFICANT HABITATS TO URBAN HEAVILY MODIFIED LANDSCAPES WITH LIMITED ECOLOGICAL DIVERSITY.

GEOLOGY:
INACTIVE SAND DUNES WITH GRAVEL RIVER DEPOSITS IN THE FLOODPLAIN OF THE WAIKANAE RIVER. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKER:
BOARD OF INQUIRY

KEY SUBMITTER CONCERNS:
- TRAFFIC
- NOISE AND VIBRATION
- GROUNDWATER
- ARCHAEOLOGY
- CULTURE AND HERITAGE

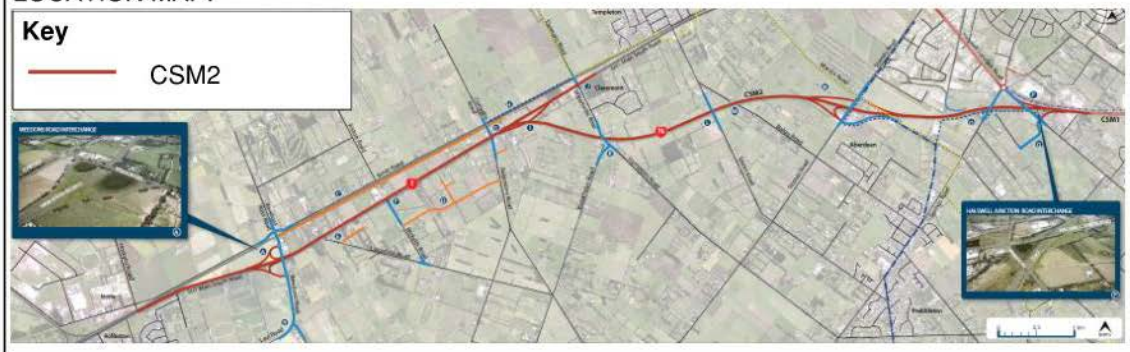
Figure A.3 Case study profile: Christchurch Southern Motorway – Stage 2

CHRISTCHURCH SOUTHERN MOTORWAY - STAGE 2

REGION:	SCALE:	ESTIMATED PROJECT COST:
CANTERBURY	**LARGE (>$50M)**	**$195 MILLION**

PROJECT OVERVIEW:
A NEW FOUR-LANE MEDIAN SEPARATED MOTORWAY FROM HALSWELL TO SH1 NEAR ROBINSONS ROAD AND AN UPGRADE OF THE EXISTING SH1 FROM NORTH OF ROBINSONS ROAD TO ROLLESTON, WITH A COMBINED LENGTH OF 16KM.

LOCATION MAP:



RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
LARGELY RURAL FARMLAND WITH ADJACENT STOCKWATER RACES. THE URBAN CENTRES OF CHRISTCHURCH AND ROLLESTON ARE LOCATED AT THE NORTHERN AND SOUTHERN EXTENTS OF THE PROJECT RESPECTIVELY.

GEOLOGY:
POORLY CONSOLIDATED MUD, SAND, GRAVEL, AND PEAT OF ALLUVIAL AND COLLUVIAL ORIGIN.[1]

1. Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKER:
BOARD OF INQUIRY

KEY SUBMITTER CONCERNS:
- SURFACE WATER EFFECTS
- NOISE AND VIBRATION
- AIR QUALITY AND DUST
- LANDSCAPE, VISUAL, AND LIGHTING
- GROUNDWATER

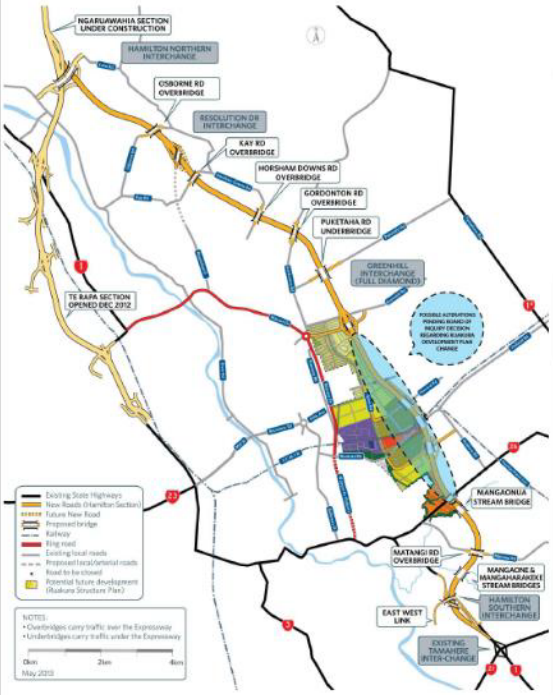
Figure A.4 Case study profile: Waikato Expressway – Hamilton Section

WAIKATO EXPRESSWAY - HAMILTON SECTION

REGION:	SCALE:	ESTIMATED PROJECT COST:
WAIKATO	**LARGE (>$50M)**	**$637 MILLION**

PROJECT OVERVIEW:
A NEW 22KM FOUR-LANE EXPRESSWAY THAT BYPASSES HAMILTON ON THE EASTERN SIDE, AND FORMS PART OF THE SH1 WAIKATO EXPRESSWAY. IT CONNECTS THE EXISTING TAMAHERE INTERCHANGE IN THE SOUTH TO THE NGĀRUAWĀHIA SECTION OF THE WAIKATO EXPRESSWAY IN THE NORTH.

LOCATION MAP:



RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
THE HAMILTON SECTION OF THE WAIKATO EXPRESSWAY BYPASSES HAMILTON ON THE EASTERN SIDE OF THE CITY, AND IS LARGELY SITUATED WITHIN RURAL FARMLAND. THE PROJECT RUNS PARALLEL TO THE WAIKATO RIVER, WHICH IS SITUATED TO THE WEST. THE EXPRESSWAY CROSSES BOTH THE MANGAONUA AND MANGAONE GULLIES AND ASSOCIATED STREAMS.

GEOLOGY:
THE PROJECT RUNS THROUGH LAND MAINLY CONSISTING OF PEATY SWAMP DEPOSITS AND SANDY RIVER DEPOSITS. THERE ARE ALSO POCKETS OF PUMICEOUS MUD, SILT, SAND AND GRAVEL WITH MUDDY PEAT BEDS. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKERS:
WAIKATO DISTRICT COUNCIL, HAMILTON CITY COUNCIL, WAIKATO REGIONAL COUNCIL

Figure A.5 Case study profile: SH1 Barters Road/Pound Road Improvements

SH1 BARTERS ROAD/POUND ROAD IMPROVEMENTS

REGION:	SCALE:	ESTIMATED PROJECT COST:
CANTERBURY	**SMALL (<$50M)**	**$19 MILLION**

PROJECT OVERVIEW:
ROAD UPGRADES NEAR THE WATERLOO BUSINESS PARK LOCATED ON THE OUTSKIRTS OF CHRISTCHURCH, INCLUDING: A NEW INTERSECTION WITH TRAFFIC LIGHTS INSTALLED AT WATERLOO AND POUND ROAD, THE CLOSURE OF THE EXISTING BARTERS ROAD RAILWAY CROSSING, AND A NEW T-INTERSECTION AT POUND ROAD VIA A NEW RAILWAY CROSSING.

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
LARGELY RURAL FARMLAND, ALTHOUGH A FEW RESIDENTIAL DWELLINGS ARE PRESENT TO THE SOUTH AND COMMERCIAL/INDUSTRIAL BUILDINGS ON THE OUTSKIRTS OF CHRISTCHURCH ARE PRESENT TO THE EAST OF THE SITE.

GEOLOGY:
GRAVEL HOLOCENE RIVER DEPOSITS INCLUDING UNWEATHERED, VARIABLY SORTED, GRAVEL, SAND, SILT, AND CLAY. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKERS:
CANTERBURY REGIONAL COUNCIL, CHRISTCHURCH CITY COUNCIL

Figure A.6 Case study profile: SH73 Arthur's Pass Mingha Bluff Realignment

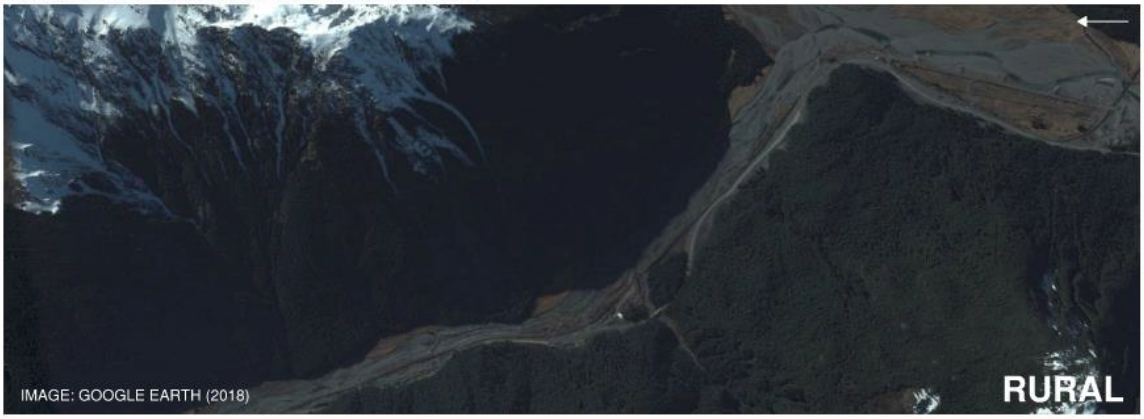
SH73 ARTHUR'S PASS (MINGHA BLUFF REALIGNMENT)

REGION:	SCALE:	ESTIMATED PROJECT COST:
CANTERBURY	**SMALL (<$50M)**	**$22 MILLION**

PROJECT OVERVIEW:
A ROAD REALIGNMENT AND RECONSTRUCTION TO IMPROVE SAFETY AND RELIABILITY OF A 5KM SECTION OF SH73 NEAR ARTHUR'S PASS VILLAGE WITHIN ARTHUR'S PASS NATIONAL PARK.

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:



RECEIVING ENVIRONMENT:
THE PROJECT IS SITUATED ON THE TRUE RIGHT BANK OF THE BEALEY RIVER IN ARTHUR'S PASS NATIONAL PARK. THE CONFLUENCE OF THE BEALEY RIVER WITH THE WAIMAKIRIRI RIVER IS APPROXIMATELY 5KM DOWNSTREAM OF THE PROJECT.

GEOLOGY:
THE UNDERLYING GEOLOGY CONSISTS OF BASEMENT (EASTERN PROVINCE) SEDIMENTARY ROCKS OF GREYWACKE SANDSTONE AND ARGILLITIC MUDSTONE/SILTSTONE. THE PROJECT IS ADJACENT TO THE ACTIVE FLOODPLAIN OF THE BEALEY RIVER MADE UP OF GRAVEL RIVER DEPOSITS. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKERS:
CANTERBURY REGIONAL COUNCIL, SELWYN DISTRICT COUNCIL, DEPARTMENT OF CONSERVATION

Figure A.7 Case study profile: SH2/SH58 Haywards Interchange

SH2/SH58 HAYWARDS INTERCHANGE

REGION:	SCALE:	ESTIMATED PROJECT COST:
WELLINGTON	**SMALL (<$50M)**	**$43 MILLION**

PROJECT OVERVIEW:
A NEW INTERCHANGE AT THE SH2 AND SH58 INTERSECTION LOCATED NEAR THE NORTHERN OUTSKIRTS OF LOWER HUTT.

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
SITUATED ON THE NORTHERN OUTSKIRTS OF LOWER HUTT. BELMONT REGIONAL PARK IS LOCATED IMMEDIATELY NORTH AND THE HUTT RIVER IS LOCATED APPROXIMATELY 500M TO THE SOUTH.

GEOLOGY:
THE MAJORITY OF THE PROJECT IS LOCATED WITHIN THE HUTT RIVER FLOODPLAIN CONSISTING OF GRAVEL RIVER DEPOSITS. THE GEOLOGY OF THE NORTHERN PORTION OF THE SITE CONSISTS OF BASEMENT (EASTERN PROVINCE) SEDIMENTARY ROCKS OF ALTERNATING SANDSTONE AND MUDSTONE. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKERS:
HUTT CITY COUNCIL, GREATER WELLINGTON REGIONAL COUNCIL

Figure A.8 Case study profile: Welcome Bay Road and Te Puke Highway Intersection

WELCOME BAY ROAD AND TE PUKE HIGHWAY INTERSECTION

REGION:	SCALE:	ESTIMATED PROJECT COST:
BAY OF PLENTY	**SMALL (<$50M)**	UNAVAILABLE

PROJECT OVERVIEW:
REPLACING THE EXISTING T-INTERSECTION WITH A SINGLE-LANE ROUNDABOUT AT THE WELCOME BAY ROAD AND TE PUKE HIGHWAY INTERSECTION, LOCATED SOUTH OF PAPAMOA BEACH.

LOCATION MAP:

RURAL/URBAN SURROUNDING AREA:

RECEIVING ENVIRONMENT:
RURAL FARMLAND WITH A FEW RESIDENTIAL DWELLINGS NEARBY.

GEOLOGY:
PLEISTOCENE RIVER DEPOSITS MADE UP OF POORLY TO MODERATELY SORTED GRAVEL WITH MINOR SAND AND SILT UNDERLYING TERRACES. [1]

[1] Heron D. W. (custodian) 2014. Geological Map of New Zealand 1:250 000. Institute of Geological & Nuclear Sciences.

RESOURCE CONSENT DECISION MAKERS:
BAY OF PLENTY REGIONAL COUNCIL, TAURANGA CITY COUNCIL

Appendix B: Case study consent assessments

The RMA conditions and management controls across case studies showed some variability as a function of size of the project, submission process, region, types of receiving environment, and urban/rural split. The variability between case studies was assessed across four topic areas:

- ecology
- erosion and sediment control (ESC)
- stormwater
- noise and vibration.

Detailed assessments of the consent and decision-making process and outcomes are outlined below.

B.1 Ecology

B.1.1 RMA condition requirements

A large number of RMA conditions and ecological management requirements were attached to the four large-scale projects (project value >$50M), while limited ecological RMA conditions were attached to the four small-scale projects (project value <$50M). Mingha Bluff was the only exception, with several freshwater and terrestrial ecology requirements imposed due to the significant ecological value of the Arthur's Pass National Park receiving environment.

The four large-scale projects were required to produce **ecological management plans** (stand-alone or included in an overarching construction environmental management plan (CEMP)) that were also required to be certified by the local authority or a suitably qualified independent person. The RMA conditions for M2PP further required site-specific ecological management plans to be prepared for each ecological mitigation area. There were no requirements for ecological management plans in the RMA conditions of the four small-scale projects. However, the Mingha Bluff RMA conditions did require that the works were consistent with the existing Arthur's Pass National Park Management Plan.

Most ecology conditions were categorised within the consent by classification; for example, freshwater ecology, marine ecology, avifauna, herpetofauna, or terrestrial ecology.

Every case study, except for Barters Road, had at least one condition related to **freshwater ecology** (particularly in relation to fish passage). The four large-scale projects and Mingha Bluff all had detailed freshwater ecology conditions with additional management plans required and provisions for specific species (eg, mudfish), including fish rescue and relocation.

Only two projects – M2PP and Waterview – had **marine ecology** conditions, largely based around marine ecology construction monitoring. There were no marine ecology RMA conditions imposed on the other case studies as there were no marine receiving environments affected nearby.

Three of the large-scale projects had **avifauna and bat** requirements. M2PP avifauna requirements were specific to the fernbird, including avoiding habitat during the breeding season and conducting pre- and post-construction monitoring as well as requirements associated with the pipit and grey duck.

WEX:H avifauna and bat conditions also specified species of importance, including the little shag and long-tailed bats. WEX:H required a bat management plan to be developed in addition to the overarching ecological management and restoration plan and a pre-construction survey and relocation of threatened or at-risk birds. In contrast, Waterview conditions did not specify any species of importance but had several

avifauna and bat requirements related to providing temporary high-tide roosting structures, monitoring, and pest control. CSM2 and the four small-scale projects did not have any avifauna and bat requirements.

All four large-scale projects had **herpetofauna** conditions, with each project required to develop a lizard management plan/measures. M2PP and WEX:H also had conditions around capture and relocation of lizards prior to construction. The four small-scale projects did not have herpetofauna conditions.

Six case studies had **terrestrial ecology** requirements, including all four large-scale projects, Mingha Bluff and SH58 Interchange. Terrestrial ecology requirements were highly variable between projects, which reflects the environments in which the projects were completed. These include:

- M2PP – monitoring vegetation and wetlands
- Waterview – controls on significant and valued vegetation; supervision of works by a project botanist; eco-sourcing and weed control; requirements for vegetation on Traherne Island
- CSM2 – weed-spread prevention strategies; requirements for riparian vegetation planting
- WEX:H – pre-construction survey; relocation of threatened or at-risk plants; protection and monitoring of kahikatea trees
- Mingha Bluff – mistletoe, *Coprosma acerosa* and riparian remediation plan; eco-sourcing provisions; mistletoe inventory; vegetation clearance plan (approved by DOC)
- SH58 Interchange – revegetation plans (developed in consultation with DOC and Greater Wellington Regional Council (GWRC)).

Barters Road and Welcome Bay had no terrestrial ecology conditions.

All four large-scale projects also had specific mitigation requirements to mitigate, remedy or offset effects. M2PP had the most onerous requirements, including a minimum of 40.7 ha of planting of indigenous terrestrial and wetland habitats, and 5,240 m of stream mitigation with riparian planting. WEX:H also had large mitigation requirements, with a minimum of 10.2 ha within gullies, including 4 ha of gully swamp forest. Waterview RMA conditions required 343 m of stream offset mitigation. CSM2 did not specify mitigation measures in the RMA conditions other than to generally state that they were to be included in the CEMP. No mitigation work was required in any of the small-scale projects.

M2PP, Waterview, and WEX:H all had ecological monitoring requirements. A summary of the monitoring requirements is presented in Table B.1 below. None of the other case studies had RMA conditions that required any form of ecological monitoring.

Table B.1 Summary of ecological monitoring requirements for M2PP, Waterview, and WEX:H

M2PP	Waterview	WEX:H
• 1 year of baseline pre-construction monitoring – vegetation, freshwater and marine ecology, fernbird • 2 years of post-construction vegetation and freshwater and marine ecology monitoring • 5 years of post-construction wetland monitoring • 2 years of post-construction fernbird monitoring • 4 years of post-construction fish passage monitoring	• Freshwater: two baseline surveys pre-construction, twice annual during construction (fish and macroinvertebrates), annually for (up to) 3 years post-construction, additional monitoring in the event of a trigger event • Oakley Creek water quality: monthly water quality survey, four event-based surveys, two sediment quality surveys per annum • Marine: 6-monthly monitoring starting at least 12 months prior to commencement of construction and continuing for (up to) 3 years post-construction, with additional monitoring in the event of a trigger event	• Kahikatea monitoring (Mangaonua Gully) for 3 years post-construction • Pre-construction monitoring, including minimum of two bat surveys • Annual bat monitoring reported annually for 5 years, then 5-yearly until 15 years post-commencement of works • Little shag nesting activity monitoring for 3 years post-construction

B.1.2 Decision-making process

The decision-making process for granting the consent occurred at the local and regional authority level for the small-scale projects and WEX:H. M2PP, Waterview, and CSM2 consents were all granted through the Board of Inquiry decision-making process.

B.1.2.1 M2PP

M2PP conditions were prescriptive in terms of the area and length of mitigation to be provided, timeframes for pre- and post-construction monitoring, and fernbird requirements. All other matters described in the RMA conditions were outcome based, with the detail left to the ecological management plan and site-specific ecological management plan. The site-specific ecological management plans in particular allowed for the mitigation sites to be designed around the expressway infrastructure, which had only been done to a high-level at the Board of Inquiry stage, thereby allowing flexibility in detailed design. This approach was likely appropriate for the scale of ecological effects expected.

Aquatic ecology effects ranged from very low to high, depending on the watercourse. Experts accepted that most streams were in low ecological condition, with some disagreement around the ecological value but general acceptance that the proposed mitigation was appropriate. The exception was the Waikanae River, where witnesses agreed that it had higher ecological values and more sensitive taxa. The primary concerns of submitters were about effects on streams, mitigation provisions, and the possibility of earthquake-related sediment discharge. One submitter sought to limit the reclamation or diversion allowed pursuant to the resource consent. However, the view of the Board of Inquiry was that this would remove a significant degree of flexibility due to the potential for stream length to alter depending on the final design. In the view of the Board, limits on reclamation and mitigation provisions should be set out in the ecological management plan, and overall they considered that the proposed conditions adequately addressed potential adverse freshwater ecology effects.

Avifauna effects were assessed as potentially high for the fernbird and low for all other species. This is reflected in the specificity of the fernbird requirements set out in the RMA conditions. Herpetofauna effects

were also assessed as low, and the few conditions addressing these effects are likely sufficient. Marine ecology effects were determined to be negligible. Discussion around avifauna, herpetofauna, and marine ecology effects was very limited in the Board of Inquiry hearing.

Terrestrial ecology effects varied from low to moderate in most places, except for an area of kānuka forest remnant which the project was expected to have a high effect on. There was some disagreement over appropriate ecological compensation ration for terrestrial/wetland vegetation – but the Board (and experts) accepted that there are no standards or mandatory tools in New Zealand and therefore it must be considered on a case-by-case basis. Agreement was reached between experts over the general appropriateness of terrestrial ecology conditions after extensive conferencing during the Board of Inquiry process.

Overall, the RMA conditions set specific requirements for mitigation and monitoring timeframes, but details were left to management plans. Therefore, the ecological management plan itself is a large determinant as to the success of mitigating adverse project effects on ecology. Nevertheless, after applying RMA considerations, the Board of Inquiry was satisfied that any potential adverse ecological effects were appropriately mitigated in the RMA conditions.

B.1.2.2 Waterview

Waterview RMA conditions were typically general, with references back to the ecological management plan and requirements to undertake works in accordance with other specified environmental plans. However, there were some specific monitoring and mitigation requirements. This approach was likely appropriate for the scale of ecological effects expected. The general intent of the Board of Inquiry during the decision-making process was to preserve or improve the current ecological values on site.

Aquatic ecology effects were expected to be minor or less than minor with appropriate mitigation, and some benefits were expected with additional water quality treatment. The avifauna and herpetofauna effects were assessed as minor. The freshwater, avifauna, and herpetofauna conditions were all agreed by experts in the Board of Inquiry hearing process.

Marine ecology effects were determined to range between minor and moderate. Temporary marine effects were expected to be negligible with adequate mitigation, while permanent occupation of the coastal area was deemed to be at least a moderate effect. Submitters were concerned about water quality effects in the Waterview estuary, on mangrove habitat, on shell beds, and on the nearby marine reserve (which was outside the scope of the Board of Inquiry). However, experts agreed in the hearing that the proposed loss of mangrove habitat was not significant, that the monitoring conditions were sufficient, and that there was limited capacity for any further on-site mitigation. Limited matters were not able to be agreed between experts, but the Board preferred the position of Waka Kotahi (consent applicant). Having considered all the evidence and submissions, the Board concluded that the proposed marine ecology conditions were appropriate for the effects identified.

Terrestrial ecology effects were expected to be minor in most areas but significant related to the eco-tone sequences at Traherne Island. Vegetation conditions were largely agreed between experts, with some outstanding matters decided by the Board. Ongoing weed management was a subject of debate in the decision, with matters discussed including the responsibilities of Waka Kotahi under other legislation, and the ability to enforce proposed requirements.

Overall, as the conditions have a strong reference back to the ecological management plan, the ecological management plan itself was a crucial factor in determining whether ecology goals were met across the project. In general, the consensus was that the urban receiving environments and streams (eg, Oakley Creek) were already highly modified environments, so the project and subsequent conditions were likely to benefit the ecological environment, thus achieving the Board’s general intent.

B.1.2.3 CSM2

In contrast, CSM2 conditions were not very prescriptive at all for the size of the project. Effects on aquatic ecology, terrestrial vegetation, and herpetofauna were expected to be low, and relatively few conditions were framed around these areas.

In the Board of Inquiry process there were no submissions related to negative ecological effects and two submissions that supported the proposed enhancement of aquatic ecology. It was discussed that the project footprint consists of pasture, shelterbelts, rural/residential areas, and road verges with low ecological value. While there was likely to be displacement of bird species, it was assessed that the further disturbance to the already highly modified existing environment would not adversely affect existing bird populations to any significant degree. The only adverse terrestrial effect was expected to be habitat loss for lizards, and therefore a consent condition for a lizard management plan was required. In terms of aquatic ecology, it was noted that low-value stockwater races were present and would be diverted or piped. Piping water races would result in habitat loss, but this was appropriately mitigated through riparian planting. Overall, there was very little consideration of ecology for this project; however, the RMA conditions were likely to be sufficient for the environment.

B.1.2.4 WEX:H

WEX:H conditions were also prescriptive and specific in relation to bats, gully systems, and lizards. Other details were typically left to management plans. Unlike the other large-scale projects, WEX:H was consented through the relevant local authorities. There was agreement between the regulatory authorities (Waikato District Council, Hamilton City Council, and Waikato Regional Council) that ecological effects were best addressed through regional consents rather than designations. A joint hearing was held to address issues raised for both the regional consents and notice of requirements applied for.

Aquatic ecology effects were expected to be significant if not managed correctly. While most watercourses along the proposed alignment were deemed significantly modified by farming, some drains and gullies provided habitat for the ‘at-risk’ black mudfish and other threatened or at-risk species. Provisions were made for these species in the RMA conditions, and overall the hearing commissioner was satisfied that the adverse effects on aquatic ecology could be adequately avoided, remedied or mitigated.

The effects on bird populations and bird habitat were considered less than minor, as were the effects on herpetofauna. However, the effects on the long-tailed bat, a threatened endemic species classified as ‘nationally vulnerable’, were considered to be potentially significant. There was some disagreement between the application, reporting officers and DOC in relation to the limited knowledge on long-tailed bat populations within the project area during the hearing, but consensus was reached that the conditions were appropriate to manage the potential effects.

Terrestrial ecology effects were expected to be no more than minor, subject to the recommended mitigation. It was noted in the application that the majority of the WEX:H corridor consisted of a highly modified and intensively farmed landscape, which had very limited indigenous vegetation or fauna. The main issue of contention in the hearing was the quantum of ecological restoration works proposed for the Mangaonua and Mangaone gully systems and kahikatea swamp forest. Eventually, 10.2 ha of restoration was agreed upon, deemed appropriate, and included in the RMA conditions.

Overall, there was a strong reference to the ecological management and restoration plan, and other management plans, in the RMA conditions. The RMA conditions also had a strong focus on gully restoration and bats, which is consistent with the highest identified ecological effects. It was accepted that the effects were acceptable, and the mitigation measures proposed (or otherwise imposed through RMA conditions) were appropriate in the circumstances.

B.1.2.5 Barters Road

There were no ecology conditions in the Barters Road consent. Some surface water drains were identified as flowing through the site in the assessment of environmental effects (AEE). The only potential effects on ecology identified in the AEE related to sediment discharge, and this was controlled through the ESC RMA conditions. It is unlikely that there was any potential ecological effect, and the approach taken was sufficient.

B.1.2.6 Mingha Bluff

The Mingha Bluff conditions were highly tailored to the effects on mistletoe, *Coprosma acerosa*, and the riparian environment. The focus here was on addressing and managing key effects. The resource consent decision reports for the regional consents simply stated that the proposed activity did not conflict with the purpose of the RMA, given the conditions.

The aquatic ecology effects were assessed as high but largely able to be mitigated with the RMA conditions. A number of streams and wetlands were in the path of the new section of road, but the works also presented an opportunity to upgrade aquatic habitats giving potential ecological benefit. Overall, the Environment Canterbury officer's report, assessing the application, found that the mitigation and remediation proposed would likely provide an improved ecological habitat for aquatic species and that long-term effects were minor.

Even though the project footprint was reasonably small, the terrestrial ecology effects were assessed as potentially very high due to the receiving environment consisting of at-risk indigenous vegetation in Arthur's Pass National Park. The removal of mature beech trees was an unavoidable effect in the proposal, and this had the potential to result in the loss of populations and habitat of the beech mistletoe, a critically endangered endemic species. A number of other species and habitats were also expected to be adversely affected by the project. However, the Environment Canterbury officer's report considered that the proposed mitigation and remediation would result in minor long-term effects on terrestrial ecology and that best practice had been applied.

Overall, the consent application outlines significant efforts to minimise and mitigate ecological effects, which are reflected in the RMA conditions.

B.1.2.7 SH58 Interchange

There were only a few general ecology conditions in the SH58 Interchange consent. The potential effects were expected to be low and generally related to vegetation clearance and potential sediment discharges to water. The conditions cover revegetation plans, vegetation conservation, and fish passage, and are consistent with minor stream works.

B.1.2.8 Welcome Bay

There were also very few ecology conditions in the Welcome Bay consent. The potential effects were expected to be low, and generally related to minor stream works. The conditions only require that fish passage is maintained and are consistent with minor stream works.

B.2 Erosion and sediment control

B.2.1 RMA condition requirements

The specificity and number of ESC RMA conditions was highly varied between case studies, irrespective of the scale of the project. Waterview had the most comprehensive ESC consent condition requirements, while M2PP had the least, as all details were deferred to management plans.

For each case study, the construction works were required to be in accordance with an ESC guideline document prescribed in the RMA conditions. The ESC guidance document specified in each case was developed by the relevant regional council under whose jurisdiction the proposed works would be taking place. The only exception to this rule was SH58 Interchange, where the Auckland Regional Council (1999) Technical Publication 90 (TP90) ESC guidelines were specified even though the project was in the Wellington region. However, this was only because the SH58 Interchange decision came out in 2001, prior to the development of GWRC's ESC guidelines, which were published in 2002. M2PP and CSM2 were also prescribed an additional guideline document in the RMA conditions: the Waka Kotahi *Erosion and Sediment Control Standard for State Highway Infrastructure* (NZ Transport Agency, 2014a). The content of the Waka Kotahi guideline is very closely aligned with TP90 and the GWRC guidelines.

All case studies were required to develop an ESCP that also required certification or approval by the relevant regional council. The four large-scale case studies also had to develop flocculation management plans for certification. M2PP and Waterview were further required to submit site-specific ESCPs for certification by the relevant regional council. The RMA conditions of Waterview, M2PP and WEX:H also required as-built ESCPs to be approved by council and a specific sediment-control team to be in place for the duration of construction, whose function was to oversee on-site ESC and meet on a weekly basis with the regional council.

All the case studies had some form of routine monitoring. For Barters Road, SH58 Interchange, and Welcome Bay, monitoring was not formalised in the RMA conditions; rather, it was required to be included in their respective ESCPs. M2PP, Waterview, and CSM2 all were required by consent condition to carry out turbidity monitoring. Waterview also was required to monitor pH, and routine monitoring of total suspended solids (TSS) was required for CSM2. WEX:H RMA conditions specified weekly checks to ESC structures to ensure that they were maintained to perform at a minimum of 80% capacity. Mingha Bluff RMA conditions specified visual inspections of ESC devices (weekly), visual clarity of adjacent surface water (daily), and watercourses for erosion and scour (every 6 months).

Various additional monitoring requirements were also written into the RMA conditions of various case studies. Triggered event monitoring for turbidity was required at M2PP within two hours of an exceedance or event. TSS grab sampling at the inlet and outlet of sediment retention ponds after a rainfall trigger event was required at SH58 Interchange. WEX:H and Mingha Bluff required all ESC structures to be inspected within 24 hours of a rain event. Waterview, CSM2, Barters Road, and Welcome Bay all did not specify triggered monitoring requirements in their RMA conditions; however, details of potential triggered monitoring was required in the ESCPs for both Waterview and CSM2.

The minimum discharge treatment standards applied to each project were also highly variable. Waterview set the initial treatment standard for discharges at an initial maximum threshold for turbidity of 50 NTU and pH of 7.5, but also prescribed a 3-month monitoring programme to develop better turbidity and pH standards. CSM2 set out defined treatment standards in the RMA conditions, with stormwater discharges not to exceed 55 NTU (turbidity) or 100 mg/L TSS, and dewatering discharges not to exceed 30 NTU or 50 mg/L TSS. In contrast, WEX:H focused on setting standards for maximum flocculant concentrations (soluble aluminium concentration in discharges to be less than 0.2 g/m^3 and pH between 5.5 and 8.5) rather than the desired outcome of low turbidity/TSS. Barters Road RMA conditions prescribed that TSS in any discharge must be less than 100 m/m^3, and that for discharge to ground there must be at least 5 m separation between the discharge point and the highest recorded groundwater level. The discharge treatment standard for Mingha Bluff was that reduction in visual clarity was not to exceed 20% absolute. For SH58 Interchange, flocculation was required in sediment retention ponds where efficiencies for TSS were less than 70%. No discharge treatment standards were specified for M2PP or Welcome Bay.

Waterview and WEX:H both had earthworks season requirements, where no earthworks were to take place during winter (defined as 1 May to 30 September) without written approval from the relevant regional council. No other case study had an earthworks season prescribed in the RMA conditions.

B.2.2 Decision-making process

B.2.2.1 M2PP

There were a number of ESC RMA conditions for M2PP (five specific conditions), with a number of general conditions highlighting the requirement for various ESC management plans and specific conditions addressing water quality turbidity requirements.

ESC issues were not a major consideration for the Board of Inquiry as Waka Kotahi (the applicant) and GWRC had reached a substantive agreement on this topic prior to and during the hearing process. The main disagreement was around GWRC's proposed condition to specify an efficiency figure (95%) for the sediment removal at sediment control devices. Waka Kotahi opposed this condition due to the high cost of installing devices required for this monitoring and because a high level of turbidity monitoring was already proposed. The Board agreed with Waka Kotahi, as there was an absence of real evidence as to the benefits of additional monitoring.

There was potential for ESC effects to be significant if not managed adequately, but with appropriate ESC measures in place, effects were expected to be less than minor. In general, potential effects were to be managed in accordance with GWRC's ESC guidelines unless the Waka Kotahi ESC guidelines were more stringent. As the conditions have a strong reference back to the ESC management plans, the ESCP itself was a crucial factor in determining whether ESC goals were met across the project. Overall, the thrust of the conditions was strongly influenced by the ESC guideline documents, and while the conditions are concise, it is likely that they were sufficient to avoid, remedy or mitigate potential adverse effects.

B.2.2.2 Waterview

There were a significant number of ESC conditions to be complied with for Waterview (35 conditions). While there were a number of standard ESC conditions, such as requiring perimeter controls to be operational prior to works beginning, there were also specific requirements around management plans, discharge treatment standards, and monitoring. Significant oversight and approvals were required by Auckland Council, in terms of management plan certification, pre-construction meetings, and weekly reporting.

Issues relating to ESC were not a major component of submissions and therefore the issue was only touched on briefly by the Board of Inquiry. The Board accepted, in the absence of any effective challenge from other parties, the technical suitability of the ESC devices proposed by Waka Kotahi (the applicant).

There was potential for significant effects if ESC was not managed correctly, but with the appropriate ESC measures in place, the effects are likely to be less than minor. In general, the effects were to be managed in accordance with the most stringent of the TP90 ESC guidelines or the ESCP. Overall, the conditions were likely more than adequate to minimise the potential disturbance effects.

B.2.2.3 CSM2

There were a limited number of ESC conditions associated with CSM2 (10 conditions). The majority of these conditions were not very prescriptive, with requirements around what should be included in the ESCP (without specifying any detailed requirements) and other standard conditions. However, there were a number of specific conditions around monitoring of the ESC devices and minimum discharge treatment standards.

There were a number of submitters that raised ESC issues in the Board of Inquiry process, particularly with concerns around the adverse effects of sediment discharge to surface water and stockwater races. However, the Board was satisfied with the ESC provisions outlined in the ESCP and conditions for the control and remedy of adverse effects that might arise. Based on this assessment, the Board indicated that effects of sediment discharges to the receiving environment were expected to be no more than minor.

Overall, the thrust of the conditions was strongly influenced by the ESC guideline documents, and it is likely that the conditions were adequate to manage the potential effects.

B.2.2.4 WEX:H

WEX:H had a large number of ESC RMA conditions (25 conditions). Some of these conditions were standard, with some repetition of the Waikato Regional Council ESC guidelines (Environment Waikato, 2009), while others were very prescriptive, particularly in relation to minimum discharge treatment standards.

A number of issues were raised during the hearing process, including the efficacy of the proposed discharge treatment standard (TSS limit of 100 g^3/m), and erosion and flooding effects. Based on the expert witness, it was agreed that the discharge treatment standard was appropriate and proposed measures to reduce erosion and flooding were adequate.

The ESC effects were expected to be no more than minor if the conditions were complied with. Overall, the RMA conditions were strongly influenced by the Waikato Regional Council ESC guidelines, and it is likely that the effects can be adequately managed from these conditions.

B.2.2.5 Barters Road

There were six ESC RMA conditions under the regional discharge consent and eight under the regional earthworks consent, although some of these conditions overlapped. The conditions were not very prescriptive and largely required construction works to be carried out in accordance with the certified ESCP. However, there were two performance standard conditions that specified the required discharge criteria. The ESCP was prepared in accordance with Environment Canterbury's (2007) ESC guideline.

Potential adverse effects included sediment discharged to the existing stormwater system, which may reduce the visual clarity and oxygen content of the Barters Road drain and smother in-stream habitats. However, once ESC measures were in place, ESC-related issues were expected to have a less than minor effect on the environment. The section 42A officer's report also noted that the applicant (Waka Kotahi) was relying on a robust ESCP. Therefore, even though the consent consisted of very standard ESC conditions, the effects were likely to be adequately managed through the certified ESCP.

B.2.2.6 Mingha Bluff

There were 12 ESC RMA conditions under the regional discharge consent and three under the regional earthworks consent. The conditions used were fairly standard, although prescriptive monitoring requirements and performance standards were also included. Works were required to be carried out in accordance with the certified ESCP, which in turn was to be prepared in accordance with Environment Canterbury's ESC guideline.

While the receiving environment consisted of a number of high ecological habitats and species, the section 42A officer's report was satisfied that the ESC measures proposed adequately addressed the potential effects. The overall effects were expected to be minor and the RMA conditions adequate.

B.2.2.7 SH58 Interchange

There were 20 ESC RMA conditions under the regional discharge consent, 15 under the regional earthworks consent, and five under the land-use consent, although some conditions overlapped between consents. Fairly standard ESC conditions were used, with works to be in general accordance with TP90 and the certified ESCP.

A number of issues were presented at the hearing for the SH58 Interchange project. A key issue was the potential adverse ecological effects of sedimentation resulting from the proposed construction works and the method of calculating this. For example, the universal soil loss equation was used by Waka Kotahi (the applicant) to show the additional annual sediment load for Haywards Stream would range from 23% to 113%, while the council calculations were calculated differently and ranged from 110% to 249%. This debate resulted in the overall opinion that there were potentially significant adverse effects from sedimentation that needed to be managed. ESC issues were prominent in the hearing because the mode of control, the relatively new Auckland TP90 standard, was untested in the Wellington region.

Constructing ESCs to a TP90 standard was determined to be the best practicable option to address the effects. One interesting condition imposed was a half-day training event in the practical implementation of TP90 for all contractors' staff involved in ESC. Overall, the conditions were likely more than adequate to address the potential effects; however, a cautious approach was taken because the TP90 guidelines were untested in the Wellington region at the time.

B.2.2.8 Welcome Bay

There were a limited number of ESC conditions associated with Welcome Bay (15 conditions). The conditions were not very prescriptive and required works to be in general accordance with the Bay of Plenty Regional Council (BOPRC) ESC guidelines and the approved ESCP.

The main ESC RMA conditions were associated with the replacement of a culvert under Te Puke Highway. Effects associated with construction works were expected to be no more than minor with ESCs in place. The conditions and associated ESCP were likely adequate to manage the potential effects associated with the project.

B.3 Stormwater

B.3.1 RMA condition requirements

The number of RMA conditions related to stormwater were highly variable amongst the case studies. M2PP only had three stormwater conditions, although these were detailed and had sub-parts. Waterview, CSM2, and WEX:H all had in the order of 25 stormwater-related RMA conditions. Barters Road had two stormwater RMA conditions, Mingha Bluff had six, SH58 Interchange had zero, and Welcome Bay had five.

The Waka Kotahi guidance document *Stormwater Treatment Standard for State Highway Infrastructure* (NZ Transport Agency, 2010a) was referenced in the RMA conditions of M2PP, CSM2, WEX:H and Mingha Bluff. No specific guidance documents were mentioned in the Waterview RMA conditions, but the Operational Design Philosophy report submitted with the application referenced a wide range of Australian, New Zealand, and Auckland-specific stormwater design guidance documents. Design of the culvert for Welcome Bay was to be in accordance with the BOPRC (2012) *Hydrological and Hydraulic Guidelines*. No stormwater design guidance documents were referenced in the Barters Road or SH58 Interchange consents.

Only two of the case studies – Waterview and CSM2 – were required by consent condition to develop stormwater management plans. Waterview was required to produce both a temporary stormwater

management plan and an operational stormwater management plan. CSM2 was required to produce a stormwater operation and maintenance plan.

A number of projects required design certification, with final stormwater design to be submitted for approval to the relevant regional council for all the large-scale projects. M2PP stormwater design and flood modelling was also required to be peer reviewed by a suitably qualified and experienced engineer. This was split into a number of stormwater compliance reports that essentially form stormwater management plans.

Certification of the stormwater design plans from a chartered professional engineer was also required for CSM2 prior to construction. Conversely, the Mingha Bluff stormwater system required post-construction certification by a charted professional engineer. Design of the culvert at Welcome Bay was required to be certified by BOPRC. The Barters Road and SH58 Interchange consents did not require certification for stormwater design.

Climate change considerations varied widely between consents. M2PP had the most comprehensive assessment of potential climate change effects and mitigation. Flood risk for M2PP was required by consent condition to be assessed against the 1% AEP storm, with climate change to 2115 (mid-range scenario) accounted for, and sensitivity evaluations for the high-range climate change scenario to 2115. CSM2 also had a consent condition that required the effects of climate change to be accounted for to 2080. The Waterview RMA conditions mentioned making 'allowances for climate change' but did not specify a scenario year. However, the Waterview application and decision documents accounted for climate change to 2090 and sea-level rise to 2100. Similarly, no consideration of climate change was specified in the RMA conditions for WEX:H, Barters Road, Mingha Bluff, SH58 Interchange, or Welcome Bay. Allowances for increased rainfall intensity due to climate change were, however, specified in the applications for WEX:H (for a 2090 scenario), Barters Road (for a 2100 scenario) and SH58 Interchange (no scenario-year identified).

Flood attenuation, to control the flow of water as it re-enters a drainage system or watercourse, was required for the M2PP and Waterview projects. M2PP had prescriptive requirements, where the peak rate of discharge was not to exceed 80% (urban) or 100% (rural) of the pre-expressway peak discharge. Waterview RMA conditions required flood attenuation in specific areas and identified that where attenuation was not proposed, the 100-year annual recurrence interval overflow was able to be managed in the existing overland flow paths. No other case studies had specific requirements around flood attenuation in their RMA conditions.

Stormwater treatment was required before discharge in the RMA conditions of the four large-scale projects and Mingha Bluff. Generally, treatment was required to be in accordance with the Waka Kotahi guidance document *Stormwater Treatment Standard for State Highway Infrastructure* (NZ Transport Agency, 2010a). Waterview was the exception to this – its conditions referred to Waka Kotahi Technical Report G.15 (NZ Transport Agency, 2010b) (part of the application), which references operational and construction phase treatment against Auckland Regional Council's (1992) TP10 guidelines. Operational TSS removal rates were further specified for Waterview, CSM2, and WEX:H. Waterview required a 75–80% TSS removal rate for both the construction and operation phase of the project; CSM2 RMA conditions dictated that TSS should not exceed 100 mg/L in all discharges to water; and WEX:H prescribed that TSS in discharges should not exceed 100 g/m^3.

B.3.2 Decision-making process

B.3.2.1 M2PP

While there were few stormwater conditions for M2PP, the ones applied were very detailed with prescriptive operational design standards. The conditions were largely agreed upon between Waka Kotahi (the

applicant), GWRC, and Kāpiti Coast District Council (KCDC), although some minor issues were resolved by the Board of Inquiry.

The potential effects of climate change were a major subject of debate in the Board of Inquiry hearing. Professor Martin Manning, a leading New Zealand expert on climate change, gave evidence at the hearing expressing serious reservations about the location of the expressway (in a coastal area) and the need to be conservative and risk averse when calculating potential climate change effects. This had a large influence on the resultant prescriptive climate change conditions. A large number of submitters were also concerned about the Waikanae River Bridge; hence the location was specifically chosen, and stringent design criteria were applied. All parties agreed that it was prudent to require a peer review of the stormwater management design and flood risk modelling; however, the Board sided with GWRC over Waka Kotahi that additional certification of the peer review by GWRC was also required.

During the hearing process, KCDC also argued that two-stage stormwater treatment should be applied to a wider number of streams than Waka Kotahi was proposing. Water quality effects for these streams were assessed as minor by Waka Kotahi ecologists, and the Board agreed with Waka Kotahi on the adequacy of the proposed treatment.

The stormwater-related effects of the project were assessed as minor if the proposed mitigation was implemented. A significant amount of time was invested at the Board of Inquiry hearing to ensure that the RMA conditions were adequate to address stormwater and associated climate change issues.

B.3.2.2 Waterview

Waterview had a substantial number of stormwater RMA conditions. The conditions were not very prescriptive, other than requiring the proposed works and required management plans to align with the standards presented in the technical stormwater reports submitted in the application.

The Board of Inquiry accepted the applicant's (Waka Kotahi) operational stormwater design philosophy. The Board also noted that Waka Kotahi had carried out extensive assessment of construction and operational stormwater treatment devices and no parties challenged the technical feasibility of these. However, one key area of concern for submitters was the potential for increased flooding to an area of private land where flooding was already an existing issue. Auckland Council appeared to accept the stormwater mitigation provided in the application, but the Board 'had residual concerns'. Changes were made to include a consent condition that required the operational stormwater system to mimic the existing hydrologic system, but after Waka Kotahi questioned whether they would be able to comply, the wording was changed to 'best practicably mimic'. While a number of submitters raised concerns about the level of operational stormwater treatment proposed, the Board found that the draft conditions were fit for purpose.

The scale of stormwater effects was considered to be less than minor for most of the project, and minor in relation to the potential flooding risk for specified properties. Overall, the conditions were likely adequate to address the expected effects given the high-quality application and further improvements made to the RMA conditions influenced by submitters' concerns and the hearing process.

B.3.2.3 CSM2

CSM2 also had a substantive number of stormwater RMA conditions. Some were fairly prescriptive in terms of the design and treatment standards required to be met. An operational stormwater management plan was also required to be developed.

Only one submission was received, from Christchurch City Council, in relation to a perceived conflict between plans for the CSM2 stormwater system and other stormwater infrastructure under Christchurch City Council control. However, work had been undertaken to resolve this before the Board of Inquiry hearing, and

it was no longer an issue. Overall, the Board found that Waka Kotahi (the applicant) had appropriately designed the proposed stormwater system with mechanisms for maintenance and operational procedures. The scale of stormwater effects was expected to be no more than minor, and it is likely that the RMA conditions adequately addressed effects.

B.3.2.4 WEX:H

There were a substantial number of stormwater conditions associated with the WEX:H consent. The RMA conditions were fairly general, although a prescriptive treatment output concentration was specified.

During the hearing, a number of issues related to stormwater effects were discussed. The ecological effects of construction- and operation-phase stormwater discharges were discussed in some detail, and the hearing commissioner concluded that based on expert evidence they were satisfied that the conditions imposed would adequately address effects.

Stormwater-related erosion and flooding issues were a particular concern for many submitters. The hearing commissioner accepted expert evidence that adverse erosion and flooding effects could be adequately managed but, due to inadequate information in the proposal, implemented conditions that explicitly stated that works would avoid creating new, or exacerbating existing, flooding effects.

The scale of stormwater effects for WEX:H was determined to be no more than minor if the proposed design standards were implemented. Stormwater design was based on the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* (NZ Transport Agency, 2010a). No consideration of climate change was discussed at the hearing or included in the RMA conditions, which was unique when compared against the other large-scale case studies. Nevertheless, the AEE submitted with the application acknowledged that the culverts had been designed to account for increased rainfall due to climate change for a 2090 scenario. Overall, it is likely that the RMA conditions were adequate to address the expected effects.

B.3.2.5 Barters Road

Very few stormwater conditions were imposed on the Barters Road consent. Construction stormwater issues were managed through the ESC conditions. A prescriptive consent condition required that stormwater discharge from the site was not to contain more than 100 g/m^3 TSS. The potential stormwater-related effects were expected to be no more than minor, and the section 42A officer's report accepted that the application documentation appropriately addressed all potential effects.

B.3.2.6 Mingha Bluff

A number of stormwater conditions were associated with the Mingha Bluff consent. Some prescriptive conditions in the consent included requirements for post-construction certification of the stormwater system, monitoring requirements, and a specific swale design standard.

The AEE found that there would be an increase in stormwater runoff (and associated stormwater contaminants) due to the increase in road seal. Infiltration to ground via treatment swales was proposed as the mitigation solution. Potential flooding effects were determined to have no effect on rail infrastructure, and the culvert design was peer reviewed by KiwiRail. The section 42A officer's report considered that the proposed treatment and discharge of stormwater was the best practicable option for the site.

Stormwater discharge was expected to have a less than minor effect on water quality within the waterways along the length of the proposed alignment. The consent relied on the effectiveness of the proposed stormwater mitigation devices, as visual monitoring conditions were included but no testable standard for

contaminants was implemented. Overall, it is likely that the RMA conditions were adequate to address the expected effects.

B.3.2.7 SH58 Interchange

No stormwater conditions were imposed on the SH58 Interchange consent. Stormwater design was briefly addressed in the AEE, which also stated that the culverts had been designed to account for increased rainfall intensity due to climate change.

B.3.2.8 Welcome Bay

Very few stormwater conditions were imposed on the Welcome Bay consent. The effects were expected to be minor as the roundabout construction resulted in a net decrease in surface water runoff due to a slight decrease in impervious area.

B.4 Noise and vibration

B.4.1 RMA condition requirements

The four large-scale case studies all had fairly rigorous construction and operational noise and vibration requirements to comply with. SH58 Interchange had a more limited number of noise and vibration RMA conditions. The remainder of the small-scale case studies had no construction or operational noise and vibration conditions.

B.4.1.1 Construction noise and vibration

Identical construction noise limits were applied to, and referenced in the RMA conditions of, M2PP and CSM2, based on NZS 6803:1999 *Acoustics – Construction Noise* (New Zealand Standards, 1999) using the long-term activity duration limits. WEX:H and SH58 Interchange RMA conditions also required that construction noise limits be formulated in accordance with NZS 6803:1999 but did not state these limits in the RMA conditions or specify that the long-term activity duration limits should be used. Waterview required that construction noise be assessed and measured in accordance with NZS 6803:1999; however, it prescribed comprehensive noise limits in the RMA conditions based on the type and location of the receiver, and the type of activity being undertaken. In particular, the noise criteria for air-blasting activities prescribed for Waterview allowed for a much higher level of noise than was consented for under the other case studies.

Identical construction vibration limits were also applied to M2PP and CSM2, based on the German Standard DIN 4150-3:1999 *Structural Vibration Part 3: Effects of Vibration on Structures* (German Institute for Standardization, 1999) using the most stringent Category A criteria, or the Category B criteria where Category A cannot be practically met. WEX:H specified the same vibration limits as M2PP and CSM2, but also specified additional limits for transient and continuous vibration for underground services. Waterview required that construction vibration be measured and assessed in accordance with DIN 4150-3:1999; however, the criteria referenced in the RMA conditions had more permissive long-term vibration criteria, and comprehensive short-term vibration criteria to address blasting activities. None of the small-scale projects had construction vibration requirements.

Only Waterview and CSM2 had specific consent requirements around protected premises and facilities (PPFs). If the Waterview noise and vibration monitoring indicated that the criteria set out in the consent would potentially be exceeded, then additional consent requirements came into effect, particularly around educational facilities and specific residences that may need to be relocated. CSM2 had specific noise limits for work close to a nearby wedding venue and required advance notification of pile-driving activities for livestock purposes.

Preferred mitigation options (PMOs) for operational noise were prescribed for M2PP, Waterview, and CSM2. Where practicable, these mitigation options were to be installed prior to construction works if it would also help mitigate construction noise (eg, noise barriers).

Guidelines on what must be included in the construction noise and vibration management plan (CNVMP) were stated in the RMA conditions for M2PP, Waterview, and CSM2. The CNVMP for WEX:H was required to be in accordance with the Waka Kotahi *State Highway Construction and Maintenance Noise and Vibration Guide* (NZ Transport Agency, 2013). Site-specific CNVMPs were required for M2PP, Waterview, and CSM2 where it was predicted that noise or vibration limits could not be achieved at a particular site.

Similarly, activity-specific CNVMPs were required for WEX:H for any activities that were expected to exceed the noise limits. All CNVMPs were required to be submitted to the relevant territorial authority for certification. M2PP also had an additional requirement that the CNVMPs were required to be reviewed by a suitably qualified independent acoustic specialist prior to being submitted for certification. A CNVMP was not required for any of the small-scale case studies.

B.4.1.2 Operational noise and vibration

M2PP, Waterview, and CSM2 all required operational noise levels to be in accordance with NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads* (New Zealand Standards, 2010). For Waterview, operational noise was not to exceed 40 dBA inside habitable spaces with windows closed in design year, which is stricter than the NZS 6806:2010 guidelines (45 dBA limit). This more stringent limit was also applied to the M2PP consent as a result of the Waterview decision. In contrast, WEX:H and SH58 Interchange both required operational noise to comply with *Transit New Zealand's Guidelines for Management of Road Traffic Noise – State Highway Improvement* (Transit New Zealand, 1999). Only M2PP specified an operational vibration standard: Norwegian Standard NS 8176.E.2005 *Vibration and Shock – Measurement of vibration in buildings from landbased transport and guidance to evaluation of its effects on human beings* (Standards Norway, 2005).

PMOs for operational noise were prescribed for M2PP, Waterview, and CSM2. M2PP RMA conditions included details of the locations of noise walls. Waterview required that permanent noise barriers be installed prior to construction, and that concrete batch plants and loading bays be enclosed. CSM2 RMA conditions included details for the locations, ratings and heights of noise walls. M2PP, Waterview and CSM2 all specified the minimum number of locations where open-graded porous asphalt (OGPA) or an equivalent low-noise-generating road surface was to be used. Any changes to PMOs were required to be approved by relevant councils. PMOs were not specified in the WEX:H consent, but a traffic noise mitigation plan for operation of the expressway was required to be submitted and approved by the territorial authority.

The large-scale case studies and SH58 Interchange all required monitoring for operational noise. No specific timeframe for monitoring was set for M2PP, but a noise monitoring management plan was required to be certified by KCDC. Noise monitoring was required at Waterview for two to three years following the completion of the project. WEX:H was required to conduct noise monitoring within three months, and SH58 Interchange within 6–12 months, following completion of the project. The RMA conditions of CSM2 required that the PMOs must be managed and maintained, but there were no monitoring requirements to test that they were successful in mitigating effects.

B.4.2 Decision-making process

B.4.2.1 M2PP

Prescriptive noise and vibration conditions were applied to the M2PP consent, with RMA conditions detailing specific criteria to be met and processes to follow if exceedances occurred. These conditions are the result of extensive conferencing and debate during the Board of Inquiry hearing process.

Concern around noise and vibration related issues was recorded in 362 of 725 submissions for the project. Given the high levels of concern, the Board carried out an extensive review of the proposed noise and vibration limits to ensure that the effects would be mitigated to acceptable levels. Key issues included traffic noise, engine braking, construction noise, and construction vibration. The Board also discussed the noise limits set for the Waterview project with the relevant experts and decided to adopt the same operational internal noise criterion as Waterview, which was lower than the limit set out in NZS 6806:2010.

The scale of effects was predicted to be significant in some areas, with noise limits predicted to be exceeded, even with the proposed noise mitigation measures in place, during construction at various locations along the route. Site-specific CNVMPs were proposed to manage effects.

Overall, the Board accepted the advice of the noise and vibration experts that, with the detailed suite of mitigation measures and management plans, acceptable levels of noise mitigation could be achieved during the construction of the expressway.

B.4.2.2 Waterview

Waterview had very prescriptive noise and vibration conditions, with comprehensive limits set for different types of noise- or vibration-generating activities. Significant time was spent discussing noise and vibration matters during the Board of Inquiry hearing process.

During the construction phase, 24-hour tunnelling and construction yard operations were proposed close to residential areas and other noise-sensitive areas. A significant amount of expert advice was considered to develop the construction noise criteria, including works at night, in an iterative process. During conferencing, the use of the term ‘as far as practicable’ (referring to mitigation measures) was deleted from the draft conditions; instead, processes were suggested to be followed where noise and vibration criteria could not be met.

There were also significant concerns to address in relation to operational noise and vibration. Submitters from nearby residential dwellings were concerned that significant increases in ambient noise would result for many dwellings. The applicant (Waka Kotahi) maintained that the mitigation measures proposed would be the best practicable option even though the noise effects may still be more than minor for some PPFs but would ‘not be unreasonable’. The Board reluctantly accepted that it was not feasible to mitigate outdoor noise levels any further than what Waka Kotahi was proposing but did not accept that the project should leave the occupants of any dwelling with indoor noise levels incompatible with reasonable living conditions. In a departure from the limits set out in NZS 6806:2010, a lower 40 dB L_{Aeq} internal noise criterion was set, even though Waka Kotahi offered extensive comments in opposition to this decision. The Board also directed amendments to the RMA conditions to ensure appropriate mitigation was carried out at cost to Waka Kotahi and in consultation with the affected property owners.

Overall, the Board made the radical judgement that it did not agree that NZS 6806:2010 adequately embodied the requirements of the RMA. This led to more stringent noise and vibration limits and RMA conditions in order to deliver mitigation that was acceptable to the Board.

B.4.2.3 CSM2

The CSM2 RMA conditions required that noise was managed such that it complied with the relevant standard, and where this was not practicable, alternative mitigation strategies were specifically identified in the conditions.

Several submissions raised issues relating to construction noise and vibration impacts on nearby residential properties or livestock. However, after some consideration, the Board of Inquiry was satisfied that effects would be appropriately managed through the CNVMP and RMA conditions.

Operational noise and vibration issues were more contentious, with 10 separate submissions on the topic. The effects of operational noise from CSM2 on nearby residents and a poultry farm were all determined to be negligible by the Board, so no conditions were altered or added. However, there was extensive debate over the expected noise effects on a nearby wedding venue. Ultimately, while the increase in noise levels was substantial and the mitigation measures proposed were not very effective, the resultant noise levels were still deemed fit for purpose for the venue.

The Board also commissioned an independent report on construction and operational noise relating to the project. This report included the background to NZS 6806:2010, how the standard has been applied to other roading projects, how this standard was derived, how it works, and how it deals with mitigation.

Overall, the Board was satisfied that noise and vibration issues were managed appropriately based on the consent condition requirements and proposed CNVMP.

B.4.2.4 WEX:H

The WEX:H noise and vibration conditions were prescriptive, requiring specific limits to be met and works to be in accordance with a CNVMP. The noise effect was considered as an alteration to an existing designation at the time of the hearing.

The original designation was based on the (now obsolete) Transit New Zealand noise guidelines. It was noted in the decision that NZS 6806:2010 had been adopted for all new roading projects, but the standard excludes its application to designations with existing noise conditions. NZS 6806:2010 was considered to allow similar or higher noise levels than the Transit New Zealand guidelines.

Activity-specific CNVMPs were not originally conditioned in the existing designation but were proposed as a management tool where the determined limits were likely to be exceeded. Overall, the hearing commissioners considered that with the conditions proposed, any adverse effects relating to noise and vibration would be no more than minor.

B.4.2.5 Barters Road

No noise and vibration RMA conditions were applied to Barters Road. Noise and vibration effects were not considered in the application documents (AEE) or the decision (section 42A officer's report).

B.4.2.6 Mingha Bluff

No noise and vibration RMA conditions were applied to Mingha Bluff. Noise and vibration effects were addressed in the AEE, and other than the Arthur's Pass community, no other sensitive noise receivers were identified near the site. Construction noise was proposed to be managed in accordance with the relevant standards to ensure effects were minimised. Improvements to the alignment of the road were deemed likely to result in a net decrease in operational noise due to deceased engine braking by heavy vehicles. Overall, it was determined that there would be no adverse noise effect.

B.4.2.7 SH58 Interchange

A limited number of construction noise and vibration conditions were applied to SH58 Interchange. During the hearing it was demonstrated that the construction of the project could be carried out in compliance with the limits recommended by the relevant construction noise standard (NZS 6803:1999), which was a condition of consent.

The operational noise and vibration conditions included prescriptive consultation requirements to address concerns of nearby residents and ensure that mitigation options were satisfactory. Overall, the hearing commissioners were satisfied that the conditions would ensure that the expected effects were mitigated appropriately.

B.4.2.8 Welcome Bay

No noise and vibration RMA conditions were applied to Welcome Bay. As there was no major change in alignment or the surface of the road, operational noise was not expected to increase.

Appendix C: Case study consent summaries

C.1 Ecology

Table C.1 Mackays to Peka Peka Expressway (M2PP)

Point of comparison	Comment
Decision maker	Board of Inquiry
Regional council	Greater Wellington
Number of conditions	• General: 7 (G.19, 33B, 34, 35, 36, 37, WS.12) • Monitoring: 7 (38, 38B, 38D, 39, 40, WS.3A, WS.3B) • Mitigation: 9 (41, 41A, 42, 42A, 42B, 42C, 43, 43A, WS.8) • **Total: 23**
General judgement on prescriptiveness	• Conditions prescriptive in terms of area/length of mitigation to be provided, timeframes for pre- and post-construction monitoring, and fernbird requirements. • All other matters outcomes based – detail left to ecological management plan and site-specific ecological management plans.
General observations on intent (including submissions and decision)	• Conditions agreed between Waka Kotahi, KCDC, GWRC, and DOC – exception was a limit on stream loss length (requested by GWRC and rejected by the Board). Decision therefore light on detail. • Aquatic ecology: Experts accepted streams were in low ecological condition, some disagreement of ecological value but general acceptance that mitigation proposed was appropriate. • Terrestrial vegetation: Some disagreement over appropriate environmental compensation ratio for terrestrial/wetland vegetation – but Board (and experts) accepted that there are no standards or mandatory tools in New Zealand and therefore must be considered on a case-by-case basis. • Submitters concerned about effects on streams, mitigation provisions, and earthquake-related sediment discharge.
General observations on scale of effect	• **Aquatic ecology:** Very low to high (depending on water course), permanent effects largely mitigated through new habitat creation and riparian planting • **Avifauna:** Potentially very high for fernbird, low for all other species • **Herpetofauna:** Low • **Marine ecology:** Negligible • **Terrestrial ecology:** Low to moderate, very high for kānuka forest remnant
Summary of requirements	**Documents and methods referenced in application** • *The Conservation Management Strategy for the Wellington Conservancy* (DOC, 2010) • *Protecting our Places: Information about the Statement of National Priorities for Protecting Rare and Threatened Indigenous Biodiversity on Private Land* (Ministry for the Environment [MfE], 2007) • *State Highway Environmental Plan: Improving Environmental Sustainability and Public Health in New Zealand* (NZ Transport Agency, 2008) • *Estuarine Environmental Assessment and Monitoring: A National Protocol* (Cawthron, 2002) • Stream Ecological Value (SEV) • Physical Habitat Assessment (PHA)

Documents and methods referenced in conditions

- *State Highway Environmental Plan: Improving Environmental Sustainability and Public Health in New Zealand* (NZ Transport Agency, 2008)
- *The Conservation Management Strategy for the Wellington Conservancy* (DOC, 2010)
- *The Greater Wellington Regional Pest Management Strategy 2002–2022*
- *Handbook for Monitoring Wetland Condition* (Clarkson et al., 2003)
- *Fish Friendly Culverts and Rock Ramps in Small Streams* (GWRC)
- *Freshwater Spawning and Migration Calendar* (Hamer, 2007)
- Stream Ecological Value (SEV)

General condition requirements

- Ecological management plan to be certified by GWRC, including:
  - ecological management programme
  - permanent + construction mitigation/remediation measures
  - pre-, during, and post-construction monitoring
  - adaptive management
  - details of diversion channels and success targets.
- Must be in general accordance with the draft ecological management plan submitted with the application.
- Site-specific ecological management plans to be prepared for ecological mitigation areas, including:
  - vegetation to be retained
  - target SEV scores
  - location, area, and length of mitigation
  - landscape details and specifications
  - weed and pest management
  - monitoring and replacement.

Monitoring

- 1 year of baseline pre-construction monitoring – vegetation, freshwater and marine ecology, fernbird.
- 2 years of post-construction vegetation and freshwater and marine ecology monitoring.
- 5 years of post-construction wetland monitoring.
- 2 years of post-construction fernbird monitoring.
- 4 years of post-construction fish passage monitoring.

Mitigation (NB: these were changed post-Board of Inquiry to reflect changes to affected area/length)

- Minimum total 40.7 ha of planting.
- Minimum 7.6 ha indigenous terrestrial habitat to reflect loss of 3.8 ha (environmental compensation ratio of 2:1 for kānuka forest and regenerating broadleaf scrub/low forest, 3:1 for mature indigenous forest, no explanation of reason environmental compensation ratio selected).
- Minimum 5.4 ha wetland habitat to reflect loss of 1.8 ha (environmental compensation ratio of 3:1, no explanation).
- Minimum 5,240 m stream mitigation including naturalisation and 17.7 ha riparian planting at 20 m either side (unless otherwise agreed) (SEV used to generate environmental compensation ratio for each stream reach affected).

	• Creation of at least 1.4 km of new stream channel and 10 ha of wetland and riparian planning in flood storage areas 2A and 3. • Mitigation to be implemented within 1 year of completion of bulk earthworks in each stage/area. • Mitigation areas to be legally protected (covenant or other encumbrance). **Aquatic ecology** • Ecological management plan to include a fish rescue and relocation plan. • Ecological management plan to include programme and methodology to manage migration of native fishes for works outside 1 March to 31 July. • Pre-construction mudfish survey. • Ecological management plan to include results of mudfish survey. • 1 year of pre-construction and 2 years of post-construction freshwater ecology monitoring. • 4 years of post-construction riparian mitigation vegetation monitoring and maintenance. • Culverts and bridges (including temporary crossings) to be designed for ongoing fish passage. • Structures to be inspected for fish passage at 1 and 4 years post-construction (including a fish survey in the Muaupoko Stream). **Avifauna** • Ecological management plan to include detail of avoidance of effects on fernbird (construction and operation). • Fernbird habitat to be avoided during breeding season – if any breeding or juvenile birds found, vegetation clearance cannot occur until end of breeding season; trap and transfer for any fernbird found outside breeding season. • 1 year of pre-construction fernbird monitoring. • 2 years of post-construction fernbird monitoring. **Herpetofauna** • Ecological management plan to include lizard management plan. • Capture and relocate. • Re-establishment of lizard habitat. **Marine ecology** • 1 year of pre-construction and 2 years of post-construction marine ecology monitoring. **Terrestrial ecology (including wetlands)** • 1 year of pre-construction and 2 years of post-construction vegetation monitoring. • 3 years of post-construction terrestrial mitigation vegetation monitoring and maintenance. • 1 year of pre-construction and 5 years of post-construction wetland monitoring – wet and dry season – in accordance with *Handbook for Monitoring Wetland Condition*. • 4 years of post-construction wetland mitigation vegetation monitoring and maintenance.
Summary comments	Conditions set specific requirements for mitigation and monitoring timeframes, but details left to ecological management plan/site-specific ecological management plans.

Table C.2 Waterview Connection

Point of comparison	Comment
Decision maker	Board of Inquiry
Regional council	Auckland
Number of conditions	• General: 1 (CEMP.3) • Vegetation: 18 (V.1–V.18) • Avifauna: 6 (A.1–A.6) • Herpetofauna: 1 (H.1) • Stream works/freshwater ecology: 18 (STW.1, 2, 5, 7, 15, 20–26, F.1–F.6) • Coastal/marine ecology: 13 (C.7, M.1–M.12) • **Total: 57**
General judgement on prescriptiveness	Conditions typically general with reference back to the ecological management plan and requirement to undertake works in accordance with other environmental plans. Some specific monitoring and mitigation requirements.
General observations on intent (including submissions and decision)	• Marine ecology: Experts agreed that loss of mangrove habitat not significant, that monitoring conditions are sufficient, and that there is limited capacity for further on-site mitigation. Limited matters were not able to be agreed between experts, but Board preferred the position of Waka Kotahi. • Freshwater conditions agreed between experts. • Herpetofauna conditions agreed between experts. • Vegetation conditions largely agreed between conditions, with some outstanding matters decided by the Board. Ongoing weed management discussed in the decision, including the responsibilities of Waka Kotahi under other legislation and documents and the ability to enforce those requirements. • Avifauna conditions agreed by experts. • General intent to preserve/improve current ecological values on site. • Submitters concerned with water quality in Waterview estuary, effect on shell beds, effect on marine reserve (outside of Board scope).
General observations on scale of effect	• **Aquatic ecology:** Minor or less than minor with appropriate mitigation, some benefits from additional treatment • **Avifauna:** Minor • **Herpetofauna:** Minor • **Marine ecology:** Minor to (at least) moderate – temporary effects expected to be negligible with adequate mitigation, permanent occupation considered moderate (or slightly more) • **Terrestrial ecology/vegetation:** Minor to significant (eco-tone sequences at Traherne Island significant)
Summary of requirements	**Documents and methods referenced in conditions** • Stream Ecological Value (SEV) • *Oakley Creek Re-alignment and Rehabilitation Guidelines* **General condition requirements** • Ecological management plan to be finalised and include details of: – monitoring freshwater ecology, water quality and stream sediment, marine ecology – trigger criteria – procedures for accidental discharges and contingency plans.

	Monitoring • **Freshwater:** 2 baseline surveys pre-construction, twice annual during construction (fish and macroinvertebrates), annually for (up to) 3 years post-construction, additional monitoring in the event of a trigger event. • **Oakley Creek water quality:** monthly water quality survey, four event-based surveys, two sediment quality surveys per annum. • **Marine:** 6-monthly monitoring starting at least 12 months prior to commencement of construction and continuing for (up to) 3 years post-construction, additional monitoring in the event of a trigger event. **Mitigation** • 343 m of stream offset mitigation. **Aquatic ecology** • Stream works and freshwater mitigation and enhancement details to be included in a stream works environmental management plan for approval by Auckland Council, which must be in general accordance with the *Oakley Creek Re-alignment and Rehabilitation Guidelines.* • Project ecologist to monitor all stream works and certify works undertaken in accordance with relevant drawings. • Structures not to impede fish passage. • 2 baseline surveys pre-construction, twice annual during construction (fish and macroinvertebrates), annually for 3 years post-construction, additional monitoring in the event of a trigger event. • Oakley Creek water quality: monthly water quality survey, four event-based surveys, two sediment quality surveys per annum. **Avifauna** • Temporary high tide roosting structures to be provided during construction. • Monitoring of roosting areas to be undertaken (during construction). • Vegetation clearance on Traherne Island to occur outside of breeding season (Sept to Dec), all other vegetation clearance to occur outside of breeding season where practicable. • Pest control to be undertaken on Traherne Island and coastal marine area. **Herpetofauna** • Ecological management plan to include details of lizard management. **Marine ecology** • Removal or pruning of vegetation in coastal marine area limited to areas shown in application. • Removal of mangroves implemented in accordance with the ecological management plan. • 6-monthly monitoring starting at least 12 months prior to commencement of construction and continuing for (up to) 3 years post-construction, additional monitoring in the event of a trigger event. **Terrestrial ecology/vegetation** • Significant vegetation to be identified and protected (including fencing) or relocated. • Valued vegetation to be identified and either retained or removed and replaced. • Vegetation removal to be minimised. • Project botanist to supervise all works affecting or in close proximity to significant or valued vegetation and to regularly monitor significant and valued vegetation. • 2 years of post-construction weed control.

	• Plants to be sourced from Tamaki Ecological District. • *Mimulus repens* on Traherne Island to be relocated or held, protected and replaced in the original location. • Traherne Island weed and pest management plan to be prepared for certification by Auckland Council and reviewed every 5 years. • Detailed planting plan for rock forest to be prepared and submitted for certification.
Summary comments	As conditions reference back to the ecological management plan, the plan itself is a crucial factor in determining whether ecology goals were met across the project. In general, the consensus was that the streams (eg, Oakley Creek) were already highly modified environments, so the project and subsequent conditions were likely to benefit the ecological environment, thus achieving the Board's general intent.

Table C.3 Christchurch Southern Motorway – Stage 2 (CSM2)

Point of comparison	Comment
Decision maker	Board of Inquiry
Regional council	Canterbury
Number of conditions	• Designation: 2 (DC.36, DC.37) • Resource consents: 4 (G.11, D.2, D.5, D.8) • **Total: 6**
General judgement on prescriptiveness	Conditions not very prescriptive.
General observations on intent (including submissions and decision)	• No submissions related to negative ecological effects; two submissions supported the enhancement of aquatic ecology. • Project footprint consists of pasture, shelterbelts, rural/residential areas, and road verges with low ecological value. Likely to be displacement of bird species. Only adverse terrestrial effect expected to be lizard. • Aquatic ecology: low-value stockwater races present and will be diverted or piped. Piping water races will result in habitat loss but mitigated.
General observations on scale of effect	• **Aquatic ecology:** Low (with mitigation) • **Terrestrial vegetation:** Low
Summary of requirements	• **General:** CEMP to include environmental issues anticipated during construction and management, mitigation and contingency matters. • **Herpetofauna:** A lizard management plan to be prepared. • **Vegetation:** – All machinery to be cleaned prior to entry to avoid spread of weeds (designation). – Disturbed areas adjacent to stockwater races to be planted with suitable riparian vegetation. • **Diversion of stockwater races:** – Stockwater race diversions to provide for fish passage. – Diversion works to avoid stranding fish in pools or channels.
Summary comments	Very little consideration of ecology – not a big issue for this project – but likely to be sufficient for the environment.

Table C.4 Waikato Expressway – Hamilton Section

Point of comparison	Comment
Decision makers	Waikato District Council, Hamilton City Council, Waikato Regional Council
Regional council	Waikato
Number of conditions	• Notice of Requirement (NOR) 1 (Waikato District Council): 1 (6.4) • NOR 1A (Waikato District Council): 3 (6.1, 6.3, 6.4) • NOR 1B (Hamilton City Council): 3 (6.1, 6.3, 6.4) • NOR 2 (Hamilton City Council): 3 (6.1, 6.3, 6.4) • Regional: 11 (5, 48–58) • **Total: 22**
General judgement on prescriptiveness	Conditions reasonably prescriptive and specific in relation to bats, gully systems, and lizards. Details typically left to management plans.
General observations on intent (including submissions and decision)	• Agreement between Waikato District Council, Hamilton City Council and Waikato Regional Council that ecological effects best addressed through regional consents (rather than designations). • Disagreement between application, reporting officers, and DOC regarding long-tailed bats (particularly in relation to the limited knowledge on population), terrestrial ecology (quantum of mitigation provided), aquatic ecology (physical effects, stormwater discharges) – therefore, decision report focuses on these matters. • Accepted that effects acceptable and mitigation measures proposed (or otherwise imposed through conditions) appropriate in the circumstances.
General observations on scale of effect	Potentially more than minor but conditions sufficient to mitigate the effects.
Summary of requirements	**Notice of requirement** • **NOR 1:** In relation to specified gullies, landscape management plan to be prepared in consultation with ecologist. • **NOR 1A:** Landscape management plan to enhance gully systems by improving ecology, mitigating ecological effects, and preserving soil, indigenous vegetation and significant exotic trees. In relation to specified gullies, landscape management plan to be prepared in consultation with ecologist. • **NOR 1B:** Landscape management plan to enhance gully systems by improving ecology, mitigating ecological effects, and preserving soil, indigenous vegetation and significant exotic trees. In relation to specified gullies, landscape management plan to be prepared in consultation with ecologist. • **NOR 2:** Landscape management plan to enhance gully systems by improving ecology, mitigating ecological effects, and preserving soil, indigenous vegetation and significant exotic trees. **Regional consents** • Construction management plan (CMP) to include measures and methodologies to address ecological issues. • Ecological management and restoration plan (EMRP) to be prepared and certified and to include: – pre-construction survey report – details of restoration and habitat enhancement measures (seeking no net loss) – weed/pest control – monitoring and maintenance of planting – fish rescue and relocation procedures.

	Monitoring • Kahikatea monitoring (Mangaonua Gully): 3 years post-construction. • Pre-construction monitoring, including minimum of two bat surveys. • Annual bat monitoring reported annually for 5 years, then 5-yearly until 15 years post-commencement of works. • Little shag nesting activity monitoring for 3 years post-construction. **Mitigation** • 10.2 ha ecological restoration within or contiguous with Mangaonua and Mangaone gullies, including 4 ha gully swamp forest. • Buffer planting of kahikatea tree stands. • Habitat suitable for mudfish to be provided. **Aquatic ecology** • EMRP to include measures in relation to perennial stream habitats and nationally threatened or at-risk species, including black mudfish and other indigenous fish. • EMRP to include mudfish management plan. • Habitat suitable for mudfish to be provided. **Avifauna (including bats)** • EMRP to include measures for nationally threatened or at-risk species, including little shag and long-tailed bats. • Pre-construction survey and relocation of threatened or at-risk birds. • Bat management plan to be developed. **Herpetofauna** • EMRP to include measures in relation to nationally threatened or at-risk species, including indigenous lizards. • Pre-construction survey and relocation of threatened or at-risk lizards. **Terrestrial ecology (including wetlands)** • EMRP to include measures in relation to terrestrial and wetland habitats, nationally threatened or at-risk species, and any rare or uncommon plants. • Kahikatea in the Mangaonua Gully to be identified, protected, removal minimised, and monitored 3 years post-construction. • Pre-construction survey and relocation of threatened, at-risk, or locally uncommon plants. • 10.2 ha ecological restoration within or contiguous with Mangaonua and Mangaone gullies, including 4 ha gully swamp forest. • Buffer planting of kahikatea tree stands. • Gully restoration implementation plan to be developed and certified by council.
Summary comments	• Strong reference to EMRP and other management plans. • Conditions have a strong focus on gully restoration and bats – consistent with the highest identified effect.

Table C.5 SH1 Barters Road/Pound Road Improvements

Point of comparison	Comment
Decision makers	Canterbury Regional Council, Christchurch City Council
Regional council	Canterbury
Number of conditions	None

General judgement on prescriptiveness	NA
General observations on intent (including submissions and decision)	NA
General observations on scale of effect	Works in rural farmland, unlikely to be any ecological effect.
Summary of requirements	No requirements.
Summary comments	Works in rural farmland, unlikely to be any ecological effect.

Table C.6 SH73 Arthur's Pass Mingha Bluff Realignment

Point of comparison	Comment
Decision makers	Canterbury Regional Council, Selwyn District Council, DOC
Regional council	Canterbury
Number of conditions	• Resource consent – earthworks: 7 (2, 8, 9, 10, 24, 25, 26) • Resource consent – diversion: 3 (5, 6, 9) • Resource consent – discharge: None • DOC permit: 6 (B.8, B.9, B.13, B.14, B.15, C.1) • **Total: 16**
General judgement on prescriptiveness	Conditions highly tailored to effects on mistletoe, *Coprosma acerosa*, and riparian environment – focus on key effects.
General observations on intent (including submissions and decision)	Conditions focus on key important effects and appear to meet intent.
General observations on scale of effect	• **Terrestrial ecology:** Potentially very high – reasonably small footprint, but national park, at-risk indigenous vegetation. • **Aquatic ecology:** High but able to be largely mitigated with conditions.
Summary of requirements	**General** • Retired road reserve to be rehabilitated to a state consistent with the natural surroundings. **Stream works** • No stream works to occur during fish spawning season. • Diversion shall not prevent fish passage. • Culvert design and installation to include fish resting ponds and to facilitate fish passage. • Fish rescue and relocation to be undertaken. • Habitat re-established will be suitable for native fish, primarily *Canterbury galaxias*, but not trout. **Vegetation** • Mistletoe inventory to be undertaken. • Mistletoe, *Coprosma acerosa*, and riparian remediation plan to be developed and implemented and include: – eco-sourcing of seeds/plants

	– replanting methods/number/location and methods to ensure successful rehabilitation. **Additional DOC permit requirements (works in national park)** • Vegetation clearance plan to be prepared and approved by DOC. • Any surplus vegetation waste may only be disposed of within the park. • All equipment to be cleaned and any weed plants present at completion of construction to be removed. • Site to be rehabilitated/revegetated. • Works to be consistent with the Arthur's Pass National Park Management Plan.
Summary comments	The application documentation outlines significant efforts to minimise and mitigate effects, which is reflected in the conditions.

Table C.7 SH2/SH58 Haywards Interchange

Point of comparison	Comment
Decision makers	Hutt City Council, GWRC
Regional council	Greater Wellington
Number of conditions	• Resource consent – land use consent: 1 (RC7.6.1) • Designation: 2 (G1.5.1, G1.5.2) • **Total: 3** Note: Designation includes the full SH58 alignment.
General judgement on prescriptiveness	Conditions consistent with minor stream works.
General observations on intent (including submissions and decision)	Conditions consistent with minor stream works.
General observations on scale of effect	Low – generally related to vegetation clearance and potential for sediment discharges to water.
Summary of requirements	**General** • Final design to be submitted to council and make provision for ecological treatment, including vegetation conservation and replanting. • Detailed revegetation plans and specifications to be developed in consultation with GWRC and DOC submitted to council for approval. **Stream works** • All works to provide fish passage for climbing species.
Summary comments	Consents and designation appear to rely entirely on the works being carried out in accordance with the AEE and associated reports and include very few conditions.

Table C.8 Welcome Bay Road and Te Puke Highway Intersection

Point of comparison	Comment
Decision makers	Bay of Plenty Regional Council (BOPRC), Tauranga City Council, Western Bay of Plenty District Council
Regional council	Bay of Plenty

Number of conditions	Resource consent – erect culvert: 1
General judgement on prescriptiveness	Conditions consistent with minor stream works.
General observations on intent (including submissions and decision)	Conditions consistent with minor stream works.
General observations on scale of effect	Low – minor stream works only.
Summary of requirements	**Stream works** • Minimise effects on fish passage during works. • Once completed, structure to maintain fish passage at all times.
Summary comments	Conditions consistent with minor stream works.

C.2 Erosion and sediment control

Table C.9 Mackays to Peka Peka Expressway (M2PP)

Point of comparison	Comment
Number of conditions	16
General judgement on prescriptiveness	Effects to be managed in accordance with GWRC guidelines (unless Waka Kotahi guidelines are more stringent).
Issues addressed in the Decision of the Board of Inquiry report	ESC was not a major topic considered by the Board as Waka Kotahi and GWRC reached substantive agreement prior to and during the hearing process.
General observations on scale of effect	Potential for significant effects if not managed, but with appropriate ESC measures effects likely to be less than minor.
Summary of requirements	**RMA conditions** Potential erosion and sediment effects calculated using the universal soil loss equation. ESC to comply (or be consistent) with the most stringent of: • the GWRC *Erosion and Sediment Control Guidelines for the Wellington Region* • the Waka Kotahi *Draft Erosion and Sediment Control Guidelines for State Highway Infrastructure* • the Waka Kotahi *Draft Erosion and Sediment Control Field Guide for Contractors.* Other condition requirements: • ESCP (to be certified by GWRC). • Chemical treatment/flocculation management plan. • Site-specific construction erosion and sediment control plans (CESCPs) (to be certified by GWRC). • As-builts and certified CESCPs to be kept on site and updated. • Perimeter controls to be operational prior to earthworks. • In event of a failure of an ESC device or a storm or water quality exceedance, a suitably qualified ecologist is to inspect the receiving environment within 2 working days.

	Turbidity monitoring: • Monitoring of water quality in permanently and intermittently flowing water bodies upstream and downstream of potential earthwork discharge areas. – Continuous (telemetered) turbidity loggers in specified streams/rivers. – Continuous (telemetered) turbidity loggers upstream and downstream of all water body diversions 48 hours prior to works and for 1 week post-diversion. – Triggered event monitoring (grab samples) for turbidity in event of exceedance of any site monitoring thresholds or a discharge to a water body to be carried out within 2 hours. **ESCP** Monitoring: • Freshwater monitoring – including baseline ecological survey. • Devices monitoring – weekly visual inspections. • Flocculation monitoring – receiving environment pH.
Summary comments	Thrust of conditions strongly influenced by ESC guideline documents.

Table C.10 Waterview Connection

Point of comparison	Comment
Number of conditions	35
General judgement on prescriptiveness	Effects to be managed in accordance with most stringent of Auckland Regional Council Technical Publication 90 (TP90) or ESCP. Significant oversight and approvals required by Auckland Council. Conditions set standards for pH and turbidity thresholds.
Issues addressed in the Decision of the Board of Inquiry report	Issues related to ESC were not a major component of submissions, and therefore the issue was not specifically addressed in the Decision of the Board of Inquiry report. General intent – disturbance effects minimised.
General observations on scale of effect	Potential for significant effects if not managed, but with appropriate ESC measures effects likely to be less than minor.
Summary of requirements	**RMA conditions** ESC to comply (or be consistent) with TP90. **Earthworks (22 conditions)** • CESCP (to be certified by Auckland Council). – Establishment of sediment control team (including Auckland Council, contractor, Waka Kotahi) to meet and review ESC on weekly basis. – For each stage, a CESCP submitted to Auckland Council for approval at least 20 days prior to earthworks. – Any amendments to CESCPs to be approved in writing by Auckland Council at least 10 days before implementation. • Pre-construction site meeting between Auckland Council and primary contractor. • 3-month monitoring programme to apply to discharges to Oakley Creek from dewatering activities to develop standard for turbidity and pH. Initial pump treatment standard shall be set at 50 NTU and pH 7.5. • Discharges to the coastal marine area from coffer dam sumps shall first be tested for pH and turbidity, and discharge is only permitted if pH is less than 8.5 and turbidity is below the threshold agreed upon by Waka Kotahi and Auckland Council. • Perimeter controls to be operational before earthworks begin.

	• Procedures required to prevent the deposition of slurry, clay or other materials being deposited on the road. • Notice given to Auckland Council prior to removal of any ESC measure. • Chemical treatment plan certified by Auckland Council. • All sediment retention ponds and decanting earth bunds to be chemically treated. • As-built plans to be certified by Auckland Council (that ESC is in accordance with CESCP). • Monitoring of ESCP and CESCP undertaken by Waka Kotahi. • The site to be stabilised as soon as possible in a progressive manner. • Seasonal restriction – no earthworks between 1 May and 30 Sep without written approval from Auckland Council. • Revegetation/stabilisation to be complete by 30 April in the year of bulk earthworks unless a later date is approved in writing by Auckland Council. **Stream works (11 conditions)** • Construction programme and methodology provided to Auckland Council prior to stream works, and monthly updates including dates for implementation of ESC. **Coastal (2 conditions)** • Works undertaken in accordance with ESCP. Coastal ESC measures to include coffer dam. • ESC measures to be removed from coastal marine area within 20 working days following completion of construction.
Summary comments	Thrust of conditions strongly influenced by ESC guideline documents.

Table C.11 Christchurch Southern Motorway – Stage 2 (CSM2)

Point of comparison	Comment
Number of conditions	10
General judgement on prescriptiveness	Not too prescriptive – mainly follow ESCP. Some specific discharge requirements though.
Issues addressed in the Decision of the Board of Inquiry report	• Relatively low annual rainfall and generally flat topography. • Submitters: Selwyn District Council, Canterbury Regional Council and others. • Submissions on stockwater concerns – adverse effects of discharge of surface water to stockwater races. • The Board is overall satisfied with the provisions made in the ESCP and that Waka Kotahi has mechanisms in place for maintenance and monitoring procedures etc.
General observations on scale of effect	No more than minor due to site (flat topography, low rain).
Summary of requirements	**RMA conditions** • ESCP submitted with application to be finalised. • ESCP certified by an independent suitably qualified and experienced person. • ESCP in accordance with Environment Canterbury's *Erosion and Sediment Control Guideline 2007* and consistent with the Waka Kotahi *Erosion and Sediment Control Guidelines for State Highway Infrastructure*. • ESCP to include a schedule of the frequency and methods of inspection, monitoring and maintenance of all ESC measures, including any checks proposed to be undertaken after more than 15 mm of rain falls in a 24-hour period. • Earthworks staged, disturbance to a minimum.

	• Perimeter controls to be installed prior to earthworks commencement. • ESC inspected at least once per week. • Accumulated sediment removed when it occupies more than 20% of device. • Discharges from stormwater not to exceed turbidity of 55 NTU or TSS of 100 mg/L. • Discharges from dewatering not to exceed turbidity of 30 NTU or TSS of 50 mg/L. • If flocculation used, pH of water must be between 5.5 and 8.5. • Earthworks stabilised once earthworks completed or if exposed area is not to be earthworked for 14 days. Fully stabilised is 80% vegetation cover from grassing or hydroseeding or 100% cover from mulching.
Summary comments	Thrust of conditions strongly influenced by ESC guideline documents.

Table C.12 Waikato Expressway – Hamilton Section

Point of comparison	Comment
Number of conditions	25
General judgement on prescriptiveness	Fairly prescriptive – some repetition of Waikato Regional Council ESC Guidelines – but standard conditions.
Issues addressed in the Decision of the Board of Inquiry report	Potential for land to flood or be subject to erosion was a key concern to submitters. Based on expert witness opinion it was agreed that these effects could be adequately managed.
General observations on scale of effect	No more than minor – if design and conditions complied with.
Summary of requirements	**RMA conditions** • Establish a sediment control team managed by an appropriately qualified person experienced in ESC (experience + recognised training + approved by Waikato Regional Council). • Sediment control team to monitor compliance and meet with Waikato Regional Council on a weekly basis. • ESC in CMP to be in accordance with Waikato Regional Council's *Erosion and Sediment Control – Guidelines for Soil Disturbing Activities* and CMP to be certified by Waikato Regional Council. • All disturbed vegetation to be placed in a position where it will not be causing diversion, damming or erosion of a waterway. • All clean water runoff to be diverted away from exposed areas to prevent erosion. • ESC structures inspected on a weekly basis and within 24 hours of rain event. • 'As-built certification statements' to certify that ESC has been built in accordance with certified CMP. • ESC structures to be maintained to perform at 80% capacity (minimum). • Flocculation bench testing required prior to bulk earthworks. • Flocculation management plan and associated requirements – soluble aluminium concentration not to exceed 0.2 g/m^3; pH of discharge to be between 5.5 and 8.5. • Winter works – no earthworks between 1 May and 30 September unless approved in writing by Waikato Regional Council. • Site must be stabilised by 30 April each year unless approved in writing by Waikato Regional Council. • ESCs only to be removed when Waikato Regional Council is satisfied with the soil stabilisation/vegetation, quality of water discharged, quality of receiving water.
Summary comments	Thrust of conditions strongly influenced by ESC guideline documents.

Table C.13 SH1 Barters Road/Pound Road Improvements

Point of comparison	Comment
Number of conditions	6 under CRC162603 discharge and 8 under CRC162604 earthworks (some overlapping)
General judgement on prescriptiveness	Overall, not very prescriptive, largely requires works to be in accordance with the certified ESCP. Two performance standard conditions are prescriptive about the discharge points.
Reason for decision	Environment Canterbury granted the application because they deemed that 'the activity is consistent with the purpose of the RMA'.
General observations on scale of effect	Majority of construction phase stormwater was expected to discharge to ground as it currently did. However, along the western part of the site, in close proximity to Barters Road, the stormwater may have discharged to the existing stormwater system if not managed. This may reduce the visual clarity and oxygen content of the Barters Road drain and smother in-stream habitats. Overall, expected to have a less than minor effect on the environment once ESC measures are in place.
Summary of requirements	**ESCP** • ESCP to be prepared in accordance with Environment Canterbury's *Erosion and Sediment Control Guideline 2007*. • ESCP to include standard requirements, including maps, drawings, specifications, programme of works, inspection and maintenance procedures, defined discharge points, dust mitigation. • ESCP to be submitted to Environment Canterbury at least 10 days prior to construction commencing for certification. • ESCP can be amended at any time – if this improves the ESC and is submitted in writing to the Compliance Manager at Environment Canterbury. • All practicable measures taken to prevent sediment discharge to surface water and sediment transported beyond the site boundaries. • Exposed surfaces to be stabilised if not worked for a period of >14 days. **Performance standards** • Discharge to ground to infiltrate through soils at least 200 mm in depth to free-draining gravels or undisturbed strata with at least 5 m separation from the discharge point to the highest recorded groundwater level. • Discharge points off-site to be defined so that discharge can be sampled and tested. • All stormwater discharge up to 2% AEP (24-hour duration) to be retained on site and discharged to ground. • Discharge from the site must not contain TSS >100 g/m^3.
Summary comments	Very standard conditions used – effects to be managed through certified ESCP.

Table C.14 SH73 Arthur's Pass Mingha Bluff Realignment

Point of comparison	Comment
Number of conditions	3 under CRC147313 earthworks, 12 under CRC147316 discharge
General judgement on prescriptiveness	Fairly standard conditions used – works to be in general accordance with Environment Canterbury's ESC guideline and ESCP.
Reason for decision	Environment Canterbury granted the application because they deemed that 'the proposed activity does not conflict with the purpose of the RM Act given the conditions' and 'there are no persons considered to be adversely affected by this proposal'.

General observations on scale of effect	Provided the ESCP is implemented, any adverse effects will be no more than minor.
Summary of requirements	**Guidelines** In accordance with Environment Canterbury's ESC guideline. **ESCP** • All relevant parties to have copies of the associated ESCPs and methodology. • Stage construction to minimise exposed areas. • Apply ESC measures prior to bulk earthworks. • During construction, minimise exposed surfaces and discharge of sediment-laden water beyond the boundary of site/to stormwater system/into surface water. • ESC measures to include (but not limited to) silt fences, vegetated riparian strips, staged construction, vegetated buffers and barriers between stockpiles and surface water. • ESCP to ensure compliance with consent and in accordance with Environment Canterbury ESC guideline. • ESCP to include standard requirements, including maps, drawings, specifications, programme of works, inspection and maintenance procedures, defined discharge points, dust mitigation. • ESCP to be submitted to Environment Canterbury at least 10 days prior to construction commencing for certification. • ESCP can be amended at any time – if this improves the ESC and is submitted in writing to the Compliance Manager at Environment Canterbury. • ESCs not to be decommissioned until site is stabilised. **Performance standards** • Reduction in visual clarity in receiving waters not to exceed 20% in absolute terms. **Waterways** • Structures authorised by the consent shall not result in the erosion of the bed or banks of any watercourses. • Best practicable option to be used to minimise sediment disturbance in waterways, including avoiding placing cut or cleared vegetation in a position where it may enter a waterway. **Monitoring** • One visual inspection per work day of surface water adjacent to work site and record clarity observations. • ESC devices to be visually inspected by contractor at least once per week and prior to rain. Any accumulated sediment to be removed and repairs made. • Watercourses inspected at least once every six months and scour and erosion repaired within 10 working days.
Summary comments	Fairly standard conditions used – effects to be managed through certified ESCP. Unusual that specific ESCs (including silt fences, vegetated riparian strips, staged construction, vegetated buffers and barriers between stockpiles and surface water) are required by the RMA conditions. Visual clarity of receiving waters also has specific standards applied.

Table C.15 SH2/SH58 Haywards Interchange

Point of comparison	Comment
Number of conditions	5 under 30327 land use – culverts, 20 under 30328 discharge, and 15 under 21299 earthworks (some conditions overlap consents)
General judgement on prescriptiveness	Fairly standard conditions used – works to be in general accordance with TP90 and ESCP.
Issues addressed in the hearing	• A key issue was potential adverse ecological effects of sedimentation resulting from proposed construction works. The universal soil loss equation was used by the applicant to show the additional annual sediment load for Haywards Stream would range from 23% to 113% while the council calculations were 110% to 249%. • The mode of control – the relatively new Auckland TP90 standard – was untested in the Wellington region.
General observations on scale of effect	Potentially significant with no ESCs in place. ESCs to TP90 standard was determined to be the best practicable option.
Summary of requirements	**Guidelines** • In accordance with TP90. **ESCP** • Take all practicable steps to minimise erosion or suspended solids in any discharge to water. • Minimum requirements for ESCP stated in conditions. • ESCP and any amendments to be submitted to the GWRC Consents Manager for written approval. • Consent and ESCP to be provided to all earthworking contractors. • Certificate by suitably qualified and experienced person to certify ESCs constructed in accordance with plan. • Copy of as-built plans to be kept on site and updated. • Prior to bulk earthworks, consent holder to arrange half-day field exercise in the practical application of TP90 and RMA conditions for all contractors' staff involved in ESC. • All sediment-laden runoff to be treated by ESC measures. **Watercourses** • No sediment retention ponds or silt fences to be constructed in the active channel of any stream. • If rain is forecasted, all bare areas associated with rivers or watercourses to be protected against erosion at the end of each construction day. **Sediment retention ponds** • Implement chemical treatment in sediment retention pond where efficiencies for TSS are less than 70% (for rainfall less than the 50% AEP event). • All sediment retention ponds shall be constructed to withstand the 1% AEP event without failing and incorporate an emergency spillway. • No sediment retention ponds or perimeter controls removed unless approved by manager or stabilised. **Monitoring** • Sediment retention ponds efficiency determined by grab sampling for TSS at inlet and outlet every 2 hours after initial sampling event.

Summary comments	Fairly standard conditions used. Interesting that a half-day training event in the practical implementation of TP90 is required by consent condition. Also, Auckland Regional Council ESC guidelines were used, even though these we untested at the time in the Wellington region, where the project was located.

Table C.16 Welcome Bay Road and Te Puke Highway Intersection

Point of comparison	Comment
Number of conditions	15
General judgement on prescriptiveness	Not very prescriptive – works to be in general accordance with BOPRC's *Erosion and Sediment Control Guidelines for Land Disturbing Activities* and ESCP.
Issues addressed	Main ESCP RMA conditions associated with culvert replacement under Te Puke Highway.
General observations on scale of effect (minor, moderate, significant)	No more than minor with controls in place.
Summary of requirements	**Guidelines** • In accordance with BOPRC Guideline No. 2001/01 – *Erosion and Sediment Control Guidelines for Land Disturbing Activities* – or its successor. **ESCP** • Final ESCP to be submitted to BOPRC 10 days prior to works to be certified. • All sediment controls installed prior to works commencement. • Exposed areas of earth to be stabilised against erosion as soon as practicable. • Works to minimise discharge of sediment or debris as far as practicable. • Maintain ESC until site is stabilised. **Monitoring** • 6-monthly monitoring of the site.
Summary comments	Fairly standard conditions used – effects to be managed through certified ESCP.

C.3 Stormwater

Table C.17 Mackays to Peka Peka Expressway (M2PP)

Point of comparison	Comment
Number of conditions	3
General judgement on prescriptiveness	Prescriptive stormwater-specific conditions with very specific operational design standards to be met.
Issues addressed in the Decision of the Board of Inquiry report	• Conditions largely determined between Waka Kotahi, GWRC, and KCDC. • Submitters concerned about Waikanae River Bridge, hence location specifically chosen and tight requirements applied. Board agreed with GWRC that peer review and certification is required here. • Climate change advice based on Professor Martin Manning. Hazard risks over at least 100 years to be considered. • Climate change assessment by Waka Kotahi project team based on MfE guidelines – *Climate Change Effects and Impacts Assessment* (2008).

	• KCDC argued for two-stage treatment (swales + wetlands) for Wharemakau and Waimehu streams (as well as Kākāriki Stream and Ngārara Creek). Water quality effects for these streams assessed as minor by Waka Kotahi ecologists, and Board agreed.
General observations on scale of effect	Minor – if technical report recommendations followed.
Summary of requirements	**Operational** Expressway stormwater to be treated before discharge to receiving environment in accordance with the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* (NZ Transport Agency, 2010). • Peak rate of discharge not to exceed 80% (urban) or 100% (rural) pre-expressway peak discharge. • Stormwater discharge structures designed to avoid erosion. • Primary and secondary treatment required for Kākāriki Stream and Ngārara Creek. • Any loss of flood plain storage to be offset. • Flood risk assessed against 1% AEP storm with climate change to 2115. • Stormwater design to be independently peer reviewed. • Prior to works commencement by stage, a report to be provided showing how design meets stormwater conditions. • Design of Waikanae River Bridge to provide >5 m clearance to the beam soffit for operation of maintenance machinery. • At least 4.5 m minimum clearance shall be provided for the El Rancho access road. • Top surface of berm riprap under Waikanae River Bridge no higher than existing berm. • Freeboard of Waikanae River Bridge above modelled level for 1% AEP + climate change to 2115 (at least 2.2 m). • Allowance for future services to pass under Waikanae River Bridge (oversize sleeves in abutments – size specified). • Waikanae River Bridge must consist of five spans, twin-column piers clear of permanent waterway. Main river channel at berm level must have span of >35 m. • Culvert blockage risk assessment to be undertaken.
Summary comments	Only 3 stormwater conditions but broken down into multiple parts. Conditions very specific about design requirements, particularly climate change allowances to 2115. No specific construction stormwater conditions.

Table C.18 Waterview Connection

Point of comparison	Comment
Number of conditions	23
General judgement on prescriptiveness	Not very prescriptive – other than requiring the work to align with technical stormwater reports submitted with the application.
Issues addressed in the Decision of the Board of Inquiry report	• The Board accepts the Waka Kotahi operational stormwater design philosophy (Technical Report G.27 – *Stormwater and Streamworks Design Philosophy Statement*). Noted that Waka Kotahi has carried out extensive assessment of construction and operational stormwater treatment devices (Technical Report G.15 – *Assessment of Stormwater and Streamworks Effects*) and no parties challenged technical feasibility of these. • Waka Kotahi proposed creation of 23.21 hectares of additional impervious surface area. Flooding is an existing major issue in Oakley floodplain – but prelim design

	proposed to reduce 100-year flood storage from 79,400 m^3 to 47,600 m^3. Potential for flooding to private land immediately upstream of Bollard Avenue culverts and so the Board sought clarification from Waka Kotahi of storm event design in detailed design. • Auckland Council appeared to accept Waka Kotahi stormwater proposals but Board 'had residual concerns'. A number of submitters also concerned about flooding of private properties based on personal experience. • Overall, Board agreed with Waka Kotahi except for issues around Oakley floodplain. Changes were made to conditions to include criteria that operational stormwater follow Technical Report G.27 and mimic existing hydrologic regime. Waka Kotahi did not know if they could comply with this so wording changed to 'best practicably mimic'. • A number of submitters raised concerns about the level of operational stormwater treatment proposed; however, the Board found that draft conditions were fit for purpose.
General observations on scale of effect	• Less than minor – most of project. • Minor – flooding risk for specified private properties.
Summary of requirements	**Construction** Stormwater management to be undertaken in accordance with Technical Report G.15 (submitted in application). Consent condition includes tables with treatment standards (TSS removal, flood attenuation, detention) by sector. • Stormwater system design and any amendments requires approval by Auckland Council. • Pre-construction site meeting required for each component of temporary stormwater management works. • Temporary stormwater management plan to be submitted in application as part of CEMP. • Regular inspections required for all stormwater treatment devices. • Post-construction site meeting required. • Requirement for major overland flow paths to be provided for and maintained where 100-year storm event produces flows in excess of capacity of primary systems. **Operation** Permanent stormwater measures installed and operated in accordance with Technical Report G.15. Consent condition includes tables with treatment standards for the operational phase. • Operational stormwater design and any amendments to be approved by Auckland Council and align with Technical Report G.27. • Technical Report G.15 references operational and construction phase treatment to Auckland Regional Council TP10 guidelines. • Pre-construction site meeting required for each component of operational stormwater management works. • As-builts to be submitted to Auckland Council within 30 days. • Operational stormwater management plan to be submitted to Auckland Council within 3 months of stormwater installation – to confirm performance standards in TR G.15. • Operational stormwater management plan to include a monitoring programme (2-year duration) for water quality, with report submitted annually and operational stormwater management plan updated on completion. • Post-construction site meeting required. • Requirement for major overland flow paths to be provided for and maintained where 100-year storm event produces flows in excess of capacity of primary systems.

	• Stormwater outfalls to incorporate energy dissipation erosion protection measures to minimise the occurrence of bed scour and bank erosion. • Site meeting during second year of operation to assess plant health in wetlands. **Technical Report G.27** • Mid-range climate change scenario applied for year 2090 (2.1 °C increase) as climate change predictions do not extend to end of design life ~2110. MfE guidelines – *Climate Change Effects and Impacts Assessment* (2008).
Summary comments	Conditions require standards set out in consent application technical reports to be met.

Table C.19 Christchurch Southern Motorway – Stage 2 (CSM2)

Point of comparison	Comment
Number of conditions	27
General judgement on prescriptiveness	Fairly prescriptive design and treatment standards to be met.
Issues addressed in the Decision of the Board of Inquiry report	• Only one submission from Christchurch City Council – 2012 plans for CSM2 stormwater system in conflict with Owaka stormwater basin designed and formed by council. Since then, however, work had been undertaken to resolve conflict and no longer an issue. • Design for 1% AEP etc. • Board found that evidence by Waka Kotahi indicated that they have appropriately designed the stormwater systems with mechanisms for maintenance and operational procedures.
General observations on scale of effect	Minor
Summary of requirements	• Stormwater operation and maintenance plan to be submitted to the manager and prepared in consultation with the Stockwater Race Controlling Authority. • Pumping and disposal system at Robinsons Rd overpass to accommodate a 1-hour, 100-year storm event and have emergency flood warning system. • Stormwater operation and maintenance plan to be updated upon completion of construction. • Temporary and permanent diversion to maintain function of stockwater race – including land drainage in flood flows, fish passage etc. • Diversion works shall not permanently decrease flood-carrying potential. • Stormwater infrastructure design to 1% AEP. • Swales in accordance with the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* (with some exceptions). • Soak pit design requirements, including first flush treatment depth 25 mm. • Specific requirements for stormwater treatment ponds, including ability to store a 60-hour, 100-year storm event. • Climate change effects addressed to 2080. • Construction of stormwater systems signed off by chartered professional engineer. • Monitoring inspections of stormwater systems at least once every six months and after rainfall. • Inspection for hydrocarbons, sediment, damage etc. • Maintenance and monitoring records kept. • Treatment performance monitoring, including soil samples for contaminants analysed using Environmental Protection Authority method 1312.

Summary comments	The conditions achieve the intent of the Board decision. The Board did not have much input to conditions (nothing altered and only one submission).

Table C.20 Waikato Expressway – Hamilton Section

Point of comparison	Comment
Number of conditions	25
General judgement on prescriptiveness	Conditions fairly general. Output TSS concentration specified.
Issues addressed in the Decision of the Board of Inquiry report	• Hearing – interested in effects on stormwater discharge on ecology. • Adverse effects of stormwater sediments and contaminants entering waterways. • Construction management related to ESC (Waikato Regional Council ESC guidelines). • Also, potential flooding is key issue. • Stormwater design based on the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*. • AEE states culverts designed to accommodate 1% AEP, taking into account climate change to 2090.
General observations on scale of effect	No more than minor if standards followed.
Summary of requirements	**Construction** • All sediment-laden runoff to be treated, and discharges will not cause change in water colour or clarity downstream. **Operational** • Waterways under bridges sized to allow passage of 20% AEP flow and managed overland flow paths for larger flows. • Bridge soffit at least 0.5 m higher than top of banks. • Stormwater from completed bridge decks will be directed to treatment devices. • Detailed stormwater design to be approved by Waikato Regional Council. • Design based on the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure.* • Energy dissipater design criteria for culvert outlets comply with US Federal Highway Administration standard #14. • Consent holder responsible for operation, maintenance. • As-builts to be submitted to Waikato Regional Council. • Stormwater structures to capture and retain majority of gross pollutants. • TSS concentrations not to exceed 100 g/m^3.
Summary comments	• WEX:H did not go to Board of Enquiry, therefore sourcing documents across regional, city, district councils difficult and documents not compiled in one place – multiple documents to comb through, more difficult to find intent/reasoning. • No consideration of climate change specified in RMA conditions.

Table C.21 SH1 Barters Road/Pound Road Improvements

Point of comparison	Comment
Number of conditions	2
General judgement on prescriptiveness	Very few stormwater conditions but TSS discharge standard specified.
Issues addressed in AEE	AEE states that design accounts for climate change (increased rainfall intensity).
General observations on scale of effect	Minor
Summary of requirements	**Construction** • Construction stormwater managed through ESC conditions. • Stormwater discharge from site not to contain more than 100 g/m^3 TSS. **Operational** • No operational stormwater conditions.
Summary comments	Very few stormwater conditions.

Table C.22 SH73 Arthur's Pass Mingha Bluff Realignment

Point of comparison	Comment
Number of conditions	6
General judgement on prescriptiveness	Fairly general – but design standard for swales specified in RMA conditions.
Issues addressed in AEE	Stormwater design based on the Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*. Metal contaminants expected to be reduced with project as a wider carriageway reduces frequency of braking etc associated with wear and tear of vehicle components. Flooding – no effect on rail infrastructure – culvert design peer reviewed by KiwiRail. Iwi concerned about management of stormwater and effect on aquatic ecology and water quality.
General observations on scale of effect	Discharge of stormwater will have a less than minor effect on water quality within the waterways along the length of the proposed alignment.
Summary of requirements	**Construction** • Construction stormwater managed through ESC conditions. • Stormwater system design plans to be submitted to the manager prior to construction. • Post-construction, a certificate from a chartered professional engineer is to be supplied to certify that the stormwater system complies with RMA conditions. • Stormwater system to be visually inspected by the contractor at least once per week and prior to rain. **Operational** • Operational stormwater from realigned highway. • Watercourses crossing the realignment route inspected every 6 months for visible hydrocarbons and scour/erosion. • Records of inspections/monitoring to be kept. • Stormwater discharge not to cause scour, erosion or instability to bed/banks of any watercourse. • Stormwater discharged from road surface to vegetated swales. • Swales designed so that road stormwater discharges arising from rain events up to 33 mm per hour are infiltrated to ground.

Summary comments	Conditions fairly general. Only visual monitoring in conditions, no specific testing for contaminants/metals required. Assumes that mitigation devices will treat stormwater so that scale of potential effect is less than minor.

Table C.23 SH2/SH58 Haywards Interchange

Point of comparison	Comment
Number of conditions	0
General judgement on prescriptiveness	No stormwater-specific conditions
Issues addressed in application	Stormwater works covered in AEE, which states culverts designed to accommodate 1% AEP, allowing for climate change (increased rainfall intensity).
General observations on scale of effect	NA
Summary of requirements	**Construction** • Construction stormwater managed through ESC conditions. **Operational** • No specific stormwater conditions.
Summary comments	No specific stormwater conditions, construction stormwater flows managed through ESC conditions.

Table C.24 Welcome Bay Road and Te Puke Highway Intersection

Point of comparison	Comment
Number of conditions	5
General judgement on prescriptiveness	Not prescriptive – no specific stormwater conditions.
Issues addressed in AEE	• The upgrade results in a net decrease in surface water runoff due to a slight decrease in impervious area as a result of the roundabout construction. • Water quality treatment will be provided by the proposed swale drains. • Design guidelines: – Tauranga City Council Infrastructure Development Code 2012. – Western Bay of Plenty District Council Development Code 2009. – BOPRC (2012) *Hydrological and Hydraulic Guidelines*. – BOPRC *Stormwater Management Guidelines for the Bay of Plenty Region* (Guideline 2012/01). • The stormwater system will be designed to collect the 10% AEP rainfall event from the project area.
General observations on scale of effect	Minor
Summary of requirements	Work to be carried out in accordance with AEE. **Construction** • Design of culvert to be in accordance with the BOPRC (2012) *Hydrological and Hydraulic Guidelines.* • Design of culvert to be certified by BOPRC.

	• Site to be isolated to ensure all stormwater is contained within the activity site and discharged to ground soakage. **Operational** • Ensure the culvert and accompanying structures are adequately maintained. • 6-monthly monitoring of the site.
Summary comments	No specific stormwater conditions, although stormwater management addressed in AEE and NOR. General condition stating that works to be in accordance with AEE and application plans. ESC conditions over construction stormwater.

C.4 Noise and vibration

Table C.25 Mackays to Peka Peka Expressway (M2PP)

Point of comparison	Comment
Construction	
Number of conditions	10
General judgement on prescriptiveness	Prescriptive conditions detailing specific criteria to be achieved and processes in place if not met, but methods to achieve criteria left to Waka Kotahi.
Issues addressed in the Decision of the Board of Inquiry report	• Difference between M2PP effects and Western Link Road (as designated in district plan), noting that residents in those sections where the alignment differs couldn't have anticipated the expressway affecting their house. Incumbent on Waka Kotahi (and KCDC) to give heightened attention to the implementation of the measures proposed for the management and control of the effects of construction vibration in these areas. • Assessment based on NZS 6803:1999 *Acoustics – Construction Noise*. District plan referenced an older version of the standard, which was the same for all intents and purposes. • NZS 6803:1999 allows for noise limits to be exceeded if not practicable, and in this case, site-specific noise mitigation and management plans must be used. • Noise limits predicted to be exceeded even with the proposed noise mitigation measures in place during construction for periods at various locations along the route. • 5 dBA additional tolerance was proposed in draft conditions and rejected. • Requirement to consult with property owners where site-specific CNVMPs are needed. • No current New Zealand standards which set criteria for construction or traffic vibration, and the KCDC District Plan (and those for GWRC and Wellington City) do not contain any such criteria.
General observations on scale of effect	Significant in some areas, with mitigation measures not achieving the recommended upper limits in these areas.
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999, using the long-term activity duration limits. • Vibration: German Standard DIN 4150-3:1999 *Structural Vibration Part 3: Effects of Vibration on Structures* using the Category A criteria or the Category B criteria where Category A cannot be practically met.
Other condition requirements	• CNVMP and any site-specific CNVMPs to be reviewed by a suitably qualified independent acoustic specialist prior to being submitted to the council for certification. • Measurements of noise to be for 15-minute and 60-minute periods.

	• If measured or predicted vibration levels exceed the Category A criteria, then a suitably qualified expert shall be engaged to assess and manage construction vibration to comply with the Category A criteria, and the manager shall be notified. If the Category A criteria cannot be practicably achieved, the Category B criteria shall be applied. Category B can only be applied if there is continuous monitoring. • Pre-construction surveys of buildings, services and structures at risk from vibration. • Night work notification 200 m from construction areas, daytime notification for 100 m from the construction area. • Construction noise or vibration measures to be implemented prior to commencement of work within 100 m of the mitigation. Operational noise barriers to be installed prior to work 100 m from the mitigation measure where practicable. Where not practicable, temporary noise mitigation measures shall be implemented.
Summary comments	Overall, in RMA terms, while it will not be possible to avoid construction noise and vibration, the Board accepts the advice of the noise and vibration experts that, with the detailed suite of mitigation measures and management plans, acceptable levels of noise mitigation can be achieved during the construction of the expressway.
Comparison	• Same noise limits as others, specifying long-term duration limits only. • Same construction vibration criteria as CSM2 and WEX:H. Doesn't add in requirements for vibration at underground services as does WEX:H. Different criteria to Waterview. • Prescriptive in that it specifies minimum noise barrier height and location referenced to the Traffic Noise Assessment, but provides for these to be changed if necessary. Specifies OGPA in certain locations.
Operation	
Number of conditions	15
General judgement on prescriptiveness	Prescriptive conditions detailing specific criteria to be achieved and processes in place if not met.
Issues addressed in the Decision of the Board of Inquiry report	• Difference between M2PP effects and Western Link Road (as designated in district plan), noting that residents in those sections where the alignment differs couldn't have anticipated the expressway affecting their house. Incumbent on Waka Kotahi (and KCDC) to give heightened attention to the implementation of the measures proposed for the management and control of the effects of noise in these areas. • Explain Waterview's decision and assessment of NZS 6806:2010 to assess its suitability for use in the evaluation and mitigation of road traffic noise for the Kāpiti expressway. Uses A, B and C hierarchy. • KCDC district plan focuses on *increases* in predicted noise levels whereas NZS 6806:2010 focuses on the *absolute* noise levels. • Whether there should be a distinction between daytime and night-time noise. • The contention that ambient noise in Kāpiti is considerably lower than in other urban communities. • That World Health Organization (WHO) guidelines recommend an average noise level of 40 dBA at night. • The importance of night-time noise levels between 2:00 am and 6:00 am from heavy freight vehicles. • Vibration predicted to be well below operational limits. • A lack of confidence in the effectiveness of noise mitigation measures and the impact of outside-based lifestyles. • Open space noise levels, engine braking effects, wider evaluation zone (more than 100 m away from expressway). • From our evaluation of the effects of traffic noise, a new condition is to be added to the final set of conditions attached to the Waka Kotahi closing submission to reduce

	the NZS 6806:2010 Category C internal noise trigger level from 45 dB $L_{Aeq(24h)}$ to 40 dB $L_{Aeq(24h)}$.
General observations on scale of effect	Moderate, with potential to be significant without mitigation.
Operational noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads.* • Vibration: Norwegian Standard NS 8176.E.2005 *Vibration and Shock – Measurement of vibration in buildings from landbased transport and guidance to evaluation of its effects on human beings*) using the Class C criteria.
Other condition requirements	• Noise monitoring management plan required to be certified by KCDC (to allow calibration and verification of the computer noise model, which is used to check compliance with the noise criteria categories for the PPFs). • The detailed design of any structural mitigation measures (detailed mitigation measures) shall be undertaken by a suitably qualified and experienced acoustics specialist (SQEAS) prior to construction of the project, in consultation with an urban designer and landscape architect. • Low-noise road surface (eg, OGPA) to be used in residential areas, and noise fences, walls, and bunds to be implemented in accordance with the 'Selected Mitigation Options' in the Traffic Noise Assessment. • Where Category A or B cannot be met, building-modification to be undertaken to meet Category C (40 dBA inside habitable spaces). • Must produce a detailed mitigation measures report, including a noise mitigation plan set. • Prior to the project becoming open for traffic, the requiring authority shall engage a suitably experienced independent acoustics specialist to inspect the 'as-built' structural noise mitigation measures and issue a signed certificate to the manager that the noise mitigation measures identified within DC.37C and DC.38 have been properly installed and constructed. • Keep a register of all vibration complaints in first 2 years.
Summary comments	Board 'accepts that, with the proposed noise mitigation measures in place, the predicted traffic noise levels will be mitigated to an extent which meets the requirements of the RMA.'
Comparison	• While concerns were raised over the suitability of NZS 6806:2010 for the assessment of traffic noise at Waterview, these concerns were deemed inappropriate for Kāpiti, but with the exception that the lower limit for Category C internal noise of 40 dBA be adopted as per Waterview. • OGPA and barriers in prescribed locations as a minimum.

Table C.26 Waterview Connection

Point of comparison	Comment
Construction	
Number of conditions	13
General judgement on prescriptiveness	Prescriptive conditions detailing specific criteria to be achieved and processes in place if not met. Methods to achieve criteria left to Waka Kotahi.
Issues addressed in the Decision of the Board of Inquiry report	• Construction period: 5–7 years. • Reduction in noise to be balanced with objective of having the project completed as soon as reasonably possible, and to undertake activities in the safest manner. • 24-hour tunnelling operations and 24-hour construction yard operations.

	• Works close to residential areas and other noise-sensitive activities (including Unitec, a kindergarten, Waterview Primary School and St Francis School). • Works close to active open spaces and the user experience due to construction noise. • Concrete batch plants will require full enclosure. Loading of trucks also to require full enclosure. • Uncertainty about equipment and detailed methodologies led to recommendation to use CNVMP (not be left to contractor's discretion). • Significant amount of expert advice was considered to develop noise criteria, including works at night. • 'As far as practicable' removed from draft conditions, and processes in place if conditions unable to be met.
General observations on scale of effect	Potential to be significant without mitigation.
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999 *Acoustics – Construction Noise*, using duration between 15 and 60 minutes. AS/NZS 2107:2000 was used to derive appropriate noise criteria for classrooms and educational facilities. • Vibration: German Standard DIN 4150-3:1999 *Structural vibration – Part 3: Effects of vibration on structures.*
Other condition requirements	• CNVMP to be certified by Auckland Council. • Site-specific CNVMPs to be certified by Auckland Council where the NZS 6803:1999 or DIN 4150-3:1999 limits cannot be met. • High-risk construction activities (exceeding DIN 4150-3:1999) shall be conducted so that 95% of activities, measured over 20 representative samples per activity, will not produce peak particle velocities exceeding DIN 4150-3:1999, and 100% of activities will not exceed 10 mm/s (irrespective of frequency of activity). • If monitoring shows levels in the site-specific CNVMP are being exceeded, work will stop and not recommence until mitigation is implemented based on an amended site-specific CNVMP. • If noise and vibration monitoring indicate criteria set out in consent will potentially be exceeded, temporary relocation will be offered to residents at 1510 Great North Rd. For other properties, process in the site-specific CNVMP will be followed. Relocation not to be undertaken within 10 working days of Unitec examinations.
Summary comments	Board felt that 'the important topic of construction noise and vibration has ultimately been dealt with by a very positive iterative process' under the direction of relevant experts.
Comparison	• Specific criteria relating to PPFs were included. • Waterview uses the same long-term construction noise criteria but with some significant deviations from the noise limits specified in Table 2 of NZS 6803:1999. • Includes noise criteria for tunnelling (internal structural borne) noise, which is distinct from the normal noise criteria. These are listed separately for residential and educational facilities. • Includes noise criteria for air-blast noise, which is distant from the normal noise criteria. These are listed separately for residential and educational facilities. • Vibration criteria, specified in mm/s for a range of different frequencies. • More prescriptive about the measures required for certain construction activities, rather than leaving it up to the site-specific CNVMPs (eg, concrete batch plants fully enclosed).
Operation	
Number of conditions	15

General judgement on prescriptiveness	Prescriptive conditions detailing specific criteria to be achieved and processes in place if not met.
Issues addressed in the Decision of the Board of Inquiry report	• Main concerns from nearby residential dwellings where significant increases in noise level would result for many dwellings. • Mitigation measures proposed by expert would be best practicable option, but noise effects are still likely to be more than minor but not 'unreasonable'. • The merits of using NZS 6806:2010 to establish noise criteria was called into question. Was deemed that the standard offers guidance and recommendations, and that it can constitute a 'relevant matter' to take into account when exercising functions and powers under the RMA, rather than a standard providing tests or methodology. • Amendments were made to draft conditions to delete provisions for Category A–C buildings (as set out in NZS 6806:2010) because the Board did not accept that occupants of any dwelling should have an indoor noise environment incompatible with sleep (only Category C standard is based on indoor noise levels, and as such, A and B dwellings (outdoor noise levels) may have had worse potential effects in habitable spaces even after mitigation). The new approach is set out in the conditions where Waka Kotahi appraises PPFs for indoor noise levels and provides appropriate mitigation. • Waka Kotahi offered extensive comments in opposition to this decision; however, the Board disagreed with the comments and were not prepared to change their findings.
General observations on scale of effect	• Potential for significant effects, but mitigation measures to be undertaken. • Moderate to significant at reserves, even with the mitigation measures.
Operational noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads.*
Other condition requirements	• Detailed design of structural mitigation measures shall be undertaken by a SQEAS and approved by Auckland Council. • Structural mitigation measures certified by a SQEAS and consistent with adopting the best practicable option in accordance with NZS 6806:2010. • Prior to construction, a SQEAS to identify PPFs within 100 m of motorway carriageway where habitable spaces are likely to receive excess operational noise (40 dBA inside habitable spaces) with windows closed in design year. • Waka Kotahi to work with building owners to implement building modifications, if agreed upon, in a reasonable and practical timeframe, where Waka Kotahi is responsible for obtaining necessary building consents. • Noise monitoring to be undertaken prior to and on completion of works by SQEAS in accordance with NZS 6806:2010. • Baseline ambient vibration levels shall be measured at critical locations prior to works.
Summary comments	The Board implemented conditions in a departure from standard protocol to achieve appropriate levels of indoor noise.
Comparison	• PMOs specified and required, including use of noise barriers and OGPA at specific locations. • Tunnel-specific noise criteria. • Rather than having A, B and C categories of noise control, it was determined what buildings will have an increase of more than 40+ dB $L_{Aeq(24h)}$ inside with windows closed. Those buildings are to have building modification mitigations.

Table C.27 Christchurch Southern Motorway – Stage 2 (CSM2)

Point of comparison	Comment
Construction	
Number of conditions	5
General judgement on prescriptiveness	RMA conditions relating to construction noise and vibration (DC.16 to DC.20 inclusive) require that noise is managed such that it complies with the relevant standard, and where it does not, the alternative mitigation strategies are specifically identified in the conditions.
Issues addressed in the Decision of the Board of Inquiry report	• The issue is whether noise and vibration levels will comply with relevant national and international noise and vibration standards for construction activities associated with the project in order to minimise adverse effects on the health and safety of nearby residents. • The word 'should' in Draft Condition DC.18 was replaced with 'shall' in the conditions to manage construction noise. • Works close to residential areas and properties used as wedding venues. • The Board also commissioned an independent report on construction and operational noise relating to the project. This report included the background to NZS 6806:2010, how this standard has been applied to other roading projects, how this standard was derived, how it works, and how it deals with mitigation. • Following conferencing, two agreed statements of position were received from witnesses. • A CNVMP was included in the draft CEMP, which is required to be certified. Implicitly accepted to be an appropriate way to set the framework for the development and implementation of particular noise and vibration management and control methodologies, to be implemented when triggered in order to minimise adverse effects on the health and safety of nearby residents.
General observations on scale of effect	Moderate
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999 *Acoustics – Construction Noise* using 'long-term' duration construction criteria. Different dB $L_{Aeq(T)}$ and dB L_{Amax} for different times of day. • Vibration: DIN 4150-3:1999 *Structural Vibration Part 3: Effects of vibration on structures*, using Category A and B.
Other condition requirements	• Where practicable, implement the structural mitigation measures for operational traffic noise if these measures would also attenuate construction noise, prior to commencing construction works in that area. • CNVMP to be certified by an independent suitably qualified and experienced person(s) approved by the relevant territorial authority (Selwyn District Council or Christchurch City Council). Certification to be provided to the relevant territorial authority 10 days before the relevant stage of work commences. • Where it is not practicable to achieve specified noise criteria, alternative strategies must be described in the site-specific management schedules to address the effects of noise on specific neighbours. • Where it is not practicable to achieve vibration Category A criteria, alternative strategies must be described in the site-specific management schedules required below, and a suitably qualified acoustic expert shall be engaged to assess and manage construction vibration during the activities. • If predicted construction vibration levels exceed Category B criteria, then construction activity should only proceed if approved by the independent suitably qualified certifier and if there is appropriate monitoring of vibration levels and effects on buildings at risk of exceeding the Category B criteria, in accordance with a site-specific management schedule.

	• Requirement for site-specific management schedules to include additional requirements: – Specific, more restrictive criteria for wedding venue on wedding days. – Notification of pile-driving activities that might affect livestock.
Summary comments	• Where predicted to be non-compliant against specified noise criteria, alternative strategies need to be described in the site-specific management schedule. But these are not specifically required to be approved or certified. Instead, they are just required to be stated in the CNVMP as being a requirement. • Notification of pile-driving activities not given parameters.
Comparison	• Some specific requirements to address the issues raised by individuals in the court proceedings. • Same noise limits criteria as M2PP (dB $L_{Aeq(T)}$ and dB L_{Amax} for different times of day). Same as WEX:H except WEX:H doesn't specify that it is the long-term duration to be used. Waterview uses the same table format but different values for the $L_{Aeq(T)}$ limits. • Same construction vibration criteria as M2PP. • Prescriptive in the PMOs – eg, specifies noise barrier heights at different locations. • Uses management schedules rather than site-specific CNVMPs. Schedules to address particular residences or types of activities. Schedules are not specifically required to be approved by the authorities.
Operation	
Number of conditions	4
General judgement on prescriptiveness	Prescriptive conditions detailing specific measures to be implemented and processes in place if these measures are not practicable.
Issues addressed in the Decision of the Board of Inquiry report	• The key issue before the Board is the nature and magnitude of the operational noise effect from the project on the surrounding environment, including residential properties. In considering this issue, the Board has also had to address the differences between the existing and future receiving environments and the appropriateness of different standards for measuring noise. In this respect, the Board divided its consideration between general noise amenity issues and specific effects on identified properties. In this case, it proposes to deal with the standards issue before considering concerns from individual submitters. • A noise model was developed to predict traffic noise levels and to evaluate the reduction in noise provided by various noise mitigation options. • No detailed assessment of potential operational vibration effects was conducted. • The noise assessment showed that significant noise effects can be avoided, remedied or mitigated by utilising the best practicable mitigation option approach and the achievement of compliance with the relevant criteria of NZS 6806:2010. • Rural vs urban definition by Stats NZ and as defined in NZS 6806:2010. • NZS 6806:2010 Category A noise levels for new and altered roads less onerous than WHO guidelines. A change to the standard and adoption of WHO guidelines was proposed, and later retracted. • Noise concerns of residents and poultry farm. All but one had negligible noise effects predicted so no conditions were affected/added. • Extensive discussion over the effects on a wedding venue were debated. Ultimately, while the increase in noise levels was substantial, the mitigations measures proposed were not effective and the resultant noise levels were still deemed fit for purpose for the venue.
General observations on scale of effect	Minor effects

Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads.*
Other condition requirements	• Detailed design of PMOs shall be undertaken by a SQEAS. • Low-noise-generating road surface to be used in specific locations. • If the PMOs aren't practicable, structural mitigation measures can be changed if they still achieve the same noise criteria category at relevant PPFs, and must be approved as the best practicable option by a council-appointed planner. Consultation with property owners required if this is done. • PMOs to be implemented prior to construction completion, except for low-noise road surfaces. • All PMOs to be managed and maintained.
Summary comments	The conditions are understood to result in low (acceptable) levels of noise increases and meet the Board's objectives.
Comparison	• Very prescriptive in location and use of noise barriers, and OGPA. • No specific requirement to test the noise levels achieved, only to manage and maintain the measures so that they retain their noise reduction performance.

Table C.28 Waikato Expressway – Hamilton Section

Point of comparison	Comment
Construction	
Number of conditions	6 (rationalised conditions)
General judgement on prescriptiveness	Procedure is prescriptive and approval needed for plans and site-specific plans. No real mention of specific mitigation measures, but limits are identified and procedures in place (requiring approval) when these limits aren't practicable.
Issues addressed in hearing report for resource consent application	Road will be in an existing designation, so the restrictions are less severe. Concern is about the significance of any difference between what levels have already been confirmed and conditioned, and any new or additional noise generated as a result of the alterations before us.
General observations on scale of effect	Minor (in comparison to others)
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999 *Acoustics – Construction Noise* • Vibration: Category A and B criteria for vibration specified in table in the consents, without reference to its source. (Assessment used BS 5228-2:2009 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*, and DIN 4150-3:1999 *Structural vibration – Part 3: Effects of vibration on structures*.)
Other condition requirements	• CNVMP to be submitted for approval by territorial authority. • Where a CNVMP predicts that levels from a particular activity will or will likely exceed the limits set out in conditions, or where measurements show that compliance is not being achieved, an activity-specific CNVMP for approval by the territorial authority.
Summary comments	No specific mitigation strategies are specified, but the limits and processes are in place to achieve the goals.
Operation	
Number of conditions	14 (rationalised conditions)
General judgement on prescriptiveness	Doesn't specify mitigation measures but identifies limits and procedures for when they aren't met.

Issues addressed in hearing report for resource consent application	• Road will be in an existing designation, so the restrictions are less severe (ie, New Zealand Standard allows higher noise for altered roads vs new roads). Concern is about the significance of any difference between what levels have already been confirmed and conditioned, and any new or additional noise generated as a result of the alterations. • Original designation based on the (now obsolete) Transit New Zealand noise guidelines. It was noted that NZS 6806:2010 had been adopted for all new roading projects, but the standard excludes its application to designations with existing noise conditions. NZS 6806:2010 was considered to allow similar or higher noise levels than the Transit New Zealand guidelines.
General observations on scale of effect	Minor – designation was in place so only low (1–2 dB) operational increases expected.
Construction noise and vibration to be assessed and managed in accordance with:	• Average noise design levels set out in *Transit New Zealand's Guidelines for Management of Road Traffic Noise – State Highway Improvement*, effective at 1 December 1999.
Other condition requirements	• Noise survey to be carried out for ambient noise prior to construction. • Traffic noise mitigation plan for operation of the expressway for approval by the territorial authority's CEO. Traffic noise mitigation plan is to be prepared by a SQEAS. • Identify any 'residential buildings, hospitals or educational facilities' that are predicted to receive increased noise. • Consult with owners/occupiers who receive noise that exceeds noise guidelines average noise design level. • Within 3 months of the opening of the road, noise monitoring shall be undertaken and further practical mitigation measures shall be carried out if necessary to achieve the design noise limits.
Summary comments	Limits are specified and procedures are in place for when they are not met, including requiring approval.

Table C.29 SH1 Barters Road/Pound Road Improvements

Point of comparison	Comment
Construction and operation	
Number of conditions	0
General judgement on prescriptiveness	No specific noise or vibration conditions.
Issues addressed in the AEE	Noise and vibration effects were not considered in the application documents (AEE) or the decision (section 42A officer's report).
General observations on scale of effect	NA
Construction noise and vibration to be assessed and managed in accordance with:	NA
Other condition requirements	NA
Summary comments	No specific noise or vibration conditions.

Table C.30 SH73 Arthur's Pass Mingha Bluff Realignment

Point of comparison	Comment
Construction and operation	
Number of conditions	0
General judgement on prescriptiveness	No specific noise or vibration conditions.
Issues addressed in the AEE	• Other than the Arthur's Pass community, there are no other sensitive noise receivers near the site. • Any improvements to the alignment of the road are likely to result in a net decrease in noise due to decreased engine braking by heavy vehicles. • Construction noise will be managed in accordance with the relevant construction standards to ensure that effects are minimised within the national park setting. • Following completion of construction, there will be no adverse noise effect.
General observations on scale of effect	Less than minor.
Construction noise and vibration to be assessed and managed in accordance with:	Construction standard not specified.
Other condition requirements	NA
Summary comments	No noise or vibration conditions.

Table C.31 SH2/SH58 Haywards Interchange

Point of comparison	Comment
Construction	
Number of conditions	2
General judgement on prescriptiveness	General – just requires compliance with relevant noise standard.
Issues addressed in the hearing report	• A main issue for submitters was traffic speed, noise, and emissions. • Mr Hunt (noise expert) covered investigations into traffic and construction noise and an analysis of traffic-induced vibration effects, which will be received at residential locations following completion of the project. • For construction noise, findings indicate that the construction of the project can be carried out in compliance with the limits recommended by NZS 6803:1999. • Mr Coffey (ecologist) noted that there could be ongoing disturbance/displacement of fish and wildlife due to construction noise.
General observations on scale of effect	Minor
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999 *Acoustics – Construction Noise.*
Other condition requirements	• Construction noise to comply with NZS 6803:1999, except where emergency works are to be carried out at short notice in order to protect human life or property.

	• Suitably qualified person to review existing ambient sound levels at existing dwellings to determine compliance and on-site mitigation and provide council a report on this.
Summary comments	Construction noise to comply with relevant noise standard. No vibration conditions.
Operation	
Number of conditions	7
General judgement on prescriptiveness	Fairly prescriptive consultation requirements.
Issues addressed in the hearing report	• Mr Hunt concluded that future traffic noise levels at residential locations will also largely comply with the Transit New Zealand guidelines. In half the cases a decrease in noise levels is also expected as the road will be relocated further from existing residences. • At almost all residential properties where noise increases will occur, the projected increases are largely due to natural traffic growth on SH2, which will occur whether or not this project proceeds. • At one residential location immediately adjacent to SH2 (identified as the Parbhu residence) there is the possibility of minor non-compliance with the Transit New Zealand guidelines. • Traffic-induced vibration effects will be improved.
General observations on scale of effect	Minor – Moderate
Operational noise and vibration to be assessed and managed in accordance with:	• Noise: *Transit New Zealand's Guidelines for Management of Road Traffic Noise – State Highway Improvement.*
Other condition requirements	• Work designed so that noise levels will comply with *Transit New Zealand's Guidelines for Management of Road Traffic Noise – State Highway Improvement*, with design period 10 years from the time the road is operational. • 6–12 months after the road is opened, the requiring authority to engage a suitably qualified person to undertake an operational noise survey to determine actual levels and reassess compliance. • Affected dwellings: the requiring authority to consult with council and determine options for on-site noise mitigation and provide written notice to the owner of each affected dwelling inviting further consultation. • Completion certificate to be issued after noise mitigation works certifying that they have been undertaken to appropriate standards and attain level of reduction required by conditions.
Summary comments	Consultation required with council and affected parties to ensure that operational noise mitigation measures are satisfactory. No vibration conditions.

Table C.32 Welcome Bay Road and Te Puke Highway Intersection

Point of comparison	Comment
Construction	
Number of conditions	0
General judgement on prescriptiveness	No construction noise and vibration conditions.
Issues addressed in the AEE	• During construction the project will comply with noise limits specified in New Zealand Standard NZSA 6803:1999.

General observations on scale of effect	No more than minor.
Construction noise and vibration to be assessed and managed in accordance with:	• Noise: NZS 6803:1999 *Acoustics – Construction Noise* (not specified in conditions, based on AEE).
Other condition requirements	NA
Summary comments	No noise or vibration conditions.
Operation	
Number of conditions	0
General judgement on prescriptiveness	No operation noise and vibration conditions.
Issues addressed in the AEE	• No major change in alignment or surface of road. As a result, NZS 6806:2010 will not be triggered because there will not be a 1–3 dBA increase in noise effects. • No noise assessment is required.
General observations on scale of effect	No more than minor.
Operational noise and vibration to be assessed and managed in accordance with:	Not specified.
Other condition requirements	NA
Summary comments	No operation noise and vibration conditions.

Appendix D: Case study high-level summaries

High-level summary tables of the consent requirements for each case study are presented below.

Table D.1 High level summary: Ecology

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Region	Wellington	Auckland	Canterbury	Waikato	Canterbury	Canterbury	Wellington	Bay of Plenty
# Conditions	23	57	6	22	None	16	3	2
Management plan required?	Yes – ecological management plan to be certified by GWRC.	Yes – ecological management plan.	Yes – construction environmental management plan (CEMP) and lizard management plan.	Yes – ecological management and restoration plan (EMRP) to be certified by Waikato Regional Council, and landscape management plan.	No	Works to be consistent with the Arthur's Pass National Park Management Plan.	No	No
Site-specific plans required?	Yes – site-specific ecological management plans to be prepared for mitigation areas.	No	No	No	No	No	No	No

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Freshwater ecology requirements?	Yes – including fish rescue and relocation, fish passage, mudfish survey.	Yes – including a stream works environmental management plan, fish passage, monitoring.	Yes – stockwater race diversions to provide fish passage.	Yes – EMRP to include measures for perennial stream habitats and indigenous fish. Mudfish management plan.	No	Yes – including fish passage, fish rescue and relocation, no stream works during fish spawning season, habitat re-established.	Yes – fish passage.	Yes – fish passage.
Marine ecology requirements?	Yes – pre- and post-construction marine ecology monitoring.	Yes – including limited vegetation/ mangrove removal, monitoring.	No	No	No	No	No	No
Avifauna requirements?	Yes – specific to the fernbird including avoiding habitat during breeding season and monitoring.	Yes – including temporary high tide roosting structures, monitoring, vegetation clearance outside breeding season, pest control.	No	Yes – EMRP to include measures for little shag and long-tailed bats. Pre-construction survey and relocation required. Bat management plan.	No	No	No	No

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Herpetofauna requirements?	Yes – including a lizard management plan, and capture and relocate.	Yes – ecological management plan to include lizard management.	Yes – lizard management plan.	Yes – EMRP to include measures for indigenous lizards. Pre-construction survey and relocation required.	No	No	No	No
Terrestrial ecology requirements?	Yes – including monitoring and mitigation for vegetation and wetlands.	Yes – including special requirements for significant and valued vegetation, project botanist, eco-sourcing, weed control.	Yes – machinery to be cleaned to prevent spread of weeds, and riparian vegetation planting.	Yes – EMRP to include measures for terrestrial and wetland habitats and at-risk species. Pre-construction survey and relocation required. Gully restoration implementation plan. Buffer planting.	No	Yes – mistletoe inventory required. Mistletoe, *Coprosma acerosa* and riparian remediation plan to include eco-sourcing. Vegetation clearance plan to be approved by DOC.	Yes – Revegetation plans developed in consultation with GWRC and DOC.	No
Monitoring?	Yes – vegetation, freshwater ecology, marine ecology, fernbird, fish passage.	Yes – freshwater ecology, Oakley Creek water quality, marine ecology.	No	Yes – kahikatea in Mangaonua Gully, bat surveys and monitoring, little shag nesting activity.	No	No	No	No

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Mitigation?	Yes – minimum total 40.7 ha of planting, including indigenous terrestrial habitat, wetland habitat, stream mitigation and new stream channel.	Yes – 343 m of stream offset mitigation.	Not specified but to be included in the CEMP.	Yes – 10.2 ha of ecological gully restoration, buffer planting and habitat for mudfish.	No	No	No	No

Table D.2 High level summary: Erosion and sediment control

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Region	Wellington	Auckland	Canterbury	Waikato	Canterbury	Canterbury	Wellington	Bay of Plenty
# Conditions	5	35	10	25	10	15	30	15
Guidelines prescribed?	Yes – GWRC *Erosion and Sediment Control Guidelines for the Wellington Region*, except where Waka Kotahi *Draft Erosion and Sediment Control Guidelines for State Highway Infrastructure* more stringent.	Yes – Auckland Regional Council Technical Report 90 (TP90).	Yes – Environment Canterbury *Erosion and Sediment Control Guideline 2007* and consistent with the Waka Kotahi *Erosion and Sediment Control Guidelines for State Highway Infrastructure.*	Yes – Waikato Regional Council *Erosion & Sediment Control: Guidelines For Soil Disturbing Activities.*	Yes – Environment Canterbury *Erosion and Sediment Control Guideline 2007.*	Yes – Environment Canterbury *Erosion and Sediment Control Guideline 2007.*	Yes – Auckland Regional Council TP90 guidelines.	Yes – BOPRC *Erosion and Sediment Control Guidelines for Land Disturbing Activities: Guideline 2010/01.*
Management plan required?	Yes – construction erosion and sediment control plan (CESCP) and chemical treatment plan to be certified by GWRC.	Yes – CESCP and chemical treatment plan to be certified by Auckland Council.	Yes – ESCP (certified by independent suitably qualified and experienced person).	Yes – CMP with ESC section and flocculation management plan to be certified by Waikato Regional Council.	Yes – ESCP to be certified by Compliance Manager at Environment Canterbury.	Yes – ESCP to be certified by Compliance Manager at Environment Canterbury.	Yes – ESCP to be submitted for written approval by Waikato Regional Council Consents Manager.	Yes – final ESCP to be certified by BOPRC.

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Site-specific plans required?	Yes – site-specific CEMP to be certified by GWRC.	Yes – site-specific CEMP to be certified by Auckland Council and as-built ESCPs also required to be certified by Auckland Council.	No – but ESCP submitted with application to be finalised.	Yes – as-built plans of ESC structures.	No	No	No	No
Sediment control team required?	No	Yes – to meet on weekly basis and include Auckland Council, contractor, Waka Kotahi.	No	Yes – to meet on weekly basis with Waikato Regional Council and to be managed by an appropriately qualified and experienced person approved by Waikato Regional Council.	No	No	No	No
Routine monitoring	Yes – turbidity.	Yes – turbidity and pH.	Yes – turbidity and TSS.	Yes – weekly checks of ESC structures.	No, not in RMA conditions but required as monitoring programme to be included in ESCP.	Yes – visual clarity (once per day), ESC devices (once per week), watercourses (once per 6 months).	No, not in RMA conditions but required as part of ESCP.	No, but 6-monthly monitoring of structure following completion of works.

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Triggered monitoring	Yes – turbidity.	No, not in RMA conditions. Proactive monitoring is detailed in ESCP – automated pH and turbidity meter.	No, but RMA conditions require that the ESCP includes checks after >15 mm of rain in a 24-hour period.	Yes – RMA conditions require ESC structures checked within 24 hours of rain event.	No, not in RMA conditions.	Yes – RMA conditions require ESC structures checked within 24 hours of rain event.	Yes – TSS grab sampling at inlet and outlet of sediment retention ponds after trigger event.	No
Earthworks season?	No	Yes – no earthworks between 1 May and 30 Sep without written approval from Auckland Council.	No	Yes – no earthworks between 1 May and 30 Sep without written approval from Waikato Regional Council.	No	No	No	No
Minimum discharge treatment standard specified?	No	Discharges to Oakley Creek: 3-month monitoring programme required to develop turbidity and pH standard but initial pump treatment to be set at 50 NTU and pH 7.5.	Stormwater: not to exceed turbidity of 55 NTU or TSS of 100 mg/L. Dewatering: not to exceed turbidity of 30 NTU of TSS of 50 mg/L.	Soluble aluminium concentration: <0.2 g/m^3. pH: between 5.5 and 8.5.	TSS: <100 g/m^3. Groundwater: at least 5 m separation between discharge point and highest recorded groundwater level.	Visual clarity: reduction not to exceed 20% absolute.	Flocculation required in sediment retention ponds where efficiencies for TSS are less than 70%.	No
Maximum open earthworks area specified?	No	No	No	No	No	No	No	No

Table D.3 High level summary: Stormwater

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Region	Wellington	Auckland	Canterbury	Waikato	Canterbury	Canterbury	Wellington	Bay of Plenty
# Conditions	3	23	27	25	2	6	0	5
Stormwater design guidance used	Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure.*	Operational design philosophy contained in Technical Report G.27 (dated 2010), references a variety of design standards including Australian, New Zealand, and Auckland-specific documents.	Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*.	Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure.*	Not specified	Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure.*	NA	BOPRC *Hydrological and Hydraulic Guidelines.*
Management plan required?	No	Yes – temporary stormwater management plan, operational stormwater management plan.	Yes – stormwater operation and maintenance plan.	No	No	No	No	No

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Climate change scenario (year and scenario used)	2115 mid-range climate change scenario and high-range sensitivity analysis. Written into RMA conditions. Application references MfE guidelines – *Climate Change Effects and Impacts Assessment* (2008). Comprehensive debate on climate change effects and mitigation in Board of Inquiry hearing.	2090 mid-range climate change scenario. 2100 sea-level rise. Stated in application. MfE guidelines – *Climate Change Effects and Impacts Assessment* (2008). 'Allowances for climate change' specified in RMA conditions but date not specified.	2080. Written into RMA conditions. Application references MfE guidelines – *Climate Change Effects and Impacts Assessment* (2008).	2090. AEE states culverts designed to accommodate 1% AEP, taking into account climate change. No consideration of climate change specified in RMA conditions.	2100. AEE states design accounts for climate change (increased rainfall intensity). No consideration of climate change specified in RMA conditions.	No consideration of climate change specified in RMA conditions.	AEE states culverts designed to accommodate 1% AEP, allowing for climate change (increased rainfall intensity). No consideration of climate change specified in RMA conditions.	No consideration of climate change specified in RMA conditions.
Further certification of design required?	Yes – peer review of final stormwater design and flood modelling by suitably qualified and experienced engineer and submitted to GWRC.	Yes – submit final design to Auckland Council.	Yes – design plans to be submitted to the manager and accompanied with a certificate signed by a chartered professional engineer prior to construction.	Yes – final design to be approved by Waikato Regional Council.	No	Yes – post-construction certification by a chartered professional engineer.	NA	Yes – design of culvert to be certified by BOPRC.

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Flood attenuation required?	Yes – peak rate of discharge not to exceed 80% (urban) or 100% (rural) pre-expressway peak discharge.	In limited areas – and in areas where flood attenuation not proposed, 100-year annual recurrence interval overflow can be managed in overland flow paths.	No	No	No	No	NA	No
Stormwater treatment required before discharge?	Yes – in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure.*	Yes – conditions refer to Technical Report G.15, which references operational and construction phase treatment to Auckland Regional Council TP10 guidelines.	Yes – in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*.	Yes – in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*.	No	Yes – in accordance with *Stormwater Treatment Standard for State Highway Infrastructure*.	NA	No
Required operational TSS removal rates	Not specified.	75–80%.	TSS not to exceed 100 mg/L in all discharges to water.	TSS not to exceed 100 g/m^3.	Not specified.	Not specified.	NA	Not specified.

Table D.4 High level summary: Noise and vibration – construction

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Region	Wellington	Auckland	Canterbury	Waikato	Canterbury	Canterbury	Wellington	Bay of Plenty
# Conditions	10	13	5	6	None	None	2	NA
Noise Limits from NZS 6803:1999 Table 2?	Yes – long duration only.	No – same format but with several numbers changed.	Yes – long duration only.	Yes – entire table referenced (not just long duration).	NA	NA	Yes	Not specified.
Vibration limits Category A and B from DIN 4150-3:1999?	Yes – continuous monitoring required for Category B.	No – has different criteria format and limits in mm/s for various frequencies and durations, but with specific tunnel and blasting requirements listed as well.	Yes	Yes – also specifies limits for transient and continuous vibration for underground services.	NA	NA	NA	NA

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Specific PPF requirements stated?	No	Yes – particularly around educational facilities and specific residences which may need to be relocated. No relocation of residents around exam time for Unitec.	Yes – specific noise limits for wedding venue, and notification of pile-driving activities for livestock.	No	NA	NA	No	NA
Prescribed PMOs?	Yes. Details locations of noise walls and specifies minimum locations of OGPA.	Permanent noise barriers to be installed prior to construction. Concrete batch plants and loading bays to be enclosed.	Yes. Details locations, ratings and heights of noise walls. Specifies minimum locations of OGPA.	None specified in conditions.	NA	NA	None specified in conditions.	NA
CNVMP guidelines	Stated in conditions.	Stated in conditions.	Stated in conditions.	In accordance with *State Highway Construction and Maintenance Noise and Vibration Guide* (NZ Transport Agency, 2013).	NA	NA	Not specified in conditions.	NA

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Site-specific plans?	**Site-specific CNVMPs** where noise levels can't be met.	**Site-specific CNVMPs** required based on flow chart process if noise or vibration criteria are predicted to not be met.	Site-specific **management schedules** where Category A vibration or noise limits not achieved. Management schedules are required to be stated as required in the CNVMP, but don't specifically require approval themselves.	**Activity-specific CNVMPs** to be approved for any activities that will exceed the noise limits.	NA	NA	Not specified in conditions.	NA
CNVMP and site-specific CNVMP approval required by	To be reviewed by an independent SQEAS prior to being submitted to the council for certification.	Major Infrastructure Team Manager, Auckland Council.	Relevant territorial authority (Selwyn District Council or Christchurch City Council). Vibration management schedules to be approved by independent qualified certifier.	Territorial authority's Chief Executive Officer or nominee.	NA	NA	NA	NA

Table D.5 High level summary: Noise and vibration – operation

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Region	Wellington	Auckland	Canterbury	Waikato	Canterbury	Canterbury	Wellington	Bay of Plenty
# Conditions	15	15	4	14	None	None	7	None
Category A, B and C limits from NZS 6806:2010?	Yes, except Category 3 inside habitable spaces internal limit trigger reduced from 45 dB $L_{Aeq(24h)}$ to 40 dB $L_{Aeq(24h)}$ as a result of Waterview decision.	Habitable spaces all required to have 40 dB $L_{Aeq(24h)}$ (the 45 dB $L_{Aeq(24h)}$ upper bound being removed). NZS 6806:2010 best practicable options to be used if PMOs specified not practicable. Separate tunnel-specific criteria.	Yes, but only called into question if PMOs cannot be practicably implemented.	No. *Transit New Zealand's Guidelines for Management of Road Traffic Noise* used.	NA	NA	No. *Transit New Zealand's Guidelines for Management of Road Traffic Noise* used.	NA
Prescribed PMOs?	Yes. OGPA and noise barriers in specific locations.	Yes. OGPA, twin-layered OGPA and noise barriers in specific locations to be designed by a SQEAS approved by the Major Infrastructure Team Manager, Auckland Council.	Yes. Details locations, ratings and heights of noise walls. Specifies minimum locations of OGPA.	No. Nor prescribed procedures.	NA	NA	No	NA

	M2PP	Waterview	CSM2	WEX:H	Barters Road	Mingha Bluff	SH58 Interchange	Welcome Bay
Approval required by	If specified PMOs are not practicable, changes to be certified to the council by a SQEAS.	Major Infrastructure Team Manager, Auckland Council.	Suitably qualified planner to certify to the council that any changes to PMOs are consistent with adopting the best practicable option.	Territorial authority's Chief Executive Officer or nominee.	NA	NA	Not specified	NA
Monitoring?	The certified Noise Monitoring Plan specified between 1 and 2 years post-opening.	Within 2–3 years following completion of construction.	Manage and maintain the PMOs, but no requirement to test that they were successful.	Within 3 months of opening.	NA	NA	Within 6–12 months following completion.	NA

Appendix E: Risk assessments

E.1 Quantification of risk

As discussed in section 4, the work set out in this report has been determined to be of limited relevance in terms of aiding our final analysis for the purpose of the drivers of consistency of RMA conditions. However, this work does illustrate the overall thrust of the outcomes sought, and what mitigations were determined to be appropriate and reasonable (and hence the residual environmental risk that might arise from those conditions) in the context of the environmental aspects for the projects considered.

E.2 Environmental risks

A full list of environmental risks associated with each case study for the selected environmental aspects (ecology, ESC, stormwater, and noise and vibration) is set out below. The key risks for each of these were identified and discussed with Waka Kotahi.

Whilst not an exhaustive list of RMA consent generated risks, this list provides an overview of the matters of concern canvassed through RMA processes for these projects and relevant for considering future application.

An example of an ecological project risk is ‘the loss of existing habitat negatively impacts upon ecosystem function’. For a project like M2PP, the consequence of losing ecologically significant wetland habitats located within the project designation was ‘severe’. It was assessed as ‘likely’ that this event would occur without any environmental controls in place, leading to a ‘critical’ inherent risk rating. When management controls, such as the proposed ecological management plan and site-specific ecological management plans, were applied, the likelihood of the identified risk occurring was reduced to ‘unlikely’. The proposed offset mitigation (including terrestrial habit, wetland habitat, stream mitigation and riparian planting) was justification to reduce the expected consequence from ‘severe’ to ‘moderate’. This gave a residual risk rating of ‘moderate’.

In contrast, the same ecological risk was assessed as a ‘low’ inherent and residual risk for the Barters Road project. Barters Road involved constructing a new intersection on a small piece of grassed land between existing roads on the outskirts of Christchurch. As such, the potential consequence and likelihood of the identified risk occurring were rated as ‘minor’ and ‘unlikely’ respectively. In this case, no ecology-specific conditions were included in the RMA conditions, so the rating for residual risk was the same as the inherent risk: low risk.

Other examples of environmental risks are listed below by topic.

Ecology

- Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function.
- Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control).
- Adverse effects (eg, mortality, disturbance) on native or protected freshwater ecology during construction.

Erosion and sediment control

- High levels of sediment in site runoff are discharged to the receiving environment, resulting in adverse water quality effects.
- Soil transported off-site by construction traffic enters surface water as uncontrolled sediment discharge.

- Adverse visual/aesthetic effects in local freshwater rivers/streams.

Stormwater

- High levels of stormwater contaminants are discharged to the receiving environment, resulting in adverse ecological effects.
- Flooding events increase for surrounding areas following the completion of the project.

Noise and vibration

- High daytime construction noise levels near residential areas.
- Construction vibration leads to structural building damage.
- High night-time operational noise levels in excess of the relevant standard near residential areas.

E.3 Residual risk

Residual risk refers to the risk remaining after accounting for the management controls required by RMA conditions. This assessment considers the original objective as we have judged from the drafting of the conditions and the project's application documents, and how well the condition appears to address the risk (or not) of achieving that objective. It should be noted that the residual risk level does not translate directly into adverse environmental effects.

This research focused on assessing management controls required by RMA conditions, but in practice many effects are controlled through additional factors, including design, route selection, iwi or stakeholder involvement, or even through the contractor installing additional environmental controls over and above what they are required to do by RMA conditions.

The residual risk ratings in this report are indicative of the level of environmental protection afforded, and deemed to be acceptable, through the consenting process. In principle, the residual risk should be reduced to a moderate or low risk level. However, in applying Minimum Standard Z/44 (NZ Transport Agency, 2018) and the classifications of risk, this is dependent on the projected consequence of the identified risk: if the consequence is extreme, then even if the likelihood is reduced through management controls, the residual risk will remain either high or critical (Table 4.1). Figures E.1–E.4 show the residual environmental risks associated with each case study.

For explanation, residual risks relating to achieving certain stormwater management objectives at Waterview Connection, M2PP and CSM2 were all assessed to be 'high' (Figure E.3). This may reflect on issues such as a high-quality receiving environment that the discharges could have been expected to enter. In contrast, it has been assessed that for the Barter's Road project, there was a low risk assessed in terms of noise and vibration for that project (Figure E.4).

Figure E.1 Residual environmental risks associated with ecology for each case study

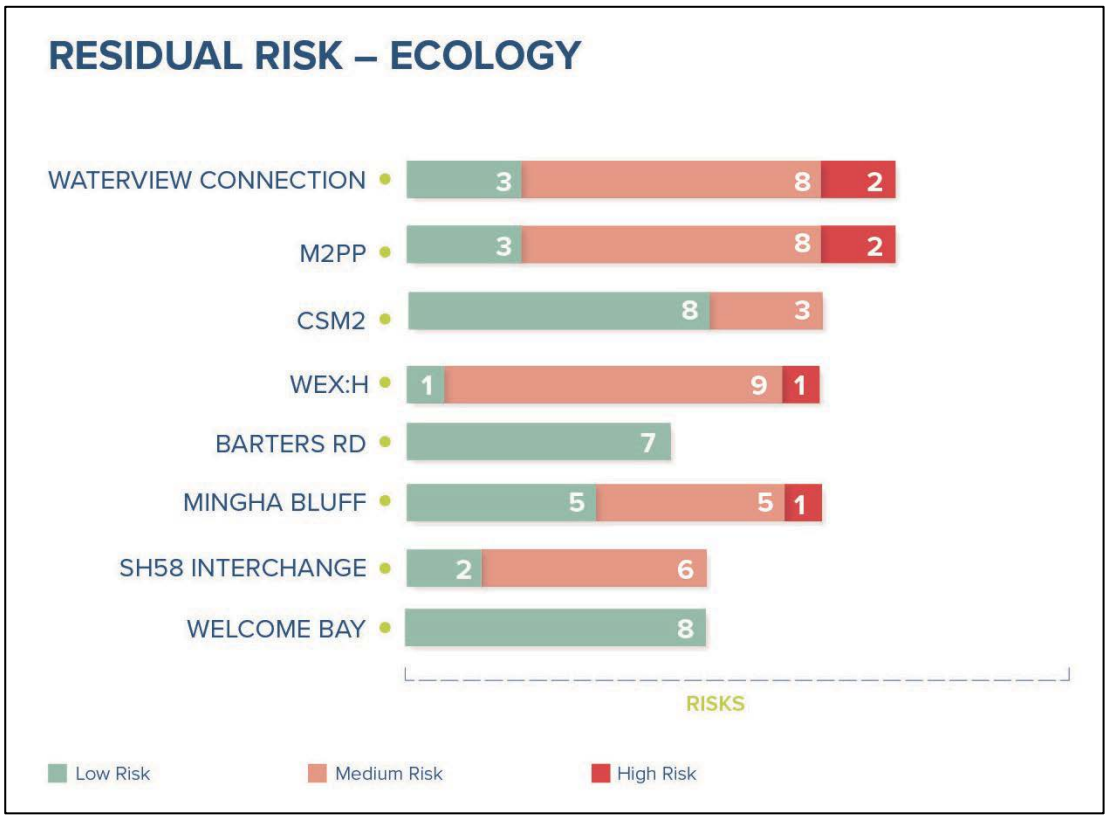


Figure E.2 Residual environmental risks associated with ESC for each case study

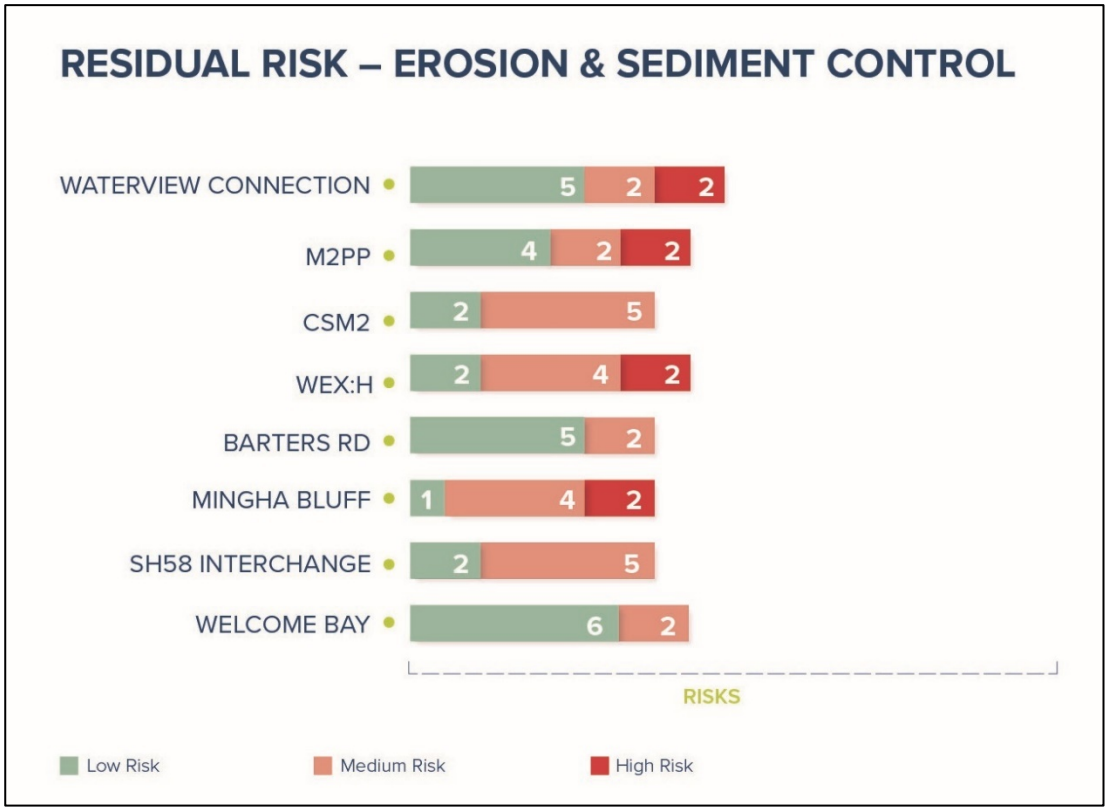


Figure E.3 Residual environmental risks associated with stormwater for each case study

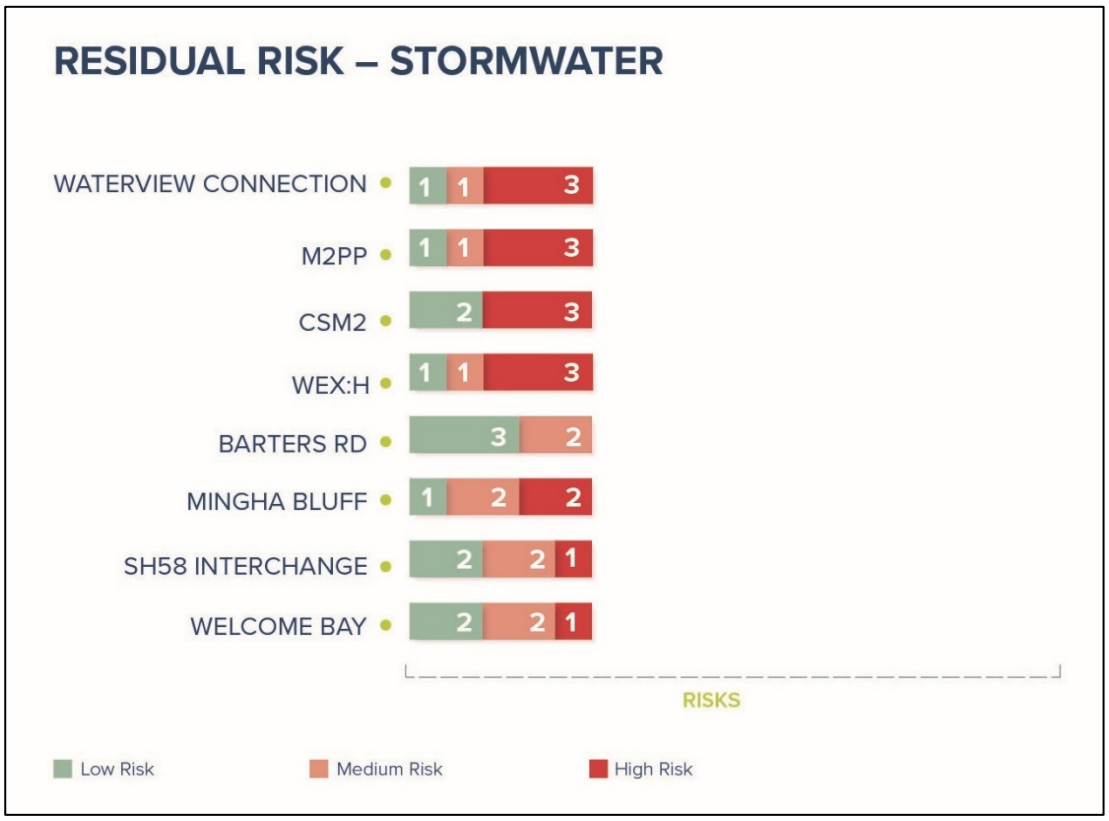
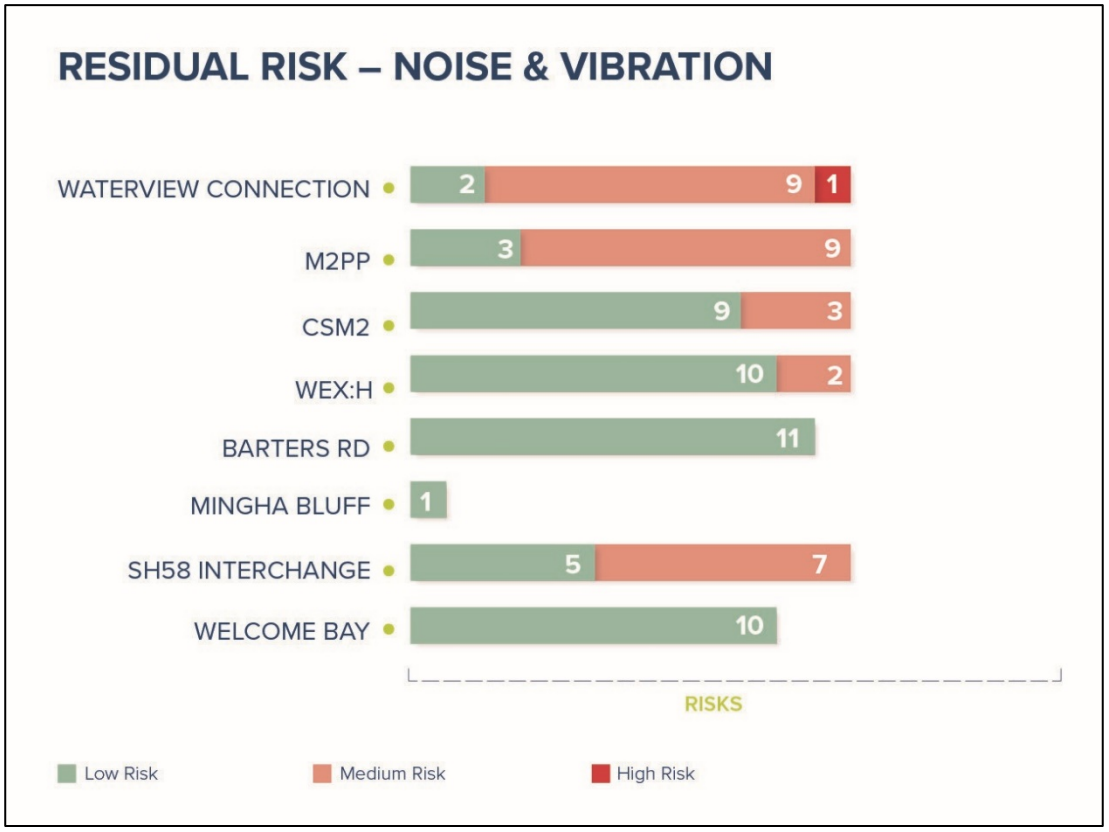


Figure E.4 Residual environmental risks associated with noise and vibration for each case study



E.4 Effectiveness of environmental management controls

The effectiveness of the environmental management controls to achieve the expected objectives was analysed by measuring the extent of the risk reduction. By further comparing the inherent risk to the residual risk, a proxy measure of the effectiveness of the consenting process at reducing environmental risks was developed. The risk reduction from inherent to residual risk was plotted by case study in four categories, as listed below:

- **Inherent risk already low:** There was no opportunity to reduce the risk as the inherent risk was already low to begin with.
- **Risk category reduced by two levels of severity:** The residual risk is two risk categories lower than the inherent risk (ie, a 'high' inherent risk reduces to a 'low' residual risk when the controls required by RMA conditions are considered).
- **Risk category reduced by one level of severity:** The residual risk is one risk category lower than the inherent risk (ie, a 'high' inherent risk reduces to a 'moderate' residual risk when the controls required by RMA conditions are considered).
- **No risk reduction:** There is no difference between the inherent and the residual risks.

Figures E.5–E.8 show the effectiveness of the environmental management controls applied to each case study.

Figure E.5 Effectiveness of ecological controls applied to each case study

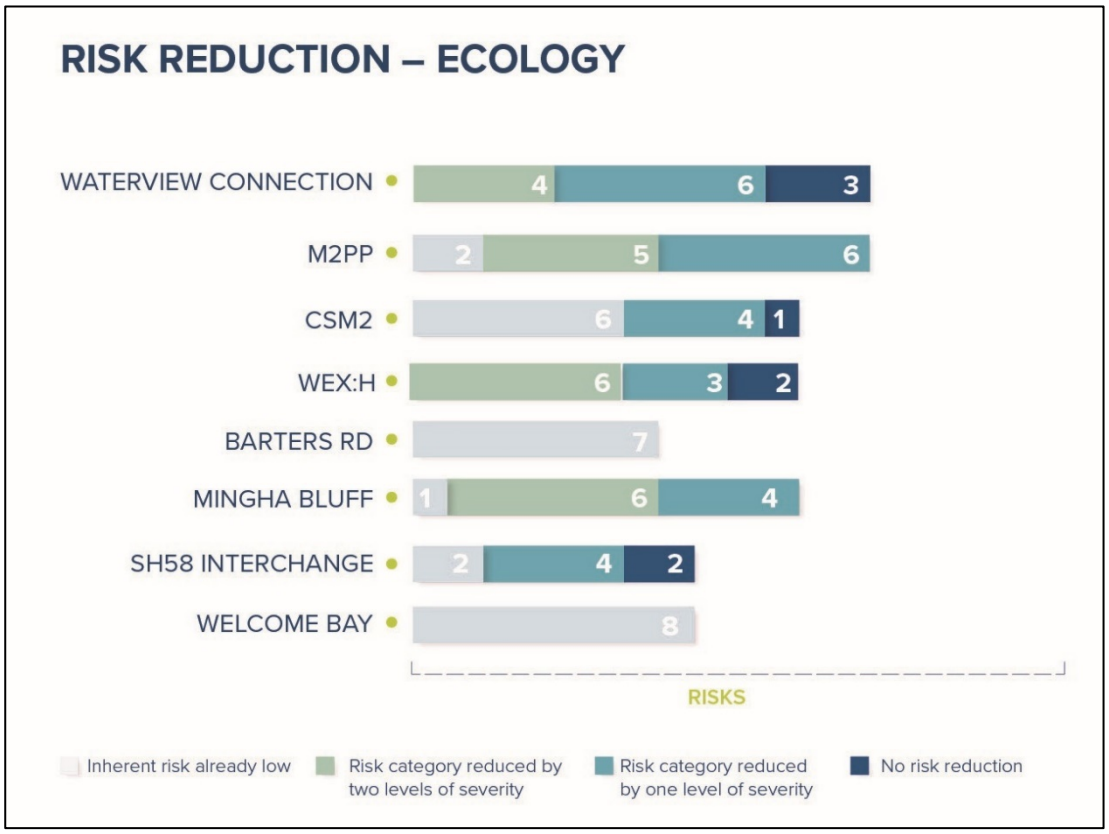


Figure E.6 Effectiveness of ESCs applied to each case study

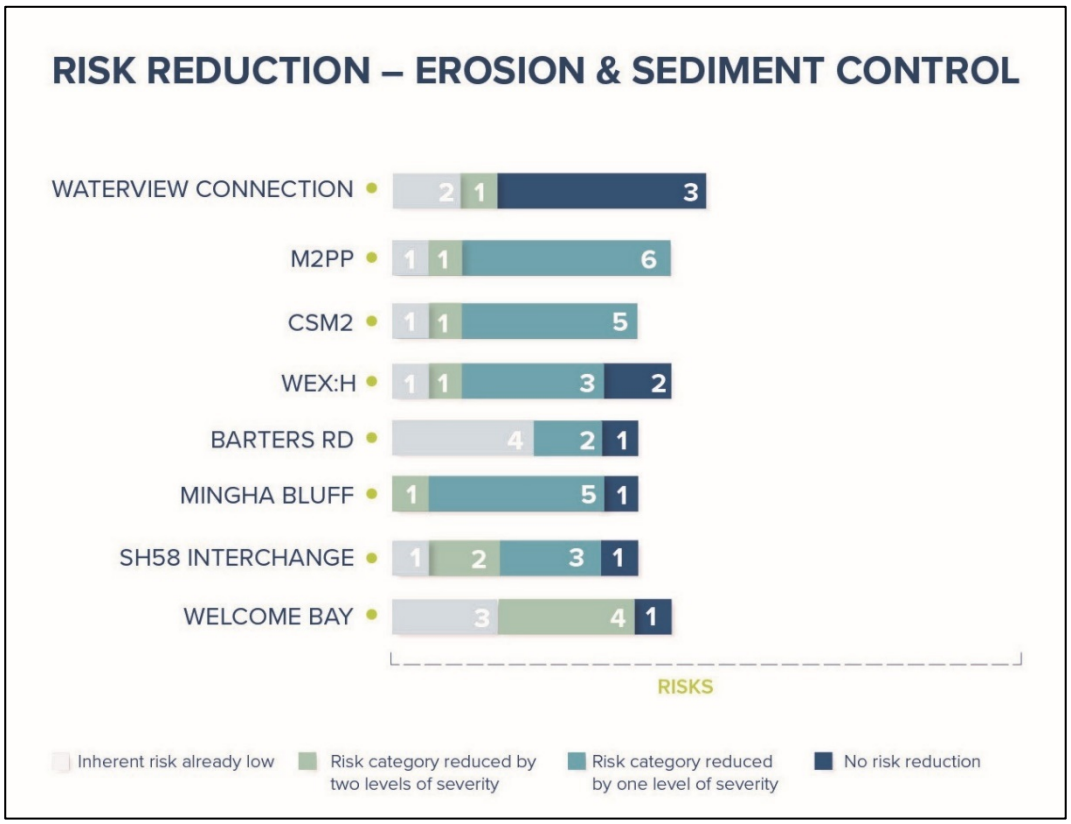


Figure E.7 Effectiveness of stormwater controls applied to each case study

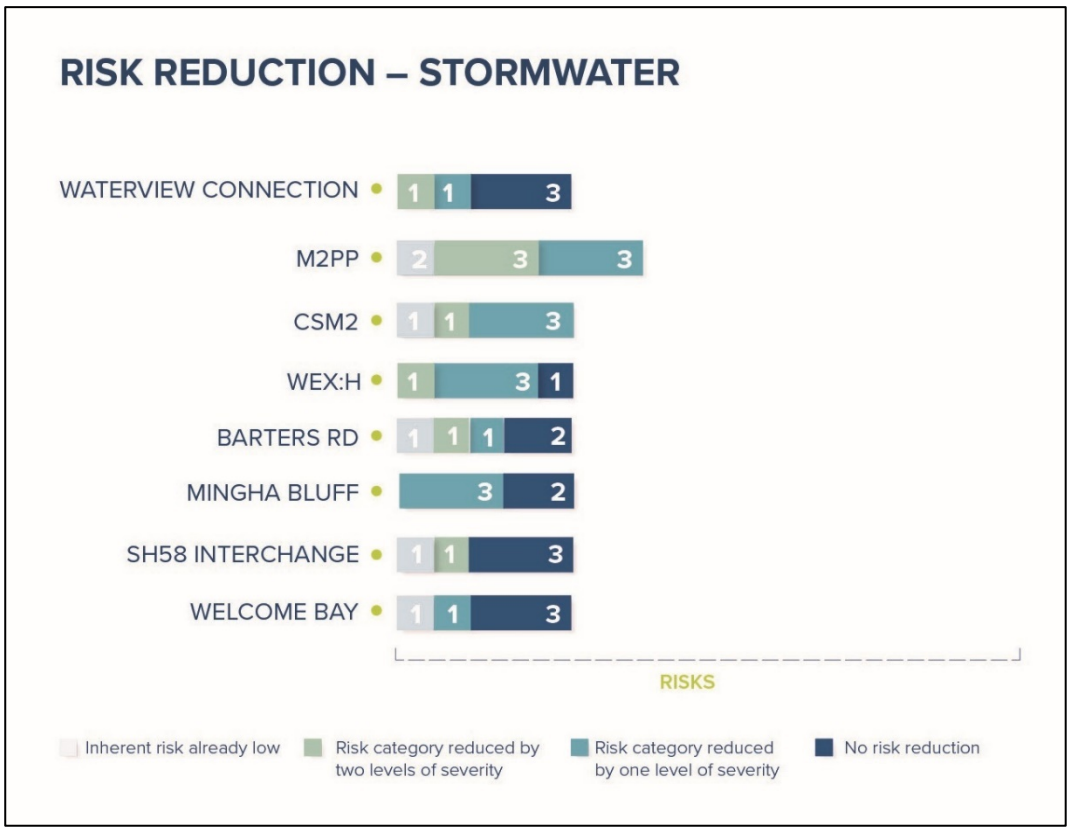
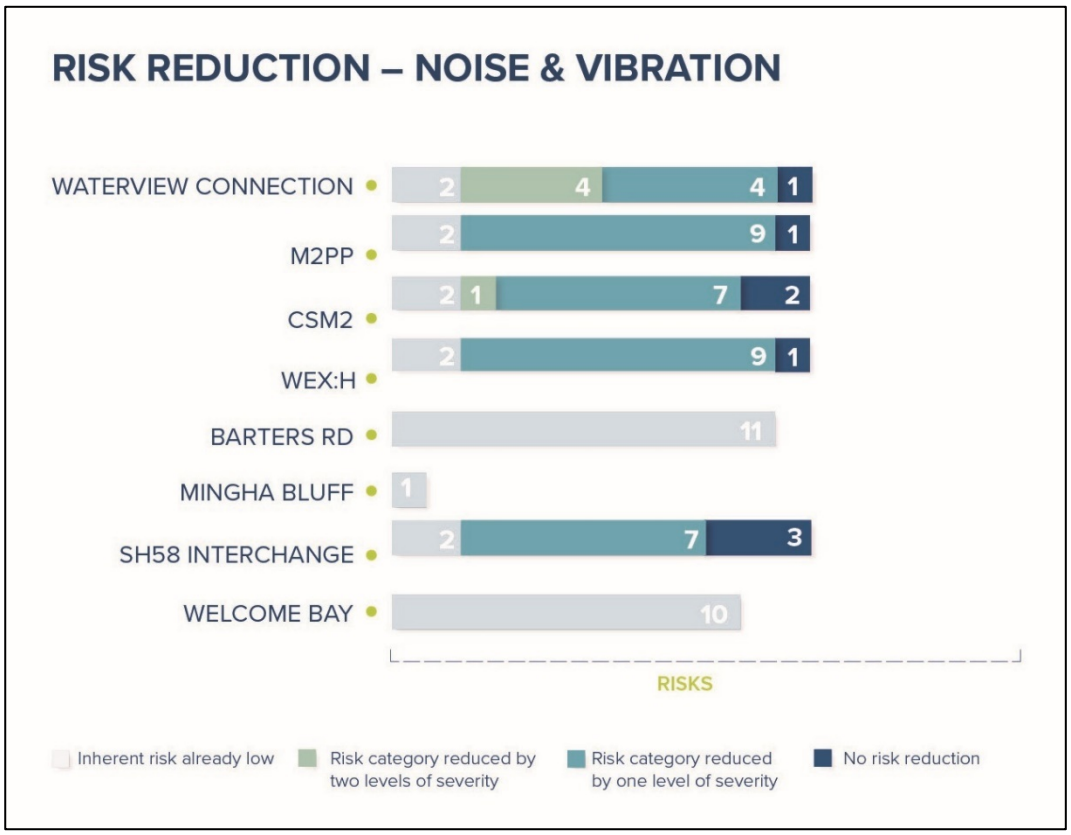


Figure E.8 Effectiveness of noise and vibration controls applied to each case study



The detailed risk assessments by environmental aspect that fed into summaries are set out in Tables E.1–E4.

Table E.1 Ecology risk assessment

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Waterview Connection								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	4	C	**RMA conditions** • Ecological management plan • Vegetation removal minimised	2	4	M
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	4	3	H	**RMA conditions** • Ecological management plan • Vegetation removal minimised	2	3	M
	Reduced water quality negatively impacting upon ecosystem function	4	4	C	**RMA conditions** • Ecological management plan • Oakley Creek monthly water quality monitoring • Erosion and sediment control plan (ESCP)	2	4	M
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	2	2	L	**RMA conditions** • Ecological management plan • Fish passage	1	2	L
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	3	3	M	**RMA conditions** • Ecological management plan • Vegetation removal minimised	2	3	M
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	3	3	M	**RMA conditions** • Ecological management plan • Landscape management plan	2	3	M
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	3	4	H	**RMA conditions** • Ecological management plan • Ecological monitoring • Offset stream mitigation	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	3	H	**RMA conditions** • Stream works environmental management plan • *Oakley Creek Re-alignment and Rehabilitation Guidelines* • Project ecologist to monitor and certify all stream works • Pre-construction and annual fish and macroinvertebrate surveys	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna** during construction	4	3	H	**RMA conditions** • Temporary roosting structures provided during construction • Monitoring of roosting areas • Vegetation clearance undertaken outside of breeding season • Pest control on Traherne Island and coastal marine area	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	3	3	M	**RMA conditions** • Ecological management plan	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	3	3	M	**RMA conditions** • Ecological management plan • 6-monthly monitoring	2	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	4	4	C	**RMA conditions** • Significant and valued vegetation to be identified and protected/replaced • Project botanist to supervise works and monitor significant/valued vegetation • 2 of years post-construction weed control • Plants sourced from Tamaki Ecological District • Traherne Island Weed and Pest Management Plan	2	4	M
Mana whenua	Adverse effects on the mauri of the receiving environment	3	5	C	**RMA conditions** • Ecological management plan	2	5	H
Mackays to Peka Peka Expressway								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	4	C	**RMA conditions** • Ecological management plan • Vegetation removal minimised • Offset mitigation: 7.6 ha terrestrial habit, 5.4 ha wetland habitat and riparian planting	2	4	M
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	4	3	H	**RMA conditions** • Ecological management plan • Vegetation removal minimised	2	3	M
	Reduced water quality negatively impacting upon ecosystem function	4	4	C	**RMA conditions** • Ecological management plan • Site-specific target stream ecological value (SEV) scores • ESCP	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	2	2	L	**RMA conditions** • Ecological management plan • Fish passage	2	2	L
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	3	3	M	**RMA conditions** • Ecological management plan • Offset mitigation: 7.6 ha terrestrial habit, 5.4 ha wetland habitat and riparian planting	2	3	M
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	3	3	M	**RMA conditions** • Ecological management plan • Landscape management plan	2	3	M
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	3	4	H	**RMA conditions** • Ecological management plan • Ecological monitoring and adaptive management programme • Weed and pest management	2	4	M
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	4	C	**RMA conditions** • Fish rescue and relocation plan • Provision for migration of native fishes • Mudfish survey • Pre- and post-construction freshwater ecology monitoring • Post-construction riparian mitigation vegetation monitoring and maintenance • Fish passage	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna** during construction	4	4	C	**RMA conditions** • Fernbird habitat to be avoided during breeding season • Trap and transfer for fernbird found outside breeding season • Avoidance of effects on fernbird • Pre- and post-construction fernbird monitoring	2	4	H
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	3	3	H	**RMA conditions** • Ecological management plan to include lizard management plan • Capture and relocate • Re-establishment of lizard habitat	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	3	2	M	**RMA conditions** • Pre- and post-construction marine ecology monitoring	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	4	4	C	**RMA conditions** • Pre- and post-construction vegetation monitoring • Post-construction terrestrial mitigation vegetation monitoring and maintenance • Pre- and post-construction wetland monitoring • Post-construction wetland mitigation vegetation monitoring and maintenance	2	4	M
Mana whenua	Adverse effects on the mauri of the receiving environment	3	5	C	**RMA conditions** • Ecological management plan	2	5	H

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Christchurch Southern Motorway – stage 2								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	2	M	**RMA conditions** • Construction environmental management plan (CEMP)	2	2	L
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	2	1	L	**RMA conditions** • CEMP	1	1	L
	Reduced water quality negatively impacting upon ecosystem function	4	3	H	**RMA conditions** • CEMP • ESCP	2	3	M
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	2	2	L	**RMA conditions** • CEMP • Riparian planting for disturbed areas adjacent to stockwater races	2	2	L
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	1	1	L	**RMA conditions** • CEMP	1	1	L
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	2	1	L	**RMA conditions** • CEMP	1	1	L
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	2	M	**RMA conditions** • Stockwater race diversions to provide fish passage • ESCP	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna** during construction	2	2	L	**RMA conditions** • CEMP	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	4	3	H	**RMA conditions** • Lizard management plan	2	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	2	2	L	**RMA conditions** • CEMP • Machinery cleaned to avoid spread of weeds • Riparian planting for disturbed areas adjacent to stockwater races **CEMP** • Enhance existing highly modified farmland • Landscape mitigation: planting tōtara/mātai forest	1	2	L
Mana whenua	Adverse effects on the mauri of the receiving environment	3	4	H	**RMA conditions** • CEMP	2	4	M
Waikato Expressway – Hamilton Section								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	4	C	**RMA conditions** • Ecological management and restoration plan (EMRP)	2	4	M
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	4	3	H	**RMA conditions** • EMRP • Buffer planting of kahikatea tree stands	2	3	M
	Reduced water quality negatively impacting upon ecosystem function	4	4	C	**RMA conditions** • EMRP • ESCP	2	4	M
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	3	3	M	**RMA conditions** • EMRP • Landscape management plan	2	3	M
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	3	2	M	**RMA conditions** • EMRP • Landscape management plan	2	2	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	3	4	H	**RMA conditions** • EMRP • Weed and pest control • Fish rescue and relocation procedures • 10.2 ha ecological restoration within gullies	2	4	M
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	3	H	**RMA conditions** • Fish rescue and relocation procedures • Mudfish management plan • Habitat suitable for mudfish provided	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna (including bats)** during construction	4	4	C	**RMA conditions** • Pre-construction survey and relocation of threatened or at-risk species • Bat management plan • Two pre-construction bat surveys • Annual bat monitoring reported annually for 5 years, then 5-yearly until 15 years post-commencement of works • Post-construction monitoring of little shag nesting activity	2	4	M
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	3	3	M	**RMA conditions** • Pre-construction survey and relocation of threatened or at-risk lizards	2	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	4	4	C	**RMA conditions** • Monitoring and maintenance of planting • Kahikatea in the Mangaonua Gully identified, protected, removal minimised, and monitored 3 years post-construction • 10.2 ha ecological restoration within gullies • Buffer planting of kahikatea tree stands • Gully restoration implementation plan	2	4	M
Mana whenua	Adverse effects on the mauri of the receiving environment	3	5	C	**RMA conditions** • EMRP	2	5	H
Barters Road								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	2	1	L	• Rural farmland – no ecology-specific conditions	2	1	L
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	0	NA	NA	• Not applicable	0	NA	NA
	Reduced water quality negatively impacting upon ecosystem function	2	2	L	• Farm drain with low ecological value **RMA conditions** • ESCP	2	2	L
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	1	2	L	• Farm drain with low ecological value – sediment control conditions but no ecology-specific conditions	1	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna (including bats)** during construction	1	1	L	• Rural farmland – no ecology-specific conditions	1	1	L
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	1	1	L	• Rural farmland – no ecology-specific conditions	1	1	L
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	1	2	L	• Rural farmland – no ecology-specific conditions	1	2	L
Mana whenua	Adverse effects on the mauri of the receiving environment	1	2	L	• Rural farmland	1	2	L
Mingha Bluff								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	4	C	**RMA conditions** • Mistletoe, *Coprosma acerosa* and riparian remediation plan • Vegetation clearance plan prepared and approved by DOC • Works to be consistent with the Arthur's Pass National Park Management Plan	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	4	3	H	**RMA conditions** • Mistletoe, *Coprosma acerosa* and riparian remediation plan • Works to be consistent with the Arthur's Pass National Park Management Plan	2	3	M
	Reduced water quality negatively impacting upon ecosystem function	4	4	C	**RMA conditions** • ESCP • Works to be consistent with the Arthur's Pass National Park Management Plan	2	4	M
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	3	3	M	**RMA conditions** • Works to be consistent with the Arthur's Pass National Park Management Plan	1	3	L
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	3	3	M	**RMA conditions** • Works to be consistent with the Arthur's Pass National Park Management Plan	1	3	L
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	3	4	H	**RMA conditions** • Works to be consistent with the Arthur's Pass National Park Management Plan	1	4	L
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	4	C	**RMA conditions** • No stream works during fish spawning season • Facilitate fish passage • Fish rescue and relocation • Habitat re-established suitable for native fish including *Canterbury galaxias*	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna (including bats)** during construction	4	2	M	**RMA conditions** • Vegetation clearance plan prepared and approved by DOC	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	2	2	L	• Not addressed in RMA conditions	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	4	4	C	**RMA conditions** • Vegetation clearance plan prepared and approved by DOC • Mistletoe inventory • Mistletoe, *Coprosma acerosa* and riparian remediation plan • Eco-sourcing of seeds/plants • Works to be consistent with the Arthur's Pass National Park Management Plan	2	4	M
Mana whenua	Adverse effects on the mauri of the receiving environment	3	5	C	**RMA conditions** • Works to be consistent with the Arthur's Pass National Park Management Plan	2	5	H
SH58 Interchange								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	4	3	H	**RMA conditions** • Final design submitted to council and must include provision for ecological treatment (vegetation conservation and replanting) • Revegetation plans and specifications to be developed in consultation with GWRC and DOC	2	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	1	1	L	• Not addressed in RMA conditions	1	1	L
	Reduced water quality negatively impacting upon ecosystem function	4	3	H	**RMA conditions** • ESCP	2	3	M
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	0	NA	NA	• Not applicable	0	NA	NA
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	4	3	H	**RMA conditions** • Fish passage to be provided	3	3	M
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna (including bats)** during construction	4	2	M	• Not addressed in RMA conditions	4	2	M
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	2	2	L	• Not addressed in RMA conditions	2	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	4	3	H	**RMA conditions** • Final design submitted to council and must include provision for ecological treatment (vegetation conservation and replanting) • Revegetation plans and specifications to be developed in consultation with GWRC and DOC	2	3	M
Mana whenua	Adverse effects on the mauri of the receiving environment	3	3	M	**RMA conditions** • Revegetation plans and specifications to be developed in consultation with GWRC and DOC	2	3	M
Welcome Bay								
Habitat	Loss of existing habitat negatively impacts upon ecosystem function	2	1	L	• Rural farmland – no specific conditions	2	1	L
	Fragmentation/isolation of existing habitat negatively impacts upon ecosystem function	1	1	L	• Rural farmland – no specific conditions	1	1	L
	Reduced water quality negatively impacting upon ecosystem function	2	2	L	**RMA conditions** • ESCP	2	2	L
Ecosystem services	Loss of provisioning ecosystem services (eg, energy, seafood, transport)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of regulating ecosystem services (eg, flood prevention, climate regulation, erosion control)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of cultural ecosystem services (eg, educational, recreational, heritage, spiritual)	0	NA	NA	• Not applicable	0	NA	NA
	Loss of supporting ecosystem services (eg, nutrient cycling, biodiversity)	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flora & fauna	Adverse effects (eg, mortality, disturbance) on native or protected **freshwater ecology** during construction	1	2	L	**RMA conditions** • Fish passage maintained	1	2	L
	Adverse effects (eg, mortality, disturbance) on native or protected **avifauna (including bats)** during construction	2	1	L	• Rural farmland – no specific conditions	2	1	L
	Adverse effects (eg, mortality, disturbance) on native or protected **herpetofauna** during construction	2	1	L	• Rural farmland – no specific conditions	2	1	L
	Adverse effects (eg, mortality, disturbance) on native or protected **marine ecology** during construction	0	NA	NA	• Not applicable	0	NA	NA
	Adverse effects (eg, mortality, disturbance) on native or protected **terrestrial ecology** during construction	1	2	L	• Rural farmland – no specific conditions	1	2	L
Mana whenua	Adverse effects on the mauri of the receiving environment	1	2	L	• Rural farmland – no specific conditions	1	2	L

Table E.2 ESC risk assessment

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Waterview Connection								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • Environmental monitoring • Seasonal earthworks restriction • ESC devices installed to TP90 standards	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	4	C	**RMA conditions** • Staged earthworks • Environmental monitoring • ESC devices installed to TP90 standards	2	4	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	**ESCP** • Stabilised entranceways • Wheel washes at all ingress and egress points	3	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	2	2	L	**RMA conditions** • Perimeter controls • Contaminated soils management plan	1	2	L
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • Environmental monitoring • Freshwater monitoring programme • Seasonal earthworks restriction • ESC devices installed to TP90 standards	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	5	C	**RMA conditions** • Environmental monitoring • Freshwater monitoring programme • Seasonal earthworks restriction • ESC devices installed to TP90 standards	2	5	H

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • ESC devices installed to TP90 standards • Environmental monitoring **ESCP** • Visual assessment of receiving environment by contractor	2	2	L
	Visual sediment plume in the coastal receiving environment	2	4	M	**RMA conditions** • ESC devices installed to TP90 standards • Environmental monitoring **ESCP** • Visual assessment of receiving environment by contractor	1	4	L
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	5	C	**RMA conditions** • Staged earthworks • Environmental monitoring • ESC devices installed to TP90 standards	2	5	H
Mackays to Peka Peka Expressway								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • ESC devices installed to GWRC guideline standards **ESCP** • Environmental monitoring	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	4	C	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Staged earthworks	2	4	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	**ESCP** • Stabilised entranceways • Wheel wash facilities only if necessary	3	2	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	2	2	L	**RMA conditions** • Contaminated soils and groundwater management plan	1	2	L
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Freshwater monitoring programme	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	5	C	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Freshwater monitoring programme	2	5	H
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Super silt fences installed upslope	2	2	L
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	5	C	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Staged earthworks • Environmental monitoring	2	5	H
Christchurch Southern Motorway – stage 2								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • ESC devices installed to Environment Canterbury guideline standards **ESCP** • Environmental monitoring	2	1	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	3	H	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Staged earthworks to be implemented by contractor	2	3	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	• Assumed to be managed by the contractor	5	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	0	NA	NA	• Not applicable	0	NA	NA
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Visual assessment of receiving environment by contractor	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	4	H	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Visual assessment of receiving environment by contractor	2	4	M
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Visual assessment of receiving environment by contractor	2	2	L
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	5	C	**RMA conditions** • ESC devices installed to guideline standards **ESCP** • Environmental monitoring • Staged earthworks to be implemented by contractor	2	5	H
Waikato Expressway – Hamilton Section								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • Environmental monitoring • Seasonal earthworks restriction • ESC devices installed to Waikato Regional Council guideline standards	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	4	C	**RMA conditions** • Staged earthworks • Environmental monitoring • ESC devices installed to guideline standards	2	4	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	**ESCP** • Stabilised entranceways • Wheel wash facilities	3	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	0	NA	NA	• Not applicable	0	NA	NA
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • Environmental monitoring • Flocculation management plan • Seasonal earthworks restriction • ESC devices installed to guideline standards	2	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	5	C	**RMA conditions** • Environmental monitoring • Flocculation management plan • Seasonal earthworks restriction • ESC devices installed to guideline standards	2	5	H
Visual	Visual sediment plumes in local freshwater rivers/streams	3	3	M	**RMA conditions** • ESC devices installed to guideline standards • Environmental monitoring	2	3	M
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	5	C	**RMA conditions** • Staged earthworks • Environmental monitoring • ESC devices installed to guideline standards	2	5	H
Barters Road								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • TSS performance standards • ESC devices installed to Environment Canterbury guideline standards	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	3	H	**RMA conditions** • TSS performance standards • ESC devices installed to guideline standards	2	3	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	• Assumed to be managed by the contractor	5	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	0	NA	NA	• Not applicable	0	NA	NA

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • TSS performance standards • ESC devices installed to guideline standards	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	4	H	**RMA conditions** • TSS performance standards • ESC devices installed to guideline standards	2	4	M
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • TSS performance standards • ESC devices installed to guideline standards	2	2	L
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	3	H	**RMA conditions** • TSS performance standards • ESC devices installed to guideline standards	2	3	M
Mingha Bluff								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • Environmental monitoring • ESC devices installed to Environment Canterbury guideline standards	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	4	C	**RMA conditions** • Environmental monitoring • ESC devices installed to guideline standards	2	4	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	• Assumed to be managed by the contractor	5	2	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	0	NA	NA	• Not applicable	0	NA	NA
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • Environmental monitoring • ESC devices installed to guideline standards	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	5	C	**RMA conditions** • Environmental monitoring • ESC devices installed to guideline standards	2	5	H
Visual	Visual sediment plumes in local freshwater rivers/streams	3	4	H	**RMA conditions** • ESC devices installed to guideline standards • Daily visual inspections by contactor to observe water clarity	2	4	M
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	5	C	**RMA conditions** • Environmental monitoring • ESC devices installed to guideline standards	2	5	H
SH58 Interchange								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • Environmental monitoring • ESC devices installed to TP90 standards • ESC training day for contractors' staff	2	1	L
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	4	C	**RMA conditions** • Environmental monitoring • ESC devices installed to TP90 standards • ESC training day for contractors' staff	2	4	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	• Assumed to be managed by the contractor • ESC training day for contractors' staff	4	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	0	NA	NA	• Not applicable	0	NA	NA
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • Environmental monitoring • ESC devices installed to TP90 standards	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	4	H	**RMA conditions** • Environmental monitoring • ESC devices installed to TP90 standards	2	4	M
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • ESC devices installed to TP90 standards • Environmental monitoring • All sediment-laden runoff to be treated prior to leaving site	2	2	L
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	4	C	**RMA conditions** • Environmental monitoring • ESC devices installed to TP90 standards • ESC training day for contractors' staff	2	4	M
Welcome Bay								
Water quality	Low levels of sediment in stormwater are discharged to the receiving environment	5	1	L	**RMA conditions** • ESC devices installed to BOPRC guideline standards	2	1	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	High levels of sediment in stormwater are discharged to the receiving environment resulting in adverse visual and ecological effects	4	3	H	**RMA conditions** • ESC devices installed to guideline standards	2	3	M
	Soil transported off-site by construction traffic enters stormwater network as uncontrolled sediment discharge	5	2	M	• Assumed to be managed by the contractor	3	2	M
	Existing contamination enters stormwater through surface water runoff. Uncontrolled mobilisation or release of contaminants from ground disturbance.	2	2	L	**RMA conditions** • Contaminated soils management plan	1	2	L
Ecology	Damage to ecology of receiving environments from sustained high sediment loads	4	3	H	**RMA conditions** • ESC devices installed to guideline standards	2	3	M
	Significant damage to ecology and biodiversity of receiving environments from sustained high sediment loads leading to long-term environmental degradation	3	4	H	**RMA conditions** • ESC devices installed to guideline standards	2	4	M
Visual	Visual sediment plumes in local freshwater rivers/streams	3	2	M	**RMA conditions** • ESC devices installed to guideline standards	2	2	L
	Visual sediment plume in the coastal receiving environment	0	NA	NA	• Not applicable	0	NA	NA
Mana whenua	Significant discharge of sediment negatively impacts upon the mauri of the receiving environment	4	4	C	**RMA conditions** • ESC devices installed to guideline standards	2	4	M

Table E.3 Stormwater risk assessment

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Waterview Connection								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Temporary and operational stormwater management plans • Water quality monitoring programme • Operational TSS removal rate: 75–80% • Energy dissipation at outfalls • Certification of stormwater design	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		1	4	L
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	5	C	**RMA conditions** • Operational stormwater management plan • Major overland flow paths provided for and maintained • Design to 'best practicably mimic the existing hydrologic regime'	2	5	H
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	4	5	C	**Stormwater design philosophy statement** • Mid-range climate change scenario applied to design for year 2090 (+2.1 °C) (end of design life ~2110).	2	5	H
Mackays to Peka Peka Expressway								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Primary and secondary treatment for runoff into Kākāriki Stream and Ngārara Creek • Treatment devices in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* (eg, swales and wetlands) • Independent peer review and certification of stormwater design	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		1	4	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	5	C	**RMA conditions** • Peak rate of discharge designed not to exceed 80% (urban) or 100% (rural) pre-expressway peak discharge • Any loss of flood plain storage offset	1	5	H
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	5	C	**RMA conditions** • Designed to account for climate change to 2115 (end of design life)	1	5	H
Christchurch Southern Motorway – stage 2								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Stormwater operation and maintenance plan • 6-monthly monitoring inspections for hydrocarbons, sediment, damage to stormwater infrastructure • Treatment performance monitoring • TSS not to exceed 100 mg/L in all discharges to water • Treatment devices in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* • Design certified by chartered professional engineer	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		1	4	L
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	5	C	**RMA conditions** • Stormwater infrastructure designed for 1% AEP • Pumping and disposal system at Robinsons Rd overpass and emergency flood warning system	1	5	H
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	5	C	**RMA conditions** • Designed to account for climate change to 2080	2	5	H

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Waikato Expressway – Hamilton Section								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Stormwater from bridge decks directed to treatment devices • Stormwater structures to capture and retain majority of gross pollutants • TSS not to exceed 100 g/m^3 • Treatment devices in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure* • Design approved by Waikato Regional Council	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		1	4	L
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	5	C	**RMA conditions** • Bridges sized for 20% AEP flow and larger flows managed in overland flow paths	2	5	H
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	5	C	**RMA conditions** • No consideration of climate change specified **AEE** • Culverts designed to accommodate 1% AEP, taking into account climate change • Rainfall intensities adjusted for a 2.08 °C increase by 2090	2	5	H
Barters Road								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Construction stormwater managed through ESC conditions • Operational stormwater not addressed **AEE** • Operational stormwater treatment design includes a pre-treatment swale, first flush infiltration basin, and attenuation basin	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	2	M		2	2	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	3	M	**RMA conditions** • Flooding risk not addressed **AEE** • Operational stormwater system design sized for 2% AEP events • Existing system already has flooding issues, but proposed stormwater design should address this	2	3	M
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	4	H	**RMA conditions** • No consideration of climate change specified **AEE** • Design to account for climate change (increased rainfall intensity) to 2100	1	4	L
Mingha Bluff								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • 6-monthly inspections of watercourses crossing the realignment route for visible hydrocarbons and scour/erosion • Stormwater discharged from road surface to vegetated swales • Treatment devices in accordance with Waka Kotahi *Stormwater Treatment Standard for State Highway Infrastructure*	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		1	4	L
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	1	L	**AEE** • Culvert design peer reviewed by KiwiRail and flooding assessed as having no effect on rail infrastructure	3	1	L
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	4	H	**RMA conditions** • No consideration of climate change specified	3	4	H

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
SH58 Interchange								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	M	**RMA conditions** • Construction stormwater managed through ESC conditions • Operational stormwater treatment not addressed	5	1	M
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	4	H		3	4	H
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	3	M	**RMA conditions** • Flooding risk not addressed in RMA conditions **AEE** • Culverts designed to accommodate 1% AEP, allowing for climate change (increase in rainfall intensity)	2	3	M
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	4	H	**RMA conditions** • No consideration of climate change specified **AEE** • Culverts designed to accommodate 1% AEP, allowing for climate change (increase in rainfall intensity)	1	4	L
Welcome Bay								
Water quality	Low levels of stormwater contaminants are discharged to the receiving environment	5	1	L	**RMA conditions** • Design to be certified by BOPRC • Design consistent with the BOPRC *Hydrological and Hydraulic Guidelines*	3	1	L
	High levels of stormwater contaminants are discharged to the receiving environment resulting in adverse ecological effects	3	2	M		2	2	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Flooding	Flooding events increase for surrounding areas following the completion of the project	3	3	M	• Flooding risk not addressed in AEE **RMA conditions** • Design to be certified by BOPRC • Design consistent with the BOPRC (2012) *Hydrological and Hydraulic Guidelines*	2	3	M
	Assessed flood risk does not account for climate change leading to an increased frequency of flooding events	3	4	H	**RMA conditions** • No consideration of climate change specified	3	4	H

Table E.4 Noise and vibration risk assessment

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Waterview Connection								
Construction noise	High daytime construction noise levels near residential areas	5	3	H	**RMA conditions** • Noise levels in accordance with NZS 6803:1999 *Acoustics – Construction Noise* • Construction noise and vibration management plan (CNVMP) certified • Site-specific management plans • Works to stop if site-specific management plans exceeded • Temporary relocation offered to residents at 1510 Great North Rd if monitoring indicates that consent limits will be exceeded • Relocation not to be undertaken within 10 working days of Unitec examinations	3	3	M
	High night-time construction noise levels near residential areas	5	3	H		3	3	M
	High construction noise levels near noise-sensitive activities (eg, schools)	5	3	H		3	3	M
Construction vibration	Construction vibration leads to aesthetic building damage	3	3	M	**RMA conditions** • Vibration levels in accordance with German Standard DIN 4150-3:1999 • CNVMP certified • Site-specific management plans • High-risk activities (exceeding DIN 4150-3:1999) conducted so that 95% of activities from 20 representative samples will not exceed limits • No activity to produce peak particle velocities exceeding 10 mm/s • Temporary relocation offered to residents at 1510 Great North Rd if monitoring indicates that consent limits will be exceeded • Relocation not to be undertaken within 10 working days of Unitec examinations	2	3	M
	Construction vibration leads to structural building damage	3	5	C		2	5	H

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Operational noise	High daytime operational noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads* • Design of structural mitigation measures by a suitably qualified and experienced acoustics specialist (SQEAS) • Design to be approved by Auckland Council • SQEAS to identify habitable spaces that are likely to receive excess operational noise • Waka Kotahi to work with the building owners to implement agreed building modifications • Noise monitoring required prior to works and on completion of works	1	3	L
	High night-time operational noise levels near residential areas	4	3	H		1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	4	3	H		1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	**RMA conditions** • Baseline ambient vibration levels to be measured at critical locations prior to works	1	3	L
	Operational vibration leads to structural building damage	1	5	H		1	5	H
Mackays to Peka Peka Expressway								
Construction noise	High daytime construction noise levels near residential areas	5	3	H	**RMA conditions** • Noise levels in accordance with NZS 6803:1999 *Acoustics – Construction Noise* • CNVMP certified • Site-specific management plans	3	3	M
	High night-time construction noise levels near residential areas	5	3	H		3	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	High construction noise levels near noise-sensitive activities (eg, schools)	5	3	H	• CNVMP and any site-specific management plans to be reviewed by an independent SQEAS prior to being submitted to council for certification • Noise monitoring to be for 15-minute and 60-minute periods • Night work notification for those located within 200 m of construction areas • Daytime notification for those located within 100 m of construction areas	3	3	M
Construction vibration	Construction vibration leads to aesthetic building damage	3	3	M	**RMA conditions** • Vibration levels in accordance with German Standard DIN 4150-3:1999 • CNVMP certified • Site-specific management plans • CNVMP and any site-specific management plans to be reviewed by an independent SQEAS prior to being submitted to council for certification • Pre-construction surveys of buildings, services and structures at risk from vibration • Night work notification for those located within 200 m of construction areas • Daytime notification for those located within 100 m of construction areas	2	3	M
	Construction vibration leads to structural building damage	3	5	C		2	5	H
Operational noise	High daytime operational noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads* • Noise monitoring management plan to be certified by Kāpiti Coast District Council	1	3	L
	High night-time operational noise levels near residential areas	4	3	H		1	3	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	High operational noise levels near noise-sensitive activities (eg, schools)	4	3	H	• Design of structural mitigation measures to be undertaken by a SQEAS • Low-noise road surface to be used in residential areas • Detailed mitigation measures report required • An independent SQEAS to inspect the as-built structural noise mitigation measures and issue signed certificate	1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	**RMA conditions** • Register all vibration complaints for the first 2 years	1	3	L
	Operational vibration leads to structural building damage	1	5	H		1	5	H
Christchurch Southern Motorway – stage 2								
Construction noise	High daytime construction noise levels near residential areas	5	3	H	**RMA conditions** • Noise levels in accordance with NZS 6803:1999 *Acoustics – Construction Noise* • CNVMP certified by an independent SQEAS approved by council • Site-specific management plans • More restrictive criteria required for nearby wedding venue on wedding days • Notification required for pile-driving activities that may affect livestock	3	3	M
	High night-time construction noise levels near residential areas	5	3	H		3	3	M
	High construction noise levels near noise-sensitive activities (eg, schools)	5	3	H		3	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Construction vibration	Construction vibration leads to aesthetic building damage	3	3	M	**RMA conditions** • Vibration levels in accordance with German Standard DIN 4150-3:1999 • CNVMP certified by an independent SQEAS approved by council • Site-specific management plans • SQEAS to assess and manage construction vibration • Where predicted vibration levels exceed criteria, proposed monitoring must be approved by an independent SQEAS	2	3	M
	Construction vibration leads to structural building damage	3	5	C		2	5	H
Operational noise	High daytime operational noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with NZS 6806:2010 *Acoustics – Road-Traffic Noise – New and Altered Roads* • Design of PMOs to be undertaken by a SQEAS • Low-noise road surface to be used in specific locations • PMOs to be implemented prior to construction completion and managed and maintained	1	3	L
	High night-time operational noise levels near residential areas	4	3	H		1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	4	3	H		1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L
	Operational vibration leads to structural building damage	1	5	H		1	5	H
Waikato Expressway – Hamilton Section								
Construction noise	High daytime construction noise levels near residential areas	3	3	M	**RMA conditions** • Noise levels in accordance with NZS 6803:1999 *Acoustics – Construction Noise* • CNVMP certified • If levels are predicted to exceed limits set out in CNVMP or monitoring indicates non-	2	3	M
	High night-time construction noise levels near residential areas	4	3	H		2	3	M

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	High construction noise levels near noise-sensitive activities (eg, schools)	4	3	H	compliance, then an activity-specific CNVMP will be submitted to the territorial authority for approval	2	3	M
Construction vibration	Construction vibration leads to aesthetic building damage	3	3	M	**RMA conditions** • Vibration levels in accordance with German Standard DIN 4150-3:1999 and British Standard BS 5228-2:2009 • CNVMP certified • If levels are predicted to exceed limits set out in CNVMP or monitoring indicates non-compliance, then an activity-specific CNVMP will be submitted to the territorial authority for approval	2	3	M
	Construction vibration leads to structural building damage	3	5	C		2	5	H
Operational noise	High daytime operational noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with average noise design levels set out in *Transit New Zealand's Guidelines for Management of Road Traffic Noise* (1999) • Noise survey of ambient noise required prior to construction • Traffic noise mitigation plan to be prepared by a SQEAS and approved by the territorial authority • Any residential buildings, hospitals, or educational facilities expected to experience an increase in noise to be identified • Consultation required with owner/occupiers where noise exceeds guidelines • Noise monitoring to be undertaken within 3 months of opening the road and any further practical mitigation measures carried out if necessary	1	3	L
	High night-time operational noise levels near residential areas	4	3	H		1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	4	3	H		1	3	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L
	Operational vibration leads to structural building damage	1	5	H		1	5	H
Barters Road								
Construction noise	High daytime construction noise levels near residential areas	2	2	L	• Not addressed in RMA conditions	2	2	L
	High night-time construction noise levels near residential areas	2	2	L	• Not addressed in RMA conditions	2	2	L
	High construction noise levels near noise-sensitive activities (eg, schools)	2	2	L	• Not addressed in RMA conditions	2	2	L
Construction vibration	Construction vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L
	Construction vibration leads to structural building damage	1	5	H	• Not addressed in RMA conditions	1	5	H
Operational noise	High daytime operational noise levels near residential areas	1	3	L	• Not addressed in RMA conditions	1	3	L
	High night-time operational noise levels near residential areas	1	3	L	• Not addressed in RMA conditions	1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	1	3	L	• Not addressed in RMA conditions	1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Operational vibration leads to structural building damage	1	5	H	• Not addressed in RMA conditions	1	4	L
Mingha Bluff								
Construction noise	High daytime construction noise levels near residential areas	1	1	L	• Not addressed in RMA conditions.	1	1	L
	High night-time construction noise levels near residential areas	1	1	L	• Not addressed in RMA conditions.	1	1	L
	High construction noise levels near noise-sensitive activities (eg, schools)	1	1	L	• Not addressed in RMA conditions.	1	1	L
Construction vibration	Construction vibration leads to aesthetic building damage	1	1	L	• Not addressed in RMA conditions	1	1	L
	Construction vibration leads to structural building damage	1	4	L	• Not addressed in RMA conditions.	1	4	L
Operational noise	High daytime operational noise levels near residential areas	1	1	L	• Not addressed in RMA conditions	1	1	L
	High night-time operational noise levels near residential areas	1	1	L	• Not addressed in RMA conditions	1	1	L
	High operational noise levels near noise-sensitive activities (eg, schools)	1	1	L	• Not addressed in RMA conditions	1	1	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	1	L	• Not addressed in RMA conditions	1	1	L
	Operational vibration leads to structural building damage	1	4	L	• Not addressed in RMA conditions	1	4	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
SH58 Interchange								
Construction noise	High daytime construction noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with NZS 6803:1999 *Acoustics – Construction Noise* • SQEAS to review ambient sound levels at existing dwelling to determine compliance and on-site mitigation	2	3	M
	High night-time construction noise levels near residential areas	4	3	H		2	3	M
	High construction noise levels near noise-sensitive activities (eg, schools)	4	3	H		2	3	M
Construction vibration	Construction vibration leads to aesthetic building damage	2	3	M	• Not addressed in RMA conditions	2	3	M
	Construction vibration leads to structural building damage	2	5	H	• Not addressed in RMA conditions	2	5	H
Operational noise	High daytime operational noise levels near residential areas	4	3	H	**RMA conditions** • Noise levels in accordance with *Transit New Zealand's Guidelines for Management of Road Traffic Noise* (1999) • 6–12 months after completion, a SQEAS was required to undertake an operational noise survey to determine actual levels and reassess compliance • Consultation required with owners of affected dwellings to determine on-site noise mitigation options • Completion certificate to be issued after mitigation works certifying appropriate build standard and noise reduction levels.	1	3	L
	High night-time operational noise levels near residential areas	4	3	H		1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	4	3	H		1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L

Risk type	Risk identified	Likelihood	Consequence	Inherent Risk	Controls required	Likelihood	Consequence	Residual Risk
	Operational vibration leads to structural building damage	1	5	H	• Not addressed in RMA conditions	1	5	H
Welcome Bay								
Construction noise	High daytime construction noise levels near residential areas	2	2	L	• Not addressed in RMA conditions	2	2	L
	High night-time construction noise levels near residential areas	2	2	L		2	2	L
	High construction noise levels near noise-sensitive activities (eg, schools)	2	2	L		2	2	L
Construction vibration	Construction vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L
	Construction vibration leads to structural building damage	1	4	L	• Not addressed in RMA conditions	1	4	L
Operational noise	High daytime operational noise levels near residential areas	1	3	L	• Not addressed in RMA conditions	1	3	L
	High night-time operational noise levels near residential areas	1	3	L	• Not addressed in RMA conditions	1	3	L
	High operational noise levels near noise-sensitive activities (eg, schools)	1	3	L	• Not addressed in RMA conditions	1	3	L
Operational vibration	Operational vibration leads to aesthetic building damage	1	3	L	• Not addressed in RMA conditions	1	3	L
	Operational vibration leads to structural building damage	1	4	L	• Not addressed in RMA conditions	1	4	L

Appendix F: ESR screen

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN V2.FEBRUARY 2016

NZ TRANSPORT AGENCY WAKA KOTAHI

Use to assess options in the Indicative Business Case

Use this screen to identify opportunities and risks and assess options for state highway projects. Complete the screen for each option to distinguish them from one another or bundle options where appropriate. Screen results will signal where technical assessments are required and provide a written record to support the alternatives assessment required for statutory applications. For further assistance contact the EUD Team.

Additional instructions and content, including information sources, to help complete the screen can be found on the Highways Information Portal Screen pages here.

Decide how many times screen should be filled out (Group Options) ▶ Answer screen questions using project information and suggested information sources ▶ Refer to screen questions explanation, particularly if you answered yes to any of the questions ▶ Complete page 2 of screen ▶ Incorporate page 2 text in IBC assessment of options table (Background and MCA)

PROJECT LOCATION: | PROJECT PURPOSE: | DATE: | OPTION DESCRIPTION:

CATEGORY		QUESTION	ANSWER				USEFUL INFORMATION SOURCES
GENERAL	G1	What is the zoning of adjacent land? Are there any encumbrances on the land? e.g. Maori Reserve or other reserve/covenants	Rural ☐	Commercial ☐			District/Unitary Plan Zoning Maps
			Industrial ☐	Residential ☐			
			High density residential ☐	Parks/open space ☐			
	G2	Does the option disturb previously undisturbed land?	Y ☐	N ☐			
	G3	What is the construction timeframe?	>18 months ☐	<18 months ☐			
NATURAL ENVIRONMENT	NE1	Are there any outstanding/significant natural features (e.g. geological or geothermal)/landscapes?	Y ☐	N ☐			NZTA MapHub Environmental and Social Risk Map- Natural Environment Regional Plan Maps and Schedules District Plan Maps and Schedules Department of Conservation
	NE2	Will the option affect the coastal marine area, wetlands, lakes, rivers, streams or their margins?	Y ☐	N ☐			
	NE3	Will the option affect areas of the conservation estate, or areas of known significance for biodiversity or known habitats of uncommon or threatened species?	Y ☐	N ☐			
	NE4	Is the option in an area of potential hazard risk e.g. fault lines, significant erosion, flooding, sea level rise etc?	Y ☐	N ☐			
	NE5	Will more than 0.5 hectares of vegetation be removed?	Y ☐	N ☐			
		What type?					
CULTURAL AND HISTORIC HERITAGE	CH1	Are there sites/areas of significance to Maori within 200m of the area of interest?	Y ☐	N ☐			Iwi NZTA MapHub Environmental and Social Risk Map- Culture and Heritage Heritage New Zealand List NZ Archaeological Association District Plan Maps and Schedules Regional Plan Maps and Schedules IPENZ Heritage List NZTA GIS predictive models
	CH2	Are any recorded, scheduled or listed archaeological sites within 200m of the area of interest?	Y ☐	N ☐			
	CH3	Are any scheduled, listed or other important heritage buildings/ structures within 200m of the area of interest?	Y ☐	N ☐			
	CH4	Will the option affect the setting of any historic building/structure or archaeological site?	Y ☐	N ☐			
	CH5	Is a group of archaeological sites or an area of historic built environment (even partially) within 200m of the area of interest?	Y ☐	N ☐			
HUMAN HEALTH	HH1	What is the One Network Road Classification?	National ☐	Regional ☐			NZTA MapHub Environmental and Social Risk Maps- Human Health and Community which includes: - Designated airsheds (including one network classification) - Highly sensitive receivers Regional Council Contaminated sites Team
			Arterial ☐	Collector ☐			
	HH2	Is the area of interest designated as a non-compliant airshed?	Y ☐	N ☐			
	HH3	Are there medical sites, rest homes, schools, child care sites, residential properties, marae or other sensitive receivers located within 200m of the area of interest?	Y ☐	N ☐			
	HH4	Does land use within 200m of the area of interest include industrial sites, chemical manufacturing or storage, petrol stations, vehicle maintenance, timber processing/treatment, substations, rail yards, landfills or involve other activities that may result in ground contamination?	Y ☐	N ☐			
		OR Are there HAIL or SLUR (contaminated) sites within 200m of the area of interest?	Y ☐	N ☐			
SOCIAL	S1	Does the option affect access to community facilities i.e. libraries, open space etc (either temporarily or permanently)?	Y ☐	N ☐			NZTA MapHub Project Team District Plan Maps Council and Community Strategy Documents
			Which?				
	S2	Does the option affect community cohesion and accessibility including vehicular connectivity on the local road network?	Y ☐	N ☐			
URBAN AND LANDSCAPE DESIGN	ULD 1	Are there opportunities to enhance infrastructure for, and/or improve access to, public transport and/or active modes of travel such as as walking and cycling?	Y ☐	N ☐			NZTA MapHub Environmental and Social Risk Map- Natural Environment (Scenic Routes) Regional Land Transport Plan Project Team Strategies and District Plan
	ULD2	Does the option enhance the development potential of adjacent land where appropriate?	Y ☐	N ☐			
	ULD3	Is the option located on a themed highway? Is the option part of or near a national cycle or walking route?	Y ☐	N ☐			
	ULD4	Are there opportunities to enhance the urban character, landscape character and visual amenity?	Y ☐	N ☐			

Source: NZ Transport Agency (2016, p. 1)