

# **A natural environment and cultural asset management system for New Zealand's state highway network: towards a practical concept and application November 2012**

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## Abbreviations and acronyms

DOC	Department of Conservation
EAMS	environmental asset management system
GIS	geographic information system
GPS	global positioning system
LENZ	Land Environments of New Zealand
LOS	level of service
MVM	multi-value management
NECAMS	national and cultural asset management system
NZTA	New Zealand Transport Agency
RAMM	road assessment and maintenance management
SH75	state highway 75
TLA	territorial local authority

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# Executive summary

## Project and client

Internationally there is an increasing demand for roadways to have a minimal environmental impact and footprint, to express local environmental and cultural context, and to protect or respect natural, historical and landscape assets – in addition to being efficient and safe. For New Zealand to keep pace with these trends, research is required to test and demonstrate methods for identification, evaluation, and enhancement of environmental and cultural assets along corridors of the state highway system.

The NZ Transport Agency (NZTA) engaged Landcare Research to investigate these concepts and methods within an Aotearoa New Zealand context, and thereby assist the NZTA in leading these multi-value outcomes that are aspired to internationally. We carried out field trials to inform enhanced use of indigenous species in roadside landscaping, explored perceptual and cultural values of the highway experience, and reviewed existing NZTA landscape guidelines, policies, methodologies and asset management. Landcare Research subcontracted Lincoln University to contribute to a theoretical framework and to carry out an investigation into the human experience of roads and preferences, and subcontracted Robert Watts (GreenVisioNZ) to assist with development of an asset management system based on his experience of waterway and wetland asset management for the Christchurch City Council.

## Objectives

In response to the aspirations and research questions identified above, four broad themes were addressed in this work: biodiversity and ecological management; human perceptions and values; an operational system to accommodate and implement these ecological and human values; and a plan to raise in-house capacity and test the system. These were aligned to objectives (below), each of which was underpinned by empirical data and/or review of accepted and successful precedents.

- Identify opportunities for and test the performance of new roadside landscaping designs utilising indigenous species.
- Develop an evidence-based understanding of perceptions and values of road-users, designers and managers.
- Develop an approach for a natural environment and cultural asset management system (NECAMS).
- Identify areas requiring capacity building and engage in some exercises to begin that process.

## Methods

Specific work comprised: 1) a literature review of road values and asset management, 2) an analysis of perceptions, attitudes and preferences regarding roadside environments and issues including a tangata whenua perspective, 3) development of a conceptual NECAMS integrated with current practices and systems, 4) a proposal for a real-world demonstration and refinement of the process on a particular highway, 5) review and edit of existing NZTA practices, policies and species guidelines in the current landscape design manual, 6) field trials to test new combinations of indigenous species suitable for roadside plantings, and 7) an analysis of the capital and maintenance costs of mown grass versus more sustainable, woody road-verge vegetation. Item 2 was conducted through the NZTA and stakeholder workshops. This report primarily presents outputs from the first four items. The outputs from item 2 is elaborated in a separate report (Wilson and Swaffield 2010), items 6 and 7 in Simcock and Meurk (2010) and item 5 has been supplied directly to the NZTA.

## Conclusions and recommendations

The report reveals global trends in roading philosophy (chapters 2 and 3) that demonstrate the interconnectedness of heritage visibility, cultural groundedness and landscape distinctiveness – at international, regional and local levels. Visibility of heritage requires retention of geomorphological features, a tangata whenua presence (showcasing earthworks, taonga plants, sculpture or artefact) and revelation of colonial relics. Dominance and viability of indigenous plants and wildlife along road corridors will reinforce unique regional and national identities – supporting national imperatives and tourist expectations. Introduced accent species may be valid to accommodate a wider cross-section of values, but should not pose biosecurity risks nor visually overwhelm the unique and indigenous. Debate about national identity, and how New Zealanders in a bicultural context project themselves, is a necessary part of the process. Towards this, an independent but linked report (Wilson and Swaffield 2010) discusses the road-user experience. This is summarised together with a tangata whenua perspective in chapter 5.

The road asset management horizon (section 4.1) in the broadest sense comprises the carriageway or built road corridor, the roadway and grassed berm corridor (to the adjacent property boundary), a visual corridor of varying width and a downstream catchment corridor. The first component relates to the paved road and other engineered structures or works, the second to the NZTA-vested berm of generally mown grass, 2m to 10m wide within a fenced or hedged border. Together these make up the roadside corridor (the zone currently managed by the NZTA). The visual corridor is the fore- to mid-ground visual horizon or view to the nearest line of hills or trees (10m to 100m away). Beyond is a corridor that extends 'as far as the eye can see' and is relevant here in the sense of bio-geo-climatic context and natural character. Downstream-affected waterways or runoff areas fall within the catchment corridor directly affected by the highway. These wider zones may be termed the landscape corridor appropriately considered as legitimate responsibilities of the NZTA, at least as interested party or stakeholder. There is also a sound or noise corridor which has not been specifically considered here. Each of these nested 'corridors' will be treated and managed in distinctive ways but increasingly within an integrated framework.

Simcock and Meurk (2010; see also appendix C) separately demonstrate an expanded palette of indigenous plant species (in the context of the above zones) that allows highways to project an evolving Aotearoa New Zealand identity. In particular, road verge designs with dense, frangible vegetation closer to the carriageway are deemed sustainable and maintain visibility and safety. The use of divaricating shrubs and tussocks, to form a border or low hedge to roadside plantings, can minimise the need for expensive mown grass verges and this is more widely recommended. There is a start-up cost, but over time, savings on maintenance are predicted. Some biosecurity risks that demand urgent attention and control are documented. Some preliminary estimates of relative costs of establishment and maintenance of such designs against the conventional extensive mowing of grass verges are given (Simcock and Meurk 2010).

Full realisation of multi-value landscape management goals may occur over a century or more – conforming to timescales of ecosystem building and intergenerational changes of culture and heritage (section 4.2). So, the cost of achieving these goals needs to be discounted over the longer term, while fitting within the usual road maintenance and building cycles. It will increasingly deliver the culturally and commercially vital branding of the nation's clean green image. Unlike built assets, natural asset values tend to increase over time. This is essentially a revisit of triple bottom-line thinking and the six values approach developed and employed successfully in the case of the Christchurch waterway management system over a decade ago. In the end, New Zealand must strive to be world class and distinctive and the NZTA, through the management of its all-pervasive roading network, can be a leader within the country and contribute a point of difference by managing and celebrating the unique attributes that make the Aotearoa New Zealand brand (one that is under considerable scrutiny at present).



An asset management system is recommended (section 6 and appendix A) that promotes, accommodates and gives effect to these learnings and findings. To be successful, it must have wide acceptance by the NZTA, the general public and tangata whenua; it must sit within conventional and long-established practices of resource-intensive and heavily engineered enterprises such as road building, management and maintenance; a multi-value approach needs to be part of the institutional culture and memory, with this reinforced on a regular basis and amongst new employees; it will need a champion within the organisation and a few key supporters who will 'make it happen'; there needs to be enhanced capacity building within the institution so the connectedness between structures, activities, utility, safety, water quality, ecology, socio-cultural needs and aesthetics is understood and maintained. It must have continuity, checklist consistency and integrity through the chain of command between the NZTA, contractors and subcontractors. Such an asset management system has to be viable over the long term – it has taken 150 years to build the current road network (and in the process eliminate many values); it may take another 150 years to resurrect and retrofit desirable values into this vital, and culturally significant asset, given the difficulty of rebuilding functional natural ecosystems where exotic pests abound. This will require precise ecological and landscape knowledge in the design and protection of primary remnants, not only for motorways and highways but for the often less modified secondary road verges. If these values are to be regarded as bottom lines, then tangible environmental, biodiversity, social and cultural performance indicators have to be defined and adopted. Examples are provided in appendix D. For instance, in line with both 'sense of place' and ecological criteria, it would be reasonable to set a 20-year target of 10% of all roadsides traversing cultural landscapes to be dominated by indigenous vegetation and in particular noble New Zealand trees; that 90% of all picnic lay-bys are framed by indigenous species, and have interpretation of local natural and cultural history; that guide books are available for the traveller that interpret all the dimensions of the landscape; and that in a century, 75% of the road experience is clearly and distinctively Aotearoa New Zealand. Successful adoption of these values will require changes in institutional culture regarding natural and indigenous values, not just in the NZTA but in similarly influential organisations across the country. It is a paradox that there is often more knowledge and experience with regards to the use and management of exotic plant species in cultural landscapes than for the often difficult, idiosyncratic requirements of indigenous species. Exotic species are now such familiar and integral parts of the Aotearoa New Zealand backdrop that they are often perceived as the desirable norm.

A collaborative learning approach with stakeholders, including adjacent land owners/managers, is the most viable means of realising a holistic vision. We recognise landscape evolution is now largely directed, rather than developing organically as in ancient times. Road planning must therefore accommodate modern thinking on a wider than conventional range of values and minimise damage to their embracing landscapes and embedded history. Notwithstanding that all these values will be contested, they might be regarded as bottom lines recognised in national policies. If we cannot avoid directing the landscape then we need to ensure there is a robust, inclusive approach to its development and ultimate appearance that avoids sacrificing the unique and endemic elements we have an international duty to protect.

Guidelines for how this concept may be achieved and incorporated within the NZTA's operating structures are provided (chapter 6 and appendix A4). The next step will be to test the concept in a desk exercise among selected or representative managers and practitioners within the industry, then after refinement to run a full-scale demonstration on a road sector (one either undergoing a retrofit, a full-scale makeover or being built anew). The Christchurch – Akaroa Highway is proposed as a test case for a retrofit option.

## Abstract

Internationally there is an increasing expectation for roadways to have a minimal environmental footprint, to express local environmental and cultural context, and to protect or respect natural, historical and landscape assets – in addition to being efficient and safe. New Zealand depends on the integrity of its clean green brand and the highways are the shop window of the nation and critical to the impression gained by overseas tourists and traders, but also to residents. Legibility of heritage is a sign of identity, protectiveness and cultural maturity. Key elements that should be revealed are geo-morphology, indigenous biota, Maori and colonial culture. This can be achieved through conservation, restoration and interpretation. Engagement with communities, iwi, engineers and ecologists is crucial, and culture change has to be championed at the highest level. Leadership must reinforce the latent interest in asserting an Aotearoa New Zealand identity. Aspirational milestones for ‘naturalising’ the highways should be set. Planting guidelines are appropriate to conventional requirements while contributing to these goals. Despite start-up costs, the system will become cheaper to run while the heritage assets will increase in value and become largely self-sustaining. The natural environment and cultural asset management process is designed to address these national and local priorities.

# 1 Introduction

## 1.1 Rationale for study

The state highway system is one of New Zealand's primary public infrastructure networks, connecting communities, towns and cities to farms, forests, industry and ports, and region to region. The network comprises over 10,000km of highways and crosses the full range of New Zealand's natural and modified environments. It is a critical element in the New Zealand economy, supporting the primary production industries, and, as the shop window to New Zealand Inc, is an integral part of the international and domestic tourism industry.

The NZ Transport Agency (NZTA) manages the state highway system on behalf of the government and has well-developed project evaluation and engineering asset management systems for the built infrastructure of roads, bridges and earthworks, including management of the environmental effects of highways and management of roadside reserves. However, there has been little research into wider understanding of the environmental and cultural values within the highway corridor, and how these might be incorporated into management of the highway assets with which the values are associated.

There are many values associated with the non-engineering assets of the highway. They range from the experiential values of travelling along the road, to the recreational and heritage values offered by roadside features, to the biodiversity values and other ecosystem services of the vegetation and substrate of the roadside reserve and contiguous landscape. In this report these values are termed (natural) environmental and cultural values.

This investigation has as its basis the need to enhance the services provided to the nation by the New Zealand state highway network, by better recognising the environmental and cultural values of the network roadsides and wider corridor, and by integrated and visionary management of the assets with which the values are associated. In economic terms it may be called 'added value'.

A second reason for investigating multiple values and their relationship to highway infrastructure assets is to improve decision making related to the existing highway network. As Greg Brown, Director of the Environmental Studies Program at Central Washington University, notes:

*Much highway planning and monitoring activity is oriented toward assessing and maintaining physical inventories (e.g. surface condition, structural integrity, and hazard areas) because knowledge of these attributes is essential to system functionality and safety. But it is often the lack of social knowledge about how people value and use a particular landscape, including the highway system, that can generate user conflict and mistrust of public transportation agency behaviour (Brown 2003).*

This report is based on the premise that better knowledge of environmental and cultural values and their potential for enhancement and regeneration can improve both decision-making processes and the outcomes they are intended to achieve. Two pertinent outcomes in this regard are stated in the NZTA *Statement of intent*, which in general contributes to the government's overarching goal of 'growing New Zealand's economy to deliver greater prosperity, security and opportunities for all New Zealanders': 1) an accessible and safe transport system that contributes positively to the nation's economic, social and environmental welfare, and 2) an efficient transport system that ... provides strong international connections for freight, business and tourism, and meets international obligations (see imperative for the system in chapter 2).

Examples: It might seem that all these values are taken for granted and are being enacted in the normal course of road construction and management. Two recent cases from Christchurch show there is a need for a fail-safe system of maintaining and supporting multiple-value highways. The first pertains to the Russley Road widening. In the early 2000s, environmental impact reports were commissioned in relation to the widening and, given the extreme modification of the local environment, the only recommendation regarding mitigation was the shifting of the native hedges of bracken and scrambling pohuehue back to the new corridor boundary. This would require some pre-construction work and preparation but with use of a mechanical bucket should have been simple to achieve at the right time of year. It is apparent from recent inspection that nowhere has this relatively simple recommendation been followed. Regarding the southern motorway extension, a subcontractor had responsibility to carry out an environmental audit for the construction and landscaping of the motorway. Advice was given that upheld new expectations of the NZTA and mana whenua with respect to protecting and restoring and mitigating losses of biodiversity. This involved recommending landscaping faithful to the landforms and climate, which vary along the length of the extension, and propagating material for this. Despite repeated requests to see the developing plans, the consultants were fobbed off with claims that they were still drafts and there would be plenty of time to sort them out later. But 'later' never came, and eventually the expensively propagated material had to be shoe-horned into small blocks. Some of the planting locations are not suitable and it is clear no experienced ecologist was employed to review or design the planting plan. It is these kinds of experiences that involve the waste of public money, disdain for certain expertise, and loss of values that this programme aims to overcome. It is clear that, as well as in ecological understanding, the institutional culture, through the often tenuous contractor and subcontractor chain (vertical integration), needs to be strengthened.

## 1.2 Research outcomes and objectives

### 1.2.1 Outcomes

Deriving from extensive and collaborative interactions with the NZTA, and perusal of documents outlining the NZTA's mission and modus operandi, come a number of aspirational outcomes that recognise existing and potential values, and enhance performance and stakeholder experience in these areas:

- Provide a way to enhance environmental and cultural values and assets within conventional safety, efficiency, environmental and cost parameters – along corridors of the state highway system.
- Enhance the landscape experience of travelling along state highways, and thus contribute to the New Zealand 'clean green' brand and consequent improved earnings from tourism.
- Promote opportunities to reinforce regional identity and history as revealed from the highway and thus engender a wider sense of shared nationhood – both Māori and Pākehā.
- Identify opportunities to treat contaminants from transport on site (air, water, soil, noise).
- Reduce maintenance costs through appropriate landscape and vegetation design.
- Increase indigenous biodiversity and wildlife habitat opportunities associated with highways – at a range of scales.
- Enhance vertical and lateral integration and synergy across different values and through the length of the command chain – the road building and management culture.

## 1.2.2 Objectives

Towards achieving these outcomes Landcare Research was engaged to address the following objectives: (note, other project results have been furnished separately – Simcock and Meurk 2010; Wilson and Swaffield 2010):

- Identify and demonstrate opportunities for, and test, monitor and evaluate the performance of new roadside landscaping designs utilising indigenous species.
- Develop an evidence-based understanding of perceptions and values of road-users, designers and managers.
- Develop an approach and process for a NECAMS that first identifies environmental and cultural (including landscape) values associated with the state highway network and their relationship to highway assets and, second, implements regional and local strategies and plans that protect, conserve and regenerate values and manages them in a way that is consistent with other imperatives and policies of road management.
- Identify areas requiring capacity building, engagement of stakeholders and highway locations where proof of concept exercises can test the proposed process.

## 1.3 Approach

To achieve the objectives in section 1.2, we familiarised ourselves with relevant aspects of NZTA road building and management processes and associated corporate culture, used our existing knowledge and carried out further investigations.

The approach taken in this report was to: 1) report on primary and secondary research into the environmental and cultural values associated with the state highway network (chapters 3–5), and 2) suggest ways in which management of these multiple values could be better integrated into the current systems and work practices operated by the NZTA (chapter 6), and 3) encapsulate these findings in the proposed NECAMS for trialling in a real world situation and then refining on the basis of that experience.

## 1.4 Research programme and methods

The NZTA – Landcare Research programme 2008–10 comprised seven work streams:

- 1 A selected literature review of road values and asset management (chapter 3)
- 2 Consultative workshops were completed with the NZTA and stakeholders. These were structured to elicit attitudes, perceptions and preferences of key issues including Māori values, with regard to roadside environments. The results and analysis are presented in chapter 5, appendix B and in Wilson and Swaffield (2010)
- 3 Development of a conceptual proposal for a NECAMS that integrates with current NZTA practices and systems (chapter 6)
- 4 Preparation of a proposal for a real-world/pilot demonstration and refinement of a NECAMS and the corresponding process on a particular highway (appendix A)
- 5 Review of existing NZTA practices and editing of the species guidelines in the current landscape design manual (Transit NZ 2006).

- 6 Field trials of indigenous plantings, on both North and South Island motorways, were established to examine expanding the diversity and variety of combinations of species used and to assess their survival and performance, and how these can fit into the health, safety and amenity requirements of roadside landscaping and management
- 7 Analysis of the capital and maintenance costs of mown grass versus more sustainable woody road-verge vegetation.

This report presents outcomes from work streams 1–4 (the objectives, section 1.2). The key informant survey in work stream 2 has been published as a separate report (Wilson and Swaffield 2010). Work stream 5 has been reported directly to NZTA as edited texts. The results of work streams 6 and 7 are contained in Simcock and Meurk (2010).

## 2 History of natural and cultural asset management in New Zealand – creating a new vision

For its size, New Zealand is a remarkably diverse country – ‘a land of little landscapes’ (Hayward and O’Connor 1981). It owes its uniqueness to its long oceanic isolation from the major continents; its size, range of elevations and broad latitudinal span; and its relatively recent colonisation by humans. However, change has been rapid and a significant part of the contemporary landscape diversity is the result of introduced technologies and species (production systems, crops, plantations and weeds) that overlay, and in many locations displace, the original forest, scrub, wetlands and grasslands, and material evidence of the ‘first nation’ – the tangata whenua.

The highway network is an integral part of this transformation, a primary means by which New Zealanders and our international visitors see and experience (and cause) the changes in our landscapes, and a potential catalyst to achieve long-term sustainable management of New Zealand’s unique landscape attributes and potentials.

There are a range of imperatives for enhanced environmental and cultural management of the highway network. Statutory purposes and obligations include the Land Transport Management Act 2003 (LTMA) and the Land Transport Management Amendment Act 2008, which provide the basis for managing and funding land transport activities. The statutory purpose of the LTMA specifies an integrated planning and management approach that takes into account the views of affected communities. The Resource Management Act 1991 (RMA) is the primary environmental planning statute in New Zealand. Its purpose is the sustainable management of natural and physical resources. The RMA places focus upon procedures and actions to avoid, remedy or mitigate adverse environmental effects caused by land use activities, including transport infrastructure. The Local Government Act 2002 (LGA) empowers territorial local authorities to play a broad role in promoting the social, economic, environmental and cultural well-being of their communities, taking a sustainable development approach. Public roads that are not part of the state highway system are managed as local authority assets, as are some roadside facilities.

A common strand throughout the current statutory framework in New Zealand is an emphasis upon sustainable management of multiple values, and the need for integrated and systematic approaches to the assessment and management of both new and existing infrastructure.

Environmental and landscape values are currently addressed in the management framework for the New Zealand state highway network at several levels. This includes the *New Zealand transport strategy* (Ministry of Transport 2008)<sup>1</sup>, an *Environmental plan* (Transit NZ 2008), and *Guidelines for highway landscaping* (Transit NZ 2006). The transport strategy aims to provide an affordable, integrated, safe, responsive and sustainable transport system. The environmental plan emphasises multi-purpose management of roadsides. The guidelines aim to foster best practice in landscape management of the roadside reserve by maintaining and improving safety, promoting biodiversity, improving visual quality, managing stormwater runoff, managing pests, improving local air quality and improving business

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<sup>1</sup> *Connecting New Zealand* is a more current summary of the government’s transport policy and intentions. While *Connecting New Zealand* is largely focused on the government’s direction for the next decade, it draws on government documents that have different time horizons, including up to 20 years for the National Infrastructure Plan.

practices. They take into account the complexity of the interaction between the highway and the wider landscape, and are intended to 'help integrate the highway into the surrounding landscape' (figure 2.1a and b).

The promotion of biodiversity conservation is particularly important in New Zealand, which is a global biodiversity 'hotspot' (Myers et al 2000) as a result of its long history as an outpost of Gondwanan heritage (Swaffield et al 2009). The fact that vast tracts of New Zealand countryside are nearly devoid of indigenous elements (Ullmann et al 1995) raises the very real possibility of disconnecting people from their heritage and an authentic, post-colonial sense of place (Meurk and Swaffield 2000). This has been termed 'extinction of experience' (Miller 2005), which in turn threatens the basis of New Zealand's 100% pure tourist pitch. NZTA goals include helping to halt the decline of New Zealand biodiversity and 'managing its state highway corridors in such a way that protects and enhances ecosystems and habitats, avoids adverse environmental effects and promotes biodiversity' (Transit NZ 2006, p2-2).

**Figure 2.1 Two possible vistas from a high-country road**

**a) Semi-modified native tussock grassland reinforcing natural character**



**b) Intensively developed pasture of Eurasian fodder species**



The above photographs both present perceptual, conceptual and technical challenges in roadside management in order to ensure sensitivity to landscape, biodiversity, history and other functional relationships between the highway and its context.

Strategies to achieve this include the protection of existing pockets of biodiversity along the highway; the planting of native species that are appropriate to the environmental and biogeographic context and positively affect ecosystem integrity by encouraging protection of ecological values in adjoining land; and managing pest plants to reduce the biosecurity risk to biodiversity and farmland.

In addition to the countrywide statutes and policies, there are also statutory imperatives associated with particular parts of the highway network – for example, the Conservation Act 1987 and other provisions relating to national parks and the wider public conservation estate. Particular features may be recognised under the Historic Places Act 1993, and there is also a range of relevant provisions related to tangata whenua values and management.



Since the reform of public management in New Zealand in the late 1980s there has been a progressive evolution of more integrated and explicit financial management systems, aimed at achieving more effective and efficient utilisation of publicly owned assets, as well as greater transparency in management and better connection of asset management with community outcomes.

Asset management utilises computer-based records of the age, capacity, condition and strategic importance of individual system components. This data, along with other issues such as level of service (LOS), urban intensification and expansion, provide the basis for the determination of expenditure and revenue needs. LOS is a fundamental requirement of management plans for public assets, and subject to scrutiny by the Auditor-General. At present, LOS tends to be defined at a generic system-wide or organisational level, but there is increasing integration of LOS specifications with locally expressed needs. Hence the nature and level of environmental and social services that should be provided by state highways has to be derived from both statute and local stakeholder needs. Management of natural assets is somewhat different from built assets in that they may not depreciate, but rather gain value over time (Watts and Greenaway 1999). The ultimate aim of this report is to define a process through which these LOS can be expressed as visions, strategies and operational plans for specific sections of the highway network.

## 2.1 Summary

New Zealand has a unique geology, landscape, biodiversity and culture which are under increasing threat from globalisation and homogenisation. As global citizens, we have a duty to protect this important heritage. There has been a steady development of legislation, policies, strategies and plans over the past 25 years that recognise these attributes and their cultural and economic importance (clean green branding) to nationhood. These statutes and associated thinking emphasise sustainability, integration of multiple purposes, accountability to diverse stakeholder interests, Treaty of Waitangi partnership, international obligations to preserving our part of global diversity, and economic benefits. There is nevertheless considerable inertia, lost opportunities and lack of awareness leading to ongoing attrition. Government agencies are not immune. The NZTA, along with other influential agencies, are at a crossroads (figure 2.1) and can be part of the inertia. Or they can be part of the spirit and intent to rectify past mistakes and work inclusively towards achieving a vision of a special Aotearoa New Zealand which has a distinctive, legible and accessible cultural landscape that reflects, celebrates, interprets and transports locals and tourists alike to experience the unique attributes of the nation. In this respect the journey is as important as the destination. Happily, the NZTA has demonstrated a willingness to embrace such a vision and to contribute in a tangible way to achieving it.

## 3 New insights

This section summarises the key findings of stakeholder workshops, an investigation into Māori values and a West Coast case study of stakeholder values, all undertaken as part of this research project.

### 3.1 Workshops

An initial workshop with a range of invited stakeholders was held on 9 June 2009 (for a list of participants see appendix B), and several other meetings were held with interested agencies. The goals for the workshop and meetings were to review current practice, identify needs and opportunities, integrate diverse perspectives, and to begin the development of concepts for a NECAMS that was wanted, realistic and could operate within the NZTA management structure and organisational culture.

The key outcomes and learnings from these meetings are detailed in appendix B. They are summarised below:

- The state highway network is a major national asset and stakeholders are keen that it should be well used and managed for multiple values.
- Recognised values of efficiency, safety, and quality of noise, air and water (already NZTA policy) are and should remain paramount.
- While financial cost-benefit is a key driver, stakeholders recognise that other values can and should be incorporated. These include the role of the roadside reserve as a buffer or absorber of pollutants; other environmental services such as biodiversity and carbon sequestration; experiential landscape values such as legibility, which is important to tourism's 'clean green image', variety and visual amenity; psychological effects on road users such as calming; recreation; and heritage.
- There is a desire to better integrate these broader environmental and cultural values in triple bottom line or other 'holistic' perspectives, but these values need to be prioritised.
- Interaction with community/stakeholders/iwi/territorial local authorities (TLAs) is very important to bring in a greater range of support. Adjoining landowners and farmers can make significant contributions to multi-value highways through co-management activities on their own land and through guardianship of adjacent public land.
- There is a need for capacity building and training at all levels to address lack of consistency and continuity and to raise ecological and cultural awareness. It is important to provide technical manuals that are high quality, attractive and user friendly and to better link policies, vision and goals to processes, structures and contracts (the contracting culture can lead to fragmentation and loss of institutional memory).
- Spatially explicit technologies, such as geographic information systems (GIS) can provide great opportunities for enhanced management, and it is important to identify and protect indigenous biodiversity and ecological systems as first priority, and to look at roadsides as corridors that can add value to the ecological integrity of lowland landscape.
- Stakeholders recognise the need to think long term but act now; moving forward creatively to achieve a vision that may take centuries to fully realise.
- Review what is already good in NZTA policy but identify gaps and improvements that are realistic.

Overall, the workshops suggest that:

- Existing manuals, protocols and policies adopted by the NZTA or its predecessor are well founded and generally require only minor modification or updating.
- The main gap is in the full implementation of the spirit and intent of the policies. The fulfilment of these objectives is patchy and may depend on individual or local decisions that may be inconsistent with national standards or expectations.
- There is a general willingness and structural ability to accommodate new or enhanced ideas among some key managers at the NZTA; although as with any large organisation there is always some disconnect between 'left and right hands'.
- The caveat is that improved environmental asset management does not cost more than the conventional approach. This is especially the case in the current climate of economic austerity. However, experience is that asset values increase in multi-value systems and, generally, full external costs of conventional, single-purpose systems are not properly accounted for. Whereas some (rare) assets must be acted on immediately, costs of full recovery and restoration landscaping may be discounted over decades.
- It is possible to 'paint a picture' of a vision, and provide a checklist of the key components and how these may be achieved; however, constraints on the size of the full NECAMS project and co-funding mean that full engagement of the project with MWH and setting up a GIS-based system fully integrated with the existing asset management system is not possible.
- There is an aspiration in the NZTA to be the best at what they do and to be up with the international field.
- Mitigation or prevention at source may well be the most effective method of reducing waterway contamination – rather than subsequent treatment.

Overall, there was good support for the exploration of more environmentally sensitive management approaches. As former waterways engineer with Christchurch City Council Robert Watts commented, 'we didn't know at the beginning how the Christchurch waterway asset management process would pan out, but they took a bold step in adopting the six-values approach to see where it would take them, and it took them to a good place'.

## 3.2 West Coast case study survey of key informants

Following the scoping workshops, a case study was piloted and implemented to develop a deeper understanding of the revealed values. This section summarises the findings of the work undertaken by Wilson and Swaffield (2010). The choice of case study was determined through discussion with the NZTA. The goal was to identify values associated with the environmental and landscape condition of the state highway corridor, with particular emphasis on the roadside reserve. Sixty key informants from the NZTA and its consultants and contractors, a selection of road-user organisations, representatives of the local rūnanga, and professional road users were asked to assess (by ranking in order of preference and recording explanatory comments) a range of West Coast roadside settings shown in a set of 25 photographs. The photographs were selected based upon an analysis of the roadside conditions observed in the case study area, with the selection intended to provide a wide range of surface and vegetation types and management regimes, in a variety of landscape settings. The key informants were asked to rank the photographs using a 'Q sort' method according to three criteria – general preference, regional identity and type of roadside management. Full details of the method are set out in Wilson and Swaffield (2010).

The analysis identified distinctive orientations in respect to each of the criteria. When asked about preference, 90% of respondents expressed one of two orientations: 'cultured nature' or 'wild nature'. 'Cultured nature' valued roadside conditions that featured a variety of types of native vegetation, but placed a high value on the reserve being neat, tidy and well cared for. 'Wild nature' valued more natural looking native vegetation, less obvious signs of management, and a bush edge closer to the road.

When asked about regional identity, three distinctive orientations were expressed, which accounted for 83% of respondents. 'Proud community' valued features that indicated evidence of a proud human history of endeavour within a distinctive and vigorous natural environment. This included appreciation of the human stories represented by heritage features and communities within the landscape. 'Rugged bush' was more focused on the identity created by the natural environment of the West Coast bush. This favoured situations where the unmanaged bush came closer to the road, with a variety of vegetation types, and also indicated an appreciation of evidence of mining history. The 'working landscape' orientation favoured roadsides that provided evidence of the distinctive types of human activity on the West Coast, particularly extractive industries and their supporting infrastructure.

The third question was about roadside management. Three distinctive orientations were expressed, accounting for 82% of respondents. A 'care' orientation emphasised the importance of neat, tidy and well-maintained roadsides. It indicated clearly defined management regimes, good drainage and visibility, neatly mown grass, and absence of weeds and rubbish. The 'safety' orientation focused on a minimisation of hazards associated with the highway. It favoured wide road shoulders, clearly marked pull-offs, vegetation kept well back to ensure good visibility, lack of potentially dangerous obstructions, and space for different users. An 'amenity' orientation focused on the provision of well-managed and attractive rest areas and roadside facilities, which related well to the wider landscape and allowed travellers to pull off safely and then stop at some distance back from the highway.

The analysis also identified distinctive values and concerns associated with different roadside settings:

- *Pristine* roadside reserves were highly valued by all stakeholders but did not always satisfy safety and amenity requirements.
- *Revegetated native vegetation*, if well planted and maintained, was visually appealing and served multiple purposes. The transition from the road into the natural environment and the neatness of the roadside reserve were particularly valued.
- Roadside reserves with *wide grass verges and revegetated native vegetation* were generally appreciated for the high degree of maintenance they displayed as well as for safety reasons. In some landscape settings, however, they were seen as being too artificial and generic in character.
- Where *exotic species* were visible alongside natives in roadside reserves, the issues of most concern were the degree of care and maintenance, safety, and lack of local identity.
- The way in which *weed species* were managed had a significant influence on evaluations of the roadside. The management regime was more likely to attract comment if the visual condition of the roadside contrasted with the character of the wider landscape.
- For a significant number of stakeholders *large expanses of grass* at the roadside were regarded as a waste of space. For others, it was important that these grass expanses were well maintained.
- *Rest areas* needed to be both inviting and interesting, and to be constructed and managed in a way that was congruent with the setting. 'Generic' designs were disliked.
- *Heritage features* needed to be both appropriately and well-presented and were most popular in combination with other amenity features.

- Roadside *operational areas*, while seen as a necessary feature, nonetheless needed to be carefully managed. If screening was not possible, some effort should be made to keep these areas tidy, especially as they were seen to have considerable potential to worsen over time.

The stakeholder values indicated particular support for context-sensitive management of the highway corridor:

- For sensitivity to the landscape context, (ie use design and management styles and materials that relate to the specific landscapes through which the road corridor passes, rather than using standardised solutions).
- For sensitivity to local ecology, retain and re-establish native vegetation, limiting grass to those areas needed for safety.
- For layered or gradual transitions from the carriageway into the reserve, provide a transitional view through to the surrounding landscape (ie avoid a sense of being confined).
- Minimise the visual impact of operational areas, and where possible screen unattractive land uses adjoining the road.
- Manage weed species in a way that reduces their visual impact as well as their biological impact.
- Minimise the use of exotic species (other than grass).
- Provide stopping areas that feature views to the surrounding landscape and also feature local heritage and history in a subtle way.

Stakeholders identified opportunities for improved safety through better vegetation management and advocated methods that reduced the visibility of dead weeds. They wanted active management of the view from the road and improved legibility of roadside conditions and facilities. They sought improved facilities for cyclists and suggested categorising recreation areas to ensure consistent management.

Overall, the findings show a close interrelationship between evaluations of the road reserve and evaluations of adjacent land. The condition of the roadside reserve was recognised as an important focus of highway management, and the conditions were given careful attention, but their management was required to be 'context sensitive'.

### 3.3 Māori cultural values and the environment

This section is based upon a report prepared for the project by team member Shaun Awatere, Landcare Research. It is based upon generic rather than local values, but the emphasis is upon context sensitivity, with a cultural rather than a geographical emphasis.

Māori recognise the interrelatedness and interdependence of all things in the world. Whakapapa (genealogy), an important concept within the Māori worldview, explains the relationship Māori have with each other, with natural resources, the environment and the world, as well as with spiritual and cosmological entities. Based on this belief a large number of responsibilities and obligations were assumed by Māori to sustain and maintain the well-being of people, communities and natural resources (Marsden 1989; Haami and Roberts 2002; Marsden et al 2003; Mead 2003). Whakapapa is an integral part of all traditional Māori institutions and is a major determinant of rights to use, access and manage natural

resources (Mahuika 1998). The implementation of whakapapa is through kaitiakitanga<sup>2</sup> – the expression of a two-way relationship that involves obligations to give, receive and repay.

Land, mountains, valleys, rocks, water and sea ways are viewed not only as resources, but more importantly, as manifestations of collective identity. They are the essential roots that entwine the component parts of what it means to be Māori. Such resources are vital taonga (treasured possessions) to be protected. The role of kaitiaki (resource manager) reflects the individual and collective role to safeguard ngā taonga tuku iho (those treasures that have been passed down) for present and future generations (Minhinnick 1989; Crengle 1993; James 1993; Tomas 1994; Kawharu 2000).

On the whole, most kaitiaki would support the promotion of indigenous vegetation on roadsides for the reasons stated above. An important issue, however, is to decide which plants should be planted. Like people, plants have a whakapapa that is also contextual. A person's whakapapa will change depending upon the physical locality in which they find themselves. Likewise, vegetation will change depending on the local ecology. A planting regime that focuses on taonga species or species that are deemed cheap to maintain may not flourish in areas where they are not suited.

Application of Māori values in resource management is also contextual. While there is recognition of a shared value system amongst iwi/hapū of core concepts such as mana, mauri tapu, and kaitiaki; the application of these values is most assuredly dynamic and dependent on the response from the local iwi/hapū (Awatere 2008). Indeed, not only are there variations to resource management options amongst iwi but there may also be differences regionally amongst even hapū.

The subjective and contextual nature of Māori resource management responses does pose a difficulty for resource managers/policy analysts/local government planners whose energies are focused on quantitative assessment for resource allocation. Quantitative assessment should be used with a cautionary note. The danger in co-opting Māori values into this type of method is that Māori values are then seen from within the framework of Western knowledge systems (Jackson 1992; Battiste and Henderson 2000). This is a problem because quantitative assessment may de-contextualise the indigenous perspective, rendering it malleable and conducive to the agenda of power brokers. Understanding the relationships between indigenous peoples and power structures is essential to improving the lot of marginalised or indigenous peoples. Quantitative assessment is helpful for decision makers but is it equally important for iwi/hapū? Who are the decision makers and what roles do iwi/hapū have in natural resource management? Iwi/hapū are not stakeholders whose views should be considered within the context of quantitative tools such as multi-criteria analysis or cost-benefit analysis, they are tangata whenua – treaty partners – and their role in the management of resources should be made explicit.

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<sup>2</sup> Within this section the Ngāti Porou dialect has been used – this reflects the tribal identity of the author.

## 4 Recent developments and best practice in environmental and cultural asset recognition and management

There is a clear need, and international precedents exist, to enhance understanding of the different ways in which the state highway corridor is valued by different interest groups. International best practice in highway design and management is increasingly acknowledging the need for better integration of a wider framework of environmental and cultural values along with the functional and safety considerations conventionally associated with highways. This section briefly reviews a selection of international and New Zealand examples of recent developments in environmental asset management.

### 4.1 International best practice and New Zealand context

A review of literature by Clemens et al (2010) for this project reported that attitudes towards roadsides and their landscape values have changed considerably over time. The focus of landscape appreciation in international literature during the early to mid-20th century was on scenic values associated with roads, roadsides (road corridors) and the wider environment from the perspective of road users (rather than road makers). While road corridors had value as a means to insulate road users from their surroundings and to offer safe transport through the wider environment, they also offered significant opportunities for scenic appreciation. Roadsides offered visual amenity through beautification projects and gave the public access to scenic views, in many cases through the deliberate construction of scenic roadways. The scale of 'views' addressed in literature on visual amenity varies considerably – sometimes the road itself is the limit of interest, at other times it is the wider landscape. The land lying alongside the roadway is either considered as part of the road corridor or as a frame for the landscape beyond, rather than as an entity in its own right. It is difficult to isolate the values associated with each of the three components of the highway corridor: the road, the roadside reserve and the wider landscape. It is also difficult to measure and quantify many of the values involved, and no standardised approach has been developed.

Interestingly in New Zealand, around the same time as this international focus on scenic values, there was a movement to protect the scenic qualities of the countryside by ensuring road-verge indigenous vegetation was protected. However, it seems this attitude became lost in the deregulated period following the 1980s – possibly partly as a function of the technological development of powerful machinery and herbicides for vegetation and soil clearance, their widespread deployment by local governments, and the general post-war affluence. Consequently, large swathes of semi-natural scrub and tussock with intact soil profiles were planed off road verges (on the so-called 'long acre') over the past 20 years.

The functional and ecological relationship of roads with the wider surroundings through which they pass became a key area of attention again in the late 20th century. Much debate has focused on the type of vegetation to be used at the roadside, with consideration of the more pragmatic uses of vegetation (to stabilise slopes or as a means to frame wider views) and also the enhancement of the roadsides themselves through planting. An aspect of this, in New Zealand as well as overseas, has been a changing cultural appreciation for native or indigenous vegetation over introduced species.

Increasing interest in the conservation and biodiversity potential of roadside corridors (Given 1994) resulted in a number of scientific studies on the ecology of roadside vegetation (Ullmann et al 1995; Spellerberg 1998; 2002). There was recognition of the negative impact of roads on their surrounding environments (in respect of both flora and fauna), and on ways to mitigate these impacts. A number of

positive environmental impacts were also identified, including the importance of road corridors as wildlife and vegetation habitats.

The early literature highlighted some key differences in focus between 'road users' and 'road makers' and more recent research on landscape values indicates that further segregation into a wider range of stakeholder and community groups may be required to identify all the values held. The involvement of stakeholder and community groups is formalised in statutory requirements and there are a multitude of key stakeholders involved with the construction and management of the road network, including the NZTA, local government, iwi, other statutory bodies, eg the Department of Conservation (DOC), and community members who serve on road planning and road management committees. What is needed now is a formal process that encourages and enhances the contributions of these different interest groups.

The following sections expand upon three systems of management that have particularly influenced the approach adopted by this study.

## 4.2 Context-sensitive design and management in the USA

The USA was a pioneer in environmental assessment of new highway proposals in the 1960s and 1970s, under the mandate of the 1969 National Environmental Protection Act, which required environmental impact assessments upon all federally funded projects. In the past decade this emphasis upon the relationship between a highway and its surrounding landscape has received renewed attention under the concept of 'context sensitive' design (Burley et al 2009). The extensive areas of federally owned land, under the management of agencies such as the Bureau of Land Management, have also influenced highway management - for example the development of visual resource management procedures associated with highways (Jones & Jones 1978). This work extends to investigation of public perceptions of scenic quality viewed from the highway, and the contribution and influence of roadside vegetation upon scenic quality. However, the effort in the past has largely focused on either new highway projects or the effect of federal land management proposals, such as forest harvesting.

The role of highways as a primary means to experience the natural environment has also been long recognised in the USA, with numerous examples of scenic highway designation (paralleled over the past few decades by similar movements in New Zealand in terms of scenic routes, beautification - Beautiful New Zealand Advisory Committee (1984), Kawharu (2002) - and community-based 'Adopt a Highway' projects) and construction (eg National Scenic Byways), and there are an increasing number of programmes at both state and national level to recognise and manage a variety of scenic qualities. In Nevada, for example, a state-wide programme placed emphasis upon a landscape planning framework to assess highway qualities and to integrate values in highway planning (Nevada DOT 2002), while at a national level the National Scenic Byways Program (US Department of Transportation 2010) is a community-based voluntary programme administered by the Federal Highways Administration.

The National Scenic Byways programme provides a checklist of intrinsic qualities of highways. These include scenic, archaeological, cultural, historic, natural and recreational qualities:

- *Scenic quality*, which is 'the heightened visual experience derived from the view of natural and manmade elements of the visual environment of the scenic byway corridor. The characteristics of the landscape are strikingly distinct and offer a pleasing and most memorable visual experience'.
- *Archaeological quality*, which 'involves those characteristics of the scenic byways corridor that are physical evidence of historic or prehistoric human life or activity that are visible and capable of being inventoried and interpreted'.



- *Cultural quality*, as expressed in ‘evidence and expressions of the customs or traditions of a distinct group of people. Cultural features including, but not limited to, crafts, music, dance, rituals, festivals, speech, food, special events, vernacular architecture, etc, are currently practiced’. Presumably this would also include natural, named features that are part of legends and folklore.
- *Historic quality*, which ‘encompasses legacies of the past that are distinctly associated with physical elements of the landscape, whether natural or manmade, that are of such historic significance that they educate the viewer and stir an appreciation for the past’.
- *Natural quality*, which ‘applies to those features in the visual environment that are in a relatively undisturbed state. These features predate the arrival of human populations and may include geological formations, fossils, landform, water bodies, vegetation, and wildlife. There may be evidence of human activity, but the natural features reveal minimal disturbances’.
- *Recreational quality*, which ‘involves outdoor recreational activities directly associated with and dependent upon the natural and cultural elements of the corridor’s landscape’.

There is also growing emphasis in the USA upon the long-term management of the highway corridor as an environmental asset in and of itself. One impetus for such an approach has emerged from the demand for monitoring of environmental mitigation works associated with new project permits. A recent study of the management of environmental features and assets of highways<sup>3</sup> found that while ‘few state departments of transportation (DOTs) have begun to develop a state-wide system for asset management of environmental mitigation features’ there is a growing awareness of the need for longer-term monitoring. ‘Several states are beginning to use environmental commitment tracking systems beyond the construction phase to monitor and maintain mitigation features. The most progress has been made in systems for vegetation management and culvert management as maintenance of these features is closely tied to routine maintenance of the major transportation infrastructure. In most states, however, monitoring and maintenance of most other mitigation features ends when the environmental permit is closed.’

The recognition of the role of highway corridors as ecological assets have been formalised in the USA as part of the context sensitive design and management movement. Examples are greenways such as the ‘Mountains to the Sound’ project in the Pacific North West, which opened the way to enhancement projects such as the ‘Environmental Retrofit for Highways: Making Wildlife a Priority’ project undertaken by Washington State Department of Transportation (Wagner 2005).

*This program is designed to identify environmental deficiencies within the highway system and address them both as parts of planned transportation projects and also as stand-alone environmental-retrofit projects. These standalone retrofit projects may be conducted not only where the transportation needs are currently satisfied, but where significant ecological impacts exist. The focus areas for this program are based on the ecological priorities, including fish-passage correction, stream habitat restoration, and water-quality improvements.*

We have not yet identified examples of comprehensive environmental and cultural asset management systems in the USA that are fully integrated with engineering asset management. However, there are important precedents in the Australian experience.

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<sup>3</sup> <http://pubsindex.trb.org/view.aspx?id=898390>

## 4.3 Environmental management systems

*VicRoads' roadside management strategy* (2002) implemented by the State of Victoria provides a valuable example of integrated management of multiple values. It considers 'all the values and requirements of the roadside', with sections on roadside management, environmental and cultural heritage, amenity and access. Statutory obligations with respect to the environment (eg for protecting biodiversity, weed control and sustainable development) were combined with community and stakeholder expectations to devise the strategy. The most important 'outcome areas' for the public were 'safety, landscape, environmental and cultural heritage, and the aesthetics and amenity of the roadside'.

Integration of multiple values within an asset management framework has recently been explored in Queensland, in the *Environmental asset management plan* (EAMP) feasibility study (Pearson et al 2007) prepared for Brisbane City Council. It proposed that the EAMP should be based on the ecosystem services that natural assets provide to the community of Brisbane. Implementing ecosystem services as the basis for an environmental asset plan is difficult as not all services are created equal – no single category captures the diversity of what a fully functioning ecological system provides to humans. For all of these services to be included in an EAMP they need to be linked to an environmental asset and associated with 'values'. The feasibility study asked: What are ecosystem services and how are they linked to natural assets, particularly in urban areas? What is an asset management plan? Where and how have they been applied in Australian local government areas? What are the findings from the investigation? And, what recommendations to Brisbane City Council are there from the feasibility study?

One of the most relevant Australasian examples of an operational environmental asset management plan is the *Waterways and wetlands natural asset management strategy* prepared by Christchurch City Council (CCC 1999; 2000; Watts and Greenaway 1999). The strategy was adopted by the council in 2000 and lists over 300 projects totalling \$160 million, scheduled over a 40-year period. It represents a commitment to wise resource management as inspired by the RMA, the City Plan and key stakeholders.

The waterways and wetlands strategy can be simply described as an investment in the sustainable management of the natural and physical resources that make up Christchurch's system of waterways, wetlands and drainage. Restoration and protection of natural waterways systems are the main capital expenditure items, but the strategy also required the employment of people with appropriate skills. There is now an expert group of staff and consultants with considerable experience who work collaboratively on surface-water management projects. Organisational changes within Christchurch City Council have assisted in this regard by combining surface water management with parks and recreation management.

The conventional utility asset management approach seemed well suited to the built component of the land drainage system. However, it was not compatible with the natural component as there were other values to consider. Also, a uniform level of service was inappropriate as natural waterways vary greatly in character, and the values are not evenly distributed in space.

Preparation of the strategy therefore commenced with a consultation and visioning exercise organised under a set of values: ecology, landscape, recreation, heritage, culture and drainage.

The next step was to divide Christchurch into project areas. This was done to acknowledge the diversity of surface-water environments within the city. For each area a set of issues was identified and from these a set of objectives and an overall vision were developed. A key feature was that the visions were underpinned by a comprehensive financial plan and linked to both capital works projects and management service levels and contracts. This ensured that individual asset management initiatives were planned and designed in a way that supported both the area-based objectives and the overall city vision. Plans and

illustrations were prepared to help stakeholders visualise the transformation that would occur within the different project areas.

An important feature of the Christchurch example was the geographic organisation of analysis and management strategies based upon catchments. Spatial indicators of environmental and cultural values and spatialisation of service levels is a critical dimension of any enhanced asset management system (Willemen et al 2008).

The Environmental Information System (EnviS) is a UK approach to monitoring environmental assets in a spatial database. In the words of Highways Agency Chief Executive, Graham Dalton, 'EnviS is an easy to use GIS asset system that will provide a real improvement in the quality and availability of environmental data for the strategic road network'. Its motto is: 'Safe roads – reliable journeys – informed travellers'. The first two elements are conventional roading goals, but the third opens up a new arena of knowledge transfer and education ... to achieve what landscape architects call 'legibility'. The term legibility from here on in this report follows this philosophy.

There is an increasing array of systems and policies around the world converging on a universal imperative to establish multi-value, sustainable highways and road experiences. Key words are legibility, information and knowledge, sustainability, spatialisation (GIS), values, identity, context and asset management. There have been efforts to engage stakeholders increasingly in working with road builders and managers to achieve the wider remit. The asset is now more varied and requires a more multi-pronged approach to its establishment and management.

## 4.4 Landscape legibility

The Council for the Preservation of Rural England (CPRE; established 1926) believed that roadside plantings should harmonise with regional surroundings, and that non-British plants should be confined to urban areas. Brenda Colvin (1948) argued that roadside plantings were to be designed to provide 'interest and variety to keep the driver alert and vigilant' in order to overcome the monotony induced by engine and road sound (and other soporific features of road transport) and Crowe (1960) saw native plants as enabling the 'road to be read'!

Legibility came to prominence as a management concept in the USA, where it was first used in expert visual assessments such as *The image of the city* by Kevin Lynch (1960), and subsequently was incorporated into synthetic models of human perception of natural environments (eg Kaplan and Kaplan 1989). It is now widely recognised in both theories of environmental perception and cognition and in design and management strategies for a range of types of environment, where it is important to encourage and enable informed community involvement in land management. It is widely accepted that legibility is a factor that enhances enjoyment by visitors such as tourists, and increases spending.

The significance of legibility for a highways asset management system and strategies is that it provides a way to identify and manage visual indicators of otherwise intangible ecological values (Fry et al 2009). Nassauer (1995) has demonstrated the importance of what she describes as 'cues for care' in promoting and implementing nature conservation projects in both rural and urban settings, in a process which she subsequently described as 'framing nature' (Nassauer 1997). The insights she offers are that managers, communities and visitors all respond more positively when they can see evidence that vegetation and other surface features are actively managed to promote stewardship. In a simple example, regenerating native species are more accepted in urban areas and along roadsides (Fairweather et al 2003; Wilson and Swaffield 2010) if they are edged by mown grass, fencing or signs to show that the 'unkempt' appearance is in fact intentional.

At a larger scale, local and regional identity is better recognised and can be enhanced if distinguishing features such as landform, cultural features, etc are highlighted and framed in views from highways and other vantage places, and are better appreciated and valued by people who have learnt to read the signs of their presence and their wider cultural meaning (Stephenson et al 2004).

## 4.5 Summary

The discussion above (sections 4.1 to 4.4) illustrates the way that environmental assessment procedures have increasingly become integrated with the traditional engineering approach to asset management. Visionary and creative approaches to managing non-engineering assets, using spatially explicit frameworks such as greenway corridors and catchments, seem to be the hallmark of this sea change. Key ingredients of this new way are explicit acknowledgement of history and context through promoting landscape legibility (a concept already present in Transit NZ (2006)), and developing a visionary aspiration for the highway experience that engenders stakeholder support and buy-in. There remains the challenge of resolving or accommodating competing or conflicting values. Consequent planning, development and management processes must, to be viable, be community inclusive and, while informed by international best practices, have to have a local perspective or flavour.

Roads are for the immediate future and central to Western culture on so many levels. This was the task for this Landcare Research project – seeking approaches to not only provide transport services, but along with it identity, crucial to community well-being and ultimately nationhood – since roads connect the nation.

Key lessons from this brief overview are:

- Context sensitive design and management are of growing international significance.
- Greater recognition and understanding of multiple values associated with highways, ie those that extend beyond the conventional utilitarian and safety concerns – are needed.
- Asset management has become widely established as an operational tool to achieve effective and economic delivery of multiple services to communities from public infrastructure.
- Challenging conventional asset management systems to better integrate multiple environmental and cultural values and services is necessary.
- Processes are required that are both creative and locally specific, within a wider framework of generic goals and performance standards.
- Legibility is an important concept in connecting visual indicators of values and services with stakeholders and the wider community.
- Visioning, informed by international and national working examples, is a crucial component of directing the asset management process from a higher coherent plane.

The proposal outlined in section 6 and the pilot study in appendix A draws upon the best features of these examples. These recognise a range of values, involve stakeholders, evaluate and manage values in a landscape context, and use spatially explicit indicators that are integrated with financial and engineering management systems.

## 5 Towards a natural environment and cultural asset management system (NECAMS)

### 5.1 Conceptual frameworks for management

The NZTA, as operator of one of the nation's critical and most visible, infrastructural assets, has statutory duties but, also increasingly, community aspirations to support.

As such, the NZTA is in an influential position, as it moves with the times and international trends with respect to modern approaches to road construction and maintenance. This goes beyond conventional engineering and safety requirements into a more multi-value/multi-use mode. It has already exercised leadership in operating an environmental management group, adopting progressive policies and landscaping guides, and appointing stakeholder reference panels. It now stands at a threshold where it can make decisions that will have far-reaching effects on New Zealand's biodiversity, culture and sense of self; this is then projected to the rest of the world – as branding and for tourist marketing. The road network is the showcase for this branding so it is vital to get it right. It can realistically be said, that it can make or break New Zealand's clean green image on which a robust and enduring nationhood could well rest.

These developments are consistent with what is happening elsewhere and reflect biodiversity, and landscape and cultural needs that have become absolutes in a modern, sustainable society (chapter 2). This is apparent from our engagement with NZTA staff and reference groups (section 3.1 and appendix B), the analysis of road-users' and managers' perceptions (section 3.2), Māori perspectives (section 3.3), and an international review of conceptual frameworks and delivery systems (chapter 4).

Here we build on these histories, experience, imperatives and aspirations to develop further the framework for defining the 'road' boundary, identifying and ranking the values within it, and delivering a robust asset management system that responds to these values and is based on best practices.

There is a hierarchy of conceptual frameworks that must be accommodated, from the specific to the general. These frameworks/issues must all be accommodated within a successful NECAMS to provide the basis of an auditable set of factors, which through consultation and agreement can be managed and resourced as appropriate.

The frameworks include:

- *Functional indicators* – specific and measurable indicators of conditions, such as grass height and species' frangibility.
- *Safety standards* – assessments of risk that determine provision and location of biophysical indicators (eg sightlines).
- *Experiential qualities* – for example, evaluations of the legibility of landscape identity, or the presence of cues for care (see section 4.4), or the serial experience of travel.
- *Landscape areas* – a pragmatic way to coordinate value assessments and management actions within a defined spatial frame of reference. The 'landscape' scale (Selman 2006) is conventionally recognised as larger than an ecosystem, but at a scale that can be easily understood and comprehended, eg one to three square kilometres.
- *Community associations* – the networks of meaning and association that are embedded in particular communities (Stephenson et al 2004). These may be geographically extended beyond particular landscapes, but are nonetheless specific to location.

- *Coupled human-environmental systems* are a more abstract concept used by the Global Land Project to recognise the inter-relationship between communities and organisations and the condition and management of particular landscapes. This is particularly relevant for managing corridors.
- *Values* – the qualities we might recognise in particular environmental attributes and objects but which are grounded in wider social and cultural meanings and activities – such as the value of a working community, which is represented by farmland or industrial sites, but is wider than the meanings associated with any particular site.

In the proposal below (chapter 6), the landscape scale and its associated elements (Forman and Godron 1986) are adopted as the stage on which these different concepts can be interlinked and mediated. We begin with definitions of the natural and cultural asset boundary and then the time frame over which management and development may operate.

## 5.2 Definition of the corridor

There must be a clear definition of the highway corridor for the purposes of unambiguous environmental and cultural asset management that can be achieved by a range of methods. The term 'road asset management horizon' is used from here on for these purposes.

The minimum definition of the highway itself comprises the highway pavement (carriageway, shoulders, water table) and supporting engineering infrastructure such as bridges and culverts. Around this is a varying berm and area of land that is modified to create supporting earthworks – primarily embankments and cuttings – that are needed to ensure a suitable alignment and to support the pavement (this generally results in no natural soil profiles being present). The embankment and cutting surfaces may comprise a significant proportion of the roadside, but may not all be actively managed. The managed area of the roadside may therefore be either greater or lesser than the area of modified roadside. The area of NZTA ownership may be different again, and extend beyond the actively managed area. In many parts of the network the boundaries of land ownership are not physically marked, and/or may differ from the stock fences typically found alongside the highway.

Beyond the legal and managed road corridor lies a wider zone of influence. There is a visual catchment corridor – the area from which the road itself can be seen – and this may vary in width according to the terrain and vegetation. There is also a sound catchment, which may differ from the visual catchment, and vary with weather conditions. There is a hydrological catchment, and the functional relationship with the highway varies significantly between the upstream and downstream sides. There is a landscape ecological catchment, comprising the mosaic of ecosystems directly impacted by the highway, and at the broadest level, a landscape character catchment, being the tracts of landscape visually affected in some way by the presence of the highway. This may be termed the far-visual corridor.

Environmental assessment and management procedures may take into account some or all of these different catchments and the corridors they create along the highway network. Development of an integrated environmental and cultural asset system requires specification of the scope or scale of management. For the purposes of this report two zones are identified – the area we describe as the roadside corridor, comprising the land currently managed by the NZTA or co-managed with adjoining landowners, and the landscape corridor, being the wider zone in which the environmental effects of the highway have a tangible effect on landscape function and character. The landscape corridor can practically often be identified as the visual catchment (corridor – as seen from the road), although hydrological considerations will complicate the definition. This landscape corridor or horizon may be very near (where

there is dense roadside bush or a steep embankment) or very far – out to the distant skyline. Thus the road asset management horizon may in fact have a near or far visual horizon.

The current road reserve length in New Zealand (state highways and rural local roads) amounts to 76,123km (2002). Using an estimate of average road verge area of 2.5m width x two sides of road, this means the roadside verge alone would be about 38,000ha or half the area of Tongariro National Park. The area of the road reserve (the land owned and managed by the NZTA) is often significantly wider than 2.5m, and so could double this total. The landscape corridor – the wider zone of influence (fore- to mid-ground horizon) – is typically several orders of magnitude larger again.

Management of these corridors for ecological and biodiversity functions could make a major difference to the current lack of protected lowland ecosystems – most importantly to the visibility of these systems. The corridor could also contribute to the functionality of lowland nature by providing space for habitat and often endangered species (Dawson 1994) and linkages across cultural or rural landscapes between perhaps other (riparian) corridors, larger parks, reserves and domains – habitat patches acting as stepping stones (Meurk and Hall 2006).

### 5.3 Definition of time frame

Just as there is a range of spatial possibilities for defining the scope of an environmental asset management strategy, so there is also a range of time periods that must be recognised and considered for management purposes. These time frames range from single events to intergenerational visions. An environmental asset management strategy must anticipate responses to:

- one-off weather-related and traffic-management events and incidents
- seasonal management regimes
- contractual cycles (2-3 years)
- financial plan periods (5-10 years)
- statutory planning cycles (typically 10 years)
- strategic planning horizons (20-25 years)
- intergenerational goals and visions (25-100 years).

The approach proposed below promotes a nested hierarchy, with long-term visions framing successively shorter-term strategies, capital plans, service indicators and plans, and contingency plans.

Incrementalism or evolutionary change can achieve even the most ambitious vision, provided that a realistic expectation is taken; but there has to be an agreed vision that can endure for long periods of time even if interpretation of it may subtly change over that time – as new knowledge, experiences and circumstances come to pass. But if there is continual removal of natural or historical soil, vegetation, artefacts, and built structures in their original configuration, history cannot ‘accumulate’ value; for example, hedgerows in the UK accumulate species at a rate of about one species per century<sup>4</sup>. Accordingly it would not be unreasonable to expect more ambitious projects being achieved in anything less than a century or more.

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<sup>4</sup> Hooper’s law: [www.bna-naturalists.org/mags/aut-wintr04/hedges.html](http://www.bna-naturalists.org/mags/aut-wintr04/hedges.html)

## 5.4 Institutional framework for implementation

It is essential that any enhanced approach to environmental and cultural asset management be fully integrated with the existing asset management systems utilised by the NZTA, such as the road assessment and maintenance management (RAMM) system (Transfund NZ 1997). This system has a focus upon service delivery from engineering assets, with less attention to non-engineering values. It is primarily inventory driven, rather than visionary.

We have looked at international and New Zealand systems and approaches and consolidated that information into a conceptual framework (NECAMS). This, and its associated strategies, builds upon the pre-existing systems we have reviewed, and places emphasis upon early identification of values, envisioning possibilities and adapting to future needs; develops spatially explicit implementation strategies (GIS); and incorporates system-wide asset management and monitoring processes that are sensitive to particular communities, ecologies and landscapes. In this sense it is a type of intelligent system with checklists of key, detailed information (appendix D). Importantly, it aligns with the existing asset management system and avoids unnecessary disruption as might occur if a new integrated system was built from the ground up.

From this the NECAMS now proposed is based on:

- a checklist of factors outlined in section 3.1 and appendix 4 specifically arrived at for each location/project area through a consultative process
- evaluation and prioritisation of the factors (appendix 4)
- management of these factors as determined (appendix 4)
- an endeavour to integrate with the RAMM software (RAMMS) system.

This is further detailed in chapter 6, taking into consideration insights gained on a practical level from stakeholders, as discussed in chapter 3.



## 6 Proposed NECAMS

### 6.1 Overview

This chapter outlines an approach to a proposed national, environmental and cultural asset management system (NECAMS) and a development process that is intended to achieve the principle and ultimate purpose and objective of the study (sections 1.2. and 1.3). This will establish a process that:

- 1 identifies environmental and cultural values associated with the state highway network and their relationship to highway assets
- 2 implements regional and local strategies that protect, conserve and regenerate values and manages them in a way that is consistent with other imperatives of road management.

It is anticipated that such an approach will enhance the services provided by the New Zealand state highway network to the nation, by better recognising the natural environmental and cultural values of the network roadsides and wider corridor (road management horizon), and by integrated and visionary management of the assets with which the values are associated. This will meet the expectations of a wider cross section of the community and add marketing value to New Zealand Inc.

Appendix A contains a recommended process for a pilot study to develop and test the system.

One of the greatest challenges for this work is how to develop a system that can recognise and accommodate:

- the range of values across the country and across communities
- the 'beautiful New Zealand home and garden, neat and tidy' approach through to a fervent ecologist's dream
- a Māori perspective
- a no-frills, cost-accounting approach of core, infrastructural service provision
- potential contention between an expansive horizon-to-horizon, holistic, integrated, multi-value, public good, planned approach versus a strict adherence to minimalism and unfettered property rights.

The proposed NECAMS would achieve synthesis and add value to a primary, strategic asset by identifying all values early (no surprises), reinforcing collaborative learning as a tool for engaging and resolving conflict, and focusing initially on achieving outcomes where there is not too much conflict – such as on public land or with the assistance of enthusiastic landowners. There would need to be widespread buy-in to a shared vision, ensuring all parties and vested interests are accommodated, and applying the collaborative governance model to constructive problem solving from the collective wisdom of the affected and interested community. Whereas we emphasise indigenous landscaping for the reasons given in chapter 2, this is not to say that exotic species are banned, even if it were possible. Rather, the future for New Zealand's natural heritage and consequently for its nationhood and tourist industry, grounded in authentic uniqueness, is so vulnerable that affirmative action is imperative, and furthermore, the NZTA is in a critical position to give effect to this. In a sense there is no neutrality and large influential agencies cannot avoid taking a position.

Based on a spatially explicit landscape approach, the RAMMS system is extended by taking a wider definition of the zone of interest into account and strengthening the connection to the NZTA's environmental policies and guidelines. The key to achieving this is through an overall system of guidelines that are implemented through place- and corridor-based strategies – similar to the approach used in Nevada (Nevada DoT 2002)

and engaging with the community as in the National Scenic Byways Program (US Department of Transportation 2010) and the Christchurch waterways and wetlands asset management system (Watts and Greenaway 1999), incorporating cultural and ecological/management aspects (chapter 3). It is proposed that this can adopt the methodologies of the RAMMS monitoring and management systems through a spatial viewer that provides an online geographical tool for NZTA staff, relates activities and projects to defined and named sections of road visible on the viewer, and generates survey forms with checklists of items to be periodically monitored, with associated descriptive material that standardises assessment parameters. This provides the formal requirement of the system to be implemented.

There are a number of prerequisites:

- Capacity building – requiring a series of workshops and periodic refresher courses to develop an institutional culture that supports a NECAMS concept and nurtures champions.
- A robust planning cycle that accommodates a range of views, can deliver successful outcomes supported by a majority of stakeholders, and upholds nationally significant bottom lines (triple bottom line at the Board table)<sup>5</sup>.
- Consultations held at regular intervals throughout the process to inform decision making, ensuring ‘no surprises’.
- Strong connections with on-the-ground works – using enhanced construction techniques (cf low impact urban design and development practices – Hostetler’s (2010) construction and post-construction phases) and landscaping supported by built interpretative structures that contribute to biodiversity awareness and legibility.
- Monitoring and being willing to adapt – adaptive management is the necessary system for any complex and iterative enterprise.
- Achieving vertical, horizontal and temporal integration and continuity of corporate intelligence and processes.

## 6.2 Proof-of-concept proposal

A demonstration trial of the process is proposed, along with a pilot assessment of an existing state highway section (appendices A and D). The main challenge here is to ensure that a robust demonstration trial takes place because there is much hinging on its success. There are deep sensitivities, especially among rural communities, to, on the one hand, feeling they are being regulated, constrained or over-consulted, to, on the other hand, feeling they are being left out of the discussion and presented with a *fait*

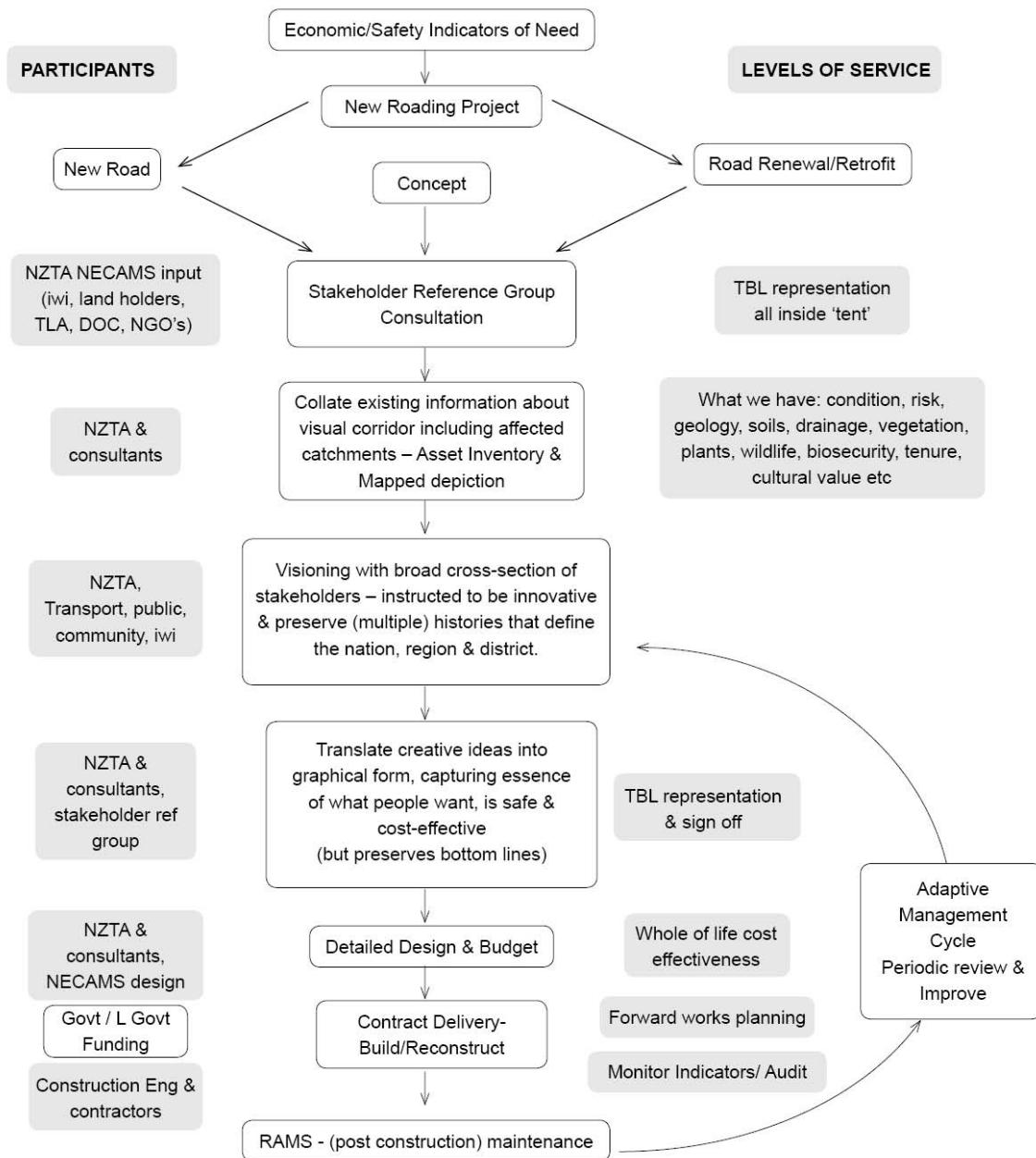
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<sup>5</sup>The triple bottom line concept was developed in the 1990s to ensure a range of social and environmental factors was added to the usual single (economic) bottom line in land management and decision making, in order to attain sustainability. The ideal of ensuring there were representatives, or champions, of each of these pillars at decision-making tables from the outset never really happened and instead the concept was generally applied as *post hoc* consultation. However, in New Zealand, it was recognised that the social dimension needed to be split into social and cultural components in order to give particular reference to tangata whenua; hence quadruple bottom lines. It is apparent, also, that the environmental pillar needs to be differentiated into the physical environment and biodiversity, as unlike many other parts of the world, the two are not necessarily correlated. In other words, New Zealand’s endemic biota is not necessarily assisted by clean or stress-free environments as introduced competitors or predators do better. Indeed, the reverse can be the case as with exotic fish benefitting preferentially from cleaner water and eating smaller native fish.

*accompli.* In light of this, an assessment of an existing state highway section is considered important to check how it may already address some of the outcomes sought by the NECAMS approach and process, and be used to iron out unforeseen wrinkles.

The proposed process involves a collaborative-learning context, brainstorming, identifying or developing an idea or need, visioning, preparing detailed plans and indicative costs, wider consultation (after ensuring relevant stakeholder representatives/participants are able to take supportive recommendations back to their wider constituency), modification of plans following feedback, construction, post-construction management, monitoring and adaptation (see figure 6.1).

**Figure 6.1 A flow diagram of a NECAMS process involving identification and justification of a roading project, collating information, engaging professionals (to define heritage bottom lines) and stakeholders, design, build and adaptive (feedback) management (incorporated into RAMMS visual data base system). Components, actions and participants are indicated**



The proposed NECAMS is evolutionary rather than revolutionary, involving grafting new dimensions onto existing systems. It features an adaptive management cycle that may spread out over a very long time frame – anything from zero to 100+ years.

The proposed trial is intended to achieve the following objectives:

- 1 *Inform and refine* the NECAMS being developed with the NZTA.
- 2 *Engage NZTA staff* in the trial so the system ultimately offered has been tried and tested, is practical and provides capacity building within the organisation.
- 3 *Broaden the base of environmental knowledge and responsibility* (statutory and financial) by conducting the trial in collaboration with regional and district councils.
- 4 *Gain experience* in constructive engagement between communities and non-governmental organisations.
- 5 Provide a *set of pragmatic operational tools* that can be used by regional management teams to implement local corridor strategies, and hence cumulatively, to objective 6.
- 6 *Contribute to a more sustainable network* of assets and a legible and stimulating highway experience of Aotearoa New Zealand.

## 6.3 Moving from policy to planning then reality...

Existing NZTA policies describe relevant environmental and cultural issues and provide the mandate for addressing them.

The NZTA's environment policy is set out in its *Environment plan* version 2 (Transit NZ 2008). In the hierarchy of policies this plan is the most relevant to environmental and social issues. Its concerns include noise, air quality, water resources, resource efficiency, culture and heritage, water quality, ecological resources, vibration, land-use planning, contractual processes and environmental assessment. The mechanism for implementing policy is still evolving and this project is designed to assist this.

By addressing the objectives identified in the plan together, several benefits could be achieved simultaneously with an enhanced prospect of a favourable benefit-cost ratio and minimised community tensions.

For example, a water quality improvement system could achieve the following (non-exhaustive) outcomes:

- Improve the health of aquatic ecosystems by using treatment wetlands to strip nutrients and trap sediment downstream of highways.
- Create a more natural, less peaky flow regime for the receiving waters by attenuating storm flows.
- Form a habitat for indigenous flora and fauna.
- Help protect and restore wetlands.
- Enhance the landscape and 'clean green' brand.
- Be used as a rest area.
- Incorporate indigenous art such as stone sculptures or walls that also act as sound or sight screens.
- Form part of an ecological and/or pedestrian/cycling corridor.

The objectives contained in the *Environmental plan* could provide the basic framework for a NECAMS in a similar way to the use of the six resources/values – ecology, landscape, recreation, heritage, culture and drainage – in the Christchurch waterways and wetlands strategy (CCC 1999): Having an easy-to-remember set of objectives that encapsulates the breadth of considerations required from staff and contractors is very helpful. Creative input is needed from an interdisciplinary team. Economic assessment and planning would come separately or jointly from the NZTA, district and regional councils and perhaps a landowner or developer.

The physical setting of a particular length of highway is likely to determine the nature of the issues to be addressed. This setting should inform and inspire the way in which its assets are managed. Consensus is also needed on the importance of the wider visual corridor of highways. It may be that in the future the value to tourism or traffic behaviour, from incorporating a wider cross-section of values from a wider corridor, is of greater merit to the nation than other competing land uses.

Specific works derived from visions and strategies can be connected to existing asset management systems such as RAMM via NOMAD, with a work module for balancing and programming. Use could also be made of geographical tools, for example the global positioning system (GPS) component in RAMMS. Indeed a GIS system set up specifically could also be an efficient tool linkable with other asset management systems. To progress from high-level goals, objectives and policies to satisfactory, on the ground outcomes, the following need to be set up:

1. Frameworks of values and service levels – *What does NZTA require?*

The initial phase establishes the framework of service within which strategies and values will be nested. It draws explicitly upon the *Environmental plan* and the draft environmental asset management plan to establish the categories of values and service levels, and provisional indicators. The locational information for the proposed project area is entered into a RAMM-type spatial database and the viewer is then available for ongoing additions and scenario building.

2. Regional values and aspirations – *What does the community value?*

The second phase identifies region-specific values and aspirations. It comprises an analysis of existing relevant strategies, visions and plans such as regional policy statements, district plans, long-term council community plans, iwi management plans etc, to identify values and aspirations that have been expressed by the community and will frame a specific corridor vision and strategy.

Areas of landscape character are defined and the state highways within them identified. For each corridor, a set of environmental, social and cultural issues is collated from discussion with regional and district councils, iwi and other stakeholders. This phase may also involve general (ie non-location-specific) surveys of community values (such as the West Coast case study reported in section 3.2 and listed in appendix D).

3. Visions and alternative futures – *What is the scope and what is possible?*

In phase three, an interdisciplinary group (the Stakeholder Reference Group in figure 6.1), drawn from TLAs, iwi, landowners, ‘experts’ and other stakeholders, would create a preliminary regional vision and identify alternative futures that address the issues for a specified part of the state highway network. The vision should describe the character of the landscape, significant values that exist within it, the existing and potential benefits provided by the existence of the highway, and present a written and graphic illustration of the alternative futures that could be possible. Strategies might include revegetation, co-management of land, road improvements, land-use strategies, or integrated catchment management. Regional visions and strategies need to be represented and communicated in an inspirational, aspirational and informative way in both words and images on a map. They provide the catalyst and basis for ongoing engagement with stakeholders and the monitoring of progress and environmental results. Each region

might adopt some iconic symbols from the natural or cultural sphere to highlight their point of difference, alongside other values such as commercial, pastoral landscape, sports prowess etc.

#### 4. Strategies and priorities

The preliminary vision and possible or projected futures need to be shared with the relevant communities and shareholders, in a series of workshops (using modern 'place making' techniques; Healey 1998) designed to test and prioritise the options, leading to a preferred strategy with natural, social and cultural bottom lines (see 'visioning' figure 6.1).

#### 5. Specific projects

These are the physical works and activities needed to implement a strategy. Each project would have its benefit, cost and priority assessed. The assessment of benefits and cost would tend to be used in a comparative sense, ie comparing a proposed project with the status quo or with other options.

Priorities will be determined using current practice, with weightings extended in order to take account of environmental and social factors. The assessment method will acknowledge the need to conform to national, regional, and district environmental standards. Examples of possible actions include traffic-calming measures for approaches to settlements, modifying road batters to allow low-maintenance native plant species to flourish, revegetation schemes (appendix C), land swaps, covenants etc.

#### 6. Implementation and testing processes for the NECAMS

A NECAMS will exist when visions and strategies have been completed for all regions, and the visions, strategies, feedback monitoring and adaptive management have been incorporated into the existing asset management system, followed by the establishment of pathways into budgets (capital, operational and maintenance). Budgets will need to evolve incrementally, based upon the outcomes of the initial programmes.

## 6.4 A proposed pilot

A pilot study is recommended as an initial proof of concept, based upon the process outlined above. This includes a study of a state highway, along with a desktop assessment of a second site, to establish the types of issues that may or may not have been considered previously. A proposal for studying SH75 is included in appendix A although this could be undertaken in a range of settings depending upon NZTA priorities. This will help define the precise elements and parameters needed in the integrated RAMMS database and interactive system.

## 7 Conclusions

The highway travelling experience is worldwide being reimagined to reflect the full sweep of topographic, natural and cultural diversity as it can, and should, reinforce local sense of place and points of difference. In the modern shrinking world it must also be sustainable, safe, economically viable, minimise carbon footprints, generate ecosystem services such as stormwater management, and provide for multiple values such as biodiversity and calming influences. How, then, do responsible authorities accommodate these multiple bottom lines (values) in the face of economic and popular constraints?

The aim of this work was to explore opportunities and ways to achieve enhanced management of the environmental and cultural assets of the state highway network corridor. For the purposes of this exercise the corridor is termed the road asset management horizon, made up of the fore- to mid-ground and far visual horizons, plus any downstream-affected waterways or runoff areas. Importantly, this is designed to not threaten adjacent landowners, but rather is aspirational and provides a model to engage with all stakeholders over a long period of time in achieving common visions and goals, and pathways to achieve them. This may be seen in the context of post-colonial nation building. Four broad themes that characterise the proposed process are suggested.

- **Biodiversity and ecology** – to conceptualise roadsides as corridors that can add value to ecological integrity of lowland landscape.
- **Cultural values and Identity** – to seek opportunities to strengthen local and regional identity through roadside management, enhancing the tourist experience as well as local sense of place. With ecology, these contribute to a multi-layered landscape with historical legibility and acknowledgement or celebration of the unique identifiers of Aotearoa New Zealand.
- **Integration** – linkage of policies, vision and goals to processes, structures and contracts (the contracting culture and breaks in the vertical and horizontal chains can lead to fragmentation and loss of institutional memory) and formulation of a system to achieve these aims.
- **Identification of a means of nurturing an NZTA culture conducive to maintaining a multi-value highway system and carrying out a pilot project to test and refine the system.**

New Zealand's long-term well-being may partly depend upon development and maintenance of a world-class and distinctive environmental brand. The NZTA, through the management of the state highway network, can be a leader in smart 'green' growth, and contribute a vital point of difference to Aotearoa New Zealand.

Highways play a significant role in the experience of New Zealand, both for domestic and international travellers. Originally, roads in New Zealand were constructed to improve access between destinations, to open up the country, and demonstrate colonial energy. Over time, points of interest, viewing stops and rest areas were added. Scenic reserves were established, especially where roads intersected remnant areas of native forest – often on steep or gorge country. Now there is a global expectation of roads in general being experiences in themselves. The NZTA, charged with constructing and reconstructing roads, is bound to engage the views and values of communities and stakeholders. There will be scope for local approaches so long as they do not conflict with road construction bottom lines of safety, efficiency and sustainability. The NZTA must also exercise leadership in reflecting a New Zealand-wide view of environmental and cultural policies or sensitivities – a wider set of bottom lines. Accordingly, a default treatment of highways should be one that protects and conveys regional natural and cultural history in a balanced, attractive and informative way while meeting conventional standards. The NECAMS process as outlined suggests an

approach to formally incorporating these considerations into the highway construction and management process.

An enhanced asset management system also has to be technically and economically viable over the long term – it has taken 150 years to build the current road network and it may take another 150 years to retrofit desirable values into this vital and culturally significant asset. *The costs need to be discounted over a longer period of time than the usual maintenance and building cycles.* Experience of value-based asset management, in the USA, elsewhere in the world, and in the Christchurch waterways and wetlands strategy, shows the potential for long-term appreciation of environmental assets. Enhancement of the roadside assets of the state highway network will generate benefits for New Zealand's clean green image, which underpins tourism and primary production, as well as local community well-being.



## 8 Recommendations

### 8.1 NECAMS

NECAMS is proposed as an extension of the current engineering asset management framework operated by the NZTA. The proposed system adopts a framework that has been derived from best current practice in a number of countries including New Zealand. A collaborative and visionary learning approach is recommended, involving a cross section of experts, stakeholders and adjacent land managers.

A NECAMS based upon collaborative learning must achieve several things. It must:

- be 'owned' by the NZTA, the wider public and tangata whenua
- be integrated within the conventional practices and established systems of highway asset management and be part of the institutional culture
- recognise multiple values
- have champions
- ensure capacity building within the NZTA

so that the interrelationships between the diverse values of utility, safety, water quality, ecology, socio-cultural needs, heritage and aesthetics are widely understood.

### 8.2 Triple bottom line approach

A triple bottom line approach in a broadened sense (see footnote 5) is proposed, encompassing ecological (biodiversity and corridors), social (journey as important as destination with historical layers revealed in landscape) and economic (ecosystem services such as muffling noise, visual barriers, storm water treatment, soil conservation, long-acre grazing, frangible vegetation minimising accident impact, reduction of pollution, carbon sequestration, calming, education, tourism and reduced maintenance footprint) criteria. These values should be a part of the whole NZTA culture.

### 8.3 Pilot study

A pilot study is proposed to test the process, based upon SH75 and desktop study of an existing highway. A detailed proposal for SH75 is included as appendix A with checklists of attributes and parameters, their evaluation and management, in appendix D.

Appendix C contains some preliminary practical landscape design guidelines for how enhanced habitat, ecosystem services and landscape legibility may be achieved. Particular focus has been directed towards improved road-verge design and management to bring more sustainable, dense, frangible native vegetation closer to the carriageway – while not interfering with visibility and safety considerations, and avoiding biosecurity risks. The use of distinctive, small-leaved, divaricating shrubs and tussocks to form a border or low hedge to roadside plantings is recommended to minimise the need for mown grass verges. We provide some initial estimates of relative costs of establishment and maintenance of such designs against the conventional extensive mowing of grass verges (separately in Simcock and Meurk 2010). In general this leads us to recommend that the tallest, densest roadside vegetation should be established in place of mown grass as a later, more stable stage of plant succession, with greater wildlife value, and ultimately cheaper to maintain. Also, divaricating shrubs that form dense hedges up to 1m to 3m tall will

be a more sustainable vegetated state than the recent fashion of planting large beds of native, short silver tussock and *Carex* species. These will inevitably be swamped by taller exotic grasses and create an insurmountable maintenance task until the tussocks succumb.

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## Appendix A: Proposal for a pilot study (2011)<sup>6</sup>

**Project: Multiple-value management of environmental assets of the New Zealand highway network: improved analysis of benefits and costs**

**Environmental asset management system for state highways: proposed trial – SH75**

### A1 Executive summary

Landcare Research is currently working for the NZTA on a project entitled: A multiple-value management of environmental assets of the New Zealand highway network: improved analysis of benefits and costs. Recently a discussion document was prepared that suggested a trial be undertaken of the environmental asset management approach that was developed as part of the project. Subsequently the NZTA requested a formal proposal based on SH75, the Christchurch–Akaroa Highway as the subject of the trial.

The trial will be a demonstration of the environmental asset management system (EAMS) process, involving interdisciplinary teams and engagement with communities of interest and engineers, visioning and developing plans. It is based on the importance of the journey as a reflection of Aotearoa New Zealand and nationhood, as well as the destination. Hence we are looking at the visual corridor – not just the carriageway and verge ‘owned’ by NZTA.

It is a grand, long-term, vision requiring imagination and collaboration in its conception and shared responsibility in its implementation. It will involve NZTA and regional and district councils together with key stakeholders.

### A2 Introduction

The proposed trial is based on the work undertaken on the current NZTA multi-value management (MVM) project that has confirmed the benefits of highways are many and varied. The NZTA MVM project interviews also confirm that the values of highways we enjoy, and which attract overseas visitors, are sustained or lost by many influences. The ability to prevent loss is limited by modest resources as individuals, or by the constrained, institutional thinking of the organisation we belong to, or contracts under which construction or maintenance is done. Prevention is often better and cheaper than a cure when it comes to protecting vulnerable natural and cultural assets.

The recommended way forward therefore is to adopt a collaborative approach both to the identification of issues and the implementation of appropriate responses.

Broad-based collaborative approaches have been used by the National Scenic Byways Program in the USA, and by the Christchurch City Council (1999) with its *Waterways and wetlands natural asset management strategy*.

Both identified a very similar set of resources/values and both recognised the need to engage with others on issues within the surrounding landscape. The National Scenic Byways Program promotes the development by communities of corridor management plans that protect six resources: scenic, historical, recreational, cultural, natural and archaeological. The *Waterways and wetlands natural asset management*

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<sup>6</sup> This proposal was provided to NZTA prior to completion of the main report and will require adjustment to the proposed approach to NECAMS.

*strategy* satisfies six values: ecology, landscape, recreation, heritage, culture and drainage at costs similar to conventional drainage systems but not needing eventual replacement.

### A3 Objectives of the proposed trial

The proposed trial is intended to achieve the following four objectives:

- 1 Inform the EAMS that is being developed with NZTA
- 2 Engage NZTA staff in the trial so that the system ultimately offered has been tried and tested, is practical and provides capacity building within the organisation
- 3 Broaden the base of environmental knowledge and responsibility (statutory and financial) by conducting the trial in collaboration with regional and district councils.
- 4 Contribute to a better, more legible view of Aotearoa New Zealand.

### A4 Environmental- and social-values-based thinking

There are two aspects to asset management for highways:

- A utility aspect that is concerned with age, condition, capacity, safety performance and strategic importance of carriageways, earthworks, structural elements, signage etc and various uses by network utility operators.
- A component that is concerned with society and the environment.

The latter encompasses consideration of five other values based on the Christchurch waterway and wetland natural asset management system: landscape, ecology, recreation, heritage and culture. The following illustrates the kinds of issues that emerge when consideration is given to these significant societal values.

#### A4.1 Landscape

One of the great joys of travelling along a highway is seeing the landscape glide past. The quality of this experience depends partly on the nature of the landscape itself, partly on the degree of contrast between landscape and road corridor, partly on the way the highway has been designed – including encapsulation of information directly or subliminally, and partly on the personal interests of the observer. Relevant aspects (especially pertinent to the tourist experience) include:

- avoiding alignments, earthworks and developments that compromise the visual quality and functioning of landforms, including rivers, streams, wetlands and lakes
- using alignments that enable good views, but not necessarily continuous, unbroken views
- blending a road into the landscape when viewed from a distance or external to the carriageway, or contrasting the road corridor with adjacent landscapes
- complementing the contribution made by properties and their frontages
- imparting information without it intruding or creating a distraction.

The width and treatment of road verges and the road corridor are key controls of the degree of blending and contrast with adjacent frontages.

#### A4.2 Ecology

- Highways can act as barriers to the movement of some species of flora and fauna by creating spatial separation or by restrictive bridges and culverts.



- Habitat fragmentation can affect ecosystems and individual species by diminishing populations or territory and mobility and increasing edge effects.
- On the other hand highway corridors can be used to enhance the viability of ecosystems, eg:
  - the use of culverts as a barrier between native fish and the introduced fish that prey on them
  - the use of specially designed and maintained walls or cuttings to provide habitat for threatened native plants and vertebrates
  - the development of corridors of vegetation that allow for movement and migration through otherwise fragmented landscapes.
- Water quality can be compromised by sediment from new and existing earthworks, road runoff and chemical spillages.
- Highway earthworks and cuttings can intercept and divert surface and ground water to the detriment of aquatic habitats and adjacent terrestrial habitats. Flash flows of runoff from highways can exacerbate erosion of small watercourses.
- Highway traffic noise can affect some bird species by drowning out group communication.
- Road kill is a major cause of mortality for some pest and indigenous species, and can be highly site specific (eg penguins, possums, pūkeko).

#### **A4.3 Recreation**

The Hillary Commission found that walking is the most popular form of recreation for New Zealanders. There needs to be provision for walkways that cross or follow highways. Cycling is another major form of recreation and is gaining in popularity especially with overseas visitors – separation will improve the performance and safety of all users.

#### **A4.4 Heritage and culture**

Residents of a locality become imbued with visual reminders that provide a sense of place and belonging when they travel along their local stretch of highway, for example, old stone bridges and culverts, distinctive rocks or soils exposed in cuttings, views of significant natural features (mountains, lakes, forests or wetlands) or built features (eg bridges, viaducts). A sense of place can be reinforced through manipulating the aesthetics of highway structures (eg Auckland Motorway concrete barrier patterning, bridge structures), use of local stone as masonry in structures, and exposure of cuttings by avoiding revegetation. Signature vegetation/habitat groupings can reflect natural heritage or support identification of sites of importance to Māori and non-Māori alike and may contribute to a developing sense of nationhood and thereby strengthen our discrete marketing profile to international tourism.

Design is important in reducing distraction, in using frangible vegetation to buffer accidents, in calming traffic and in manipulating shade and frost pockets. The Transit NZ (2006) *Guidelines for highway landscaping* provides detailed guidance on many of these issues.

The following section describes the phases that are considered desirable for the development of a well-founded EAMS for state highways.

### **A5 Moving from policy to planning then reality, using an environmental asset management approach**

The following phases were identified during work on this project. They are intended to provide a way in which high-level goals, objectives and policies can be translated into satisfactory outcomes on the ground.

## 1 Vision and strategy

- a In this phase existing regional boundaries are used to define the spatial extent of a vision and strategy. Within each region areas of landscape character are defined and the state highways within them identified. For each length of highway so identified, a set of environmental, social and cultural issues is collated from discussion with regional and district councils, iwi and other stakeholders.
- b An interdisciplinary group would create a regional vision and strategy that addresses the issues.
- c A vision should describe the character of the landscape, significant values that exist within it, and existing and potential benefits provided by the existence of the highway and present a written and graphic illustration of the vision.
- d Strategies might include traffic-calming measures for approaches to settlements, modification of road batters to allow low-maintenance native plant species to flourish, influence on land use decisions, or collaboration with regional and district councils on integrated catchment management.
- e Regional visions and strategies can be represented in an inspirational and informative way in both words and images on a map, as part of a GIS. This would provide the basis for ongoing engagement with stakeholders and the monitoring of progress and environmental results.
- f Most of the information needed for this phase could be derived from existing planning studies by regional and district councils.

## 2 Specific projects

- a These are the physical works and activities needed to implement a strategy. Each project would have its benefit, cost and priority assessed. The assessment of benefits and cost would tend to be used in a comparative sense, ie comparing a proposed project with the status quo or with other options.
- b Priorities will be determined using current practice, with weightings extended in order to take account of environmental and social factors. The assessment method will acknowledge the need to conform to national, regional, and district environmental standards.

## 3 Completing the asset management system

- a An EAMS will exist when the foregoing has been completed for all regions and the visions and strategies incorporated into the existing asset management system, followed by the establishment of pathways from there into actual budgets (capital, operational and maintenance).
- b Only when the first two phases are completed for the whole country will it be possible to gain an overview of the nature and cost of the environmental component of the asset management system. For example, such an overview will help assess net savings in operations and maintenance, how budget constraints will affect timing of projects, and the benefits of collaboration and cost sharing.
- c The time taken to turn visions and strategies into reality can be long, both nationally and regionally, but maintaining the vision will ensure continuity of purpose when changes occur to staff, priorities and practices.
- d Note: We see native vegetation and habitat as essential components to identity and nationhood although bio-safe exotics may provide accents at specific locations or communities throughout the country. However, we see the dominance of native species as being in keeping with long-term goals of the nation.

## A6 Trial study area

It is recommended that the trial be undertaken on SH75, the Christchurch–Akaroa Highway.

This length of highway connects urban Christchurch with Banks Peninsula and ends at Akaroa Township on Akaroa Harbour, areas possessing many outstanding values. The highway and the surrounding landscape have all the attributes considered desirable for a study area, including bridges, culverts, ecological diversity and a variety of urban and rural land uses. It has the advantage of being close to Landcare Research, Lincoln, and NZTA’s regional office, Environment Canterbury’s office and that of the Christchurch City Council.

The width of the study area should be defined by the horizon visible to a passenger on a bus, although this boundary may need to be modified to suit the landscape context or other needs of the study.

## A7 Trial process

The following five steps will enable the completion of phases one and two (above) for the trial.

### *1 Prepare a plan of the study area*

The plan should show existing topographical information and the boundary of the study area together with the following information: running distances along the highway, work proposed by the NZTA, work proposed by network utility operators who occupy space in or alongside the road reserve, current land use zonings including reserves of all kinds, land owned by the Crown or ‘mayors, councillors and citizens’, sites of importance for their cultural and heritage value, and all waterways and wetlands.

### *2 Identify and record issues on the map*

Undertake this with the assistance of staff from regional and district councils and others who have knowledge related to the range of values identified in the Introduction. Also record the nature and extent of any works proposed by councils or developments approved by them. During this process identify other groups, such as iwi, councillors, local federated farmer representatives and community organisations, who are likely to have a specific interest within the study area.

### *3 Arrange a session with interested parties for the creation of mutually beneficial visions and strategies*

This session is likely to focus on particular areas of interest, eg a settlement, waterbody or marae. Participants would be encouraged to liberate their imaginations and state what they believe are the best possible outcomes.

### *4 Prepare a vision and strategy based on the foregoing*

This should be in accord with phase 1. Also give consideration to alternative methodologies that help to maximise the potential for multiple gains.

### *5 List, estimate the cost of, and prioritise specific works and agree on cost sharing where necessary*

This would be in accordance with phase 2 and would include how to integrate with the existing asset management system. Here again there can be a long time frame for physical work.

## A8 Participants and their roles

These need to be carefully chosen (or self-chosen) to ensure all valid input and potential innovative ideas are received and given due consideration.

## **Appendix B: Results of forum held at NZTA meeting room, Wellington, 9 June 2009, with NZTA staff and key stakeholders**

### **Morning discussion with NZTA staff**

#### **Key NZTA distinction between capital and operational projects and costs**

### **B1 New projects**

- 1 Go through quality gates
- 2 Follow established design principles
- 3 Aim to involve stakeholders early in process, including maintenance people, local communities, community groups, local councils
- 4 Vision for projects

### **B2 Operational asset management plans**

- 1 Responsibility of regional network engineers, implemented through network management consultants (for local NZTA regional office-client)
- 2 Current focus is strongly economic cost-benefit
- 3 Include environmental vision
- 4 Whole-of-life costs would be an inspirational concept for network engineers
- 5 Opportunities for change occur at the annual updates. New projects go through quality gates and these could be useful for maintenance and operations too

### **B3 Are the environmental visions being put into practice?**

#### *No*

- 1 No value put on them (costing of environmental services)
- 2 Everything's driven by benefit-cost ratio (\$)
- 3 Whole-life-cycle cost concepts only recently being used/developed
- 4 Lack of communication (left and right hands)
- 5 Lack of business case
- 6 Lack of vision in operational side

#### *Yes*

- 1 Where a person/champion owns it and pushes it along
- 2 Where can be shown to be about the same cost.

#### **B4 How to get people to be champions for the vision?**

- 1 Must be early on
- 2 Must keep costs in mind
- 3 Need \$ figures to environmental and social values
- 4 Whole-of-life costs
- 5 Engage operational staff in making a vision

#### **B5 How to get maintenance performance criteria to reflect values?**

- 1 Need to get environmental values embedded more firmly into the asset management plan instructions and annual plan instructions
- 2 Need economic analysis to show benefits of implementing environmental values.
- 3 Show how small/cheap this is compared to the cost of a [human CDM] life (\$4 million/life used to justify safety projects).

Already value:

- 1 Noise
- 2 Air
- 3 Stormwater

Need to value:

- 1 Environmental services
- 2 Intangibles

Give more certainty they will save money

#### **B6 How well do existing processes work to achieve the goals?**

- 1 Network contracts need to report on targets/objectives in NZTS
- 2 Cost-bottom-line issue
- 3 Constrained by lack of project management understanding/skills into contracts
- 4 Processes in place work at identifying issues to be addressed

#### **B7 Constraints**

- 1 Funding of local authorities
- 2 Availability of 'left over' funds
- 3 Inability to value wider benefits
- 4 Inconsistent reporting (if done)
- 5 Application of generic safety rules, eg 9m clearance
- 6 Lack of vision of professional services contractors
- 7 Reduced maintenance costs

- 8 Need to upskill project managers
- 9 NZTS objectives
- 10 National guidance for local authorities

## **B8 Limitations in national/regional relationships**

- 1 Limited resource in regions
- 2 No follow through; lack of continuity
- 3 Project delivery; new teams every project (need more continuity)
- 4 Debriefing; knowledge transfer within and between regional council input to nature of projects
- 5 Not retaining ownership and control of projects
- 6 No good systems for transferring knowledge
- 7 Disjointed manuals

## **B9 Opportunities**

- 1 Opportunities for learning from projects
- 2 Passing on knowledge from project teams
- 3 Widen field of collaborators
- 4 Capability building (in-house) so that knowledge and learning can be applied project-to-project
- 5 Upskill project managers
- 6 Change in focus to increased project support
- 7 Prioritising (priority shift)
- 8 Notice and requirement; designations – identification of issues
- 9 Make stronger links to TLAs
- 10 Investigation and research phase approval – identified and addressed issues
- 11 Turn this kind of work into the GPS and the kind of language used.
- 12 Be proactive. Environmental conditions to be sought on resource consents (currently reactive)
- 13 Change the systems to address the fact that ecological boundaries are not clearly defined.
- 14 Ecological corridors across state highway more important than parallel corridors (focus)

## **B10 General issues and comments**

- 1 Purpose of road – we have an enormous asset, so how best to use this
- 2 Good visibility and open vistas; but when probed, accept variety of vistas is a good idea
- 3 Fine-tuning of experiences
- 4 Ministry of Transport has crash database and statistics on lives saved by removing objects
- 5 Distractions/psychology

- 6 By installing obstructions, makes people more careful
- 7 Prof .Waikato University – effect of road environment on speed
- 8 Wildlife – seal colonies, penguins (Kaikoura) – attracts tourists to stop in dangerous places
- 9 Signage telling people what’s coming up so don’t get impatient – barriers to penguins, underpasses
- 10 Two different perspectives on purpose/role of road: carriageway = quickest route between origin and destination versus an experiential journey – and control versus tamed wilderness
- 11 Sculptures/information, litter/cleanliness
- 12 Pedestrian/cycling access alongside road – ideally on secondary roads
- 13 Landscape legibility – explaining landscapes and soils (especially influences of glaciation, volcanism using road cuttings)
- 14 Much of roadside is used to provide access and site for other infrastructure, eg power lines, phone, gas, water (especially in cities)
- 15 Roading corridor can also be used in ‘soft engineering’ to be a natural defence against a) climate change, eg dunes, and b) erosion above the roads stabilised with vegetation

## **B11 Annotated notes from free-format discussion with NZTA staff**

- 1 Are existing guidelines in accord with our external perspective?
- 2 Need to provide support or mandate for action reinforced by peer review
- 3 Refine/enhance/provide mechanisms for giving effect
- 4 Integrate – graft into asset management protocols
- 5 How well does existing structure/process and contracting arrangements (construction and maintenance) give effect to goals – relate to national vision
- 6 Where are sticking points/barriers (information, values, money, training, practices, decision-making structures)
- 7 Opportunities
- 8 Refer to tensions – how can these be overcome
- 9 Information systems – GIS spatially explicit
- 10 How does organisational structure support innovation
- 11 At generic level, what are visions – then putting flesh on the bones
- 12 Continuity from historical experience (previously all works carried out by government agencies such as Ministry of Works) to potential for current contracting culture to provide fragmented results – danger of loss of institutional memory
- 13 Hands-on approach to projects (NZTA should be part of the project teams so that there is continual monitoring)
- 14 Building capability in-house – inform contractors on an ongoing basis
- 15 Relationship building
- 16 Economics – a biggy!

- 17 Natural environmental approach – no net loss; use of offsetting
- 18 Reporting back [adaptive management – Colin D Meurk (CDM)]
- 19 Regional variation in implementation [NB there are 7 regions – but see 14 later]
- 20 Consistency – but don't/mustn't increase compliance costs
- 21 No planting of non-frangible species within 9 m of pavement
- 22 Single focus/value
- 23 Legibility
- 24 Everything connected – no free lunches
- 25 Sensitivity to natural landforms/dynamic processes/living systems
- 26 Case study – evolving catchment management
- 27 Hopefully see relevance to visioning, design and management of multiple-value highways
- 28 Enormous assets – enormous visual impact on environment and culture
- 29 Space – inside/outside to achieve what is wanted
- 30 Catchment framework
- 31 Consultation – collaborative learning – never stop learning
- 32 Broadening mind – vision feeding into [scaup to lizards – CDM]
- 33 Certainty of time (Carl Reller)
- 34 Tension between environment/maintenance/engineers
- 35 Distraction if there is too much information (roadsides being too complex and busy) – psychology of information levels [CDM]
- 36 Change only happens if there is a champion
- 37 And/or there is a good business case put up
- 38 [Need list of all/inventory of policies, documentation, manuals, NZTA organisational structure]
- 39 Capacity building I&R = identification and reporting
- 40 Spatial implications
- 41 Single rather than three bottom lines – seems to be the norm
- 42 Building relationships – also guiding district roads using experience
- 43 Lowest common denominator
- 44 How to mesh everything together (integration)
- 45 What scale can make a difference
- 46 14 regions (see above). A manageable district is one in which it takes no more than two hours to drive each way
- 47 HO guidance then to regions – global consents, eg water standards
- 48 Institutional memory – staff turnover; redundancy (duplication?)



- 49 Release creativity – because given permission
- 50 Constraints on way roads look – building, main, funding, how limited compliance is
- 51 Could be more proactive (see guidelines)
- 52 Is participating in urban growth strategy and urban design protocols
- 53 RMA submissions as a third party to district and regional plans
- 54 Do have project discussions, but need wider cross-sectoral discussion periodically
- 55 Economic justification/business case
- 56 Capacity building
- 57 Continuity/connectivity/integration
- 58 Flesh on bones
- 59 Triple bottom line/multi-value

<b>Afternoon discussion with external stakeholders</b>
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## B12 Participants

Roger Maxwell	Manager Māori Relationships, NZTA
Carl Reller	Environment Manager, NZTA
Georgina Cranswick	Environment, NZTA
Larry Cameron	Principal Transportation Planner, NZTA
William Gimpsey	Federated Farmers
Rod Auton	Truckers Association
Rochelle Comber?	Automobile Association
Dave Jane	Department of Conservation
Amy Holden	Wellington Regional Council
Alayna Renata	Landscape architect and planner, MWH
Simon Swaffield	Professor, Landscape Architecture, Lincoln University
Robert Watts	GreenvisionNZ; formerly CCC planner and Landcare Research
Shaun Awatere	Economist, Landcare Research
Robyn Simcock	Ecologist & Soil Scientist, Landcare Research
Colin Meurk	Landscape Ecologist, Landcare Research
Other invitees:	Te Araroa; Bus & Coach Association NZ Inc.; Port Nicholson Ponoke Cycling Club; Kapiti Coast Council (Gael Ferguson); Ministry of Transport (Carolyn Lukkien)

## **B13 Summary**

### **B13.1 Context is critical**

- 1 Landscape values are created by adjoining land and land uses
- 2 Opportunities and threats are context dependent
- 3 Need balance between safety and character
- 4 Role of corridors depends on context and is scale dependent

### **B13.2 Future directions**

- 1 Strategies and guidelines
- 2 Identify best public use for land – ecosystem services, highway security, leaseback to adjoining landowners
- 3 Explore co-management options
- 4 Undertake demonstration projects

### **B13.3 Visions and priorities**

- 1 Place-based conservation strategies
- 2 Better understanding and implementation of statutory intentions
- 3 Effective use of public resources
- 4 Value adding
- 5 Safety and convenience
- 6 Security of highways

### **B13.4 Who should be involved?**

- 1 TLAs are critical
- 2 Sector groups
- 3 Non-motor users
- 4 Young people [often disenfranchised]
- 5 Conservation/biosecurity agencies

### **B13.5 Annotated notes/questions from discussion**

- 1 We have an asset – how can we best use it? To avoid the tragedy of the single focus or single-purpose?
- 2 Co-located utilities
- 3 Acts as buffer to coastal erosion – and railway line (also noise, toxins/contaminants etc) – cost of effectiveness of water treatment on site versus loss of productive land
- 4 Building in climate change – effects of erosion and vegetating to stabilise against erosion (i.e. need trees, not pasture), carbon sequestration
- 5 Wider roads, **or** roads with verges/margins that have vegetation that allows occasional passage of wider farm machinery (eg harvesting machines)

- 6 Ecosystem services – economic justification
- 7 Is giving land back to adjacent landowner, because surplus to immediate needs of single-purpose highways, a false, short-term economy? There has been an investigation to identify land to return, and much land returned/sold in early 1990s
- 8 Lead (Pb) signal – the roadside legacy of leaded petrol
- 9 Horses for courses – rural, wetland, forest
- 10 Land zoning
- 11 Width – how wide does corridor need to be to cope with externalities – contaminants/visual effects?
- 12 Federated Farmers – narrow as possible to maximise production (but note comment about farm machinery and shelter trees)
- 13 Are ecosystem services, mitigation of impacts, and ‘scenery’ productive land uses?
- 14 Cost-benefit of these competing uses – should we sell off land versus a precautionary principle?
- 15 Purposes – communicate, directional, safety, amenity
- 16 Federated Farmers then said – primary purpose is transport but surplus land should be treated as ‘what is best use and who is best to manage it?’
- 17 Mitigation of toxins – at source (Robert Watts)
- 18 Not one size fits all – depends on context
- 19 Could say that ownership of largest area will simplify future decisions
- 20 Are farmers amenable to managing landscape in long term if given information and contribute to vision?
- 21 ‘What’s in it for me?’ – shelter, grazing (long acre), exchange of services/trade-offs
- 22 Pest management
- 23 Co-management
- 24 Temporal scale
- 25 Silviculture – where there is sufficient space or benefit (eg shelter, links, shading of road from afternoon heat in hot areas)
- 26 Tragedy of the Commons
- 27 Communicating processes (legibility?)

Co-management could be done through a memorandum of understanding or covenants (a 25-year lease would give potential for changes in management over time) to assist optimising management for multiple values, especially where parties are limited, eg DOC and/or farmers and/or truckers.

### **B13.6 Feedback from stakeholders**

#### *Federated Farmers*

Farming contributes to landscape. Roads regarded as:

- 1 Biosecurity issue (source of weeds and pest corridors)

- 2 Providing grazing values (especially at times of pasture shortage). Suggested potential to decrease grades of batters to allow farming (ploughing/cropping) right up to the edge of the road
- 3 Provide shelter for stock if trees are in the road reserve
- 4 Provide width to allow clear, safe passage of large cropping/farming machinery in areas where this is an important road use

Road culverts have potential to block fish passage, which is generally undesirable, except where aquatic ecosystems are being protected from trout (DOC).

Roads also act as:

- 1 Biosecurity hazards (particularly through weeds in road reserve) but also through use of non-local native plants (if not eco-sourced)
- 2 Native animal hazards, eg seals and penguins at Kaikoura, Punakaiki, Oamaru Harbour
- 3 Edge habitat – opening up of forest under-storeys through removal of large trees

Suggest that DOC site-based management plans (eg for national parks) are utilised by road management planners so NZTA road management is consistent and supportive of the conservation plans.

There is a need for high-level legislative direction and integration between government agencies.

Beneficiaries also need to be identified.

Cycling/walking networks, windbreaks, room for walking and having values that promote walking (eg sheltered and aesthetic) (identified as valuable and having potential in Greater Wellington Region).

#### *Automobile Association*

Roadside should be invisible; lower growing species and long-lived so do not need mowing – nothing that does not belong.

Rest areas – not much for big trucks – stock trucks have effluent disposal needs; in past effluent dumped in transit. Fatigue management plans require a half-hour break every 5.5 hours – provision of identified truck stops areas (separate from car rest-areas) at known stop areas (eg several hours from ferries, Christchurch) would help reduce the damage and danger associated with use of casual stops on highway edges. Have in addition to effluent dump stations. Truck stops need rubbish facilities, screening (glare), labelling to dissuade use by light vehicles.

Rest areas created to form safe areas, particularly where campervans are informally stopping now – and vegetation, signs (identifying distance to viewpoints/wildlife viewing areas/photograph areas), structures used to reduce stopping in dangerous areas – such as blind corners and narrow areas round Kaikoura Coast.

Harmonious with wider landscape.

Haast Pass debacle – mature trees cut down; bats in trees.

#### **B13.7 Final feedback**

Rod Auton, Truckers Assn – holistic approach; won't please everyone all of the time.

Amy Holden, Wellington Regional Council – historic influence; holistic approach, convenience, safety, amenity (foot or cycle), 'smelling the roses', soft edges.

Dave Jane, DOC – opportunity to hear range of views, holistic, multi-stakeholder approach; good debate.

AA – many things have implications for safety (expertise in NZTA sieves ‘dreams’); watch out for distractions; opportunity costs, eg \$0.5 billion spent on highway maintenance per year; \$3.5 billion on whole road network.

Federated Farmers – best use of money; huge asset; potential uses if not making best use of resources then ask question, how best to do that?

Shaun – informed.

Robert – success breeds success; demonstrate wonderful results, multiple benefits.

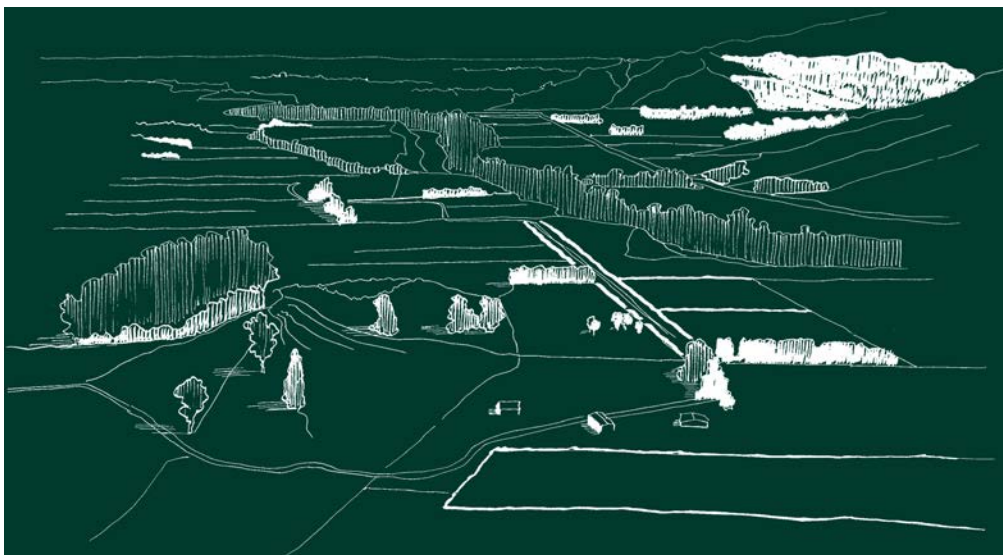
Carl – building on success.

## Appendix C: Examples of landscape designs for biodiversity, ecological function/services, natural character and maintenance reduction

There are several aspects to design according to scale. At the broad landscape scale Meurk and Swaffield (2000) and Meurk and Hall (2006) provide scenarios that support natural character, ecological integrity and landscape dynamics (figures C.1 to C.4). The essential feature is a landscape that is made up of a mosaic of habitat patches (forests and wetlands) at optimal spacing that provides sufficient density of stepping stones to ensure seed-dispersing birds cover all intervening terrain (the matrix, generally, of production land). Landscape connectivity is then enhanced by riparian, roadside and field boundary corridors.

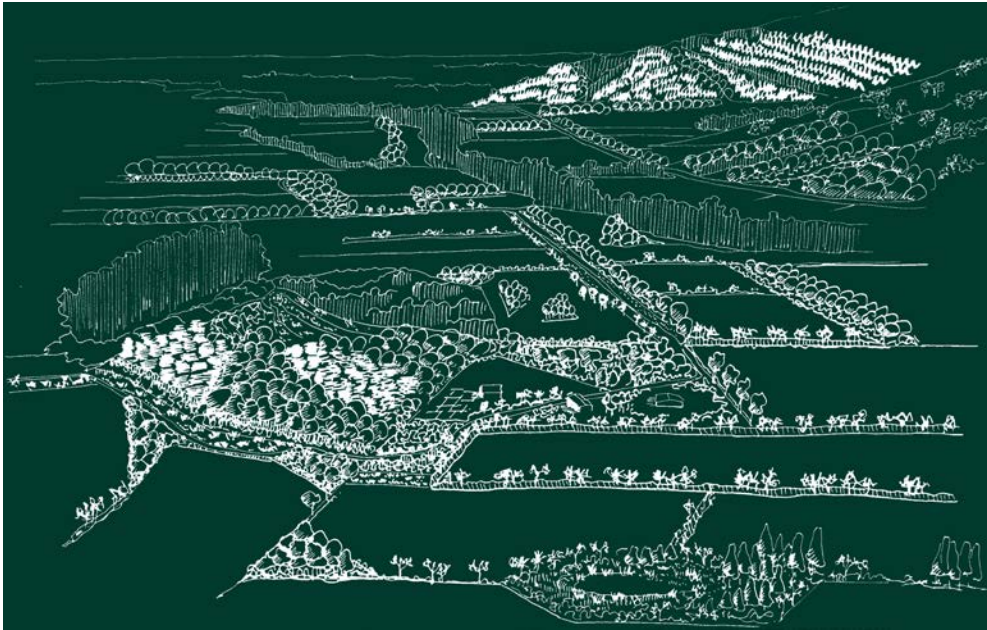
Some patches also have to be large enough to minimise edge effects and provide for a reasonable area of 'core' habitat or sanctuary for more sensitive organisms (Meurk and Hall 2006). Corridors are linear and generally narrow and so tend to be all 'edge'. Nevertheless, entrenched riparian corridors may be quite protected and natural hedges of coprosmas, etc, can provide an effective buffer. Corridors can have bulges (patches) wide enough to accommodate some 'noble trees'<sup>7</sup> and core habitat linked by narrow, linear habitat. Such bulges might reasonably be associated with enhanced picnic areas. This would be an easy area to make significant and visible changes. The current state of many of these landscape 'front windows' does little to celebrate our nationhood (figure C.5). This is sharp contrast to the expansive road corridors across South and Western Australia (figure C.6).

**Figure C.1** A contemporary dysfunctional New Zealand rural landscape with roadsides dominated by exotic pasture, shelter, timber and amenity plantings (from Meurk and Swaffield 2000)



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<sup>7</sup> Noble trees in the European sense are large, grand, graceful, long-lived and iconic trees – such as oak, elm, and beech. New Zealand's noble trees would be podocarps, southern beech, kauri, cedar, tawa, hīnau, pōkākā and in drier areas – kōwhai and even cabbage tree and kānuka.

**Figure C.2 Conceptual, enhanced New Zealand rural landscape and associated roadsides**

The above image features integration of production, conservation and cultural values with a strong incorporation of indigenous plants in pastures (savannah-like), wetlands, field and road boundaries in hedges and shelter belts, woodlots and amenity (from Meurk and Swaffield 2000). Such a landscape would have a higher degree of native wildlife functionality, connectivity and natural character. Roadsides would contribute a significant visual component to this mix.

Such habitat bulges or patches would be very well placed at the many picnic lay-bys around the countryside. Ideally they would be planted in a mix of noble and more ordinary indigenous species and importantly some interpretation provided, thereby fulfilling several values – biodiversity/habitat, safety, legibility and cultural sensitivity. Such an approach to roadside (avenue) planting would also involve randomly spaced nodes or patches of wilderness ('untidy ecosystems') in tidy foreground frames (Nassauer 1995). These nodes would provide ecological stepping stones, landscape connectivity, traffic calming and driver alertness (by avoiding the hypnotic effects of regular serried ranks of identical vertical elements – tree trunks), thereby incorporating interest, mystery and information about place and function. This would be one very easy change to make while achieving much for a modest investment.

Figure C.3 Contemporary dysfunctional New Zealand high-country landscape with roadsides dominated by exotic pasture, shelter, timber and amenity plantings (from Meurk and Hall 2006, drawn by Rebecca Wagstaff)

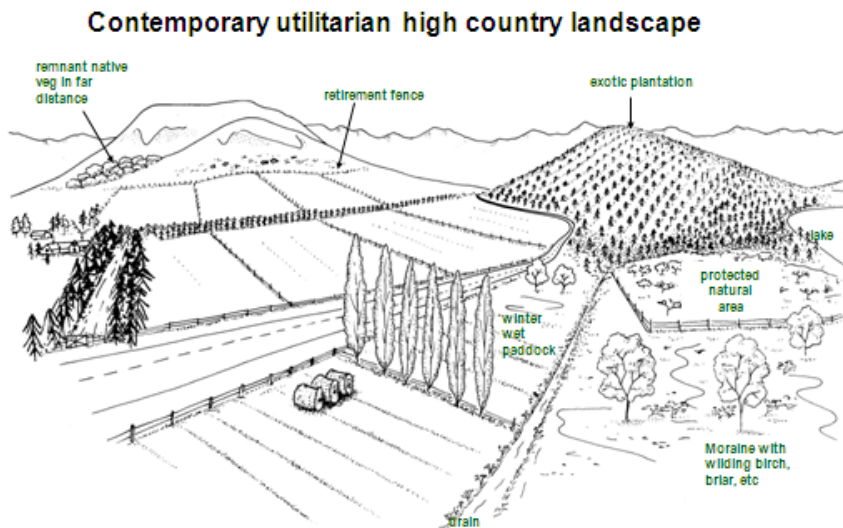
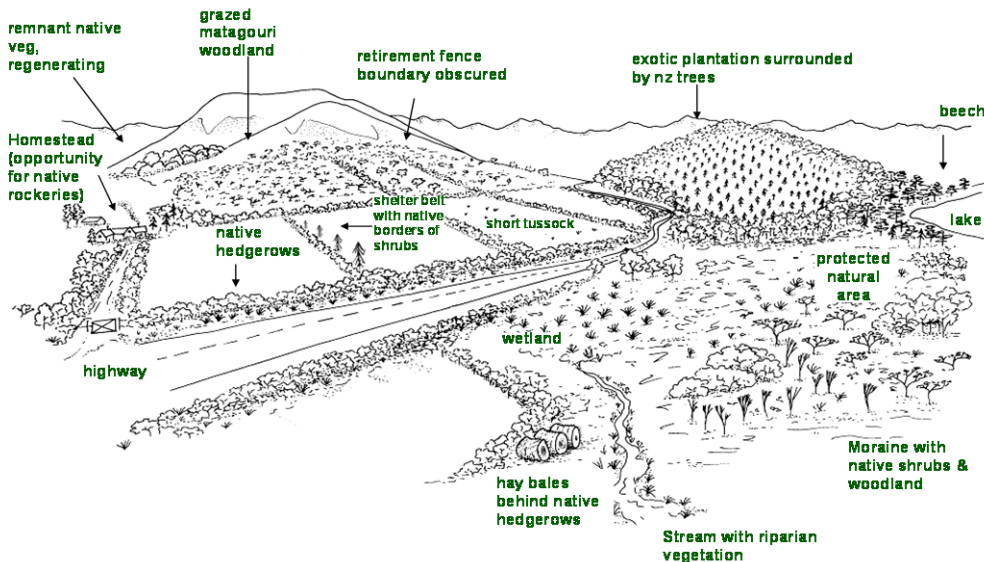


Figure C.4 A conceptual, enhanced New Zealand high-country landscape and associated roadsides

### Biodiverse high country futures



Drawn by Rebecca Wagstaff

The roadsides in the above image feature integration of production, conservation and cultural values with a strong incorporation of indigenous plants in pastures (savannah-like), wetlands, field and road boundaries in hedges and shelter belts, woodlots and amenity (from Meurk and Hall 2006). Such a landscape would have a higher value to native wildlife functionality, connectivity and natural character. Roadsides would contribute a significant visual component to this mix.



**Figure C.5** A picnic lay-by on the main highway between Palmerston North and Levin



This is the shop window to New Zealand's clean green reputation. There is not a single indigenous plant, animal or cultural icon in sight. The foreground trees are Californian macrocarpa, European ash and weeds such as stinking iris. The backdrop comprises Eurasian pasture species and cattle with more introduced pines and deciduous trees. There is one cabbage tree/ti kouka in the backyard of the distant homestead.

**Figure C.6** West Australian highway corridor of species-rich indigenous woodland and shrubs

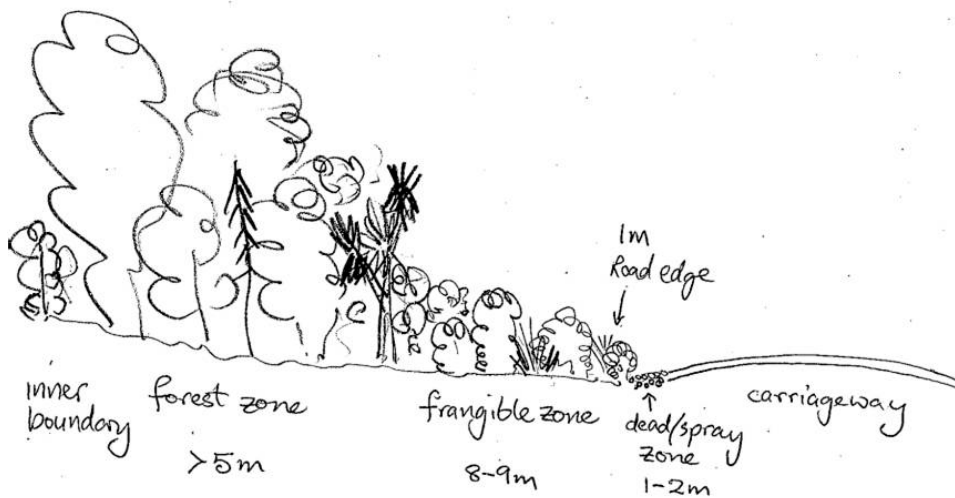


In the above image, the corridors are often in excess of 100m in width so are better able to resist edge effects and particularly weed incursion and thereby provide sanctuary habitat for wildlife and sensitive plants.

At a smaller scale and along the roadsides themselves (essentially an ecological corridor, albeit a somewhat hazardous one) zonation adjacent to edges is critical because conditions can vary significantly over short distances.

Based on Simcock and Meurk's (2010) field trials and assessments, the Simcock et al (2005) report, and other guidelines developed for urban environments (Meurk and Swaffield 2007; Ignatieva et al 2008) we propose the following design options comprising a herbicide spray zone (selective sprays to avoid damaging edge plants), an edge hedge of small-leaved shrubs, a frangible zone, a forest zone of >5m height (depending on width of road verge); and, if there is an inner boundary to farmland, another edge hedge (figure C.7).

Figure C.7 Basic road margin planting design cross-section



The scene illustrated in the above image involves a minimal dead zone immediately adjacent to the carriageway, a road edge of divaricating shrubs and tussocks that are competitive (dense and up to around 1-2m tall), a frangible zone of similar taller species (back to 9m from carriageway) and core zone of large trees. Depending on the adjacent land use, there may be an inner boundary of browse-resistant shrubs and climbers such as *Muehlenbeckia complexa* and *Rubus* spp.

## C1 Design for treatment swales and wetlands

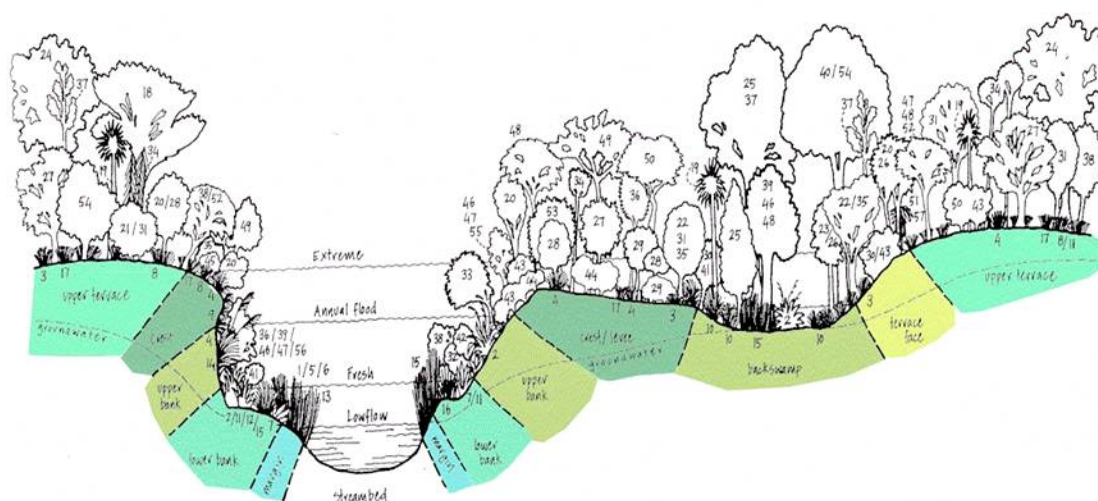
(cf <http://resources.ccc.govt.nz/files/StreamsidePlantingGuide-streamsideplanting.pdf>)

Stormwater generated from hard and contaminated surfaces such as roads needs to be treated to avoid polluting downstream water bodies. This can be achieved by ensuring contaminated water passes through natural filters of vegetation and settling ponds before entering receiving waters (figure C.8). Riparian zone plantings with particularly indigenous species can be informed by the many streamside planting guides around the country (figure C.9).

Figure C.8 Sketch of treatment wetland and swale leading to stream, capturing stormwater runoff from adjacent road. It comprises sedges, rushes, tussocks and reeds in the wettest seepage areas then swamp forest shrubs and trees in ephemerally wet sites



**Figure C.9** Idealised riparian cross-section of medium-sized river – outside bend on left and inside bend on right



The above image shows the zones from water edge, bank (lower and upper), levee, backswamp, terrace scarp (lower, mid, upper), and terrace top. The detail of this can be seen in the Christchurch *Streamside planting guide*<sup>8</sup> or the Gisborne *Streamside planting guide*<sup>9</sup>.

## C2 Summary of guidelines for multi-value design

- Use interpretation (signage, symbolism) of geomorphology, vegetation and cultural heritage.
- Expose and highlight geomorphological features and protect these, including natural or uncultivated soils.
- Preserve remnant primary vegetation; plant sequences of primarily indigenous species or safe exotics – with dead zone maintained with grass-specific spray, frangible divaricating shrubs and tussocks, then small and noble New Zealand trees beyond the 9m line.
- Promote wildlife corridors – especially for small birds, invertebrates and lizards.
- Create wider habitat patches at irregular intervals to maintain driver experience variation and provide sanctuary habitats with less edge effect.
- Avoid predominantly overshadowing indigenous species with large exotic trees – but making bold statements of one or the other biogeographic origin is more acceptable.
- Special attention must be made to visually prominent locations that are the shop windows of the region or nation (see earlier figures) – picnic areas, town portals, avenues, traffic islands (see figure C.10, embankments, foregrounds of extensive panoramic vistas of significant landscapes, etc).

<sup>8</sup> <http://resources.ccc.govt.nz/files/StreamsidePlantingGuide-streamsideplanting.pdf>

<sup>9</sup> [www.gdc.govt.nz/assets/Files/Planning-Policy/Streamside-planting-guide.pdf](http://www.gdc.govt.nz/assets/Files/Planning-Policy/Streamside-planting-guide.pdf)

**Figure C.10 Roundabout on Johns Rd, Christchurch, showing a plant signature of lancewood, snow tōtara shrubs and mikoikoi (NZ iris) providing a suitable 'island' habitat for indigenous invertebrates and lizards**



- Devices for enhancing landscape and highway legibility are available and may be used. These include preserved and revealed landform, vegetation and accented plants, water and wetland features, signage, sculpture, brochures, maps, booklets, guides and travel games.
- An effective and fair means of leavening community input on ecological and social values should be leavened with international and national bottom lines or obligations relating to ecology and social/cultural values and expert opinion on risk or threats in the same way that engineers have an effective veto on safety and built structures
- The NECAMS process ensures incorporation and accommodation of these multiple values – even if implementation is visionary and practically gradualistic or evolutionary. However, an overall consideration will be how this process will contribute to goals of an Aotearoa New Zealand clean green image, regional identity and wider nationhood.

### C3 Species composition and biosecurity

For the reasons outlined earlier, the species palette in the first instance should feature indigenous species. This would be for both general roadside planting and edges, and for treatment wetlands and swales. Whereas this should prevail as the default, there is abundant information and experience on exotic species that might perform some of these functions. The main consideration then is biosecurity. There needs to be rigorous assessment of species before being propagated and spread around the countryside. Road corridors can be both valuable wildlife links but also conduits for the many seriously invasive plant and animal pests. For this reason, breaks in corridors are not necessarily a bad thing.

Some weeds have been well established for a long time – such as gorse, broom, barberry, eleagnus; but others are only recently beginning to demonstrate a similar aggression – cotoneaster, hawthorn, and Spanish heath. Unfortunately, some known environmental weeds are still being planted. The old adage of 'one year's seeding, seven year's weeding' is very apt. Some of the weeds especially prevalent along New Zealand roadsides, apart from those mentioned above, and for which a control programme would be practical or is urgent, are: sycamore, elm, hawthorn, grey willow, cotoneaster, boxthorn, wattle, holly, ivy, periwinkle, etc. Again, this may take a long time to achieve eradication, but this should be the long-term goal, and the sooner a programme is commenced, the smaller the task. In addition, indigenous species should be locally, eco-sourced plants, although sterile cultivars that do not genetically intrude on local populations will continue to be used.

## Appendix D: Environmental and cultural criteria: identification, evaluation and management

The following are checklists of natural and cultural assets to guide a NECAMS exercise. It lists basic parameters for each asset grouped as natural (botanical and wildlife), cultural, and landscape. For each group there is a pathway from attributes to evaluation criteria to management actions. Landscape is a combination of natural and cultural assets and here includes physical environmental factors such as ecosystem services that improve water quality or enhance noise barriers. It is necessary to separate biological (biodiversity) from physical environmental factors because in New Zealand it does not follow that one is correlated with the other. These lists are not comprehensive; there are many systems developed overseas (eg US Department of Transportation 2010) and in New Zealand and all vary slightly from one another. Although it would be desirable to have a simple checklist that any roading practitioner could apply, the fact is that for many of these attributes consultation with an expert in each field will be required to scope the location. Initially this should not require more than a day or two in the field as experts will know the likelihood of finding significant elements and recognise evidence for them at a distance or from aerial imagery, or know appropriate literature or networks linking to other local knowledge.

### D1 Natural asset identification (use RAMMS-type system)

- Name and description
  - name, eg Northland podocarp rainforest
  - descriptor, eg forest (canopy >5m, >75% canopy cover), dominated by podocarps, P >1500mm or >PE
- Location/depiction
  - GIS polygon (>1 ha); GIS point (<< 1 ha); GIS linear feature (<10m wide)
  - width of corridor (road management horizon)
- Relationship to potential vegetation – Land Environments of New Zealand (LENZ) seral status
  - climax/mature
  - mid-succession
  - pioneering/early succession (can maintain by increasing stress)
- Relationship to regional degree of loss of natural habitat
  - LENZ threat level IV category (Walker et al 2008)
  - Is it a naturally rare ecosystem? (Wiser 2011)

### D2 Botanical attributes

- Significant species nationally and regionally
- Species diversity
- Significant habitat/ecosystem limits/thresholds
  - coasts

- wetlands, ponds and lakes
- waterways and rivers
- forests
- shrublands
- grasslands
- Patch size
- Naturalness
- Representativeness
- Biosecurity threats/disturbance
- Connectivity (see landscape)

### D3 Wildlife attributes

- Nationally and regionally significant species
- Species diversity
  - birds, bats, invertebrates, lizards
- Nesting sites
- Feeding/foraging sites
- Resting/roosting sites for migratory species
- Wildlife habitats
  - coasts
  - wetlands, ponds and lakes
  - waterways and rivers
  - forests
  - shrublands
  - grasslands
- Biosecurity
  - pests

### D4 Natural assets – overall evaluation (threshold approach)

- If in an ecological district with <10% natural vegetation remaining then value very high.
- If it is a naturally rare ecosystem then value very high.
- If it is a GIS line or point then value medium.
- If it is a GIS polygon then value high.
- All seral status habitats are valuable – not just the ‘climax’ state – but seral vegetation is often threatened by abundance of exotic weeds that are rapid invaders of such disturbed places.

- Intrinsic value – rare, unusual, limit condition, threatened species or habitats – value high.
- Species and habitat diversity – value high.
- Express (in landscape) the dominant/significant/most vulnerable asset first rather using additive model of value.
- Not winner takes all.

## D5 Botanical evaluation

- Standard ecological criteria
- Largely based on survey and expert/consultant opinion

## D6 Wildlife evaluation

- Standard ecological criteria
- Largely based on survey and expert/consultant opinion

## D7 Natural assets – overall management

- Protection/avoidance – always best option
- Mitigation/offset (not true compensation)<sup>10</sup>
- Remedy/restoration/offset (not true compensation)
- Monitoring
- Adaptive management (weed and pest control)
- Incorporate the layered approach – all historical layers visible during some part of the regional journey highlighted and interpreted ,eg at picnic laybys

## D8 Botanical management (at a range of scales)

- Micro-level
  - stressed berms (eg coarse, free-draining substrate) suppress succession and exotic weeds to support seral herbaceous species (Meurk 2004)
- Meso-level
  - buffering adjacent reserves
  - wetland water treatment of road runoff
  - weed control
- Macro-level

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<sup>10</sup> Offsetting can only approach true compensation for loss if the area or number of replacement plants that is used to compensate is an approximate multiple of the age of the site. In other words, a 100-year-old tree might be said, in some limited sense, to be compensated for by, for example, 50 two-year-old trees of the same species. This only covers structural elements, but it is a start.

- wider landscape – framing, buffering, complementing, integrating, channelling
- requires high level of community/neighbour buy in and participation.

## D9 Natural asset/wildlife management

- Micro-level
  - traffic islands for lizards and invertebrates
- Meso-level
  - corridors – habitat for smaller bush birds and stepping stones and corridors for larger birds – but watch for negative corridor effects (pests use them too) and manage accordingly – trapping/poisoning; they may attract birds to their deaths on the road!
  - buffering adjacent reserves
  - pest control
- Macro-level
  - wider landscape – framing, buffering, complementing, integrating, channelling

## D10 Cultural asset identification (use RAMMS-type system)

- Name and description
  - name, eg Kaiapoi tangata whenua pā site, or colonial farm building, or West Coast gold rush relics
  - descriptor, eg earthworks and middens, or weatherboard farmhouse, or water race
- Location/depiction
  - GIS polygon/plan (>0.1 ha)
  - GIS point (<< 0.1 ha)
  - GIS linear feature (<10m wide) value medium (avenue)

## D11 Cultural/historical-heritage-legacy attributes

The following are general criteria for evaluation of landscape from Schapper (1994)

- Symbolic
- Aesthetic
- Historic
- Scientific
- Social
- Archaeological

## D12 Specific attributes

- Tangata whenua
  - wahi tapu
  - mahinga kai



- sacred sites
- rohe
- taonga
- medicine/rongoa
- topographic named features
- Colonial
  - cottages
  - homesteads
  - memorials and cemeteries
  - mills
  - bridges
  - farm machinery
  - mining
- Modern social
  - technology
  - farming efficiency
  - trails
  - buildings
  - sculptures
  - notable trees

### D13 Cultural asset evaluation

- Through consultation - these values require assessment by trained practitioners
  - integrity
  - state of preservation or condition
  - authenticity
  - uniqueness
  - rarity
  - representativeness
  - example

### D14 Cultural asset management

- Through consultation (see landscape management)
- Preservation and protection
- Interpretation

## D15 Landscape asset identification (use RAMMS-type system)

- Name and description
  - name, eg Desert Road, North Westland Coast, Mackenzie Basin
  - descriptor, eg bush, rolling hills (pastoral), rivers (braided, 'mighty river', babbling brook, water race, lakes, ponds), coast (rocky, cliffed, beach, harbour, estuary, fiords), mountains (volcanic cones, tectonic, inter-montane basins)
- Location/depiction
  - GIS polygon/plan (>10ha)
  - GIS polygon (< 10ha)
  - GIS linear feature (<10m wide) value medium (avenue)

## D16 (Outstanding) landscapes attributes

For landscape evaluation the following general criteria should be used:

from SECTION 42A REPORT OF CLIVE ANSTEY ON BEHALF OF HORIZONS REGIONAL COUNCIL (14/2/09); Note C180/99 Wakatipu Environmental Society Inc V Queenstown Lakes D.C. Modified version of the Pigeon Bay criteria accepted by the Environment Court as suitable for the assessment of all landscapes.

- a) Natural science factors: These factors relate to the geological, ecological, topographical and natural process components of the natural feature or landscape:
  - Representative: the combination of natural components that form the feature or landscape strongly typifies the character of an area.
  - Research and education: all or parts of the feature or landscape are important for natural science research and education.
  - Rarity: the feature or landscape is unique or rare within the district or region, and few comparable examples exist.
  - Ecosystem functioning: the presence of healthy ecosystems is clearly evident in the feature or landscape.
- b) Aesthetic values: The scenic values of a feature or landscape may be associated with:
  - Coherence: the patterns of land cover and land use are largely in harmony with the underlying natural pattern of landform and there are no, or few, discordant elements of land cover or land use.
  - Vividness: the feature or landscape is visually striking, widely recognised within the local and wider community, and may be regarded as iconic.
  - Naturalness: the feature or landscape appears largely unmodified by human activity and the patterns of landform and land cover are an expression of natural processes and intact healthy ecosystems.
  - Memorability: the natural feature or landscape makes such an impact on the senses that it becomes unforgettable.
- c) Expressiveness (legibility): The feature or landscape clearly shows the formative natural processes and/or historic influences that led to its existing character.

- d) Transient values: The consistent and noticeable occurrence of transient natural events, such as daily or seasonal changes in weather, vegetation or in wildlife movement, contributes to the character of the feature or landscape.
- e) Shared and recognised values: The feature or landscape is widely known and is highly valued for its contribution to local identity within its immediate and wider community.
- f) Cultural and spiritual values for tangata whenua: Māori values inherent in the feature or landscape add to the feature or landscape being recognised as a special place.
- g) Historical associations: Knowledge of historic events that occurred in and around the feature or landscape is widely held and substantially influences and adds to the value the community attaches to the natural feature or landscape.

## D17 Specific landscape attributes

- Geology
  - topography (landforms: terraces, dunes, hills)
- Seismic
  - fault traces
- Soils/climate
  - cuttings, profiles, ash layers
- Coastal
  - dunes, estuaries, beaches, cliffs, rocks, islets/stacks
- Drainage waterways
  - clean water
- Vegetation integration
  - natural character
  - biosecurity (predominance of pest plants)
- Functional/services
  - buffers, filters, waterways, connectivity, clean air, noise dampening, safety, calming
- Social
  - legibility, cultural reinforcement, sense of place, identity, recreation/cycleways/walkways, Engineering feat

## D18 Landscape evaluation

Through consultancy with appropriate expertise:

- 'Wow' factor – panoramic/majestic scale
- Intimacy
- Intricacy
- Natural character

## D19 Landscape management

- Consideration of highway corridor definition:
  - carriageway
  - NZTA/public land
  - mid-ground visual horizon
  - far landscape horizon
  - catchment – realistically only deal with floodplain below road crossing
- Engagement with stakeholders
- Legibility – rebuild the associations between history and visual cues
- Rebuild connectivity between patches, stepping stones, corridors and matrix
- Interpretation/symbolism – reinforce unique aspects of nationhood and ‘clean green’ basis for heritage tourism
- In line with both ‘sense of place’ and ecological criteria, it would be reasonable to set a 20-year target of 10% of all roadsides, traversing cultural landscapes, to be dominated by indigenous vegetation, and in particular noble New Zealand trees; that 90% of all picnic lay-bys are framed by indigenous species, and have interpretation of local natural and cultural history; that guide books are available for the traveller that interpret all the dimensions of the landscape; and that in a century, 75% of the road experience is clearly and distinctively Aotearoa New Zealand.