Whangarei to Auckland – Connecting Northland

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August 2017

Programme Business Case

NZ TRANSPORT AGENCY
WAKA KOTAHI

New Zealand Government

More information

NZ Transport Agency
May 2015

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APPROVAL

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REVISION STATUS*

REVISION NUMBER:	IMPLEMENTATION DATE:	SUMMARY OF REVISION
1	April 2016	Part A only
2	June 2016	Part B draft
3	16th June 2016	For NZTA review
4	25 July 2016	Final for NZTA approval
4	23rd August 2017	Final (consistent treatment of DM)

TEMPLATE STATUS

REVISION NUMBER:	IMPLEMENTATION DATE:	SUMMARY OF REVISION
1.0	3 June 2013	1st Edition
1.1	27 April 2015	Update of the 1st edition

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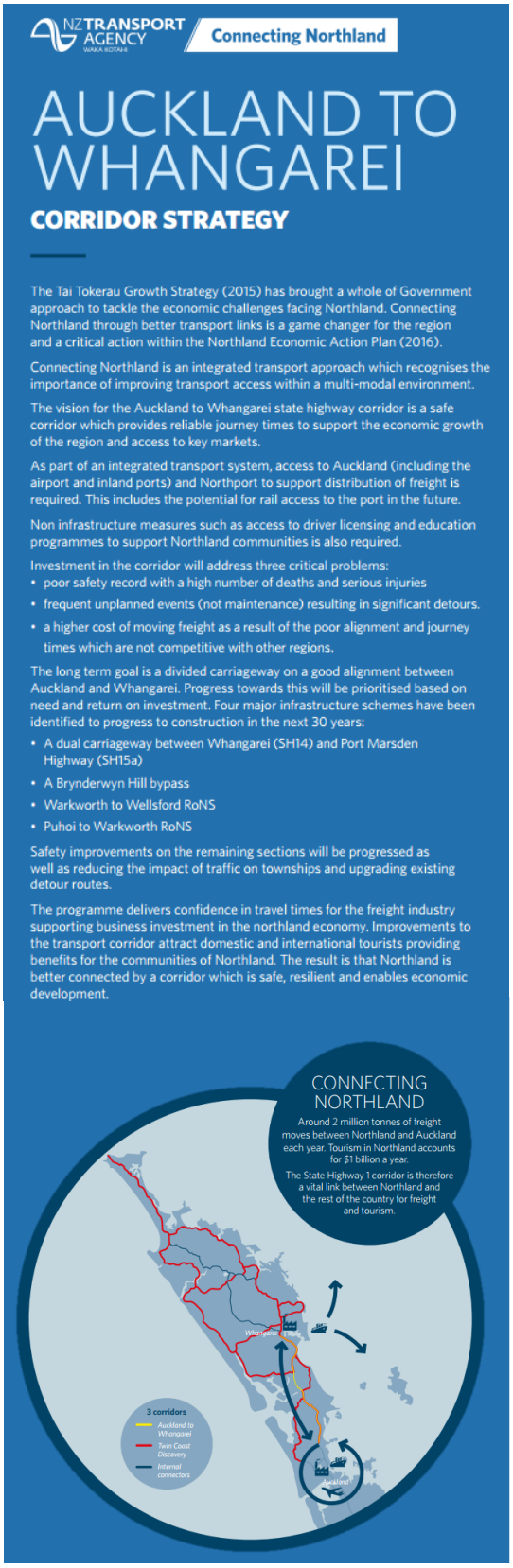
SUPPORTING DOCUMENTS

30 Year Transport Strategy for Northland, 2010	
Brynderwyn North Notice of Requirement for alteration to designation,	
Northland Regional Transport Strategy	
Rodney – Kaipara Co-ordinating Land Use Study (Dome Brynderwyn sub-region)	
Tai Tokerau Northland Economic Action Plan	
Tai Tokerau Northland Regional Growth Study	
Upper North Island Ports Study, 2012	

GLOSSARY OF TERMS

Benefit Cost Ratio	BCR
Coastal Marine Area	CMA
Detailed Business Case	DBC
Indicative Business Case	IBC
Ministry of Business Innovation and Employment	MBIE
Multi-Criteria Assessment	MCA
Net Present Value	NPV
One Network Road Classification	ONRC
Programme Business Case	PBC
Road Controlling Authority	RCA
Road of National Significance	RoNS
Scheme Assessment Report	SAR
State Highway 1	SH1
State Highway 12	SH12
State Highway 14	SH14
State Highway 15	SH15

EXECUTIVE SUMMARY



The Northland economy performs poorly when compared to other regions of New Zealand. This is particularly disappointing given its proximity to Auckland. One of the key enablers for improving the economic performance of Northland is transport accessibility. This has been confirmed through the recent all-of-government Tai Tokerau Northland Economic Action Plan.

State Highway One (SH1) plays a critical transport accessibility role, connecting Northland with New Zealand. Improving the northern state highway network will help Northland contribute to the so-called 'golden triangle' of Auckland, Hamilton and Tauranga. Together these three centres generate 36% of New Zealand's Gross Domestic Product (GDP) with a prediction for this to rise to 47% by 2026. Investment in transport between Auckland and Whangarei will contribute significantly to this.

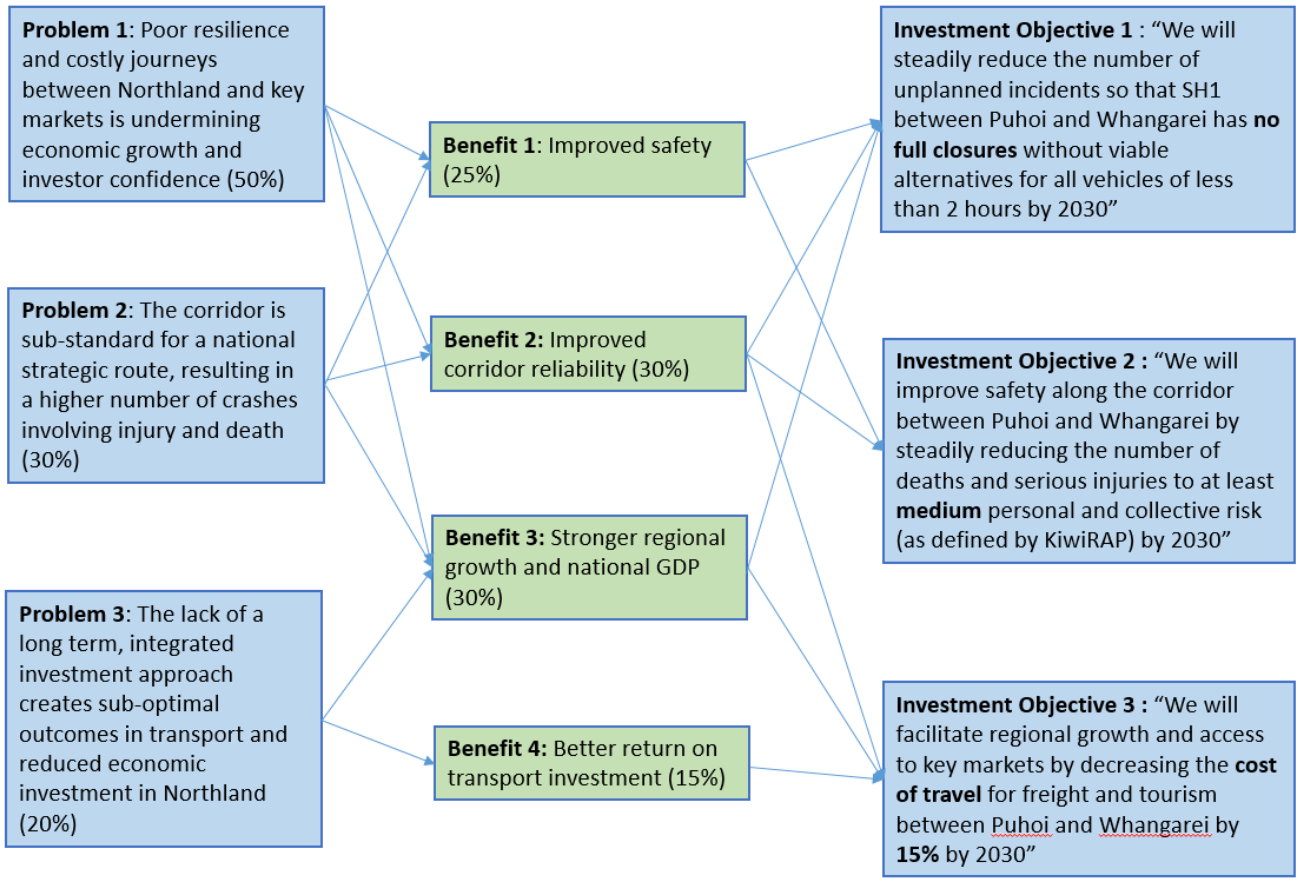
At present the corridor between Auckland and Whangarei is often closed, its alignment is comparatively unsafe by national standards and the cost of travel is an impediment to economic growth in Northland. This is not consistent with the One Network Road Classification (ONRC) aspirations of a National (High Volume) Strategic Route.

Providing a safer, more resilient and cheaper route between Auckland and Whangarei not only provides better accessibility between Auckland and Northland, but also Northland and the rest of New Zealand, and indeed the rest of the world through the Ports of Auckland and Auckland Airport.

A comprehensive and collaborative approach has been adopted with stakeholders to develop this Programme Business Case (PBC). This has resulted in alignment on the problems, benefits and investment objectives for the corridor as outlined in Figure 1.

The collaborative PBC approach has involved the development of options to best address the problems identified and then the compilation of a suite of programmes from these options to best deliver the outcomes sought by the agreed investment objectives.

Figure 1 : Project problems, benefits and investment objectives



Ten programmes were developed and assessed in detail, ranging from lower-cost interventions to programmes that aimed to fully meet the ONRC aspirations for the corridor.

The recommended programme best balances achieving the desired investment outcomes in an economically efficient manner. This has been achieved through a combination of operational and capital interventions. The recommended programme and performance against the investment objectives is outlined in Figure 2.

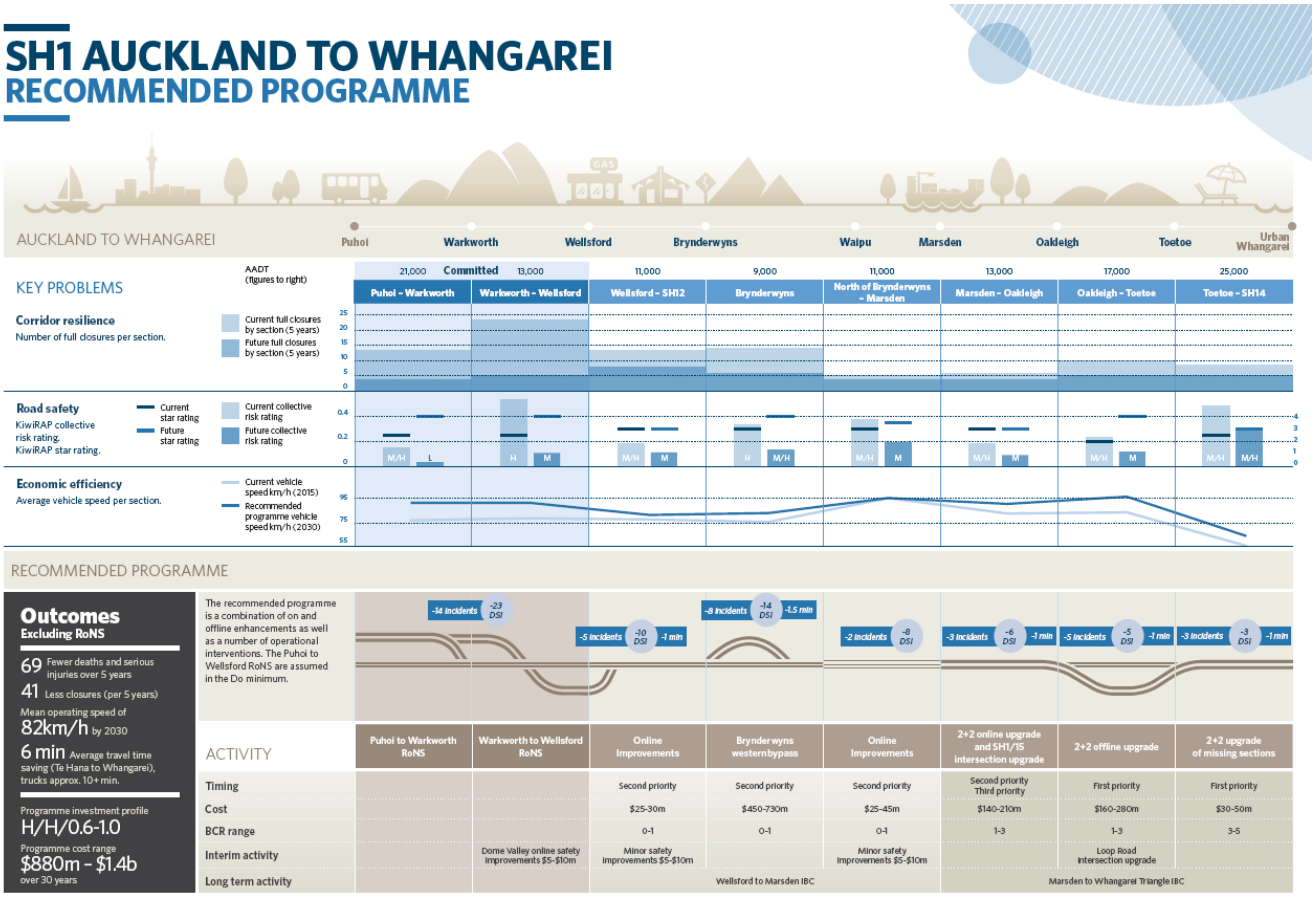
The recommended programme includes a suite of operation interventions including improved signage, targeted driver behaviour programmes, rest areas, truck stops, park n ride facilities and detour routes will also be upgraded to be fully HPMV capable. Capital projects are also part of the recommended programme. The recommended programme is shown in Figure 3.

The outcomes achieved by the recommended programme include:

PBC Investment Outcomes

- **6 min** average travel time saving (Te Hana to Whangarei), trucks approx. 10+ min
- Mean operating speed of 82km/h
- 69 fewer deaths and serious injuries every five years
- $880M - $1.4B cost, over 30 years

Figure 2: Recommended programme summary



The benefit cost ratio (BCR) for the recommended programme is between **0.6 - 1.0** and best matches the level of investment required to deliver the investment outcomes sought. As well as these transport outcomes, opportunities exist to deliver further benefits for the local, regional and national economy, including social, economic and land use benefits.

The recommended programme has an investment profile of H/H/0.6-1.0.

The recommended programme has been assessed to carry manageable implementation risks. Implementation of the programme is initially focussed on the most immediate safety areas, improving the form of the connection between Whangarei and SH15 (Port), followed by the Brynderwyn Hills bypass and then the remaining components of the programme. Due to the economic efficiency of some projects within the programme, implementation may be subject to delays in order to obtain funding.

The recommended programme meets the investment outcomes sought for the corridor, connecting Northland with a safer, more resilient and less costly journey that will enable the growth of the Northland economy. This is achieved through a wide range of projects along the corridor length.

Figure 3: Recommended programme

PART A – THE STRATEGIC CASE

1. INTRODUCTION

This Programme Business Case (PBC) considers the case for investment to address problems on SH1 between Whangarei and Puhoi. Whilst the PBC is focussed on SH1, it also includes consideration of the role of SH15, including the newly proposed inland freight route link connecting SH1 and SH14 via Loop Road and Otaika Valley Road and must be considered in the multi-modal context of the rail and coastal shipping modes that also operate in the corridor.

As shown in Figure 1, this PBC is part of a wider suite of corridor plans examining key journeys and routes in the Tai Tokerau Northland region.

Figure 4: PBC context

The Tai Tokerau Northland economy is one of New Zealand's poorest performers and, given its proximity to the country's largest and strongest performing centre there is real opportunity to improve this current situation. The recently completed Ministry of Business, Innovation and Employment (MBIE) Tai Tokerau Northland Economic Action Plan sets out an All-of-Government plan to revitalise the Northland economy. Transport connectivity is a key part of this plan, identified both in its own right and as a key contributor to a range of identified opportunities.

Connecting Northland is an integrated transport approach which recognises the importance of improving transport access within a multi-modal environment. This section of SH1 has a nationally important function, linking Northland with the rest of New Zealand and the world (through international ports and airports). SH1 has been identified in the One Network Road Classification (ONRC) as a National (high volume) road to Wellsford and a National road between Wellsford and Whangarei. It has been upgraded to allow the operation of full High Productivity Motor Vehicles

(HPMVs). It currently has a dual role providing for local and inter-regional light and heavy vehicle (freight) traffic between major centres of population and economic activity. There is a rail corridor between Auckland and Whangarei, which operates freight services, and a deep water port, NorthPort, at Marsden Point.

This PBC has been developed with stakeholders and investors to ensure that all parties are directing change and improvement in the right areas. In particular it:

- Confirms (with minor refinement) the Strategic Case problems and benefits;
- confirms the need to invest and the case for change;
- Develops investment objectives;
- Is informed by customer insights;
- Investigates options and alternatives to address the problems in the corridor; and
- Identifies a preferred programme of works to address the problems in the corridor;
- identifies the key asset and non-asset based projects that will support the programme outcomes, including proposed priority and timing, and
- seeks the early approval of decision-makers to develop subsequent project-based business cases.

2. PROGRAMME CONTEXT

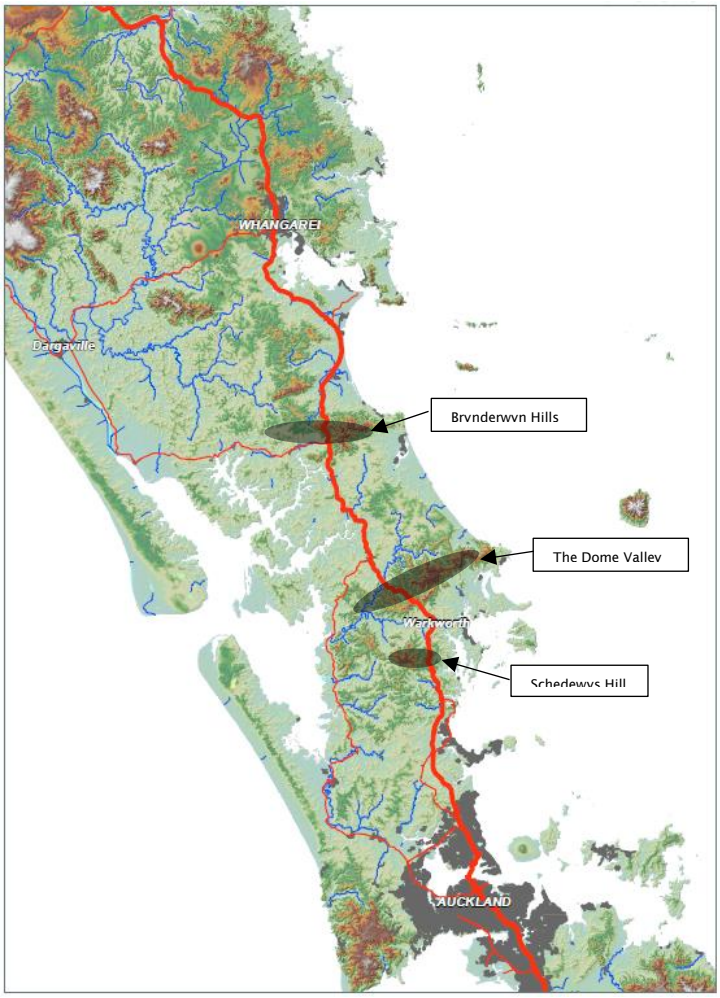
2.1 GEOGRAPHIC AND ENVIRONMENTAL CONTEXT

As outlined in Figure 5, SH1 traverses a broad range of terrain and environments along the 115km distance between Whangarei and Puhoi. Generally, the terrain is hilly between Puhoi and Waipu, with three distinct ranges crossed, being Schedewys Hill, Dome Valley and the Brynderwyn Hills. The ground conditions are challenging with poor soil conditions affecting the current performance and alignment of SH1. The geographic and geological conditions through these sections create challenges for road alignment (both vertical and horizontal) with increased cost to build and operate infrastructure.

The corridor is close to the coastline in a number of locations and therefore traverses a number of different catchment areas. Over the hillier sections of the route the environment is a combination of productive forest and native bush. In the less hilly sections, pastoral farming is more prevalent. There are a number of Department of Conservation (DoC) reserves along the route, generally protecting native bush areas.

North of the Brynderwyn Hills, the terrain flattens out and the area is predominantly used for farming at both a lifestyle block and larger scale.

Figure 5: Geographic and environmental context



2.2 SOCIAL CONTEXT

2.2.1 Region

Northland has one of the most deprived populations in the country. While 20% of New Zealand's population is in the lowest quartile of the deprivation index, the equivalent measure for Northland is 35%.

Economically this story has two distinct extremes. Auckland is New Zealand's largest economy, the economic engine room of the country. In contrast, Northland is one of the most economically deprived areas of the country.

Northland is a regional economy that has been underperforming relative to other New Zealand regions and relative to its resource base for too long. The regional economy was impacted by the Global Financial Crisis (e.g. a large reduction in tourists from the UK and the USA) and some significant climatic events, both severe storms and drought conditions. The Far North and Kaipara districts have similar economic structures, with a strong focus on primary production. Whangarei is the region's main urban and servicing centre with a higher concentration of manufacturing and service industries.

Northland's economy accounts for 2.5% of New Zealand's Gross Domestic Product (GDP). Nominal GDP in the region increased by 2.6% per annum on average over the past five years, compared to the national average of 4.1%. Northland has an unemployment rate three percentage points above the national rate and nominal GDP per capita is 32% below the national average. Just over 20% of Northland's usually resident population live in areas that have the lowest deprivation score compared to 10% nationally.

Northland's relatively low population density and geographic remoteness have contributed to its economic underperformance despite being in relatively close proximity to the strongly performing Auckland economy.

2.2.2 Growth

A number of towns and settlements are located along the route. Warkworth is an identified growth area in the Auckland Unitary Plan and considerable growth in population and employment is forecast for this area. The Eastern Beachs (Snells Beach, Algies Bay, Sandspit, Omaha and Matakana) are popular holiday desinations and are forecast for strong growth and an increasing permanent population.

Further north, other towns along the route such as Wellsford, Te Hana and Kaiwaka have not experienced growth for a number of years. The Mangawhai area (Kaipara District) has steady growth forecast with a recent acceleration. Closer to Whangarei, the Ruakaka area is also identified for considerable growth.

2.2.3 Communities

The SH1 corridor passes through a number of towns and communities between Auckland and Whangarei. The following communities are situated on SH1 with direct connection to the state highway:

- Warkworth
- Wellsford
- Te Hana
- Kaiwaka

- Brynderwyn

Townships situated along the corridor experience both positive and negative effects from the State Highway. Access and pass by trade provide opportunities to these areas, while severance, road safety, visual, emissions and noise effects reduce the sense of place to these areas.

A number of other towns are situated adjacent to the route with secondary connection to SH1:

- Puhoi
- Eastern Beachs
- Port Albert
- Mangawhai /Te Arai
- Langs Beach
- Ruakaka / Marsden Point
- Mangapai

Connectivity to these communities is seen as a critical factor. Outside of the settlements and towns, a number of residents and farms enjoy direct access to the State Highway corridor.

2.3 TRANSPORT CONTEXT

2.3.1 Economic importance

Due to its geographic position and isolation from key markets, transport connections for the Northland region are critical for its economic development. Efficient access to the large market and economic opportunities of metropolitan Auckland as well as connectivity to the Auckland airport and seaports at Northport, Auckland and Tauranga will help underpin future growth.

The recent MBIE Tai Tokerau Northland Economic Action Plan has identified the importance of the transport network as a key enabler for economic growth in Northland and in particular the role of SH1 in providing access to the rest of the country.

Given the economic structure of the region with a high proportion of primary activities relying on export markets, freight movements within the region and to Northport are of major strategic importance. It is currently proposed to strengthen the road transport network connecting Northland's primary industry, forestry, with Northport through a new state highway (SH15), which will provide a more resilient inland freight route.

2.3.2 Multimodal network

The current rail line provides very few services a day (and all freight services) and is subject to both size and weight restrictions. Perhaps the biggest constraining factor to use of the rail line for the corridor is the constraint of the urban Auckland rail network. Congestion on the Auckland Western line is a significant constraint for rail from Northland adding cost and time delay to services. As the Auckland commuter rail task increases, freight will be increasingly difficult to move through the area. The line requires a significant investment to upgrade bridges, tunnels and operating systems if this level of service is to be enhanced.

As a result of current constrianst to rail freight, usage of the freight rail service is restricted to selected industries.

Coastal shipping plays an important role in the transport of freight out of Whangarei. Due to the nature of shipping, this is restricted to moving large volumes of low value goods such as aggregate, logs and oil.

2.3.3 Road network

The ONRC is a classification system that identifies the level of service, function and use of road networks and state highways. The SH1 road corridor is identified as a National (High Volume) route between Puhoi and Warkworth (the highest classification) and a National route from Wellsford to Whangarei and SH15A, due to there role providing access between Whangarei and Auckland (including international airport and port facilities).

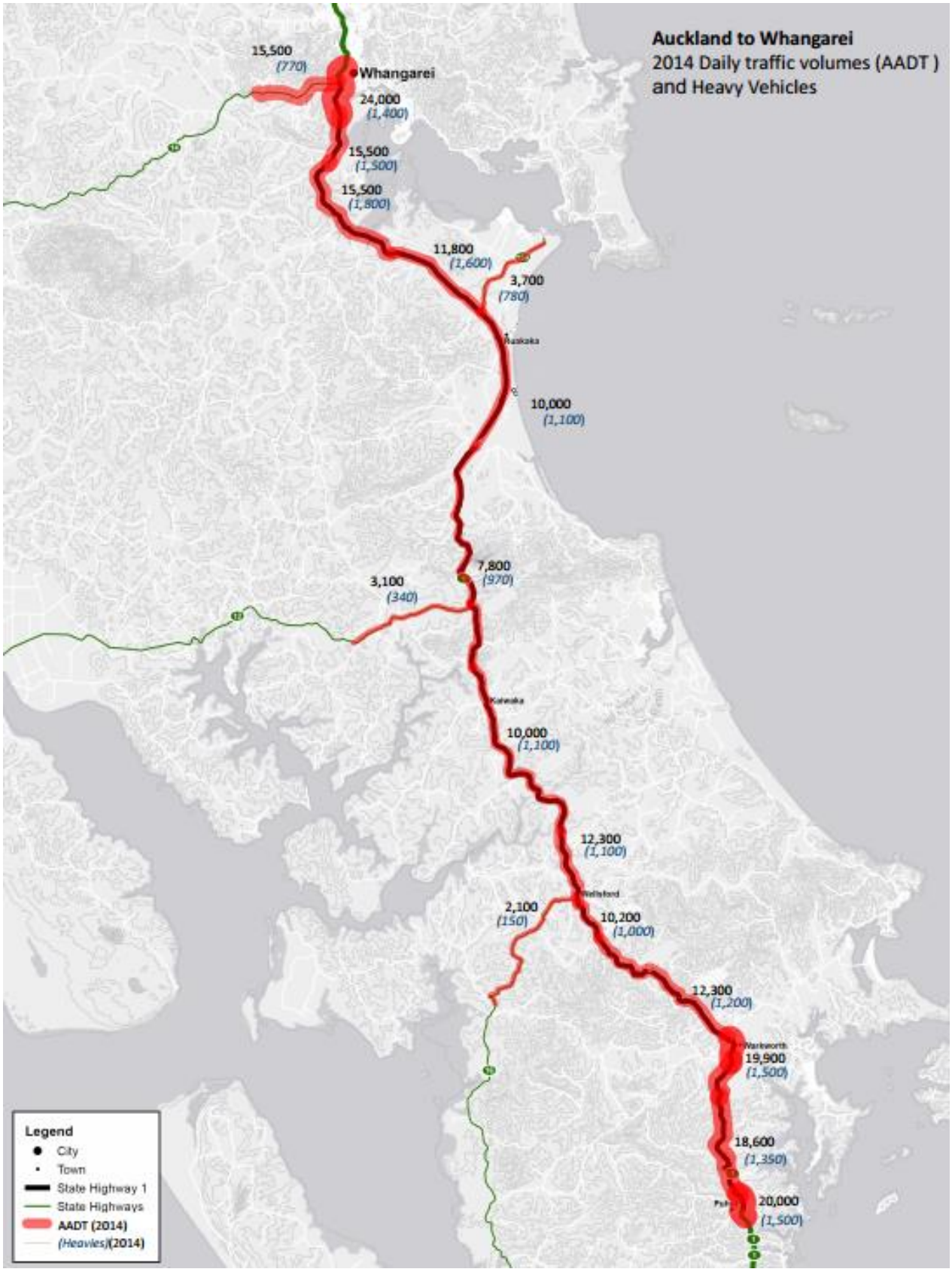
SH1 between Auckland and Wellsford is classified by the ONRC as a '*High Volume'* route with the SH1 section between Wellsford and Whangarei and SH15A classified as a '*Strategic*' route. SH16, SH12 and SH14 are classified as *'Primary Collectors'*. **Appendix A** includes a transport network plan, outlining the critical local and strategic links in the network.

SH1 between Puhoi and Whangarei is over 115km in length and there are many variables to the form of the road. In general the road is a single lane (in each direction) undivided carriageway. Figure 6 summarises the current demand and shows that traffic flows range from 8,000 – 24,000 vehicles per day. It indicates that the heaviest flows are between Whangarei and SH15 and between Wellsford and Puhoi. Traffic growth has been assumed at a rate of 1.5% over the length of the corridor between Wellsford and Whangarei.

Figure 6 also shows HCV flows per day, which range between 900 and 1800 and between 8-14% of the traffic composition. It also shows that HCV growth has been greater than other general traffic between 2010 and 2014. The greatest heavy vehicle flows are also between Whangarei and SH15 and Warkworth and Puhoi.

There are a number of passing lanes along the corridor. From Puhoi to Wellsford, the corridor is identified as a Road of National Significance (RoNS). The Puhoi to Warkworth section has statutory approval for an offline, four-lane divided, motorway-standard road, which is currently being procured through a Public Private Partnership (PPP) arrangement (with completion expected in 2021/2022). Statutory approvals applications are currently being prepared for the Warkworth to Wellsford section.

Figure 6: Existing AADT



2.4 ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES

There are a number of environmental and topographical constraints and opportunities along the corridor that have influenced the development of this PBC.

Figure 7 shows the landform and settlements along the route. Of particular note are settlements at Warkworth, Wellsford, Te Hana and Kaiwaka, which are located immediately on the corridor. Integration with these townships is a particular area of focus.

Figure 7 also indicates significant landforms through the Dome Valley and Brynderwyn Hills. **Appendix B** includes other environmental constraint plans, which show Outstanding Natural Landscapes and Features immediately adjacent to the route in the Dome Valley and Brynderwyn Hills. Although it is important to ensure that any new infrastructure sensitively addresses these features, they also represent an opportunity to attract visitors, potentially through well-designed stopping places.

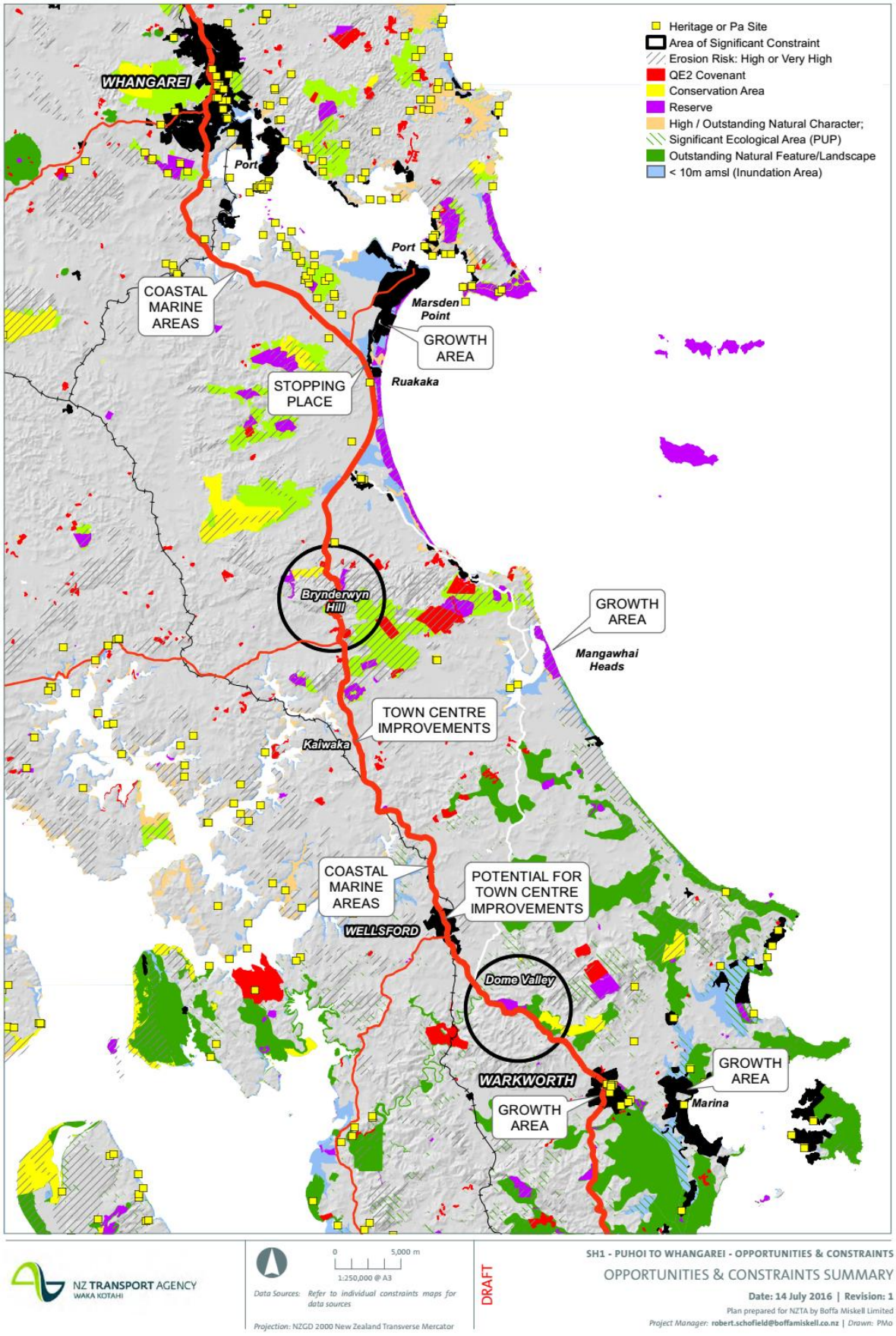
Appendix B identifies cultural and heritage features along the route. It highlights a particular concentration of archaeological and pa sites to the south of Whangarei.

Recreation and tourism opportunities along the corridor are also highlighted, including the walking / cycling tracks through the Dome Valley and close to the coast at Ruakaka. It also shows a trail connection to the Brynderwyn Hills. A key consideration for this PBC is how best to maximise these opportunities.

Environmental and social issues and opportunities were discussed at the stakeholder workshop. A range of issues and opportunities were identified for the corridor. These issues and opportunities were key inputs into the development of a social and environmental filter to test options against. The social and environmental issues and constraints specific to this corridor are as follows:

- Sustainability of towns/centres along the route (Kaiwaka, Wellsford)
- Areas of cultural and heritage significance
- Sensitive ecological areas and receiving environments
- Landscape character, and protected landscapes
- Topography and soil types
- Biosecurity (e.g. Kauri die-back)
- Land use (e.g. productive landscapes)
- The quality of the journey, visual quality, tourism experience and stopping places
- Severance, accessibility, walking, including national pathways
- Cycling and relationship with national cycle network

Figure 7: Landform and Settlements



3. PARTNERS AND KEY STAKEHOLDERS

The activities and problems relating to this section of SH1 affect a number of different organisations and customers. The engagement through the PBC built upon engagement undertaken during the development of the Strategic Case and widened the number of stakeholders to ensure a broader level of engagement across this long corridor.

As well as these stakeholders, discussion and liaison with Heavy Haulage Association, KiwiRail, and significant transport users (i.e. Northport) was also undertaken.

3.1 INVESTMENT PARTNERS

3.1.1 NZ Transport Agency

The Transport Agency is responsible for managing, operating, planning and improving state highways.

As a partner to this business case, the Transport Agency is fundamentally concerned with ensuring the safety and efficient travel for users on this section of the state highway network. Investment in the state highway network may therefore be needed to help solve the problems identified in the Strategic Case, and fully realise the benefits of investing.

3.1.2 KiwiRail

KiwiRail is responsible for the rail infrastructure that services the area. Investment by KiwiRail is potentially required to fully realise the benefits as identified in the Strategic Case.

3.2 KEY STAKEHOLDERS

Based on engagement with stakeholders, the following key focus areas have been identified. Generally, there is strong alignment between stakeholders regarding the focus areas for the corridor.

Stakeholders	Focus areas
NZ Transport Agency – Highway Networks Operations	Development of a programme of works that provides for the safe and efficient operation of SH1
NZ Transport Agency – Planning and Investment	Development of a programme that has a sound evidence base and represents a good investment
Whangarei District Council	Focussed on a programme that is implemented with priority that links Whangarei more efficiently and safely with the rest of the country, whilst also supporting growth aspirations
Kaipara District Council	Focused on the interaction with the communities along the current corridor and understanding any implications and opportunities from the programme
Northland Regional Council	Development of a fundable programme that increases accessibility to Northland
Northland Inc	Development of a programme quickly that provides for the increased economic growth of Northland
Auckland Transport	Particularly focussed on the Puhoi to Wellsford section and the interface with identified growth areas

Stakeholders	Focus areas
Auckland Council	Interface with growth areas and impact of programme on towns along the route such as Wellsford
Northport	A clear vision for the corridor to provide investors with certainty
Freight Industry	Reducing the cost of travel in Northland and addressing key areas of deficiency such as the Bynderwyns and Loop Road
Iwi Partners	Cultural assessment of the corridor and road safety on the corridor

3.3 ALIGNMENT TO EXISTING STRATEGIES / ORGANISATIONAL GOALS

This section describes how the proposed "assessment" outcomes align to relevant national, regional, sector and organisational strategies. **Appendix C** provides a detailed assessment of the applicable strategies. The strategies with the most direct impact on this PBC are outlined below.

3.3.1 One Network Road Classification (ONRC)

The ONRC has been developed by the Road Efficiency Group (which is a collaboration between Road Controlling Authorities across New Zealand) as a classification system that identifies the level of service, function and use of road networks and state highways. The SH1 road corridor is identified as a National (High Volume) route between Puhoi and Warkworth (the highest classification) and a National route from Wellsford to Whangarei, due to its role providing access between Whangarei and Auckland (including international airport and port facilities).

3.3.2 Upper North Island Freight Story

The Upper North Island Strategic Alliance undertook work in 2013 to support informed decision making on key land use, infrastructure and investment, to improve the economic performance of the Upper North Island and New Zealand. The Freight Story sought to understand the supply and demand of industrial land, promote a strategic and integrated approach towards land use and transport planning and identify constraints on the Upper North Island's strategic rail and road networks.

The problems and potential outcomes for the SH1 corridor are consistent with a number of the critical freight issues that the Upper North Island Freight Story seeks to address. The Freight Story confirmed strategic road and rail network constraints as their top critical issue and in particular, ranks highly the inter-regional road corridor (Auckland/ Waikato/ Bay of Plenty) in terms of 'scale of benefit of collective partner focus' in reducing the cost to do business.

3.3.3 Tai Tokerau Economic Action Plan

The Tai Tokerau Northland Economic Action Plan (February 2016) brings into focus a group of projects that together will contribute to transforming Northland's economy. This an all of government action plan to improve the economic performance of Northland.

The Action Plan is short to medium term, covering 10 years; one that encourages new projects to be included as existing projects come to completion. A broad range of organisations will contribute to the success of the Action Plan, from business and Iwi/Maori through to not-for-profit organisations and local and central government, inkling the Transport Agency.

The Study highlighted a range of opportunities for Northland. These have been narrowed down in the development of the Action Plan to coalesce limited resources around the projects that will make

the greatest short to medium term difference. These projects have been organised together into common work areas that fall under four broad work streams. The objectives for each are:

1. **Enablers:** To bring Northland's transport, digital infrastructure, skills and capabilities and water resources to a standard that creates an enabling environment for economic development in Northland.
2. **Land & Water:** To identify and develop opportunities for more productive use of land and water resources across a range of primary industry sectors.
3. **Visitor Industry:** To reduce the impact of seasonality, improve product dispersal across the region and enhance tourism promotion.
4. **Specialised Manufacturing & Services:** To support the development of new innovation and specialised manufacturing and service sectors.

The Tai Tokerau Northland Economic Action Plan has identified that the lack of robust transport accessibility between Northland and the rest of the country is a contributing factor to the area's poor economic situation and has identified four 'game changers' to underpin business growth. The first of these game changers is:

> **Transport:** – better connectivity with Auckland, within the region and with export markets. Northland is a place-based economy. Roading in particular, is critical for Northland to develop and affects virtually every part of the economy.

A number of sectors, identified in the Tai Tokerau study as potential growth areas, require good links to markets and suppliers in Auckland and beyond. These activities include:-

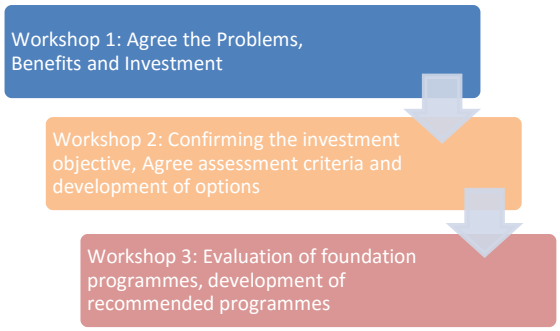
- Improving dairy and related production and processing
- Forestry and related wood processing, and especially growing wood processing including a new saw and pulp mill at Ngawha.
- Aquaculture (although the scale of this is probably more limited)
- Horticulture

Other opportunities that may depend on good links to Auckland would include:

- Marine manufacturing (links to suppliers and markets)
- International education
- Tourism

3.4 WORKSHOP COLLABORATION

The PBC has been developed through a Collaborative process with active involvement from a technical stakeholder group. The workshops held and attendance is outlined in the figure below:



NZTA Operations	WDC	WRC	FNDC	KDC	Northland Inc
✓	✓	✓			✓
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	✓

3.5 CUSTOMER INSIGHTS

Initial communications with the wider public occurred with the launch of the Connecting Northland website which was promoted to attendees at a Transport for Future Urban Growth (TFUG) public open day in Warkworth on 30 April 2016. A PDF flyer promoting the online engagement was distributed to key stakeholders via email and provided to attendees at the TFUG event.

Promotion of the online engagement was through targeted Facebook 'boosts' (which were paid advertising posts aimed at generating visitors to the Connecting Northland website). Each 'boost' generated significant site traffic with over 6,000 visits to the website 'Tell us what you think' page during the engagement period.

3.5.1 Qualitative data

Submitters were asked to consider six areas of the state highway network and to identity which three (if any) they would prioritise for future investment. The six areas were identified as:

- Dome Valley
- Kaiwaka to Te Hana
- Brynderwyn Hill
- Ruakaka to Waipu
- Otaika Valley Road (to become SH15)
- Through Whangarei

Of the 988 submissions received through the Connecting Northland website, 860 prioritised Dome Valley (87%) as the area needing transport investment due to safety risks, speed restrictions and resilience (significant detours during unplanned events). Brynderwyn Hills were the second priority with 693 (70%) and the third priority was Kaiwaka to Te Hana with 433 (44%) responses. The state highway section identified with the least priority was Ruakaka to Waipu with 102 responses.

3.5.1 Qualitative data

In order to support comments across a broad corridor, only two questions were posed:

1. Provide feedback on the areas you have prioritised
2. Any other comments on the corridor plan

Across the total survey responses, question two elicited the most written responses.Puhoi to Wellsford (including the Dome Valley) was the strongest theme represented in the comments. Other recurring themes included:

1. Resilience (SH closures due to unplanned events or weather)
2. Safety
3. Capacity (need to increase)
4. Connecting Northland
5. SH1 Brynderwyn Hill (rationale for northside safety improvements)
6. Otaika Valley/Loop Road
7. Quality of Northland roads
8. Maintenance and operations
9. Rail

Comments were also made on the timeliness of implementing projects, particularly in respect of projects around Warkworth. A number of submissions were received on Penlink and these responses have been forwarded on to Auckland Transport. The full Public Consultation Report – Auckland to Whangarei PBC has been included in **Appendix D**.

4. STRATEGIC ASSESSMENTS – OUTLINING THE NEED FOR INVESTMENT

4.1 DEFINING THE PROBLEM

A facilitated workshop was held on 17th February 2015 with key members of the internal project team to gain a better understanding of investment drivers and the need to invest in change during the Strategic Case. Subsequent to this initial session a further facilitated workshop with key stakeholders was undertaken on 19th March 2015. During the PBC, further evidence was gathered to confirm the problems of the Strategic Case.

Based on this further evidence and discussion, Problem Statement 1 has been reworded to better reflect the resilience focus of the problem, rather than the travel time reliability focus of the existing wording. Problem Statement 3 has also been refined to better reflect the discussion and focus more on its effect on investment in Northland. The weightings have remained the same. The revised wording and weights are provided below:

- **Problem 1**: Poor resilience and costly journeys between Northland and key markets is constraining economic growth and investor confidence (50%)
- **Problem 2**: The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death (30%)
- **Problem 3**: The lack of a long-term, integrated investment approach creates suboptimal outcomes in transport and reduced economic investment in Northland (20%)

The revised Investment Logic Map is attached as **Appendix B.**

4.2 THE BENEFITS OF INVESTMENT

The benefits of successfully investing to address these problems were identified as part of the ILM process in 2015. Four benefits were identified for the corridor when the problems were addressed. These benefits are:

- **Benefit 1**: Improved safety (25%)
- **Benefit 2:** Improved corridor reliability (30%)
- **Benefit 3**: Stronger regional growth and national GDP (30%)
- **Benefit 4:** Better return on transport investment (15%)

During PBC Workshop 1 there was discussion and engagement in relation to the benefits as part of preparing to develop investment objectives for the corridor. During this discussion there were no changes proposed as it was agreed that the benefits and KPI's developed during the Strategic Case remain appropriate and relate well to the updated problem statements.

4.3 IDENTIFICATION OF UNCERTAINTY AND RISK

During the development of the investment objectives, stakeholders also gave consideration to the risk and uncertainty of key assumptions that should be considered during the development of the PBC. Table 1 outlines the identified risks and uncertainties. Treatment of each risk and uncertainty has been done on a case by case basis. Some risks have been used to develop project options, others have form the backbone of a programme. The majority have been considered and will form the basis of sensitivity tests carried out on project options or become trigger points within the recommended programme.

Table 1: Uncertainty Log

Risk	Time	Likelihood	Severity / Impact on corridor	Comments
Land use changes				
Growth forecasts Whangarei changes. Marsden Point increases population and employment		Reasonably foreseeable	Medium	As per WDC high forecast for Marsden Point
Warkworth growth as per SubRAP with Future Urban area	2020	More than Likely	High	As per latest ART modelling
Wellsford population increases	2020 post RoNS	Hypothetical	Medium	Growth in accordance with Warkworth
Kaipara District Council development	2020 post RoNS	Reasonably foreseeable	Low	Growth in KDC higher than anticipated following improved access
Port activity				
Bigger containers or bulk goods import role at Northport	Post 2020	Hypothetical	High	Informed from the UNI Freight Study scenarios and the Auckland Port Study currently in progress
Air travel				
Whangarei Airport increases domestic flights	unknown	Hypothetical	Low	Informed by Whangarei Airport study
Whangarei Airport moves	unknown	Hypothetical	Low	Reduction in accessibility to Whangarei
Rail mode share				
Investment in rail network, including Marsden Rail connection	unknown	Reasonably foreseeable	Medium	Greater portion of freight transported by rail. Reduction in heavy vehicles on road.
Inability of rail freight to travel through Auckland economically following increasing Auckland commuter demand.	Post CRL	More than likely	Medium	Risk of rail investment being ineffective due to constraints outside the scope of this corridor.
Economic development				

Risk	Time	Likelihood	Severity / Impact on corridor	Comments
Development of key industries creating additional jobs	unknown	Reasonably foreseeable	Medium	Informed by Tai Tokerau Growth Study
Increased tourism industry activity – more visitors	2025	Reasonably foreseeable	Medium	Tourism in Northland accounts for a large proportion of industry and affects traffic volumes significantly
Transport baseline				
Fuel prices	unknown	Reasonably foreseeable	Medium	Change in fuel price will affect vehicle travel and traffic levels on the corridor

4.4 PROBLEM 1: POOR RESILIENCE CONSTRAINS ECONOMIC GROWTH

"Poor resilience and costly journeys between Northland and key markets is constraining economic growth and investor confidence."

4.4.1 The Evidence

SH1 from Whangarei to Puhoi is the main transport connection between Northland and the rest of the country. The evidence shows that the corridor suffers regularly from unplanned incidents, which affect its resilience and availability.

Further analysis of the Strategic Case evidence was undertaken and is summarised in Figure 8. In 2014, there were 27 full closures along the route, with an average delay of 7-8 hours. This gave a total of 216 hours of closure, equivalent to an average of nearly 20 hours per month. This data excludes partial closures, which would further compound the issues. At the end of this study, 2015 closure data was made availiable.

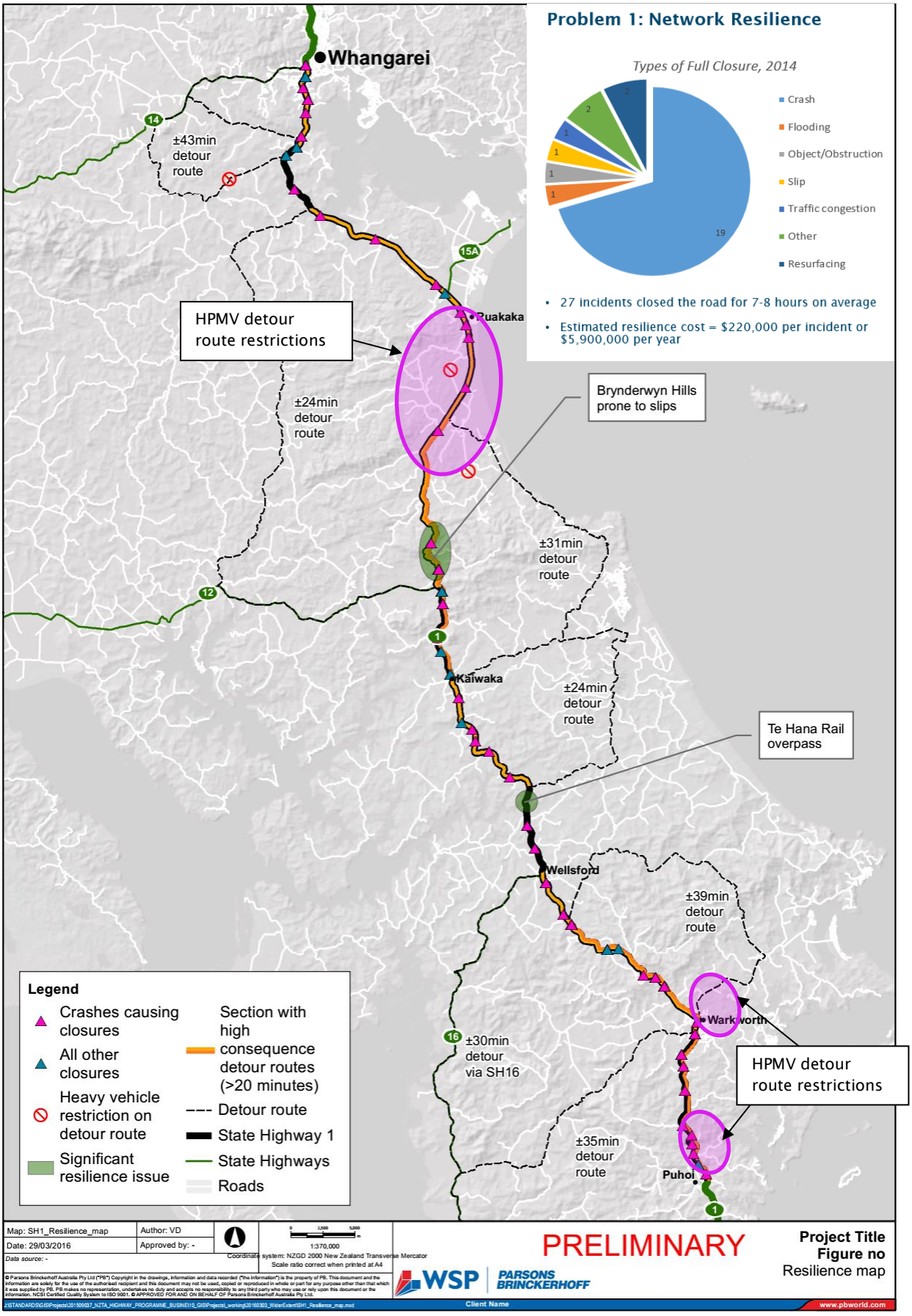
Of these unplanned incidents, 70% resulted from crashes with the remainder a combination of other predominantly environmental factors. The location of these closures is also shown in Figure 8, indicating resilience challenges in the Brynderwyn Hills as a priority. It also shows a high number of crashes along the section between Whangarei and SH15.

During the 2015 year, 19 incidents occurred on the corridor with a average delay of 2-3 hours. While significantly less than the 2014 year, the incidents followed similar trends in cause and location.

The detour routes for many of these closures are also challenging, as shown in Figure 8. These detour routes are not able to carry full HPMVs. These two factors, the length of the detour routes and their inability to carry HPMVs, significantly restrict the ability to divert freight traffic away from incidents.

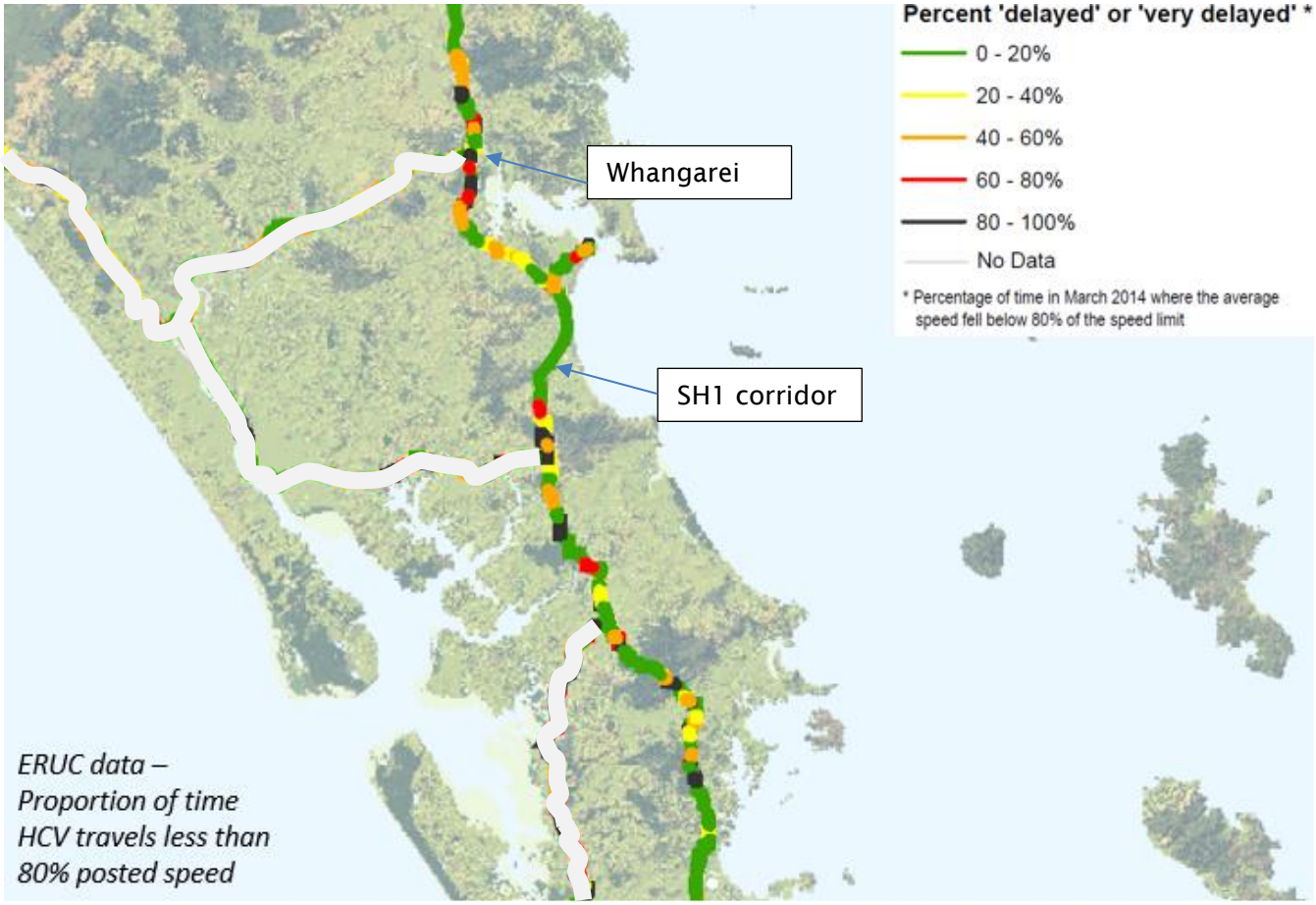
Significant delay can occur during once a detour route is implemented. Delay time on Figure 8 represent additional travel time for traffic once a detour is set up. Accounts from the network operators suggest detour routes themselves are often subject to additional delay as a result of one-lane briges, priority intersections and crashes on the detour routes themselves.

Figure 8: Unplanned Incidents and Detour Restrictions



In terms of 'costly journeys', new analysis of travel times derived from the information used to collect Electronic Road User Charges (ERUC) data is shown in Figure 9. This analysis compares actual travel times with posted speeds by road section. This shows that heavy vehicles are delayed on the hillier sections of SH1, particularly through the Brynderwyn Hills, the Dome Valley and the town centres of Wellsford and Warkworth.

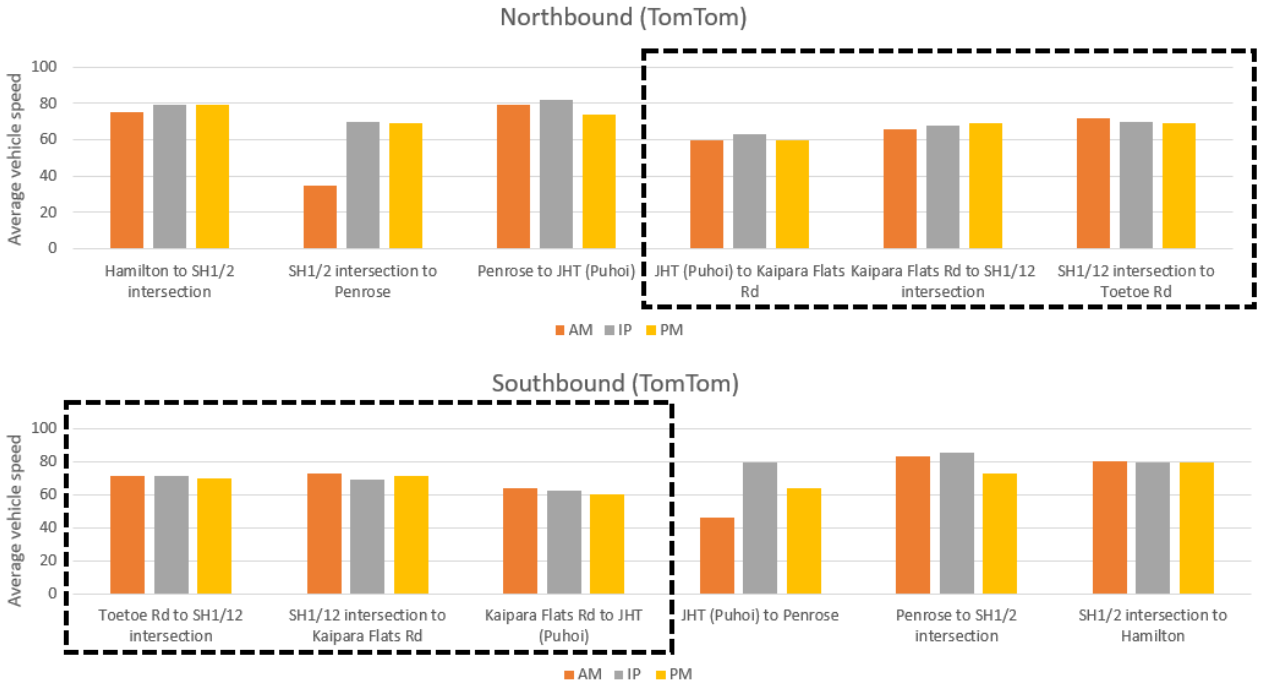
Figure 9 : ERUC Data



Speed data was analysed for the entire journey between Whangarei and Hamilton and as shown in Figure 10 and Figure 11, the trip north of Auckland is generally slower than the south of Auckland sections of the route (but is not affected by the capacity induced peak-time issues). During peak commuter periods Auckland can be slower, but generally the evidence shows that the average speed on SH1 north of Auckland is slower than through Auckland and between Auckland and Hamilton.

Figure 10 : Current Speed in Corridor by Section

Figure 11 : Speed Data Whangarei to Hamilton



4.4.2 Implications of the Evidence

This evidence strengthens the evidence gathered in the Strategic Case. The evidence has identified that some travel time variability exists but the main issue is one of resilience when SH1 is not available. With the route fully closed for over 200 hours a year and additional partial closures, there is strong evidence to support a resilience problem.

The evidence has also shown that the average speed (and therefore cost of travel) for this section of SH1 is slower than sections of highway with the same ONRC classification. Recent improvements to the Waikato Expressway have targeted 110km/h speed limits and will likely see operating speeds in excess of 90 km/h. The SH29 corridor, a 'High Volume Strategic' route, operates at an average speed of 86km/h[1]. The evidence supports the perception of costly journeys in Northland. Based on customer and industry insights, the high cost of travel is linked to decisions by industry and business to invest in the region.

Establishing a direct link between economic performance and transport accessibility is difficult as there are many factors that influence economic outcomes, particularly for regions like Northland. However, a strong message from stakeholders and the evidence we have is that the performance of the transport network, and particularly connectivity to a strong economic centre such as Auckland, has a role to play in the economic performance of a region such as Northland. This is confirmed by the Tai Tokerau Northland Economic Action Plan.

The evidence shows there is a problem with the resilience and performance of SH1 between Auckland and Northland and that the Northland economy is one of the poorer performers in New Zealand. The evidence therefore supports the following problem:

"Poor resilience and costly journeys between Northland and key markets is constraining

[1] Based on 2014 ERUC light vehicle data between Pairere and Tauriko.

economic growth and investor confidence"

A 50% weighting was identified for this problem, as it is the most significant issue for the corridor. Addressing this problem will make a real difference to the Northland economy.

4.5 PROBLEM 2: SAFETY

"The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death"

4.5.1 The Evidence

The Strategic Case undertook a review of crash data from 2010 to 2014. As part of this PBC, available 2015 data was also reviewed. The 2015 safety records indicate that the corridor continues to perform poorly from a safety perspective with 6 fatalities and 16 serious injuries recorded in the 9 months of available data.

We also know that in the first three months of 2016, there have been four fatal accidents on SH1 between Whangarei and the Brynderwyn Hills, which have not yet been included in CAS. An assessment of these crashes shows a similar pattern to the analysis undertaken in the Strategic Case.

Figure 12 includes a summary of the fatal and serious crashes through the corridor over the past 10 years. Of these crashes, more than 50% were head-on incidents. Analysis of the major contributing factors indicates that alcohol and drugs were a significant factor related to over 50% of these crashes, with speed (25%), fatigue (22%) and heavy vehicles (28%) also important contributors.[2]

The PBC corridor crash record has also been compared with other areas of the network using the KiwiRAP Collective and Personal Risk methodologies, as shown on the side of Figure 12 and in Figure 13. This identifies high-risk areas, specifically Puhoi to Wellsford and Oakleigh to Whangarei have medium-high personal risk ratings. The recent 2015 and 2016 data (fatalities) is likely to increase the risk rating further between the Brynderwyn Hills and Whangarei.

[2] It should be noted that accidents can have more than one contributing factor.

Figure 12 : Fatal and Serious Accidents 2005-2015

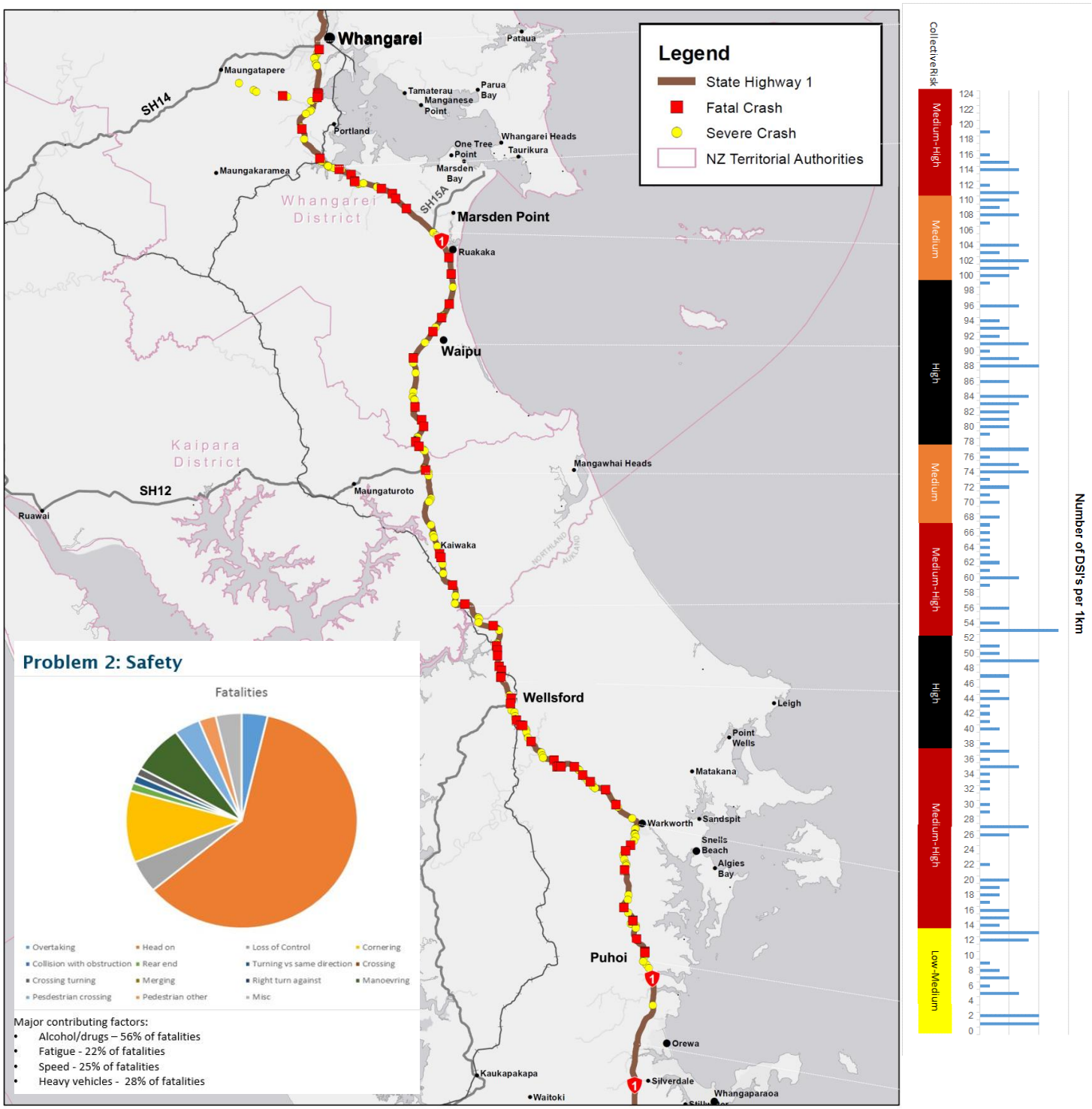
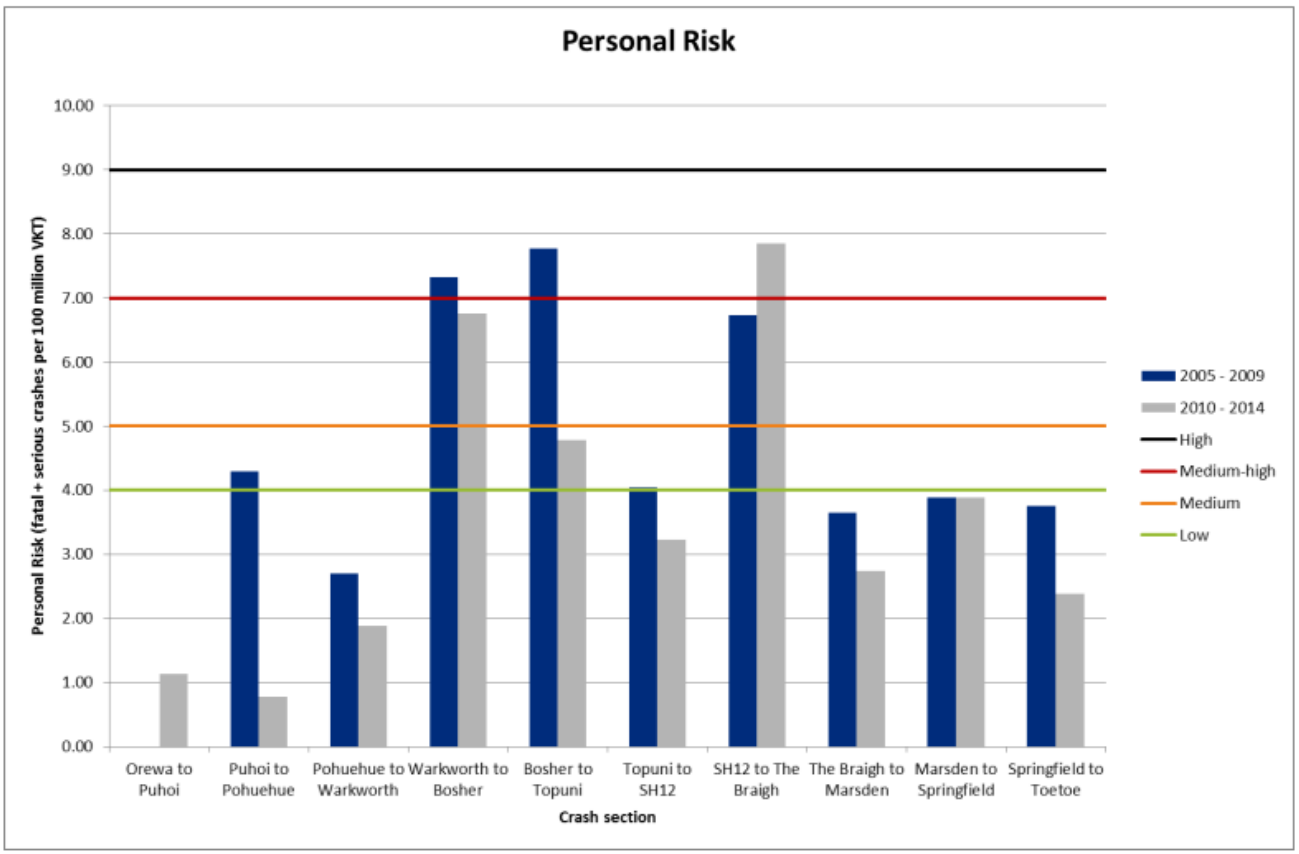
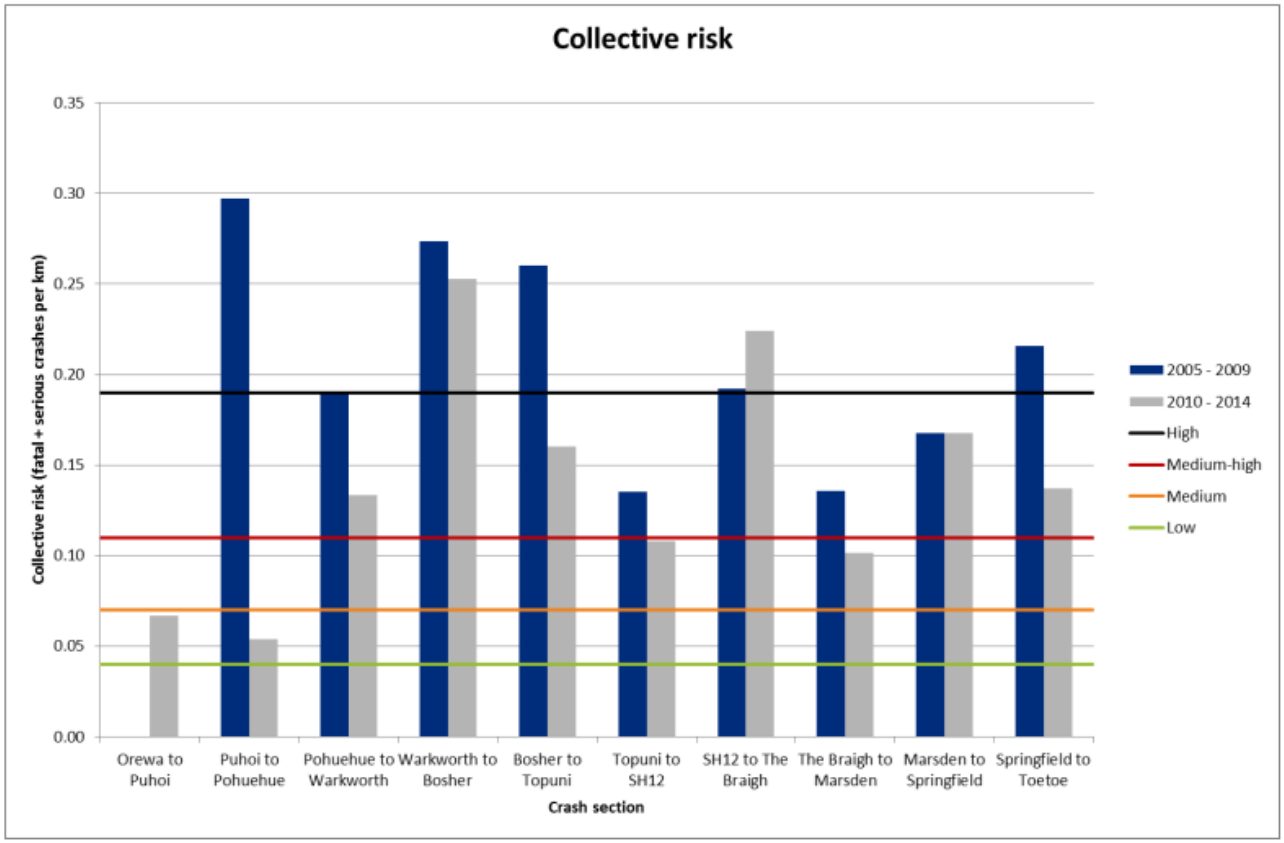


Figure 13: KiwiRAP personal and collective Risk for SH1





As outlined in **Appendix F**, this section of SH1 carries the highest classification in the ONRC system

as a "National" road, with part of the route (south of Wellsford) also being "High Volume National". From a safety perspective this requires the following standard:

- **High Volume National:** Mostly forgiving roads and roadsides, equivalent to KiwiRAP 4-Star standard. User hazards absent or mitigated, including head on risk. Active road users generally do not have access - if present, they are provided with separate space or are physically separated. The road form provides road user guidance
- **National:** A high KiwiRAP 3 or 4-star standard, or equivalent, with consistent and predictable alignment. User hazards mostly mitigated. Active road users (if present) are mostly provided with separate space or are physically separated. Some lower standards and/or winding sections may require lower speeds and extra care. High level of road user safety guidance provided.

The current route is predominantly 2 or 3 star standard. This does not meet the standard sought for a National route (and certainly not a high volume route).

Safety also has a significant impact on the resilience of the route (due to closures because of incidents) and it is noted that the ONRC also seeks the following resilience standard for a National route:

- **Resilience Level of Service** - Route is always available during major weather or emergency events and viable alternatives exist. Rapid clearance of incidents affecting road users. Road users are generally advised in advance of issues and incidents

The evidence assessed to date confirms the problem identified in the Strategic Case.

4.5.2 Implications of the Evidence

In accordance with the ONRC, this National state highway should have at least a 3-4 star KiwiRAP rating. Currently the corridor has no 4-star rated sections and 36% of its length is rated 2-star.

The evidence shows that the current SH1 safety record is poor and is not commensurate with its ONRC. The evidence shows that the worst sections of risk exposure are at Dome Valley, the Brynderwyn Hills and between SH15 and Whangarei, which all have medium-high risk ratings.

The Whangarei to Puhoi corridor is defined by a number of geometric constraints resulting in areas of tight horizontal and steep vertical alignment. This is particularly evident in many of the crash black spots on the corridor including Schedewys Hill, the Dome Valley and the Brynderwyn hills. The crash history reflects this with high proportions of head on, cornering and loss of control crashes of high severity. Cornering crashes are particularly prevalent in minor and non-injury crashes, and are the highest proportion of crash incidents overall. The lack of central median barrier on the route is considered to contribute to the high number of head-on crashes, many of which result in serious injuries or fatalities. This results in an unacceptable level of death and serious injuries.

Figure 14: Vertical profile of the Auckland to Whangarei corridor

Further analysis suggests the corridor is also over represented in crashes with driver fatigue listed as a contributing factor. Crashes involving heavy vehicles are also over represented compared with national levels and are especially high when considering crashes involving serious and fatal injuries.

Given this evidence, the following problem has been identified:

"The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death".

A 30% weighting was identified for this problem as this is a significant issue for the corridor and addressing this problem would significantly improve the corridor's performance.

4.6 PROBLEM 3: REDUCED ECONOMIC INVESTMENT IN NORTHLAND

"The lack of a long term, integrated investment approach creates suboptimal outcomes in transport and reduced economic investment in Northland"

4.6.1 The Evidence

In 2013, Finance Minister Bill English and Economic Development Minister Steven Joyce released the *Regional Government Expenditure Report* jointly commissioned by Treasury and MBIE and undertaken by NZIER. The report shows that Northland spends above the national average on operating costs for the transport network and one third less than the national average on capital investment. This leads to an increasing OPEX burden, as there is relatively little investment in new infrastructure, putting even more emphasis on the need to maintain existing infrastructure.

Issues raised during consultation on the draft Regional Land Transport Plan (RLTP) and through the development of the Network Operating Framework include:

- There is no route protection for future State Highway improvements in urban Whangarei
- Northport has highlighted the lack of an investment commitment as a reason that investors have walked away
- Intersection improvements (developer and safety led) are being constructed without a longer term plan to be consistent with
- Land use developments that are likely to be within the footprint of future road improvements are currently being consented
- Safety improvements are being developed without regard to the overall efficiency of the corridor
- Significant development is occurring in Waipu without any strategy for how this traffic will access the state highway efficiently

Customer insights from Northland Inc outline that a clear, confirmed and committed investment strategy for SH1 would significantly assist the case for upgrading Northport. It is important to note that transport is one of many factors considered to contribute to unlocking the development potential along the corridor. Consideration must be given to other infrastructure provision. Clarity on the corridor transport plan will provide certainty to allow land use planning for townships located on the State Highway, such as Kaiwaka and Wellsford, to be confirmed. Presently, planning cannot be effectively implemented because of the lack of investor confidence, with transport accessibility an important factor in these decisions, based on customer insights and stakeholder engagement.

There is also an opportunity to future proof the corridor in urban areas so that the emerging land form does not compromise the efficiency of the state highway. The recent Puhoi to Warkworth clarity commitment has helped land use planning in Warkworth to confidently identify appropriate locations for growth and necessary complementary infrastructure, some of which is already being realised.

4.6.2 Implications of the Evidence

Without the clarity of a long term investment plan for SH1, there is the risk that the current investment in the corridor will not be as effective as it could be. A corridor plan wasd last developed by the Transport Agency in 2010. Since then, the Puhoi to Warkworth section of the RoNS project has progressed through to a PPP for construction in 2021/2022.

There is considerable investment being made (or planned to be spent) in the corridor on safety improvements, such as the Loop Road intersection upgrade. It is prudent to ensure that this investment, where possible is consistent with the long term strategy for the corridor. In some locations, interventions such as median barriers may be installed and then replaced or removed in the near future to accommodate longer-term solutions for the corridor, which could include four-laning.

As outlined in the context section, the Tai Tokerau Northland Economic Action Plan has identified that the lack of robust transport accessibility between Northland and the rest of the country as a contributing factor to the area's poor economic situation and transport is one of the required 'game changers' to underpin business growth.

Given this evidence, the following problem has been identified:

"The lack of a long term, integrated investment approach creates suboptimal outcomes in transport and reduced economic investment in Northland".

A 20% weighting was identified for this problem as although the development of this PBC will assist in addressing this problem, it is seen by stakeholders in particular as of high importance for the corridor, and is likely to reinforce a communication approach for the completed PBC.

4.7 INVESTMENT OBJECTIVES

A workshop was held with stakeholders on 19 February 2016 to confirm the identified problems and benefits. The workshop was also used to develop investment objectives for the PBC.

SMART investment objectives were developed with reference to the key benefits sought. Investment objectives must provide enough information to enable an investor to make a sound investment decision. Four investment objectives were identified as outlined below.

4.7.1 Investment Objective 1: Resilience

Problem 1 identified that the unreliable and costly nature of the corridor was affecting economic growth. Safety is a part of the problem and therefore Benefits 1 and 2 are directly applicable to this problem. Benefit 3 is the opportunity to increase economic growth (because of more reliable and available transport accessibility). Linking this problem and benefits, the following investment objective was developed:

"We will steadily reduce the number of unplanned incidents so that SH1 between Puhoi and Whangarei has no full closures without viable alternatives for all vehicles of less than 2 hours by 2030"

Important considerations for this investment objective were:

- Full closures cause the most significant delays for users and are the most measurable, as the Transport Agency specifically collects this data. Partial closures often occur in an ad hoc manner and are not always reported.
- A 2-hour closure limit was selected, as this allows a optimistic but achieveable response time for operators of the network to address an incident.

- The year 2030 was selected as it allows time to complete the likely interventions.

4.7.2 Investment Objective 2: Safety

There is a real safety problem in the corridor and an opportunity to enhance the lives of users when this is addressed. Linking Problem 2 and Benefit 1, the following investment objective was identified:

"We will improve safety along the corridor between Whangarei and Puhoi by steadily reducing the number of deaths and serious injuries to at least a medium personal and collective risk (as defined by KiwiRAP) by 2030"

Important considerations for this investment objective were:

- The KiwiRAP criteria provides a nationally benchmarked standard. A medium risk level is equivalent to an average rating.
- Using both personal and collective risk criteria addresses the crash history as well as exposure rate.
- The year 2030 was selected as it allows time to complete the likely interventions

4.7.3 Investment Objective 3: Northland Economic Development

Problems 1 and 3 are related to the need for economic growth in Northland and this is a key focus for many government agencies. This is the outcome of Benefit 3 and an outcome associated with Benefit 4. The role of freight and tourism in the economic recovery of Northland is substantial. Linking these problems and benefits, the following investment objective was identified:

"We will facilitate regional growth and access to key markets through decreasing the cost of travel for freight and tourism between Puhoi and Whangarei by 15% by 2030."

Important considerations for this investment objective were:

- There was extensive discussion with stakeholders regarding the wording of this investment objective and the use of trip reliability or speed as a proxy for economic growth. Trip travel time, was considered, however as the overall intent for economic growth is to reduce the cost of travel, average speed rather than an arbitrary travel time was considered more appropriate.
- A vehicle speed / travel time measure was selected as this is the significant factor (and most easily measurable) in cost of travel.
- The corridor between Whangarei and Puhoi is currently observed to operate at an average speed of 76km/h.
- If this was improved to be consistent with other National routes, an average speed of 90km/h is considered an appropriate target. This represents a 15-minute travel time saving, which would be a noticeable improvement or roughly equivalent to a 15% reduction in Cost of travel. It would increase accessibility to Auckland and reduce the cost of travel on the route for freight in particular.
- The year 2030 was selected as it is within the timeframe of the MBIE Tai Tokerau Northland Economic Action Plan and some projects required to address this objective could be of a large scale and require longer lead times.

4.7.4 Summary

PBC investment objectives have been developed based on the problems and benefits identified through engagement with stakeholders and project partners. Three investments have been identified

as follows:

- **Investment Objective 1 :** "We will steadily reduce the number of unplanned incidents so that SH1 between Puhoi and Whangarei has no full closures without viable alternatives for all vehicles of less than 2 hours by 2030"
- **Investment Objective 2 :** "We will improve safety along the corridor between Puhoi and Whangarei by steadily reducing the number of deaths and serious injuries to at least a medium personal and collective risk (as defined by KiwiRAP) by 2030"
- **Investment Objective 3 :** "We will facilitate regional growth and access to key markets through decreasing the cost of travel for freight and tourism between Puhoi and Whangarei by 15% by 2030"

4.8 THE KEY PERFORMANCE ATTRIBUTES AND MEASURES

It is important that the potential benefits of successfully investing are able to be assessed and measured in order to demonstrate ongoing delivery against investment criteria.

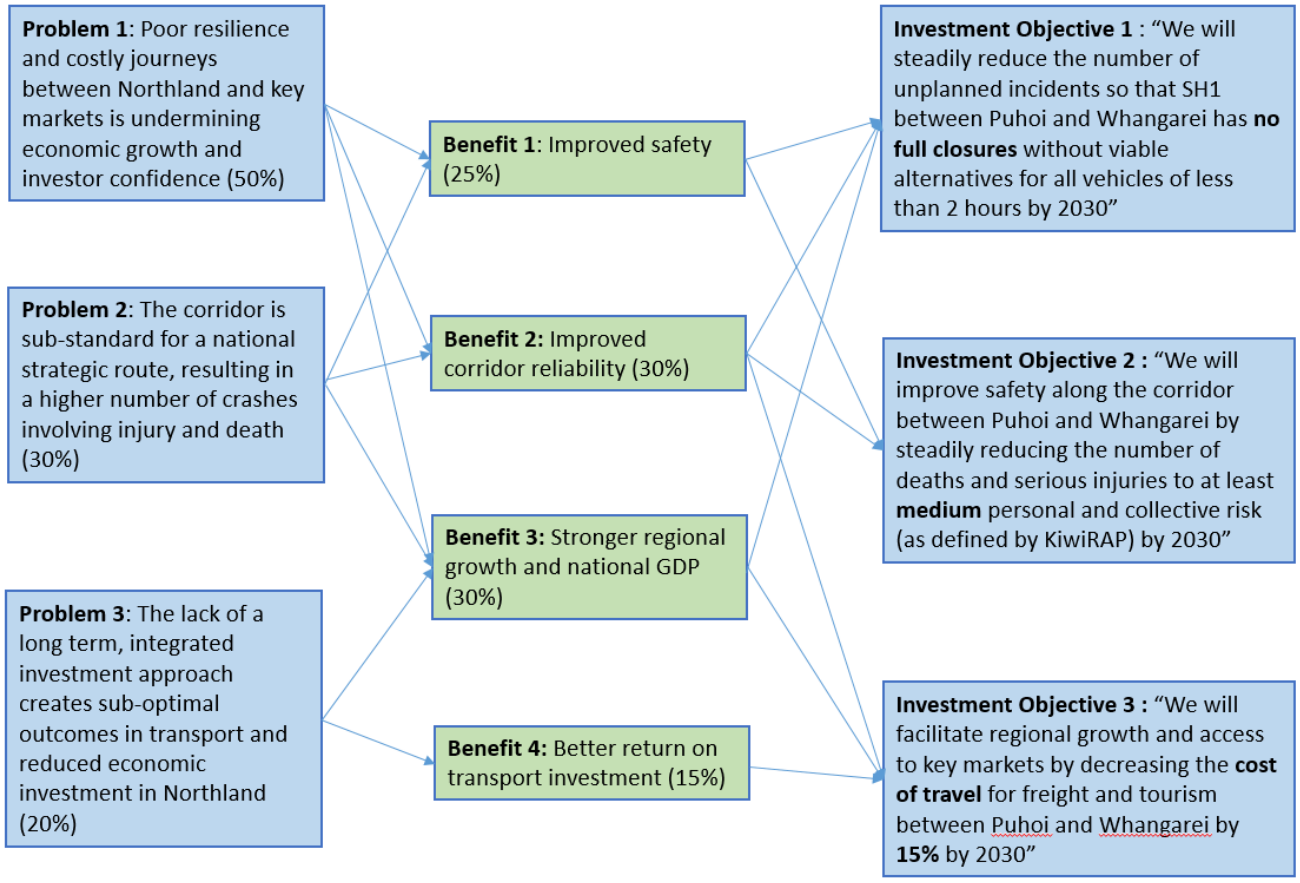
Across the different benefits highlighted above a number of KPIs have been identified during the ILM process, as set out below. These KPIs are consistent with the Investment Performance Measurement: Outcome Classes.

Table 2: Key performance measures

Investment objective	Investment KPI	Measure	Baseline	Target
Investment objective 1: Resilience	Reduction in incidents	Number of full closures per year	27 per year	0 by 2030
	Reduction in incidents without viable alternative	Closure of more than 2 hours with no viable alternative	18 per year	0 by 2030
Investment objective 2: Safety	Reduction in deaths and serious injuries	No. of deaths and serious injuries	144 DSI in 5 year period	58 DSI in 5 years
	KiwiRAP risk rating on each section	Medium personal and collective risk rating	66% personal 11% collective achieve target	All section achieve by 2025
Investment objective 3: Cost of travel	Reduced cost of travel	Average travel speed on corridor	76km/h	90km/h by 2030
	Northland regional GDP	GDP per capita	$35k in 2015 (74% of national average)	National average by 2030

Figure 15 shows how these investment objectives inter-relate to the problems and benefits identified.

Figure 15 : Investment Objective Development



The vision for the Auckland to Whangarei State Highway corridor is a safe corridor which provides reliable journey times to support the economic growth of the region and access to key markets. The long term goal is a divided carriageway on a good alignment between Auckland and Whangarei. Progress towards this will be prioritised based on need and return on investment.

The investment objectives identified for the PBC are consistent with the long term vision for the corridor.

PART B – DEVELOPING THE PROGRAMME

5. ALTERNATIVES AND OPTIONS

5.1 ALTERNATIVE AND OPTION GENERATION

Options and alternatives have been developed and subsequently combine to create programmes of work. This section presents an overview of the methodology adopted with respect to the generation of a long list and summarises the options and alternatives considered.

Options and alternatives were developed to address the problem statements and deliver the agreed investment objectives as agreed with stakeholders. The agreed problem statements and investment objectives for the corridor are set out in Part A - Strategic Case.

The methodology adopted for this process was:

- Initial development of options by project team
- Workshops with Transport Agency technical specialists to further develop and identify new options
- Workshop with stakeholders on 17th March 2016 to further develop and identify new options
- Preparation of assessment criteria by project team, based on Transport Agency guidelines
- Presentation and endorsement of assessment criteria at workshop on 17th March 2016
- Assessment of options and ranking by project team
- Endorsement of option assessment by wider team

Assessment criteria were taken from NZ Transport Agency guidelines for option evaluation, agreed with stakeholders and used to evaluate the identified options and alternatives with respect to their relative ability to deliver against the agreed investment objectives for the corridor.

This allowed the options to be ranked, with the ranking informing the compilation of programmes.

The assessment criteria agreed for this project and endorsed by the stakeholders is shown in Table 3.

The assessment criteria have been grouped according to a number of headline categories, relating to investment objectives, ability to be implemented and an assessment of effects and opportunities.

The ability for an option to be implemented was further broken down into feasibility, affordability and public / stakeholder support. The assessment of effects and opportunities was broken down into cultural heritage, environmental, social and community wellbeing, economy and safety considerations.

At the option long list stage, options have been considered against these headline categories, while the more detailed considerations will be used to evaluate the performance of programmes, once these are developed.

Table 3: Assessment Criteria

Objectives	Considerations	Measures
Investment objectives		
Investment Objective 1	We will steadily reduce the number of unplanned incidents so that SH1 between Puhoi and Whangarei has no full closures	Reduced volume, duration and impact of SH1 closures

Objectives	Considerations	Measures
	without viable alternatives for all vehicles of less than 2 hours by 2030	
Investment Objective 2	We will improve safety along the corridor between Puhoi and Whangarei by steadily reducing the number of deaths and serious injuries to at least a medium personal and collective risk (as defined by KiwiRAP) by 2030	Reduced deaths and serious injuries on the corridor
Investment Objective 3	We will facilitate regional growth and access to key markets through increasing freight and tourism average travel speeds to 90 km/h by 2030	Average travel speed over the corridor
Ability to be Implemented		
Feasibility	How straightforward is it to implement this alternative / option?	Level of complexity. I.e. tunnelling, community consultation, challenging ground conditions etc.
	Are innovative technologies involved?	Level of innovation
	Are there significant hazards that may pose a health, safety in design risk?	Level of hazards
	Are there likely property risks?	Impact of project on property
	Are other infrastructure providers affected?	Other organisations beside NZTA
	Are there consenting risks that could affect delivery or cost risk?	Level of consenting risk for option
	Are there factors likely to affect the ability to operate / maintain the option over its projected life without major additional costs?	Maintenance and operation costs
Affordability	What are the funding risks of the alternative/option?	Included in the RLTP to no funding allocation
	Can the alternative be funded traditionally? (economic efficiency)	Estimated economic efficiency of project
	Are alternative funding mechanisms required?	yes / no
	Are there cashflow risks that might affect the delivery programme?	yes / no
	Are there ongoing operating cost risks?	Level of operating costs

Objectives	Considerations	Measures
	Are operating subsidies required? How will these be funded?	Tolling / PQP procurement
Public / Stakeholders	Has the alternative been made public?	Yes / no
	How acceptable is the alternative?	Level of anticipated acceptance
	Are there real or anticipated objections from the community or stakeholders?	Level of anticipated acceptance by stakeholders
Assessment of Effects		
Cultural heritage, environmental, social and community wellbeing	Are there any sites or features (including their setting) of significance to Maori (archaeological or existent) affected?	
	Are there any historic heritage places (including their setting) (e.g. archaeological or buildings, sites, remnants) affected?	
	Are any (first tier) outstanding landscapes or natural features, or (second tier) significant/special landscape or natural features affected?	Environmental mapping
	Are there any ecological areas, or areas with habitat value (inc large areas of native vegetation) affected?	
	Are there any coastal marine areas, wetlands, lakes, rivers, streams or their margins affected?	Environmental mapping
	Are there any areas of contaminated land affected?	
	Are there community facilities (park/schools/ hospitals etc.), or residential or other sensitive land uses in the area that could be affected by adjacency effects (e.g. noise, disruption, vibration, air quality etc.)?	Assessment of proximity to settlements
	Are there potential effects from hazards or risks (including from future climate change) from erosion, flooding, fault lines, sea level rise	
	Extent to which the option integrates transport and land use to make best use of existing networks and infrastructure.	Extent of integration with land use aspirations
	Are there any communities affected by reduced cohesion, connectivity or accessibility?	Qualitative assessment of access to the road network

Objectives	Considerations	Measures
	Are there opportunities to enhance the active travel modes - cycling and walking and/or linkages to other national or regional recreational cycle networks for longer distance cyclists?	Qualitative assessment of access to alternative modes
	Extent and significance of land take, severance; negative and positive opportunities	Severance / connectivity
Economy	How will the alternative/option affect traffic volumes?	Level of growth catered for
	Does the option provide an opportunity to reduce vehicular travel time on SH1 between the Auckland and Northland regions?	Qualitative evaluation
	Does the option improve journey time reliability?	Qualitative evaluation
	Are there gainers and losers (modes / regions)? What is the overall effect?	Qualitative assessment of overall benefits to surrounding communities
	Does the option provide for more efficient freight supply chains between the Auckland and Northland regions	Route quality
	How well does the option integrate with land use with reference to regional growth strategies	Consistency with regional growth strategies
	How well does the option enhance the development potential of adjacent land / attract new jobs / help existing businesses?	Qualitative assessment of access to land use
	How well does the option preserve the function of SH1 as a National High Volume route, consistent with ONRC	Qualitative evaluation
	How well does the option address route security, resilience and flexibility	Extent to which the option improves route resilience
Safety	How will the alternative enhance safety for different types of transport users?	Alternative mode safety
	Will it involve gainers and losers in terms of safety?	Adverse safety effects from the option.
	Are there impacts on personal safety / security?	Assessment of the reduction in crash risk
	What is the impact on fatal / serious injuries?	Assessment of reduction in DSI

5.2 OPTION LONG LIST

A list of more than 115 options was developed with reference to the Agency's intervention hierarchy, in order to optimise investment in the corridor.

Firstly, a range of options that aimed to better integrate land use and transport were identified, such as safer access to rest areas, bypassing settlements and rationalising property accesses onto the State Highway.

Options that delivered a more resilient outcome were identified next. These options are intended to reduce or remove the closure of the existing state highway and improve the alternative routes available to customers.

A further suite of options focussed on making the best use of the existing network was identified as well as operational solutions. These options include a review of road marking and advisory signage to ensure consistency across the corridor. Side barriers, shoulder widening, speed restrictions and police enforcement to manage travel speeds were also considered. Social programmes focussed on the current safety issues related to alcohol and driving standards were identified.

A wide range of new infrastructure solutions were also identified, from very large offline schemes, to smaller corner realignments and intersection improvements. These were evaluated based on the level of service requirements for the corridor as well as affordability and realistic need.

The Auckland to Whangarei transport corridor is multi-modal and therefore options for the enhancement of other modes to address the investment objectives were also considered. This included options that increased the capacity of the rail network, including significant strengthening and tunnel widening works, increasing the role of costal shipping, park and ride options and active mode options.

The full list of options is included in **Appendix G** as well as further detail on how the assessment criteria was applied to the assessment of each option.

5.3 ALTERNATIVE AND OPTION ASSESSMENT

An initial assessment was undertaken for each 'head' criteria. A seven point assessment system was used, ranging from +++ for a strongly positive performance to --- for a strongly negative performance in comparison with the do minimum. This is a coarse system, given the broad nature of the assessment, however is considered appropriate at this long list stage. **Appendix G** outlines this process in more detail and the assessment of individual options.

The application of the assessment criteria to the options identified the following key outcomes:

- The cycling and walking options were assessed to not have a noticeably positive effect on any of the investment objectives
- The best performing option was safety improvements in the Dome Valley
- There were a number of highly ranked options which including operational interventions such as improved wayfinding signage on detour routes and improved police enforcement
- Highly ranked larger capital schemes included a bypass of the Brynderwyn Hills and a 2+2 configuration between SH15 and Whangarei
- Upgrade of diversion routes scored well providing resilience benefits and benefits to local communities
- The worst performing options were the freight lanes in Auckland and passenger rail between Marsden Point and Auckland

Overall, the conclusion of this long list assessment is that there is a wide range of options and ways to meet the project objectives from cheaper operational options, through to large-scale capital-intensive interventions.

5.3.1 Option Analysis

In order to analyse options in more detail, the corridor was divided into sections and a number of potential options for each section identified. Many operational interventions were applied across a number of sections, with physical options varying between sections. For example, a range of improvements such as a divided carriageway 1+1 arrangement, 2+1 divided carriageway, 2+2 divided carraigeway, offline and online were identified for the section between Toetoe Road and Oakleigh. None of these options were discarded, but some options were considered to respond better to specific issues than others. For example, an offline alignment provides travel-time savings while a divided 1+1 online alignment with wire rope responds to the high number of head-on collisions on this section. Option analysis considerations are summarised by section below:

- **Operational interventions** – A suite of non infrastructure projects were considered for the corridor, making best use of the existing infrastructure. Interventions included a strong focus on education and licensing, enforcement of speed, alcohol and heavy vehicle loads. Land use rules and regulations were considered including zoning and access restrictions. Operational options included measures to improve response times to incidents, reduce maintenance delays, improve detour operations and monitoring of the corridor. A suite of improvements were identified for tourists including improved road markings, signage and more frequent rest stops. Out of the box options such as freight lanes from Puhoi north and subsidised hotel rooms were also considered.
- **Alternative modes** – A number of options to increase the role of other modes were considered, including increased coastal shipping capacity, increased rail operation and walking and cycling schemes. The walking and cycling schemes were assessed as having good benefits, particularly with respect to tourism, albeit with limited impact on the safety and resilience problems identified in the corridor. Rail options provided opportunity to increase the rail mode share, particularly for freight trips. This was assessed positively, however delivered comparatively small outcomes for safety, resilience and economic growth with very significant implementation costs. Coastal shipping enhancements were assessed similarly to rail, with operational challenges more the issue rather than costs, with good outcomes predicted if implemented (like rail). Cycle provision has been considered over the length of the corridor providing access to the existing network and making best use of existing infrastructure.
- **SH14 to Toetoe Road (urban Whangarei)** – This predominantly urban section included a number of options focussed predominantly on additional capacity to meet expected increases in traffic demand and to tie into currently planned four-lane works between SH14 and the I-site in Otaika. Safety, increased reliability and provision for other modes, particularly walking and cycling, were also considered given the urban nature of this section. The options that best addressed capacity, safety and resilience were 2+2 alignments. Both online and offline options were considered. Both online and offline present significant challenges due to the built up nature of this section of the corridor and the close proximity of shops and dwellings.
- **Toetoe Road to Oakleigh** – This section has a high collective risk rating, including a number of recent head-on fatalities. Traffic demand forecasts indicate that additional capacity will be required within 10 years. A range of interventions were considered from very site-specific safety improvements, to comprehensive offline solutions. A major assessment consideration was the comparison between an online upgrade of this section with an offline alignment near

the Portland cement works. The offline option performs better from a safety perspective and provides travel time savings, whilst the online solution likely requires less property. Different options for this section were included in different programmes to allow different levels of intervention to be assessed, with the offline solution assessed to deliver the greatest outcomes in this section, albeit for a higher cost.

- **Oakleigh to Port (SH15)** – An IBC completed for this section concludes that an upgrade is required immediately to address the safety problem and additional capacity will be required by approximately 2025. Options for additional capacity beyond 2025 were assessed, including offline and online options in the form of either 2+1 or 2+2. The IBC recommended online upgrades as the online alignment is adequate and offline options would be more expensive with minimal additional benefit. The form of the solution was also assessed, with 2+2 considered the best long term solution as a 2+1 solution does not provide the long term capacity required and would only be 'useful' for a relatively short period of time before 2+2 was required. The level of disruption to implement two upgrades was not valued highly and the incremental benefits of this would be poor. The recent increased levels of growth at Ruakaka and Marsden Point were also factored into this assessment, as recent growth has been considerably higher than previous years.
- **Port (SH15) to Brynderwyn Hills** – A number of longer-term options were assessed in this area, including online and offline solutions in the form of 2+1 and 2+2 arrangements. The flat terrain and good existing alignment meant an offline alignment in this area is expensive and likely to provide little additional benefit. The capacity forecasts and current operation of this section also means that 2+1 solutions are adequate to meet forecast demands and therefore meet the needs of the corridor for the next 30 years. 2+2 options provided further additional capacity, but little additional benefit with respect to travel time or safety.
- **Brynderwyn Hills to SH12** – A wide range of options were assessed in this area to address the safety, resilience and travel time (speed) problems. This included consideration of online upgrades (to complement the online realignment currently under construction on the northern side of the hills), bypasses to the west and east of the current alignment and tunnelling through the Brynderwyn Hills. Western bypasses were considered to better address the identified problems as the eastern bypass terrain is poorer than the current alignment and online options would be very challenging to build and deliver against the investment objectives for the project. The tunnel option performed well, although was significantly more expensive. Three western bypass options were assessed, from a relatively short section to a larger and more significant realignment. The bigger the bypass, the flatter the resultant grades, but longer the total journey. The middle western bypass option was assessed as striking the best balance. A number of western bypass options were included in different programmes to allow the different level of outcomes to be considered at the programme level.
- **SH12 to Te Hana** – A number of options were considered in this section, from online minor upgrades through to offline 2+2 options. The 'bigger' options delivered greater outcomes, however, in this section the gap between these 'bigger' options and smaller ones was not as significant as in other areas of the corridor as the future demand is forecast to be low and level of problems were not to the same scale. Detour upgrades were also considered through this section.
- **Te Hana to Warkworth** –The Warkworth to Wellsford RoNS is assumed part of the do minimum for this PBC and one of the key considerations for this section was to confirm a termination point, including the extension of the RoNS to beyond Te Hana or Kaiwaka. The key consideration in this regard was the inclusion of options to address the problems of resilience and travel time through Te Hana. There are a number of constraints from a social, cultural and environmental perspective in Te Hana and the extension of the RoNS project was assessed as providing the strongest investment outcomes for the least impact. Options in this section are likely to be longer-term solutions and therefore options for shorter-term

implementation were also developed and assessed as performing well, particularly safety focussed options through the Dome Valley, which currently has a high-risk rating. The Kaiwaka township is also located on this section and consideration was given to safety and amenity improvements.

- **Puhoi to Warkworth** – With the RoNS well advanced, this section focussed on more operational options to maximise the opportunity the RoNS provides, included Park and Ride at Warkworth and localised safety enhancements to the existing road network.

5.3.2 Options which do not address the investment objectives

At the long list stage of the assessment some options were discarded, as they did not fundamentally address the investment objectives.

A number of walking and cycling schemes were identified along the corridor. In isolation, they were not considered to meeting the investment objectives of increasing the average corridor speed to 90 km/h, reducing deaths and serious injuries or reducing full closures of more than two hours along the corridor. However, many of these options represent opportunities to enhance the journey experience of the corridor at little cost. They could therefore be considered further with respect to the recommended programme.

Passenger rail was also discarded at this stage as it requires substantial investment to implement (estimated at over $1B) and, as it is likely to attract only a small proportion of general traffic from the corridor, has limited impact on the investment objectives.

Some of the more extreme options were also discarded at this stage, such as a proposed southern hemisphere space port for Virgin Galactic near Waipu.

Overall, very few options were discarded as being fatally flawed. However, as will be discussed in subsequent sections, not all remaining options were included in a programme in the next stage.

6. PROGRAMME OPTIONS DEVELOPMENT AND ASSESSMENT

6.1 PROGRAMME DEVELOPMENT

6.1.1 Initial Programme Development

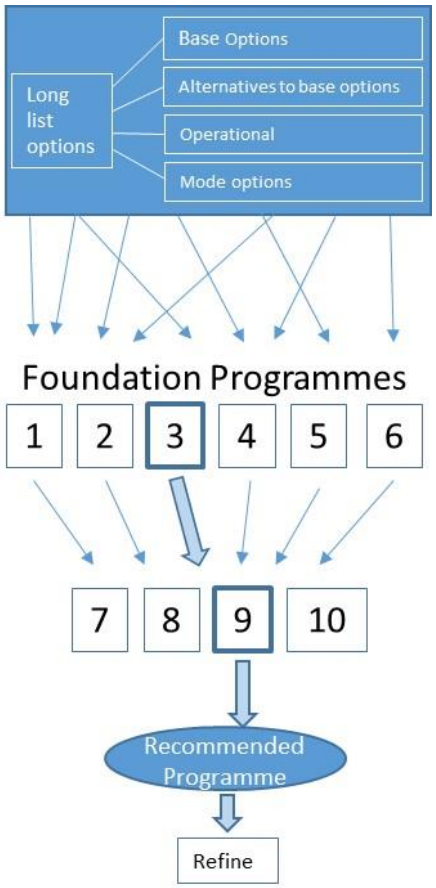
The SH1 Auckland to Whangarei PBC is a programme of works to address the corridor problems and deliver on the investment objectives. The ultimate programme will almost certainly be a package comprising a number of options.

This section summarises how the development of proposed programmes has been undertaken in a robust and transparent manner. The Transport Agency's Alternatives and Preferred Programme templates have been used to describe each programme. These templates and a detailed description of how programmes were developed is provided in **Appendix H**.

The assessment of long list options against the above criteria and relative scoring between options was a key consideration when developing each programme.

Initially, six 'foundation programmes' were developed to address individual investment objectives (programmes 1-3) with three additional programmes developed addressing the key risks and uncertainties on the corridor; investment in response to high growth, significant investment in alternative modes and a low level of investment focusing on low impact and operational measures. An outline to the process adopted is provided in Figure 16.

Figure 16 : Programme development process



The foundation programmes were developed by examining sections of the route and reviewing the options assessment to identify the best performing options for the assessment criteria related to each foundation programme. An example is Programme 1 where the best performing resilience options along the corridor were identified and compiled.

Fundamental to each programme was a suite of operational and non-infrstructure projects. A number of projects scored high in the option assessment and could be implemented with each of the programmes improving the use of existing infrastructure on the corridor in the short term.

These 'foundation programmes' were

- **Foundation Programme 1** - Resilience: This programme addresses critical resilience issues on the corridor and specifically aims to reduce full closures of more than 2 hours with no viable alternative route. It extends the RoNS to north of Te Hana and includes a bypass of the Brynderwyn Hills, as these are two high resilience risk locations. It provides a 2+2 alignment between Whangarei and SH15 (as contra-flow can be facilitated more easily on a separated carriageway). It also improves detour routes to be HPMV capable, provides a Park and Ride facility at Warkworth (as an alternative to car travel) and improves VMS to provide early warning of closures and viable detour options.
- **Foundation Programme 2** – Low Cost Safety: This programme addresses critical safety issues, predominantly using the existing route. It deliberately chooses interventions that are online, and require minimal road widening, therefore typically at a lower cost than larger intervention, including shoulder widening, corner realignments, access rationalisation, wire rope barriers, online improvements to the southern side of the Brynderwyn Hills, rest areas and travel time signage to combat fatigue. It also recommends increased police enforcement and driver education campaigns targeted at fatigue and speed.
- **Foundation Programme 3** – Economic Efficiency: This programme aims to achieve an average speed of 90 km/h for all vehicles travelling between Auckland and Whangarei. This is used to measure the decrease in cost of travel as a proxy for enabling economic growth in Northland. This programme recommends extending the four lane upgrade from Wellsford to north of Kaiwaka, bypassing the Brynderwyn Hills to the west and a full 2+2 upgrade on the current alignment from the base of the Brynderwyn Hills to Whangarei, including a four lane urban section in Whangarei.
- **Foundation Programme 4** – One Network Road Classification (ONRC): This programme aims to address the ONRC aspirations of this National High Volume corridor. It provides a full 2+2 expressway standard route between Puhoi and Whangarei (Toetoe Road) which will be constructed offline. Within Whangarei, a four-lane urban section is provided to the SH14 intersection.
- **Foundation Programme 5** - Alternative Modes: This programme aims to maximise alternative mode opportunities between Auckland and Northland. It includes Park and Ride provision at Warkworth and Wellsford and significant investment in the rail line to enable it to carry full size 20TEU containers. It also includes passenger rail services and the construction of the Whangarei to Northport rail line. Increased coastal shipping capacity is also assumed. Offline cycleways are included between Whangarei and Waipu and between Puhoi and Wellsford.
- **Foundation Programme 6** - Least Impact: This programme aims to address the investment objectives while having the lowest possible physical impact on corridor. Therefore, a number of minor online safety improvements and minor intersection improvements are recommended, as well as rest areas and investment in police enforcement, improvements to detour routes and improved provision for cyclists.

Following the development of the foundation programmes, the project team undertook an assessment against the MCA criteria to establish the effectiveness of each. This assessment was presented to the stakeholder group at Workshop 3. Stakeholders were given the opportunity to comment on each programme and its assessment.

6.1.2 Further Programme Development

Each foundation programme was developed to address a specific project objective or issue. With the knowledge of how each foundation programme performed with respect to the MCA; at Workshop 3, stakeholder groups were asked to develop programmes that best responded to all of the investment objectives. Groups were asked to take the best aspects of each foundation programme (as well as any other options that they felt would be appropriate) to create a recommended programme. Using this approach, four further programmes were developed, being:

- **Programme 7 – Stakeholder 1:** A variant of the 90km/h programme with the exclusion of any large infrastructure projects between Te Hana and Kaiwaka.
- **Programme 8 – Stakeholder 2:** Similar to the Resilience programme with a lesser treatment on the Brynderwyn Hills to SH15 section, an online solution between Oakleigh and Toetoe Road and Whangarei urban improvements added.
- **Programme 9 – Stakeholder 3:** Similar to the Resilience programme with a lesser treatment on the Brynderwyn Hills to SH15 section, an offline solution between Oakleigh and Toetoe Road and Whangarei urban improvements added.
- **Programme 10 - Stakeholder 4:** A variant of the 90km/h programme with a 2+1 solution on the Brynderwyn Hills to SH15 section.

Appendix H outlines these programmes in detail.

6.2 DO-MINIMUM

A Do Minimum programme has been developed for this corridor, against which the recommended programmes are assessed. In the first instance, the Do Minimum was developed through engagement with relevant areas of the Transport Agency. It was endorsed by the project stakeholders at Workshop 2.

In order to determine the Do Minimum network for this corridor, projects that are currently under construction, or are planned/committed have been included. The Do Minimum is summarised in Table 4.

Table 4: Do Minimum

Project	Do Minimum	Discussion
Ongoing maintenance	Yes	NOC agreements
Puhoi to Warkworth RoNS	Yes	PPP currently being tendered, complete 2022
Warkworth to Wellsford RoNS	Yes	Proposed completion by 2027
Loop Road north intersection upgrade	Yes	Intersection with Portland Road improvements 2018

Northern Brynderwyn Hills upgrade	Yes	Current safety works completed late 2016
Rail Network	Yes	No upgrades
SH14 Hospital intersection	Yes	Assume in place 2017

6.3 PROGRAMME ASSESSMENT

A three-stage programme assessment approach was used as shown in Figure 16. Firstly, the foundation programmes were assessed against the MCA criteria and then the programmes developed in collaboration with the stakeholders were assessed against the same criteria. The third step was the consideration of other factors outside of the MCA. **Appendix H** outlines in detail the assessment undertaken for the programmes, including completion of the Transport Agency programme assessment forms. A summary of the assessment undertaken is included in this section of the report.

6.3.1 Foundation Programme Assessment

The foundation programmes were developed to best address a specific issue, being one of the investment objectives, low impact or ONRC aspirations. These programmes therefore performed very well against some, but not necessarily all, assessment criteria.

Of these programmes, Programme 5 (Alternative Modes) and 6 (Least Impact) delivered the least well against the assessment criteria. Programme 5 is very expensive due to the cost of upgrading the rail line and its ability to significantly improve the safety and reliability of the road corridor is considered low. Programme 6 conversely has little impact on the environment and from a cost perspective provides exceptional value, however the scale of expected outcomes against the investment criteria was considered low. These two programmes were therefore discounted from consideration as a preferred programme.

Programme 1 performed very well against the resilience objective, however comparatively it did not perform as well as against the other investment objectives and its economic efficiency was not strong. Programme 2 likewise performed well against the safety criteria and reasonably well from an economic efficiency perspective, however did not address the economic growth investment objective well. These two programmes were therefore discounted from consideration as a preferred programme.

This left Programme 3 (Economic Efficiency) and Programme 4 (ONRC) which performed the best (and similarly) against all investment objectives and the best of all the foundation programmes. The assessment highlighted that a bigger investment provided a greater level of benefits for the corridor. The results do however, indicate a level of diminishing returns once a certain level of investment as demonstrated by the relatively close scoring of Programmes 3 and 4 with a large cost differential

It is however noted that both programmes are expensive and perform poorly from an economic efficiency perspective. However, these two programmes remained in contention for the recommended programme at this point.

As outlined previously, further programmes were then developed, taking the best from each foundation programme. These programmes were assessed and compared against the two best performing foundation programmes.

6.3.2 Further Programme Assessment

Programmes 7-10 were assessed against the same criteria as the foundation programmes. Interestingly, although developed separately by each stakeholder group, all four programmes are similar in form and therefore perform similarly against the assessment criteria.

Programme 10 was the best performing of these four programmes, best meeting the investment objectives and delivering strong outcomes.

Programmes 7, 8 and 9 performed slightly less well than Programme 10. Whilst these three programmes performed very similarly, Programme 9 was the best of these three due to its better affordability and stronger performance from a resilience perspective.

Programmes 7 and 8 were therefore discounted, leaving Programmes 9 and 10.

This left Programmes 3, 4, 9 and 10 still within contention. Figure 17 summarises the programme assessment, relative ranking of the programmes and the outcomes expected for the investment. The initially discarded programmes are 'greyed' out, to highlight the four programmes still in 'in play' for the recommended programme.

Figure 17: Programme Assessment

	Programme 1 – Resilience	Programme 2 – Safety	Programme 3 – Efficiency (90 km/h)	Programme 4 – ONRC	Programme 5 – Alternative Modes	Programme 6 – Least Impact	Programme 7	Programme 8	Programme 9	Programme 10
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Summary										
Objective 1 – reduce full closures with no alternative route	+++	+	+++	+++	+	+	+++	+++	+++	+++
Objective 2 – reduce deaths and serious injuries	++	++	+++	+++	+	+	++	++	++	+++
Objective 3 – increase travel speed to 90 km/h	++	0	+++	+++	0	0	+++	++	++	+++
Feasibility	–	–	–	– –	–	–	–	–	–	–
Affordability	–	0	– –	– –	– –	–	– –	–	0	–
Public / Stakeholders	0	–	+	+	–	–	+	+	+	+
Cultural, Social and Environmental Effects	–	0	–	–	0	0	–	–	–	–
Safety	++	++	++	++	+	+	++	++	++	++
Economy	++	0	++	+++	0	0	++	++	++	++
Ranking	7	8	3	1	11	9	6	5	4	2
Average score	**8.7**	**3.1**	**11.0**	**11.9**	**-0.4**	**0.8**	**9.8**	**9.9**	**10.3**	**11.6**
Cost (Lower Bound)	$970	$430	$1,900	$2,200	$1,000	$430	$1,500	$820	$880	$1,700
Cost (Upper Bound)	$1,500	$730	$2,800	$3,200	$2,300	$650	$2,400	$1,300	$1,400	$2,500
Cost (Lower Bound) NPV 2025	$610	$270	$1,200	$1,390	$630	$270	$950	$520	$550	$1,070
Cost (Upper Bound) NPV 2025	$950	$460	$1,760	$2,020	$1,450	$410	$1,510	$820	$880	$1,580
Benefits	$470	$240	$540	$620	$310	$310	$450	$410	$530	$550
BCR lower	**0.8**	**0.9**	**0.5**	**0.4**	**0.5**	**1.1**	**0.5**	**0.8**	**1.0**	**0.5**
BCR upper	**0.5**	**0.5**	**0.3**	**0.3**	**0.2**	**0.8**	**0.3**	**0.5**	**0.6**	**0.3**
Programme Performance	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**
Investment Objective 1: Proportion with viable alternative	100%	70%	100%	100%	70%	70%	100%	94%	100%	100%
Investment Objective 2: KiwiRAP corridor rating (collective)	0.10	0.14	0.09	0.08	0.14	0.14	0.08	0.10	0.10	0.08
Investment Objective 3: Mean vehicle speed km/h	81.7	78.5	84.8	86.6	79.7	79.7	81.7	82.5	82.1	86.6
Approximate travel time saving on corridor (min)	5.0	1.4	9.5	11.9	2.6	2.6	6.0	6.4	5.6	11.9
Reduction in DSI's per 5 years	85	77	91	99	64	64	99	85	86	99
Scoring – All average weights	9	3	11	12	0	1	10	10	10	12

The four remaining programmes, as shown in Figure 17, are the four highest ranked programmes based on the MCA. At a macro scale, the four programmes perform similarly with respect to the investment outcomes sought. There are however, differences between the four programmes. This is summarised as follows:

- **Resilience** – All of the four remaining programmes deliver well against this objective, will each programme resulting in 100% of the corridor meeting the investment objective. Not all of the previous discarded programmes achieve this level of outcome. In addition, all four of the programmes will deliver significant reductions in the number of incidents causing closure through improved safety performance and bypass of problem areas.
- **Safety** – Programmes 3, 4 and 10 deliver the greatest reduction in DSI's with the corridor meeting the objective of a medium KiwiRAP Collective and Personal Risk rating or better by providing a Low rating and between 90 and 100 DSI's forecast to be saved in a five year period. Programme 9 also delivered an overall Collective KiwiRAP rating for the corridor of Medium and over 85 DSI's forecast to be saved in a five year period.
- **Economic Growth (90km/h)** – Programmes 10 and 4 deliver the greatest outcome for this objective, with an average speed of more than 86km/h, which equates to a travel time between Puhoi and Whangarei of 1hr and 08 mins (1:08), representing over 10 minutes saving in travel time. Programme 3 is next with an average speed of 85km/h and Programme 9 the next best with an average speed of 82km/h, which equates to a travel time between Puhoi and Whangarei of 1:13 mins, representing over five minute saving in travel time.

Correspondingly, the NPV economic benefits for these four programmes are similar, with a range of between **$530M and $620M**.

Sensitivity testing of the MCA was undertaken by doubling the weighting for specific criteria. This is summarised in Figure 18. This shows some changes in order, but fundamentally the ranking of a programme stayed within one position of its base ranking, indicating that there was not a significant sensitivity to a particular category. The partial exception to this is the affordability criteria where more affordable programmes did gain a number of placings in the rankings.

Figure 18 : Programme Sensitivity Testing

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Summary										
Objective 1 – reduce full closures with no alternative route	+++	+	+++	+++	+	+	+++	+++	+++	+++
Objective 2 – reduce deaths and serious injuries	++	++	+++	+++	+	+	++	++	++	+++
Objective 3 – increase travel speed to 90 km/h	++	0	+++	+++	0	0	+++	++	++	+++
Feasibility	–	–	–	--	–	–	–	–	–	–
Affordability	–	0	--	--	--	–	--	–	0	–
Public / Stakeholders	0	–	+	+	–	–	+	+	+	+
Cultural, Social and Environmental Effects	–	0	–	–	0	0	–	–	–	–
Safety	++	++	++	++	+	+	++	++	++	++
Economy	++	0	++	+++	0	0	++	++	++	++
Ranking	7	8	3	1	11	9	6	5	4	2

Sensitivity Testing	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**
Objective 1 – increase travel speed to 90 km/h	7	8	3	1	10	9	6	5	4	2
Objective 2 – reduce deaths and serious injuries	7	8	3	1	10	9	6	5	4	2
Objective 3 – reduce full closures with no alternative route	7	8	3	1	11	9	4	6	5	2
Feasibility	7	8	3	2	11	10	6	4	5	1
Affordability	7	8	4	3	11	10	6	5	2	1
Public / Stakeholders	7	8	3	1	11	10	6	5	4	2
Cultural, Social and Environmental Effects	7	8	3	1	11	9	6	5	4	2
Enhanced safety for different types of transport users?	7	8	3	1	10	9	6	5	4	2
How will the alternative/option affect traffic volumes?	7	8	3	1	10	9	5	6	4	2

6.3.3 Other Considerations

A significant difference between the programmes is the affordability, with Programme 9 less than half of the cost of the other three programmes. This is shown in the sensitivity testing where Programme 9 jumps to the second ranked programme, from fourth when affordability is weighted more heavily.

Therefore, although Programme 9 is the 4th ranked programme in the MCA it has been selected as the recommended programme. This is because it delivers a similar level of benefit and investment outcome (at a macro level) as the three programmes ranked above it in the MCA, but it achieves this for approximately 40% of the cost. It therefore has far superior economic efficiency. It is also the only programme of these four with a BCR approaching the required economic efficiency of 1.0, with a BCR range of **0.6 to 1.0**.

Figure 19 shows the relative performance of the programmes from an economic efficiency perspective and the level of transport benefits the investment can sustain (based on the problems identified). Programme costs are reported as a range to reflect the level of detail available for cost estimates.

A threshold of programme benefits has been estimated (as indicated by the background colours) based on the problems and investment objectives identified for the corridor. This has been developed in an effort to right size the investment response. As a rough guide, $400-$500M (NPV) of benefits are considered to meet the investment objective. Programme which exceed this are providing additional benefits from those sought by the investment objective.

While most of the programmes follow a general trend of 'more investment – more benefits', the assessment indicates a level of diminishing return after a certain point. Programme 9 strikes the best balance between delivering the available level of benefits in the corridor for an economically efficient investment.

Figure 19 : Comparative Economic Efficiency of Programmes

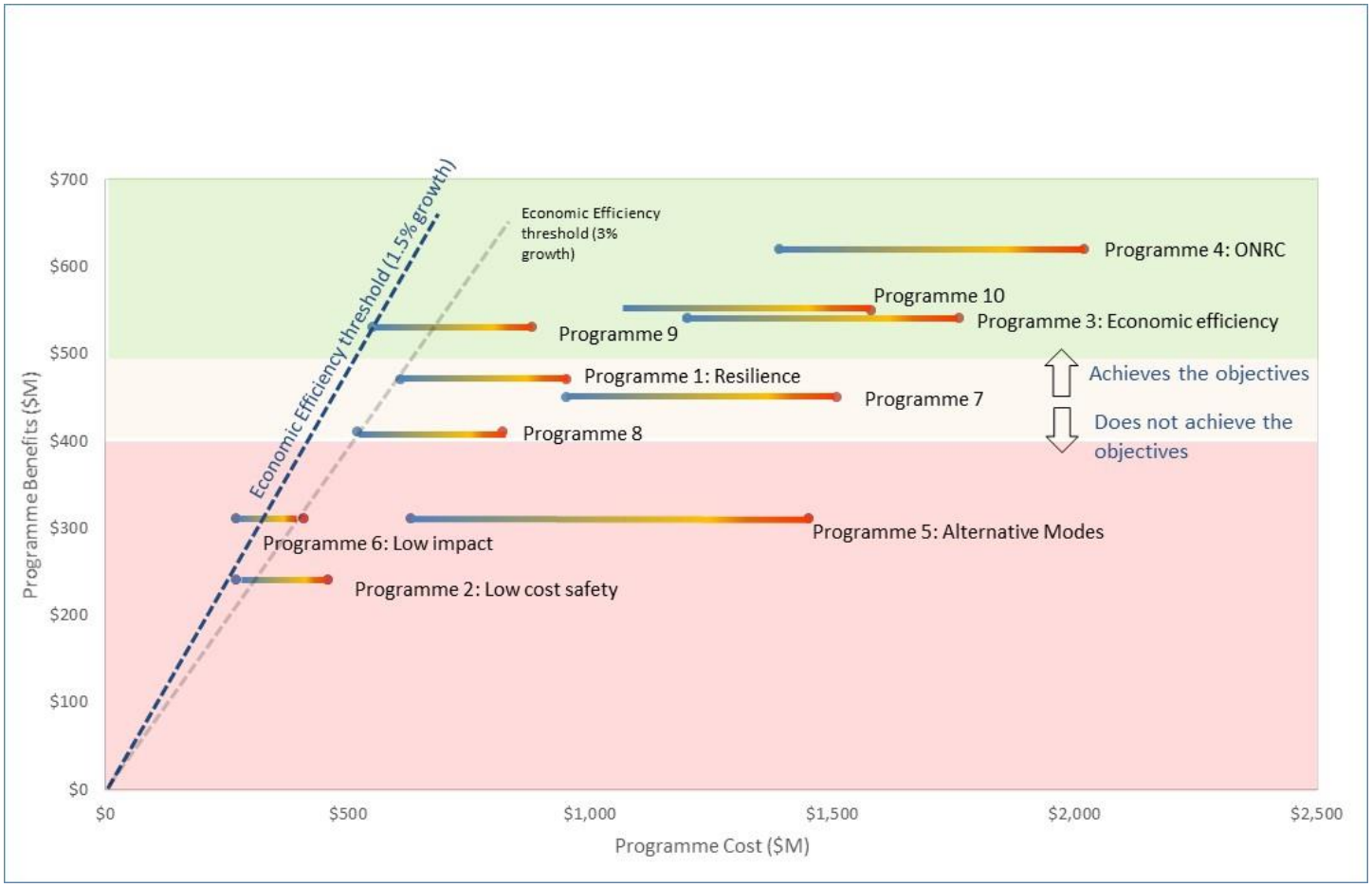


Figure 19 also indicates the change in economic efficiency threshold if forecast traffic demand on the corridor was doubled from an average of 1.5% to 3%. It indicates that Programmes 1 and 8 may become economically efficient, but that these do not deliver as fully against the agreed investment objectives. It also shows that Programmes 3 and 10, while delivering more against the investment objectives, do not become economically efficient. If greater transport outcomes were desired, Programme 4 delivers the most benefits.

There may be other reasons to justify further investment in transport outcomes that have not been considered as part of this assessment (including Wider Economic Benefits as an example). Further work would be required to quantify and justify this additional investment if additional outcomes were desired.

7. RECOMMENDED PROGRAMME

7.1 PROGRAMME OVERVIEW

The vision for this corridor is that it is safer and more reliable with a level of performance and quality of alignment and form comparable to other New Zealand roads of a similar classification, so that it is not an impediment to growth.

In a financially unconstrained environment, this vision may indicate that a four lane expressway standard alignment is required. However, this business case indicates that the transport benefits available in the corridor alone do not warrant investment of the scale necessary to deliver that outcome within the next 30 years.

The recommended programme for SH1 between Puhoi and Whangarei therefore comprises a range of interventions, including operational, supporting infrastructure (rest areas and service centre) and both online and offline alignment enhancements. The schemes that make up the recommended programme are outlined in Table 5 and Figure 20 (pictorially) although the exact details of the alignments will be confirmed in subsequent IBC stages.

Table 5 : Recommended Programme Components

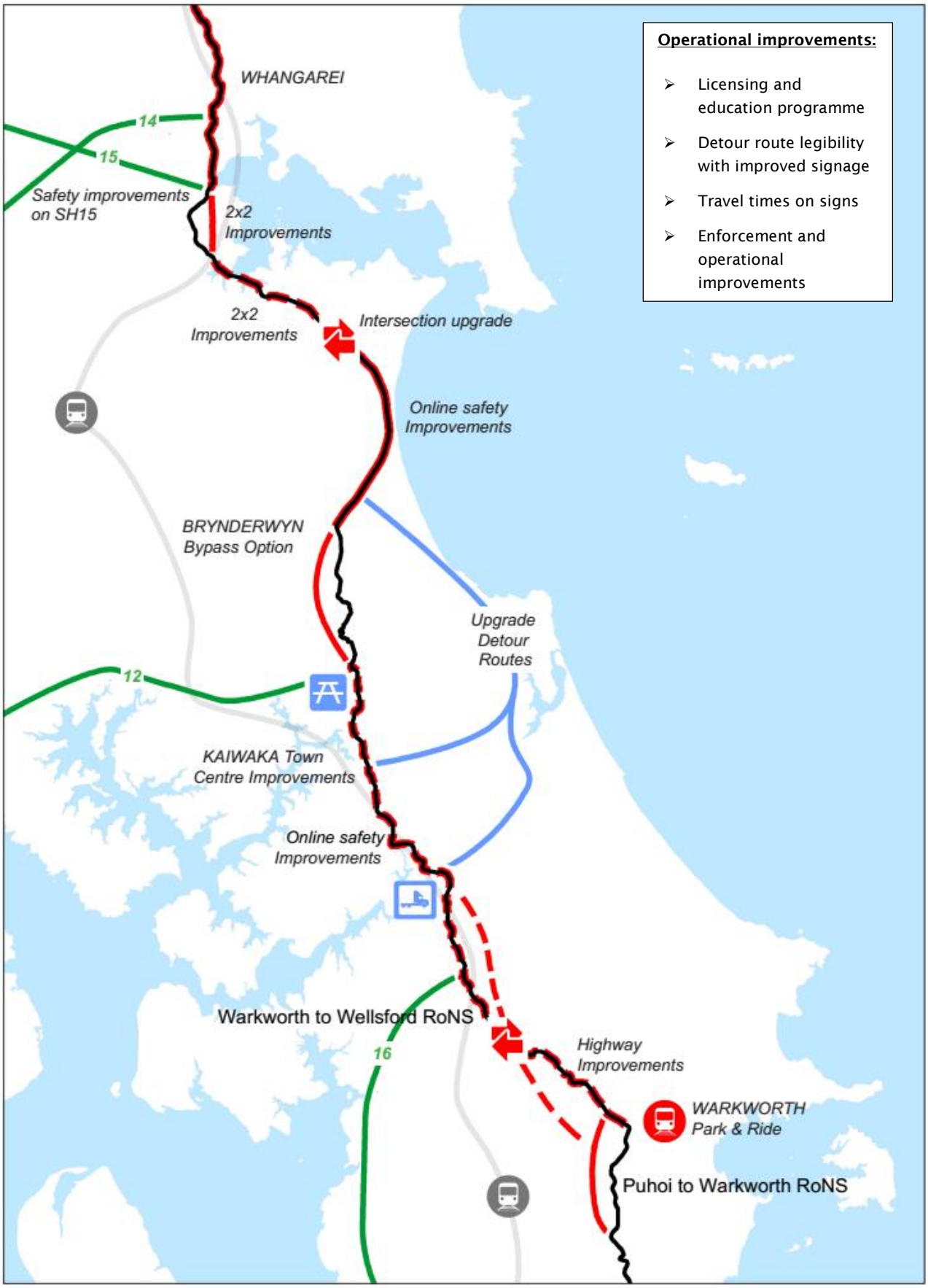
Section	Infrastructure Investment
OPERATIONAL - Driver education and enforcement	Licence assistance – programme to assist young people in Northland to obtain drivers licenses. Programme implemented in partnership with local councils and the NZ Police. Alcohol education programme to target areas of poor compliance with drink driving limits. Courtesy shuttles at popular pubs and drinking establishments along and near the corridor Increased police enforcement – Increasing budget to the Police to undertake road enforcement including drink driving, speed and *555 response. Safe Police observation bays
OPERATIONAL - Wayfinding	Tourist signage – Enhance use of the Twin Coast Discovery Route Travel time signage – Retrofit existing distance guidance with travel time in order to set travel time expectations. VMS detour advance warning at key decision points on journey. I.e. at Wellsford with information on SH16 vs SH1 to airport. Directional arrows installed at 2.5km centres. SATNav details of detour routes
SH15: Inland Freight Route (SH1 to SH14)	Corner realignment and shoulder widening on selected corners to ease significantly substandard horizontal radii to address safety concerns on this route. Includes provision for a weigh station near the SH1/SH15 intersection.
Whangarei Urban Improvements	• Four laning between Toetoe Road and Rewa Rewa Road • Four laning between Southend Avenue and Murdoch Crescent • Four laning between Murdoch Crescent and Tarewa Road • Footpath between Toetoe Road and Murdoch Crescent

Section	Infrastructure Investment
	• Cycle facilities between Toetoe to SH14 intersection
Toetoe to Oakleigh	Offline 2+2 alignment with divided carriageway between Toetoe Road and Oakleigh (Mangapai Road). Connection provided between Otaika Valley Road and Portland.
Oakleigh to SH15	2+2 online upgrade of existing alignment with installation of wire rope central and side barriers. Truck stop at SH15A intersection including vehicle charging facilities Intersection improvements at SH15A
SH15 to Brynderwyn Hills	Central wire rope barrier installed. Additional passing lanes provided to improve passing opportunities. Access rationalisation in Waipu
Brynderwyn Hills	Western Bypass of the Brynderwyn Hills. 2+1 or 2+2 lanes. Wire rope barriers provided. Tourist rest area – top of Brynderwyn Hills Truck stop – SH12 intersection including vehicle charging facilities
Brynderwyn Hills to Te Hana	Safety improvements including minor curve realignment particularly around Ross Road. Installation of some side barriers. Selected shoulder widening, paint marking and signage improvements. Kaiwaka township improvements including gateway treatments. Upgrade detour routes including Mangawhai Road and Kaiwaka-Mangawhai Road including sections of shoulder widening and minor curve realignments. Truck stop/rest area in Kaiwaka including vehicle charging facilities Improved permanent detour and tourism signage
Te Hana to Warkworth	RoNS project including extension to north of Te Hana. Offline 2+2 divided carriageway with interchanges north of Warkworth, Wellsford and north of Te Hana. Online safety improvements – Dome Valley Town Centre improvements in Wellsford.
Warkworth to Puhoi	Puhoi to Warkworth RoNS. A 2+2 divided carriageway built to a high standard. Includes interchanges at Puhoi and northern interchange at Warkworth. Park and Ride - Warkworth

The total cost of the recommended programme is between **$880M to $1,430M**. A range of costs have been provided, given the level of detail of the estimates developed, as this is a programme business case and individual options are in many instances not defined in detail.

This cost range includes operational and capital projects, however excludes the maintenance costs of the programme (which are not assumed to create a significant additional maintenance burden). The individual projects within the Do Minimum are not included in the programme costs as they are assumed committed already.

Figure 20 : Recommended Programme (9)



7.2 PROGRAMME IMPLEMENTATION STRATEGY AND TRIGGER POINTS

The implementation of the recommended programme has been considered in its development. The programme, whilst consisting of predominantly Transport Agency projects, will also require implementation by other parties.

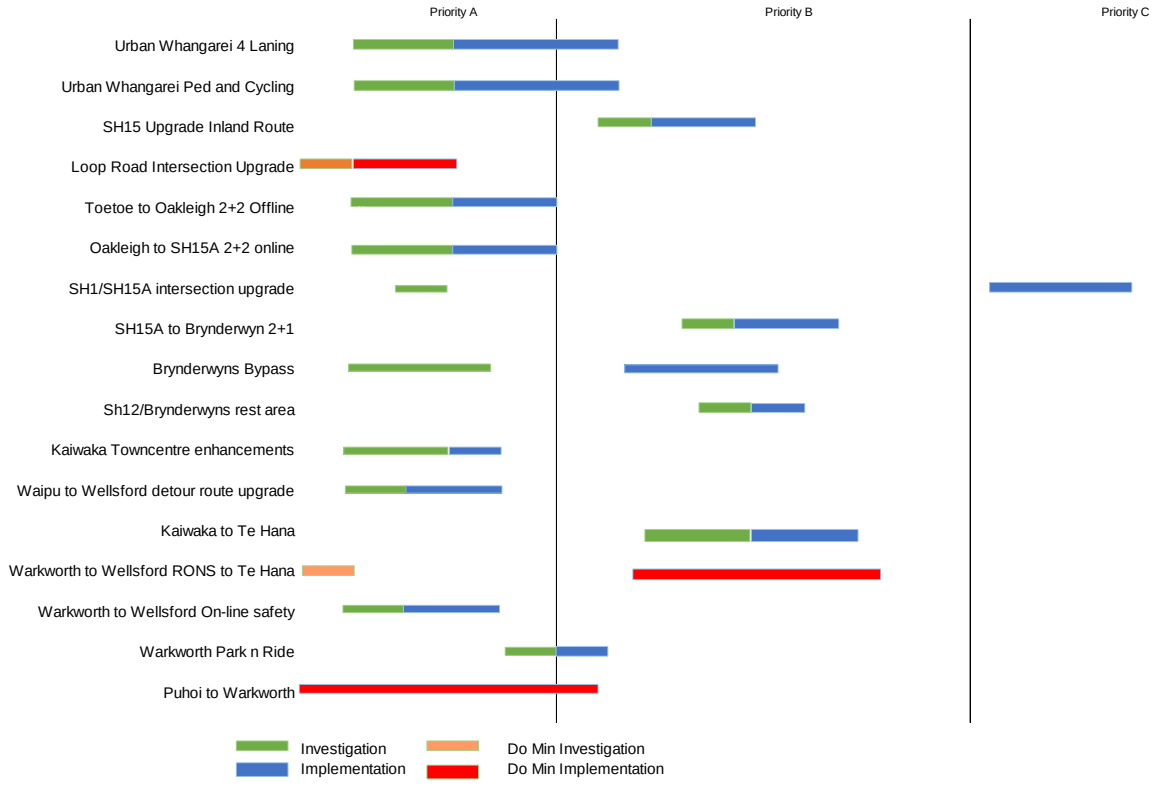
7.2.1 Timing and Triggers

In determining the timing for the implementation of the individual projects within the programme, a number of factors has been considered, including the demand, economic efficiency and the need to best meet the investment objectives. Prioritisation has been made by balancing a number of criteria and applying the Transport Agency Performance Assessment Framework, with the following priority of criteria applied:

- network performance and capability
- safety
- health
- environment
- cost

Based on this assessment, the implementation strategy for the programme from a timing perspective is outlined in Figure 21. This separately identifies the investigation and physical implementation components of each project as some warrant early investigation to understand preferred alignments and interface with others projects is considered important.

Figure 21 : Recommended Programme Implementation



The key aspects of this implementation strategy include:

- The safety and capacity improvements between Whangarei (SH14) and the Port is the most urgent part of the programme given the demand and the current safety problems. To compliment this upgrade, improvements to the inland freight route (SH15) will provide benefits to heavy vehicles. The southern section (Oakleigh to SH15 would be triggered by demand of 20,000 vpd).
- Investigation (through an IBC) of the Brynderwyn Hills bypass is an immediate priority to identify a preferred alignment so that costs, benefits and impacts can be better quantified.
- Upgrades to the detour routes between Waipu and Wellsford should be progressed immediately as HPMV resilience is required and works on SH1 in this area are not forecast for a number of years.
- The Kaiwaka town centre enhancements should be done as soon as possible given the lack of other improvements in this area of the programme and potential impact on the community.
- Online safety improvements through the Dome Valley should be undertaken immediately
- Warkworth Park n Ride should be progressed to ensure it is in place by the opening of the Puhoi to Warkworth PPP project.

7.2.2 Implementation Partners

The recommended programme requires implementation from others. This includes local Councils and partnerships in some of the behavioural options. Specifically, the implementation partnerships include:

- WDC, Kaipara District Council and Auckland Transport - proposed resilience upgrades to local roads between Waipu and Wellsford
- Whangarei District Council – in relation to the urban safety and capacity upgrades required between Toetoe Road and SH14 given the built up nature of this section of the corridor
- The behavioural options will require close collaboration and implementation with the Police and other government entities to ensure the most effective implementation of these options
- Rest areas / truck stops will require partnership with private entities

More details on the implementation of projects are outlined in the Implementation plan provided in Appendix I.

8. RECOMMENDED PROGRAMME – ASSESSMENT

A completed Transport Agency Programme Assessment Form for Programme 9 is included in **Appendix H.**

Programme 9 was selected as it delivers on the outcomes sought for the corridor in an economically efficient manner. Programme 9 offers a value for money programme that is affordable and able to be implemented in stages over the next 30 years, with a manageable impact on the environment, communities and culturally sensitive areas.

Programme 9 delivers the following outcomes:

PBC Investment Outcomes

- **6 min** average travel time saving (Te Hana to Whangarei), trucks approx. 10+ min
- Mean operating speed of 82km/h
- **69** fewer deaths and serious injuries every 5 years
- $880M - $1.4B cost, over 30 years

8.1 PROGRAMME OUTCOMES

The investment objectives describe the outcomes sought from investing in this corridor. A summary of the outcomes achieved by the recommended programme is provided below:

8.1.1 Resilience

A step change in resilience is delivered by Programme 9. Resilience problems areas at the Brynderwyn Hills and Dome Valley are bypassed by higher standard alignments. The offline upgrade between Oakleigh and Toetoe Road in the north of the corridor will provide additional resilience in this area where safety problems are significant and create route resilience challenges. Between Oakleigh and SH15 (Port) an online upgrade is provided. This new 2+2 alignment, whilst on the existing alignment will greatly increase the safety and resilience of this section of the network.

The remaining sections between SH15 (Port) to Brynderwyn Hills and Brynderwyn Hills to Te Hana will have minor alignment enhancements but the road safety preformance of thses section will improve, in turn reducing the frequency of closures.

Programme 9 will ensure that all corridor sections have a detour route suitable for all vehicles, including HPMV, of less than 2 hours, fully meeting the investment objective. This will greatly enhance the route security for users and in particular freight users.

8.1.2 Safety Outcome

Programme 9 addresses the most significant safety concern areas (Toetoe Road to SH15 and the Brynderwyn Hills) in the corridor with a mixture of online and offline improvements in these areas as outlined in Figure 20. This programme achieves the objective of a MEDIUM KiwiRAP rating for the corridor length. This rating is achieved in all areas, along the corridor with the exception of the

urban area of Whangarei and between the Brynderwyn Hills and Te Hana. The implementation of this programme is expected to save 69 deaths and serious injuries every five years (the 86 in the evaluation tables included Puhoi to Wellsford RONS savings). This will provide a safe corridor and a significant improvement over its current safety performance for all road users, including freight and tourists.

8.1.3 Economic Growth (90km/h) Outcome

Programme 9 delivers an average speed of 82km/h for the corridor (89km/h, including the Do Minimum), which equates to a travel time between Puhoi and Whangarei of 1:13 min, representing more than 5 minutes saving over the Do Minimum travel time.

The sections of the corridor that do not meet the 90km/h average speed target are between the Brynderwyn Hills and Te Hana and within the urban Whangarei area. Between Brynderwyn and Te Hana, the current speed environment is not that far from the average sought. The cost to increase the speed in this section was not justifiable given the lack of other problems and the forecast level of demand.

Within the urban Whangarei section, the presence of signalised intersections, side friction and reduced speed environments do not allow the wider target to be achieved, however travel time and reliability savings can be achieved through addressing pinch points in the network.

The improvements in freight travel times and reliability mean that economic confidence is anticipated to increase in Northland, removing one of the current barriers identified as adversely affecting the region's economic growth.

8.1.4 Benefits Delivered Spatially

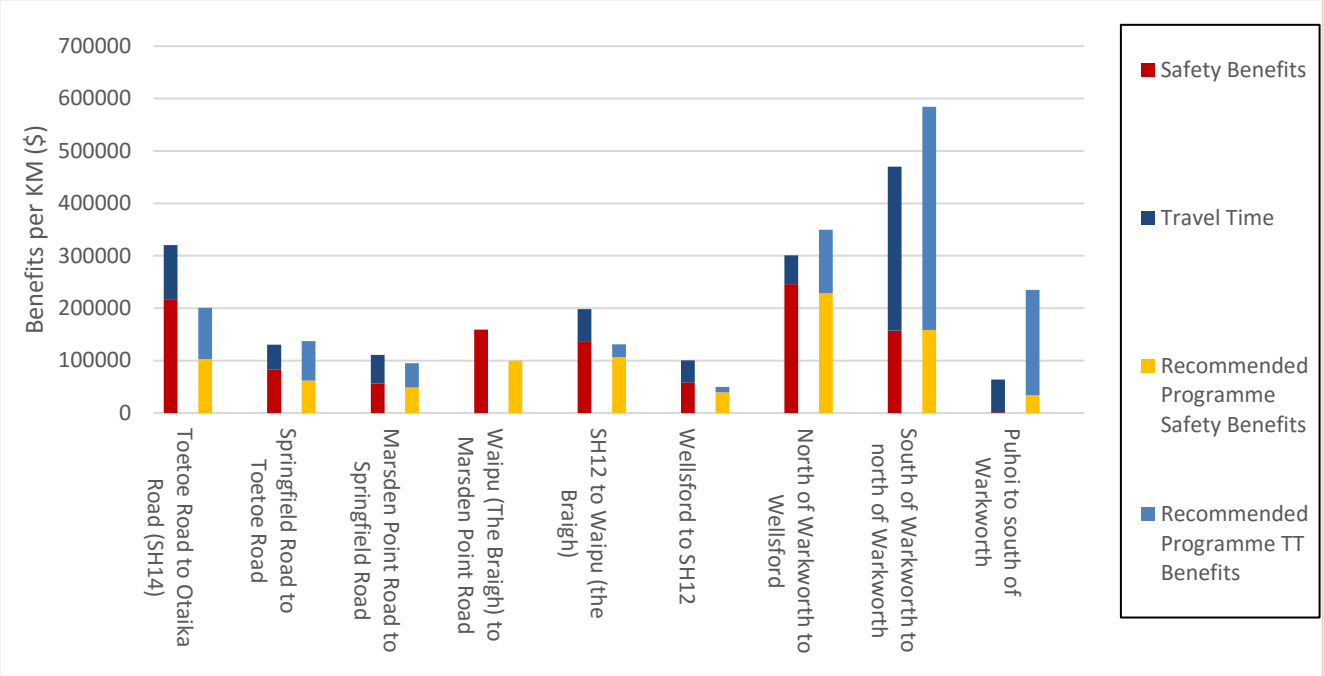
These outcomes are indicatively represented by the forecast transport benefits of the programme. Figure 22 shows the benefits available by delivering the desired level of investment outcomes for each corridor section. It compares this with the actual benefits realised by Programme 9.

Figure 22 shows that Programme 9 appropriately matches the level of investment at the northern end of the corridor, under invests in the middle section (between SH12 and Wellsford) and potentially over invests in the southern section.

The 'under investment' in the middle section relates to the significant level of investment required between the Brynderwyn Hills and Te Hana to provide a higher level of outcome (reduced gradient and improved horizontal alignment to increase average travel speed). This investment is not part of the recommended programme given the lack of current or forecast demand over the next 30 years. This is also reflected in the relative scale of available benefits in this section compared to the benefits available at the northern and southern ends of the corridor.

The indicated 'over investment' in the southern section of the corridor relates to the significance of the RoNS investment and the additional outcomes that this level of investment achieves when compared to the investment objectives outlined in this PBC (which were not the same drivers for the RoNS investment).

Figure 22 : Recommended Programme Benefits



8.2 PROGRAMME RISK

The recommended programme has a number of risks associated with its implementation that were assessed as part of the programme assessment framework. These are summarised below:

8.2.1 Feasibility

Programme 9 was considered to have minor risks with respect to feasibility. Generally, the options proposed are straightforward, well understood and 'standard' in nature.

Two new offline sections are proposed with this programme (Toetoe Road to Oakleigh and western Brynderwyn Hills bypass). These carry some property and consenting risk, particularly with respect to the coastal marine area (CMA) near Oakleigh.

The Whangarei urban improvements require widening of the State Highway in a built-up area. There are potential consenting and property risks associated with this. In addition, all online schemes will require careful planning to ensure the corridor continues to provide accessibility through construction. No fatal flaws are envisaged with respect to consenting and construction.

The operational options carry some risk, as they require careful collaboration with other parties, including the Police and other government organisations to ensure implementation is appropriately planned and rolled out.

8.2.2 Affordability

Programme 9 is considered relatively affordable, given its BCR range (0.6 - 1.0) is at or close to the the minimum threshold. Therefore, it is considered that the programme is likely to be efficient and fundable through the National Land Transport Fund (NLTF). Table 6 sets out costs and benefits for each of the programmes considered.

Table 6: Programme Benefits vs Costs

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Cost (Lower Bound)	$970	$430	$1,900	$2,200	$1,000	$430	$1,500	$820	$880	$1,700
Cost (Upper Bound)	$1,500	$730	$2,800	$3,200	$2,300	$650	$2,400	$1,300	$1,400	$2,500
Cost (Lower Bound) NPV 2025	$610	$270	$1,200	$1,390	$630	$270	$950	$520	$550	$1,070
Cost (Upper Bound) NPV 2025	$950	$460	$1,760	$2,020	$1,450	$410	$1,510	$820	$880	$1,580
Benefits	**$470**	**$240**	**$540**	**$620**	**$310**	**$310**	**$450**	**$410**	**$530**	**$550**
BCR lower	**0.8**	**0.9**	**0.5**	**0.4**	**0.5**	**1.1**	**0.5**	**0.8**	**1.0**	**0.5**
BCR upper	**0.5**	**0.5**	**0.3**	**0.3**	**0.2**	**0.8**	**0.3**	**0.5**	**0.6**	**0.3**

However, with an expected cost of between $880M and $1.43 billion, the programme represents a prioritisation risk, with respect to the potentially limited funds available through the NLTF. It is likely that construction would be staged over a number of years.

Further, detailed analysis is required to confirm these funding arrangements, as projects are developed in more detail through Indicative and Detailed Business Case phases.

Some programme options could potentially use alternative funding sources given their design, which could make tolling options possible. Further investigation would be required to understand the benefits and impacts of this funding option.

Aspects of the programme will require implementation by other parties. The details of these funding arrangements are yet to be confirmed.

8.2.3 Stakeholder / Public Considerations

Stakeholder and public perceptions are always a risk for infrastructure projects. To mitigate this risk and ensure that as many perspectives as possible were included in the development of the PBC; stakeholders were invited to attend a number of interactive workshops. In addition, public views were sought via a web page dedicated to the PBC.

Options and alternatives were developed collaboratively with stakeholders at a workshop. Assessment criteria were taken from NZ Transport Agency guidelines for option evaluation, agreed with stakeholders and used to evaluate the identified options and alternatives with respect to their relative ability to deliver against the agreed investment objectives for the corridor. Stakeholders then participated in a workshop to develop a range of potential programmes for the corridor. Programme

9 was developed by one of these stakeholder groups with only minor refinements made by the project team.

There will likely be differences of perception with respect to the proposed implementation plan. In particular different groups are likely to have differing views of the options that should be prioritised for early implementation. Specific management plans will need to be developed and actioned as the programme is developed further and implemented.

Programme 9 is considered likely to attract both support and opposition like most infrastructure projects. Fundamentally it is considered that the key aspects of the project, providing a safer and higher quality alignment from Whangarei to SH15 (Port) and through the Brynderwyn Hills will be well received by stakeholders and the public. This assessment is based on the feedback from stakeholders through this PBC process.

8.2.4 Cultural Heritage, Environmental and Social Responsibility Considerations

There are identified areas of significance from a cultural heritage, environmental and social perspective along the corridor. Programme 9 is considered to carry some risk in this area however as it does not affect any specifically identified significant areas it is considered that this risk can be managed.

Culturally there are areas of significance throughout the corridor. Detailed investigation will be undertaken as part of individual project development, however based on what is known at this time, the programme does not directly affect any specific cultural heritage sites and therefore it is considered that this risk can be avoided or mitigated appropriately.

Environmental sensitive areas exist along the route and large-scale infrastructure projects will have an effect on the environment. These will need to be managed. The main areas of concern relate to the CMA near Oakleigh and ecologically sensitive areas through the Dome Valley and the Brynderwyn Hills. Like the cultural issues, more work is needed to understand these in detail, however no significant concerns have been identified at this stage.

There will be social enhancements with the improved safety and accessibility delivered by Programme 9. This must be balanced with the potential social impacts of property purchase and severance caused by new offline alignments recommended in Programme 9.

A bypass of Te Hana is recommended. This will need to be sensitively addressed and mitigation measures provided. Kaiwaka is likely to have increased traffic volumes and appropriately managing the competing functions of through traffic and local town accessibility are an important focus for the Kaiwaka town centre improvements project.

8.2.5 Safety

This risk is closely related to the Safety Objective, with Programme 9 providing a safer corridor. Appropriate implementation planning to ensure safety during this construction will be required. This risk is well understood with the options proposed as part of the overall programme.

8.2.6 Economy

Programme 9 improves the safety, reliability and performance of SH1 between Puhoi and Whangarei. Travel times between Puhoi and Whangarei will reduce to 1:13 mins. This level of improvement in transport performance will create a greater level of confidence for investor and business in Northland.

Programme 9 is a key component of the investment story improving connectivity to the Northland region to a comparable level to the rest of the country and acting as an enabler to economic growth. If the GDP of Northland was increased by only 1% as a result of this programme, this would equate to over $60M of increased economic activity **per year**.

8.3 PROGRAMME OPPORTUNITIES

The proposed programme delivers against the investment outcomes sought and results in some risks to implementation as outlined above. The recommended programme also offers a number of opportunities to users, investors and the wider community. These include:

8.3.1 Social

The recommended programme bypasses Wellsford and Te Hana, this offers these towns the opportunity to redevelop and redefine themselves without the constraint and adverse effect of SH1 running through the middle of the town. Kaiwaka will continue to have SH1 running through the middle of town. The proposed town centre enhancement project within the recommended programme is an opportunity to realise real social and community benefits outside of the transport and safety benefits of the enhancement project. Further social opportunities exist for the communities on the eastern beaches along the corridor. The increased resilience and improved signage of roads in this area (as part of alternative route upgrades) presents an opportunity to attract more tourists and users to their communities. Finally, the social programmes to address safety problems, such as the license support programme offer greater social and community opportunities and benefits than simply the safety benefits directly claimed as part of this programme.

8.3.2 Tourism

As outlined above improving alternative routes will provide additional opportunities for tourism in the corridor. The programme is also predicted to provided increased tourism 'traffic' due to the higher quality route that will be provided, making the journey more attractive to tourists using the corridor to connect with Northland. The programme also provides enhanced and more frequent rest areas, intended to improve tourist journey quality. The recommended programme will also be more commensurate with the quality of road experienced by tourists when leaving Auckland and traveling north.

8.3.3 Land Use Integration

The recommended programme is a significant investment and offers considerable land use integration opportunities along the route and also for nearby communities. As outlined above, townships directly on or near the route will have the opportunity to respond to the programme and plan land use in an integrated manner. With increased accessibility this land use can potential change from current thinking. Further afield communities such as Mangawhai could also realise the opportunity of increased accessibility through land use changes. The enhancements between Whangarei and SH15 (port) also create the opportunity for different thinking about land use integration along this section.

8.4 VALUE FOR MONEY

Programme 9 balances the cost of achieving the investment outcomes sought, particularly compared to the other programmes assessed. With NPV benefits of $530M and a cost range of $880m to $1,430m, a BCR of between **0.6 and 1.0** is forecast.

Detailed analysis is required for each individual option within the programme, during subsequent IBC and DBC phases; however there is a good benefit stream that indicates a good value for money story.

This BCR analysis has been based on appropriate assumptions for a programme at this stage, with further benefits envisaged as more detailed analysis is undertaken. The economic assessment is based on a 6% discount rate, 40 year evaluation period, 4 year construction period and 2025 opening date. The benefits for each programme where calculated on a case by case basis but following the broad assumptions set out below:

- Safety benefits were calculated by applying a crash reduction factor of between 35 % and 75% depending on the intervention proposed on each section.
- Travel time benefits have been calculated based on changes in traffic speeds from the current operating speed up to 90km/h depending on type of intervention
- Vehicle operating costs have been assumed at 10% of travel time benefits.

Wider economic benefits have not been included, and given economic growth is a key part of the objectives of this project (and with transport identified as a key enabler for economic growth in the NEAP) it is considered likely that these would exist for this programme, further strengthening the value for money proposition of this programme.

8.5 SENSITIVITY ANALYSIS

The forecasting of future costs and benefits at the programme level involves a degree of uncertainty and the economic analysis is sensitive to the assumptions or predictions inherent in the analysis.

To ensure that the recommended programme has been selected on a robust basis, reference is made to the uncertainty log agreed with stakeholders as part of the Strategic Case and outlined in Table 1. Four scenarios were developed to assess the sensitivity of Programme 9 as the recommended programme. The scenarios were:

- **Growth forecast increases** – Part of the reason for this project is to improve the economic performance of Northland. A sensitivity test was undertaken to understand the effect on the programme if current forecast growth rates doubled. From a transportation demand perspective, this means average growth rates increasing from 1.5% to 3% pa.
- **Growth forecast reduces** – A scenario was developed assuming that current growth forecasts were not realised and the traffic growth rate halved to 0.75% pa.
- **NorthPort expansion** – If NorthPort significantly increased its tonnage due to rationalisation of ports across the Upper North Island, this could result in increased demand for road-based freight trips (500 trucks / day assumed) and increased rail demand.
- **Rail mode share reduces** – This scenario tests the effect on the programme if constraints in the downstream rail network (Auckland) for freight increase. It assumes that all current rail freight is moved by truck on SH1.

8.5.1 Scenario Outcomes

The potential outcome of these scenarios is summarised in Table 7.

Table 7 : Sensitivity Analysis Outcomes

Scenario	Safety Objective	Growth Objective	Resilience Objective	Economic Efficiency
Increased Growth	Medium KiwiRAP rating achieved for route	Average speed slows slightly and increases demand on SH15 (Port) to Brynderwyn Hills and Brynderwyn Hills to Te Hana sections. Requirement for Brynderwyn Hills bypass accelerated. Unlikely to increase requirement to 2+2 capacity on these sections.	Increased demand may accelerate implementation of Brynderwyn Hills bypass to improve the resilience of that section. Resilience interventions may be considered for Brynderwyn Hills to Te Hana section	Increases to approx. 0.7-1.2
Reduced Growth	Medium KiwiRAP rating achieved for route	Average speed increases slightly and extends the implementation timeframe for some interventions	Timeframes for interventions would be delayed, in particular the SH15 (Port) to Brynderwyn Hills section	Reduces to approx. 0.5-0.9
NorthPort Expansion	Medium KiwiRAP rating achieved for route	Average speed slows slightly and potentially accelerates requirement for the Brynderwyn Hills bypass	Increased demand may accelerate implementation of Brynderwyn Hills bypass to improve the resilience of that section. Resilience interventions may be considered for Brynderwyn Hills to Te Hana section	Increases to approx. 0.7-1.1
Rail Mode Share	Medium KiwiRAP rating achieved for route	Average speed slows slightly and potentially accelerates requirement for the Brynderwyn Hills bypass	Increased demand may accelerate implementation of Brynderwyn Hills bypass to improve the resilience of that section. Resilience interventions may be considered for Brynderwyn Hills to Te Hana section	Increases to approx. 0.7-1.2

Overall, the conclusion of this sensitivity analysis is that the timing of options within the programme could be delayed or accelerated dependent on the scenario. If the scale of the change was significant, it may be necessary to revisit the need for some of the options. If growth was significantly greater, it is possible that the section of the corridor between the Brynderwyn Hills and Te Hana could require additional capacity near the end of the 30-year time horizon of this programme. Conversely if growth was slower, the option of a 2+1 online enhancement between SH15 (Port) and the Brynderwyn Hills could be delayed further and potentially not needed at all.

The rail mode share and NorthPort scenarios would likely result in additional heavy vehicles and freight movements on the route, which could result in the acceleration of the Brynderwyn Hills bypass option within the programme.

Overall, it is considered that the recommended option responds to these sensitivity scenarios well.

8.6 ASSESSMENT PROFILE

An assessment profile of H/H/0.6-1.0 has been determined for the programme using the Transport Agency's Investment Assessment Framework as detailed below:

8.6.1 Strategic Fit

Strategic fit of the problem, issue or opportunity that is being addressed: H/M/L

Overall the corridor has been given a **high** strategic fit as the problems and benefits defined by the project partners, and supported by the currently available evidence, are closely aligned with achieving the Government's goals for land transport and the Transport Agency's three-year strategic priorities on predictable journeys for urban customers and improved freight network productivity.

The Strategic Case confirms that the key problems relate to safety, efficiency, reliability and resilience, particularly for freight, and that these are significant from a national perspective.

Evidence collected through the Strategic Case indicates that the gap between current customer levels of service on the corridor and that considered appropriate for a National High Volume corridor is significant.

In line with the Transport Agency's current Investment and Revenue Assessment Framework, the Strategic Case also focuses on improving SH1 as a national route by:

- Contributing to economic growth and productivity through improving the cost of travel along SH1, especially for the movement of freight
- Improving the safety of the corridor so that it is consistent with requirements for a National High Volume route, resulting in a reduced number of crashes involving injury and death
- Improving the resilience of the corridor between Northland and key markets to remove constraints on economic growth and investor confidence

This indicates a high Strategic Fit.

8.6.2 Effectiveness

Effectiveness of the proposed solution: **H**/M/L

Overall, the corridor has indicatively been given a **high** effectiveness rating subject to further investigation. Whilst options have not yet been considered in detail, the following provides an indicative view of the potential effectiveness of improving the SH1 corridor.

This is based on the intent and potential scope of the preferred programme(s) to deliver against the range of effectiveness criteria set out in the current Investment Assessment Framework, as set out below.

Component	Explanation	Rating
Outcomes focused	• tangible change in addressing the problem, issue or opportunity identified in the Strategic Fit assessment • consistency with levels of service in an appropriate classification system	L/M/**H**
Integrated	• consistency with the current network and future transport plans • consistency with other current and future activities • consistency with current and future land use planning • accommodates different needs across modes • support as an agreed activity across partners	L/M/**H**
Correctly scoped	• the degree of fit as part of an agreed strategy or business case • has followed the intervention hierarchy to consider alternatives and options including low cost alternatives and options • is of an appropriate scale in relation to the issue/opportunity • covers and/or manages the spatial impact (upstream and downstream, network impacts) • mitigates any adverse impacts on other results	L/M/**H**
Affordable	• is affordable through the lifecycle for all parties • has understood and traded off the best whole of life cost approach • has understood the benefits and costs between transport users and other parties and sought contributions as possible	L/M/**H**
Timely	• delivers enduring benefits over the timeframe identified in the justified strategy or business case • provides the benefits in a timely manner	L/M/**H**
Confidence	• manages current and future risk for results/outcomes • manages current and future risk for costs	L/M/**H**
Overall	• Assessment based on lowest rating of all components	L/M/**H**

Achieving the agreed benefits would support and promote the National High Volume role of SH1.

Based on the problems identified, there is sufficient scope to identify appropriate alternatives that would make a significant contribution to achieving the multiple impacts of the GPS.

The agreed problems and benefits are integrated, and therefore there is scope to make a significant contribution to multiple outcomes including:

- Improving safety outcomes for the corridor
- Improving journey time reliability
- More efficient and productive freight supply chains
- Improving route resilience and route security

The PBC will have a role in wider regional strategies and planning documentation though increased confidence in the corridor and will provide ongoing integration between land use and transport for the corridor.

8.6.3 Efficiency

Benefit and cost appraisal: H/M/0.6-1.0

Details of the benefit and cost appraisal are provided in Section 8.4, above. The BCR has been assessed to be within the range of 0.6 – 1.0.

9. PROGRAMME FINANCIAL CASE

9.1 INDICATIVE COST

The cost of the programme was developed through the development of costs for each individual option that made up the recommended programme. These individual costs were then combined to give a total cost.

These costs were developed through the knowledge of Transport Agency projects and previous costings for options from early investigations (where this existed). All cost estimates are expressed as a range, i.e. upper-bound and lower-bound values only have been provided.

Given the strategic nature of a programme business case, detailed option development has not been undertaken and therefore a range best represents the costs at this stage in the programme life cycle. Table 8 shows the cost per project element within the programme.

It indicates that the expected total cost range for Programme 9 is **$880 to $1,430M**.

Table 8 : Programme Cost

Section	Road Infrastructure Investment	Cost of project ($M undiscounted)
Inland Freight Route	SH15 improvements for HPMV	$20-30
Whangarei urban	Urban multi-modal capacity improvements Footpath and cycle facilities	$30-50
Toetoe to Oakleigh	2+2 offline	$160-280
Oakleigh to SH15A	2+2 online	$140-210
SH15A to Brynderwyn Hills	Online safety improvments + extension of passing lanes. Intersection upgrade	$30-50
Brynderwyn Hills	2+2 bypass to the west Tourist rest area – top of Brynderwyn Hills Truck stop – SH12 intersection Upgrade detour routes: • Improved permanent signage • Satnav details of detour routes • Improved alignment Provision for cyclists	$450-730
Brynderwyn Hills to Te Hana	Minor online improvements Kaiwaka township improvements	$10-30
Te Hana to Warkworth	Truck stop – Te Hana Online safety improvements – Dome Valley Improvements to SH16	$30-40

Section	Road Infrastructure Investment	Cost of project ($M undiscounted)
Warkworth to Puhoi	Park and Ride – Warkworth	Less than $5
Driver education and enforcement	• Licence assistance • Alcohol education programme • Courtesy shuttles • Increased police enforcement	Less than $5
Wayfinding	• Tourist signage • Travel time signage • VMS detour advance warning	Less than $5
TOTAL		$880-1430

9.2 FUNDING ARRANGEMENTS

The expected programme BCR is at the minimum threshold. Therefore, it is considered that the programme will be efficient and fundable through the National Land Transport Fund (NLTF).

However, with an expected cost of between $880M and $1.43 billion, the programme represents a prioritisation risk, with respect to the potentially limited funds available through the NLTF.

It is likely that construction would be staged over a number of years, with improvements to the section between SH14 and Oakleigh recommended to commence within 5 years, while the full programme is not expected to be constructed for more than 20 years.

Further, detailed analysis is required to confirm these funding arrangements, as projects are developed in more detail through Indicative and Detailed Business Case phases.

Funding will need to be confirmed through the inclusion of individual components of the programme in the 2018-2021 National Land Transport Plan, which is due for development for the next 3+3+4 years in June 2017.

Aspects of the programme will require implementation by other parties. The details of these funding arrangements are yet to be confirmed.

9.3 AFFORDABILITY

As indicated above, it is consider that the recommended programme will be efficient and fundable through the NLTF. Implementation would be staged over several years.

The recommended programme will be jointly progressed in coordination with Road Controlling Authorities Auckland Transport (AT), Kaipara District Council (KDC) and Whangarei District Council (WDC). This approach is proposed, as several programme elements are located on the local road network, under the control of these organisations.

PART C – DELIVERING AND MONITORING THE PROGRAMME

10. MANAGEMENT CASE

The management case assesses whether a programme is deliverable. It tests the programme planning, governance structure, risk management, communications and stakeholder management, benefits realisation and assurance. It sets out a plan to ensure that the programme benefits are realised and includes measures to assess and evaluate this.

10.1 PROGRAMME GOVERNANCE AND REPORTING

The programme will be led by the NZ Transport Agency. Some components of the programme will require investment from other organisations including Auckland Transport, Whangarei District Council, Kaipara District Council and the NZ Police.

A project management team will be responsible for the day-to-day management of the project. A project control group will meet fortnightly to consider and endorse key project milestones.

The project team will engage Professional Services specialists to develop Indicative and Detailed Business Cases for individual projects as required. These Professional Services resources would report directly to the in-house project team. The subsequent stages of project development should use this PBC as a key reference document for an subsequent development and could trigger the need to update the PBC should any of the key assumptions change.

In addition, inputs from a number of Transport Agency teams will be required. The table below shows the responsible person in each case:

Role	Responsible Person
Programme Sponsor	Jim Sephton
Stakeholder / Comms	Kelli Sullivan
Transport Planning	Sebastian Reed
Planning and Investment Case Manager	Martin Taylor
Road Safety	Brian Rainford
Network Operations	Graham O'Connell
Network Management	Tim Crow
Project Services	TBA

10.2 STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS PLAN

The key stakeholders for the PBC are listed below. The stakeholders have been identified based on the practical and technical details of the range of issues, interactions and alternatives/options that may be considered. Most of the stakeholders have been engaged through participation in the PBC workshops including confirming the strategic case, developing alternatives/options and the preferred option(s) workshops. They will also be included in the circulation of the related business case documents for review and agreement.

- Auckland Council
- Auckland Transport

- Kaipara District Council
- Whangarei District Council
- Northland Inc
- Iwi
- Road Transport Association
- NZ Police
- National Road Carriers
- Northport

Different stakeholders will bring specialist judgement or bring different perspectives and skills at different stages.

A stakeholder plan will be developed to ensure these relationships are appropriately managed and to optimise the development of individual IBCs and DBCs. This will also address the specific details for each stakeholder, including key contact person and approach for engagement.

Stakeholders will be managed through the Programme Manager, with support from the Agency's communications team, who knows the stakeholders well and will assist with organisation and preparation for this stakeholder engagement.

External communications will be managed through the Programme Manager, with support from the Agency's communications team, who will assist with organisation and preparation for these communications. A Communications Plan will be prepared.

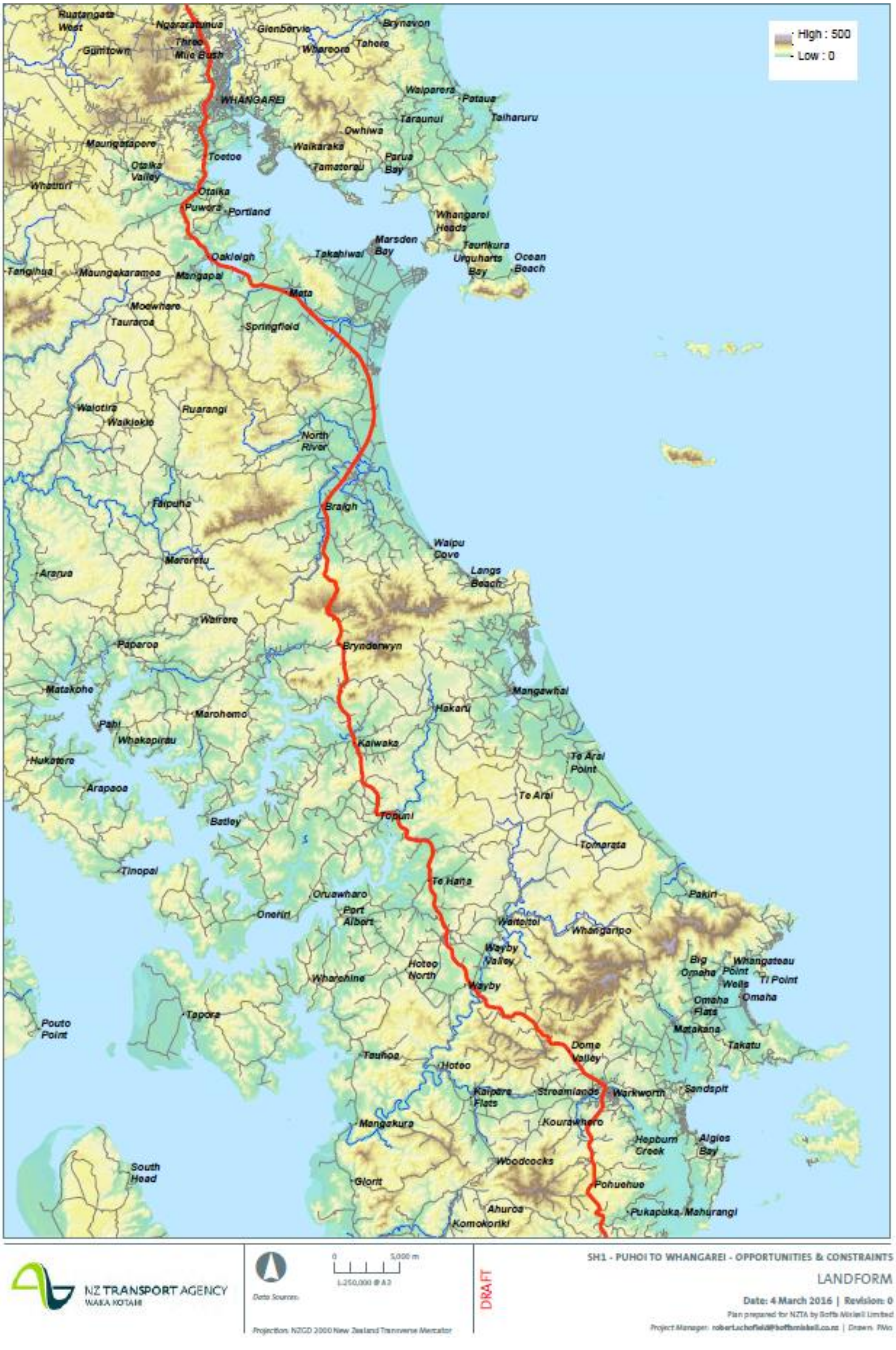
10.3 PROGRAMME PERFORMANCE AND REVIEW

It is important that performance against the investment objectives and desired outcomes be reviewed following implementation of each programme element. This review may indicate that other parts of the programme may not need to be pursued or that triggers may need to be reviewed.

With respect to the SH1 Auckland to Whangarei corridor programme, it is likely that the four-lane component of the programme from Whangarei to SH15 will be delivered ahead of other programme components. As such, a performance review hold-point is recommended following construction to determine whether triggers for further interventions remain appropriate.

APPENDIX A – NETWORK PLAN

APPENDIX B - ENVIRONMENTAL PLANS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Low : 0
WHANGAREI
Whangarei Heads
Marsden Bay
Ruakaka
Waipu Cove
Langs Beach
Brynderwyn
Mangawhai
Kaiwaka
Topuni
Te Hana
Wellsford
Warkworth
Sandspit
Pohuehue
Puhoi
Mahurangi
Matakana
Omaha
Dome Valley
Hoteo
South Head
Pouto Point
Tinopai
Batley
NZ TRANSPORT AGENCY
WAKA KOTAHI
Data Sources:
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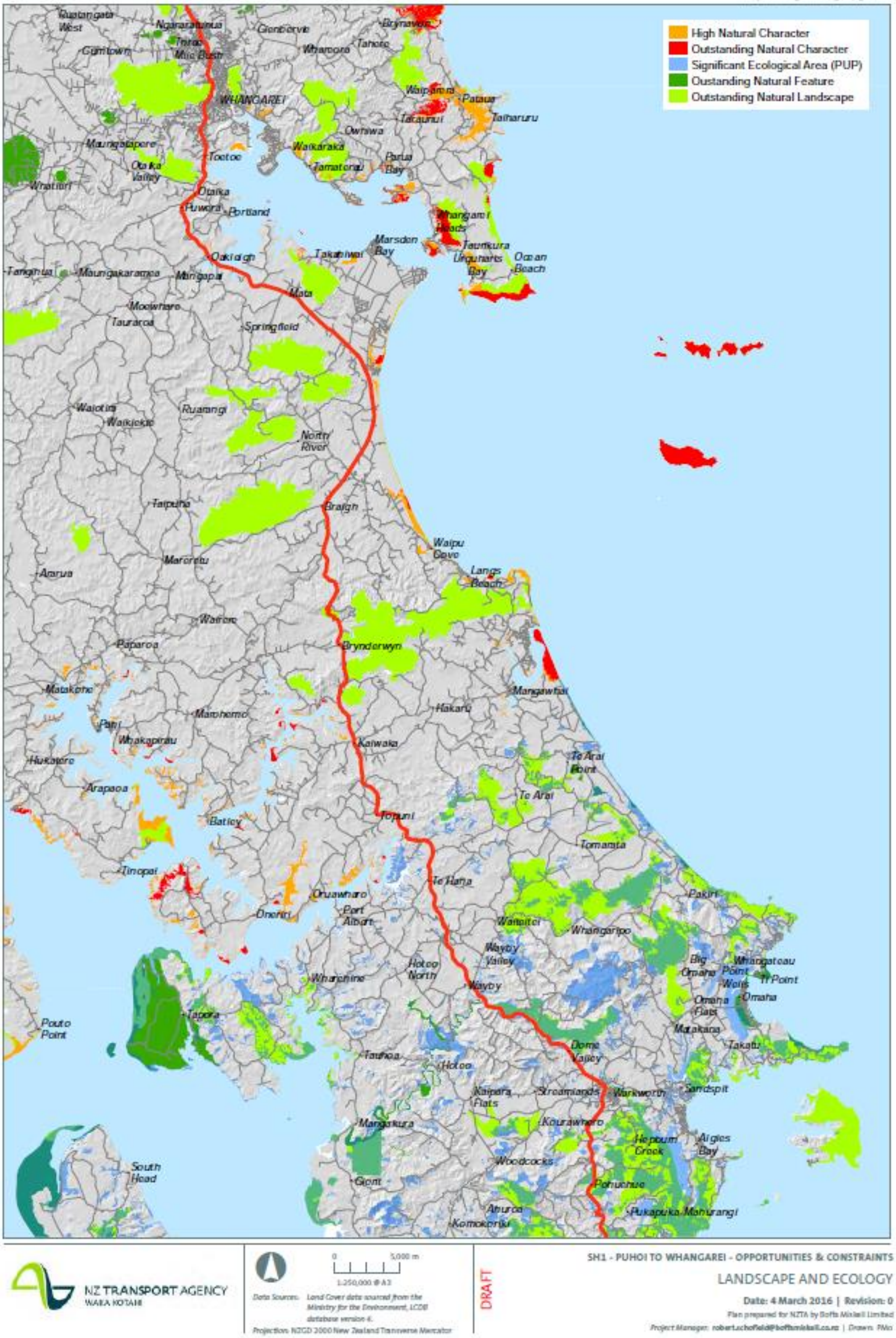
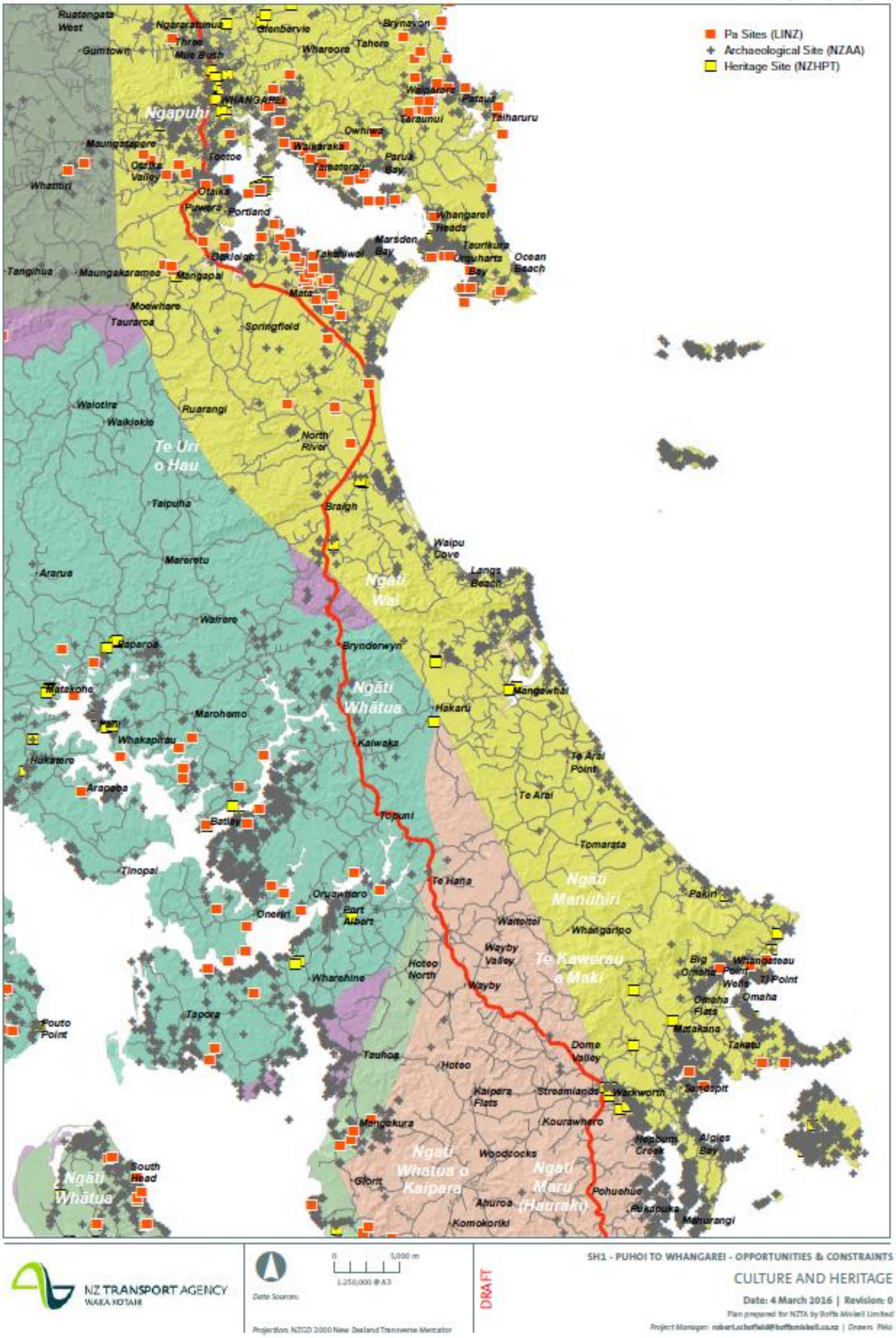
SH1 - PUHOI TO WHANGAREI - OPPORTUNITIES & CONSTRAINTS
LANDFORM
Date: 4 March 2016 | Revision: 0



High Natural Character
Outstanding Natural Character
Significant Ecological Area (PUP)
Oustanding Natural Feature
Outstanding Natural Landscape
WHANGAREI
Whangarei Heads
Marsden Bay
Ocean Beach
Waipu Cove
Langs Beach
Brynderwyn
Mangawhai
Kaiwaka
Topuni
Te Hana
Wellsford
Warkworth
Puhoi
Pakiri
Omaha
Matakana
Sandspit
South Head
Pouto Point
NZ TRANSPORT AGENCY
WAKA KOTAHI
0
5,000 m
1:250,000 @ A3
Data Sources: Land Cover data sourced from the Ministry for the Environment, LCDB database version 4.
Projection: NZGD 2000 New Zealand Transverse Mercator
DRAFT
SH1 - PUHOI TO WHANGAREI - OPPORTUNITIES & CONSTRAINTS
LANDSCAPE AND ECOLOGY
Date: 4 March 2016 | Revision: 0
Plan prepared for NZTA by Boffa Miskell Limited


Pa Sites (LINZ)
Archaeological Site (NZAA)
Heritage Site (NZHPT)
Ngapuhi
Te Uri o Hau
Ngāti Wai
Ngāti Whātua
Ngāti Manuhiri
Te Kawerau a Maki
Ngāti Whātua o Kaipara
Ngāti Maru (Hauraki)
Ngāti Whātua
WHANGAREI
Ruatangata West
Gumtown
Three Mile Bush
Glenbervie
Brynavon
Whareora
Tahere
Maungatapere
Whatitiri
Oakleigh
Tangihua
Maungakaramea
Mangapai
Portland
Otaika
Puwera
Tikipunga
Whangarei Heads
Marsden Bay
Taurikura
Urquharts Bay
Ocean Beach
Parua Bay
Taiharuru
Pataua
Taraunui
Owhiwa
Waikaraka
Springfield
Tauraroa
Ruarangi
Waiotira
Waikiekie
North River
Braigh
Waipu Cove
Langs Beach
Taipuha
Mareretu
Ararua
Wairere
Paparoa
Brynderwyn
Matakohe
Marohemo
Whakapirau
Hukatere
Arapaoa
Batley
Kaiwaka
Hakaru
Mangawhai
Te Arai Point
Te Arai
Topuni
Tomarata
Te Hana
Tinopai
Oruawharo
Port Albert
Oneriri
Wharehine
Wellsford
Wayby Valley
Wayby
Whangaripo
Hoteo North
Pakiri
Big Omaha
Whangateau
Ti Point
Omaha
Omaha Flats
Matakana
Takatu
Dome Valley
Pouto Point
Tapora
Tauhoa
Hoteo
Kaipara Flats
Streamlands
Warkworth
Sandspit
Kourawhero
Mangakura
Woodcocks
Hepburn Creek
Algies Bay
South Head
Glorit
Ahuroa
Komokoriki
Pohuehue
Puhoi
Mahurangi
NZ TRANSPORT AGENCY
WAKA KOTAHI
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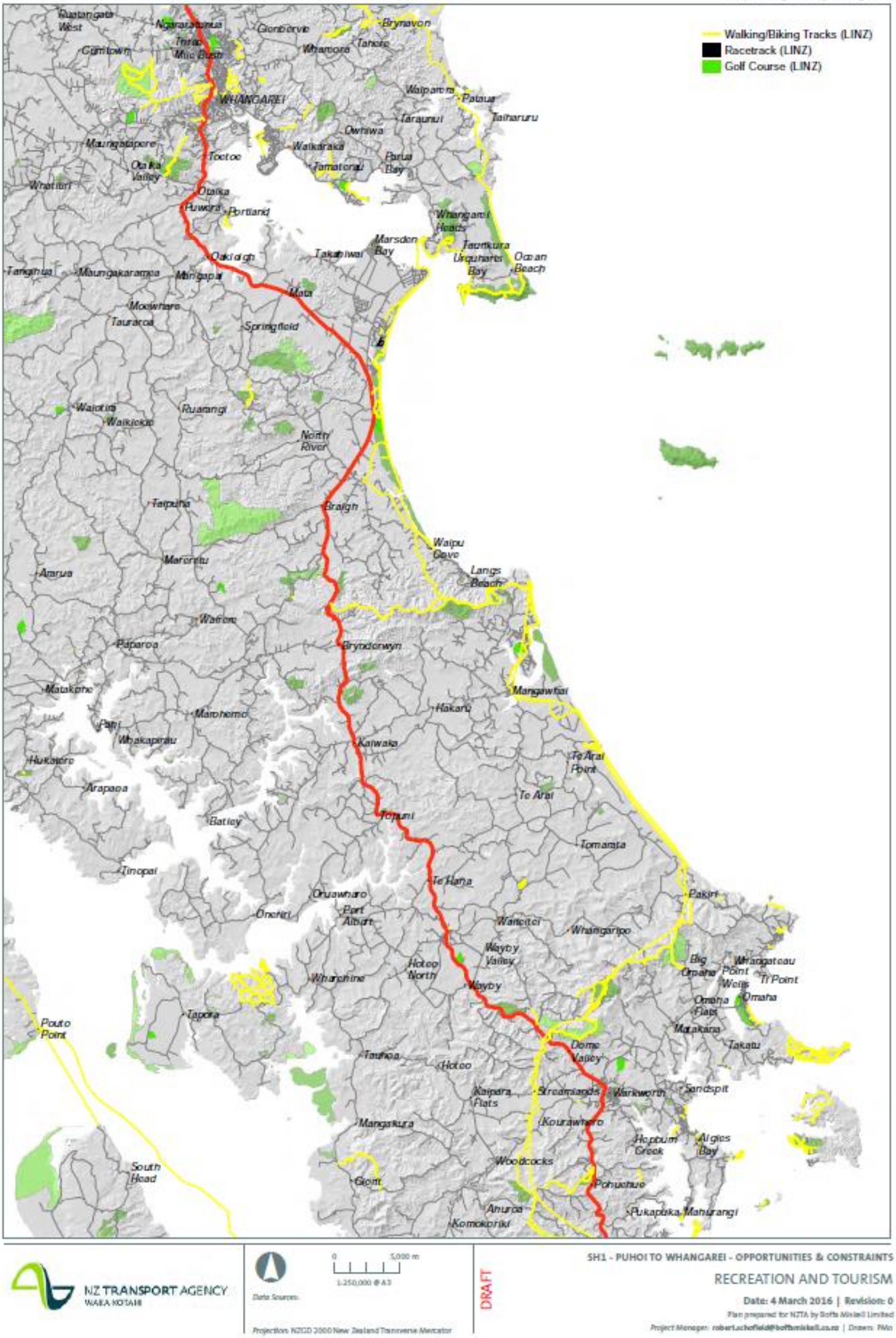
SH1 - PUHOI TO WHANGAREI - OPPORTUNITIES & CONSTRAINTS
CULTURE AND HERITAGE
Date: 4 March 2016 | Revision: 0
Plan prepared for NZTA by Boffa Miskell Limited
Project Manager: robert.schofield@boffamiskell.co.nz | Drawn: PMo


Walking/Biking Tracks (LINZ)
Racetrack (LINZ)
Golf Course (LINZ)
WHANGAREI
Glenbervie
Brynavon
Whareora
Tahoroa
Gumtown
Maunu Bush
Pataua
Taiharuru
Taraunui
Owhiwa
Maungatapere
Waikaraka
Tootoe
Parua Bay
Tamaterau
Whatitiri
Otaika
Otaika Valley
Puwera
Portland
Whangarei Heads
Marsden Bay
Taurikura
Urquharts Bay
Ocean Beach
Takahiwai
Oakleigh
Tangihua
Maungakaramea
Mangapai
Mata
Mooswhare
Tauraroa
Springfield
Waiotira
Waikiekie
Ruarangi
North River
Tapuhi
Brynderwyn
Braigh
Waipu Cove
Langs Beach
Mareretu
Waiwera
Paparoa
Matakohe
Mangawhai
Hakaru
Marohemo
Pahi
Whakapirau
Hukatere
Kaiwaka
Te Arai Point
Te Arai
Arapaoa
Topuni
Batley
Tomarata
Tinopai
Te Hana
Oruawharo
Port Albert
Oneriri
Pakiri
Wellsford
Whangaripo
Wayby Valley
Hoteo North
Big Omaha
Whangateau
Point Wells
Ti Point
Wharehine
Wayby
Omaha Flats
Omaha
Pouto Point
Tapora
Matakana
Takatu
Dome Valley
Tauhoa
Hoteo
Kaipara Flats
Streamlands
Warkworth
Sandspit
Mangakura
Kourawhero
Hepburn Creek
Algies Bay
Woodcocks
South Head
Pohuehue
Anuroa
Komokoriki
Pukapuka
Mahurangi
NZ TRANSPORT AGENCY
WAKA KOTAHI
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Data Sources:
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SH1 - PUHOI TO WHANGAREI - OPPORTUNITIES & CONSTRAINTS
RECREATION AND TOURISM
Date: 4 March 2016 | Revision: 0
Plan prepared for NZTA by Boffa Miskell Limited

APPENDIX C –STRATEGY DOCUMENTS

Government Policy Statement on Land Transport 2015/16 – 2024/25

The NZ Transport Agency must give effect to the Government Policy Statement (GPS), which sets out the Government's strategic direction for investment in the land transport network. The GPS places particular importance on investment in the state highway network, in recognition of its importance to the efficient movement of people and freight, and addressing the safety problems across the network. Whilst the focus of the GPS is very much on delivering the current Roads of National Significance programme, the associated long-term results sought are intended to directly support economic growth and productivity through provision of better access to markets and employment.

Regional Land Transport Strategy

The current Regional Land Transport Strategy (RLTS) identifies a number of regional policies and priorities that seek to achieve integrated transport outcomes in the future. Four of the seven priorities are key to supporting the outcomes that are desired for the SH1 corridor:

- Resilience of the road network
- Alignment with HMPV usage
- Freight and economic development
- A safer road network, reducing fatalities and serious injuries.

The RLTS recognises that volumes of freight are significant and the importance of the Auckland to Whangarei transport corridor (SH1) as critical to the Northland region's growth and performance:

"The Auckland isthmus effectively separates the Northland region from the rest of New Zealand. As a result, Auckland is a key lifeline for Northland. Secure and reliable transport connections to Auckland and beyond are critical for economic success of both regions. Access difficulties (through Auckland, through Northland or both) may deter some visitors and have significant implications for freight movements, particularly with the trend towards 'just in time deliveries' to retail and wholesale sector outlets serving Northland's consumer and tourism sectors rather than businesses stockpiling supplies.

Secure transport connections are therefore vital to ensure the security of supply of the goods, food and fuel that the region depends upon. Northland's road network is also vital for access to emergency and essential services."

NZ Transport Agency

National Programme Business Case - Safer Journeys (Roads & Roadsides)

The National Programme Business Case for Safer Roads and Roadsides identifies the majority of the SH1 corridor between Puhoi and Whangarei as high-risk roads requiring action over the next 10-year period (See Section 3.4). This confirms the case for change to improve road safety along the whole of this PBC corridor, and that this will contribute to reducing deaths and serious injuries.

Network Resilience - National Strategic Case

The Transport Agency is currently preparing a National Resilience Business Case to assist planning for investment to improve network resilience. This study has identified three key problem areas and associated benefits, each of which are relevant to SH1:

- Poor highway resilience may impede critical services from providing disaster response and recovery support.
- Unreliability of some highways affects businesses and undermines economic growth.

- The risky environment of some roads increases the possibility of harm to road users.

The development of the National Resilience Programme Business Case is ongoing. However current indications are that a preferred programme focus will be to keep the state highway network open or to ensure that alternative routes are always available. The indication at this stage is that priority will be given to the national routes and high volume routes. This confirms that resilience (and route security) issues along SH1 between Auckland (Puhoi) and Whangarei are significant and support the case for future improvement.

High Productivity Motor Vehicles – National Strategic Case

The Transport Agency has prepared a Strategic Case that outlines the case and context related to allowing heavy vehicles to operate outside the current mass and dimension limits. Beyond the Strategic Case, work to develop and assess alternative programmes to achieve the associated productivity gains is ongoing. The National Strategic Case for HPMV confirms the investment routes for the 2012-15 period and this includes SH1. Physical works have been undertaken to strengthen bridges in the corridor, allowing the route to be used by full HPMVs.

One Network Road Classification (ONRC)

The ONRC system classifies all roads into different types of roads. This is based on criteria in relation to safety, resilience access, traffic volume and other measures. There are also Level of Service guidelines for how the different types of classification should be performing against the above criteria. The Transport Agency uses this system to classify all of the state highways in the country.

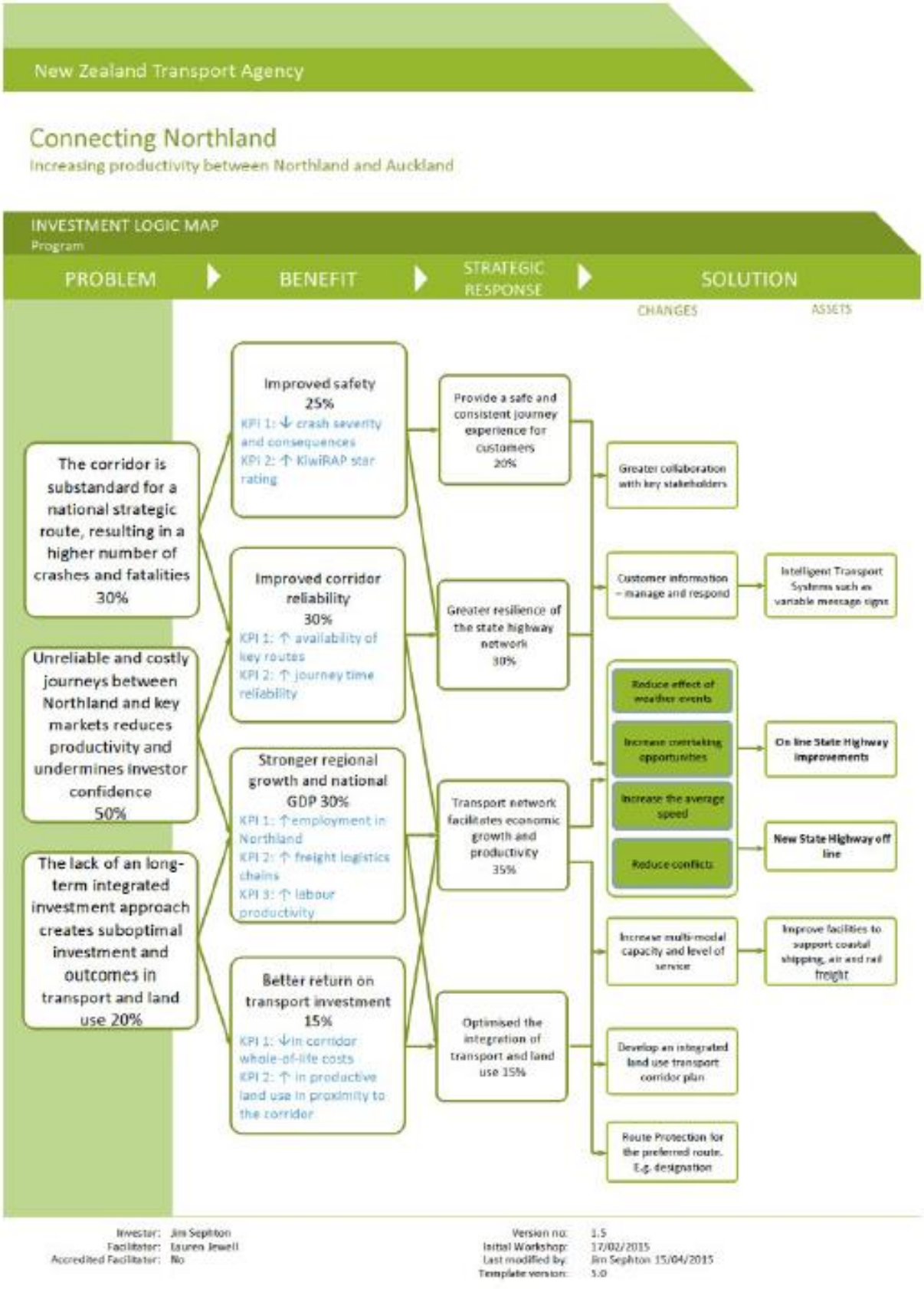
As outlined in Figure X below, state highway one in this corridor is classified as a National route for the entire length of the PBC area, with the section south of Wellsford classified as "High Volume" also due to the traffic volumes. The National classification is the highest classification in the system and is defined as:

National: *These are roads that make the largest contribution to the social and economic wellbeing of New Zealand by connecting major population centres, major ports or international airports and have high volumes of heavy commercial vehicles or general traffic. They must meet the thresholds for 3 criteria, including at least one of the following movement criteria (Typical Daily Traffic, Heavy Commercial Vehicles or Buses, Urban Peak) and at least one of the economic and social criteria (i.e. 3 in total). To be included in the high volume subset a road must meet one of the high volume criteria for typical daily traffic or HCVs.*

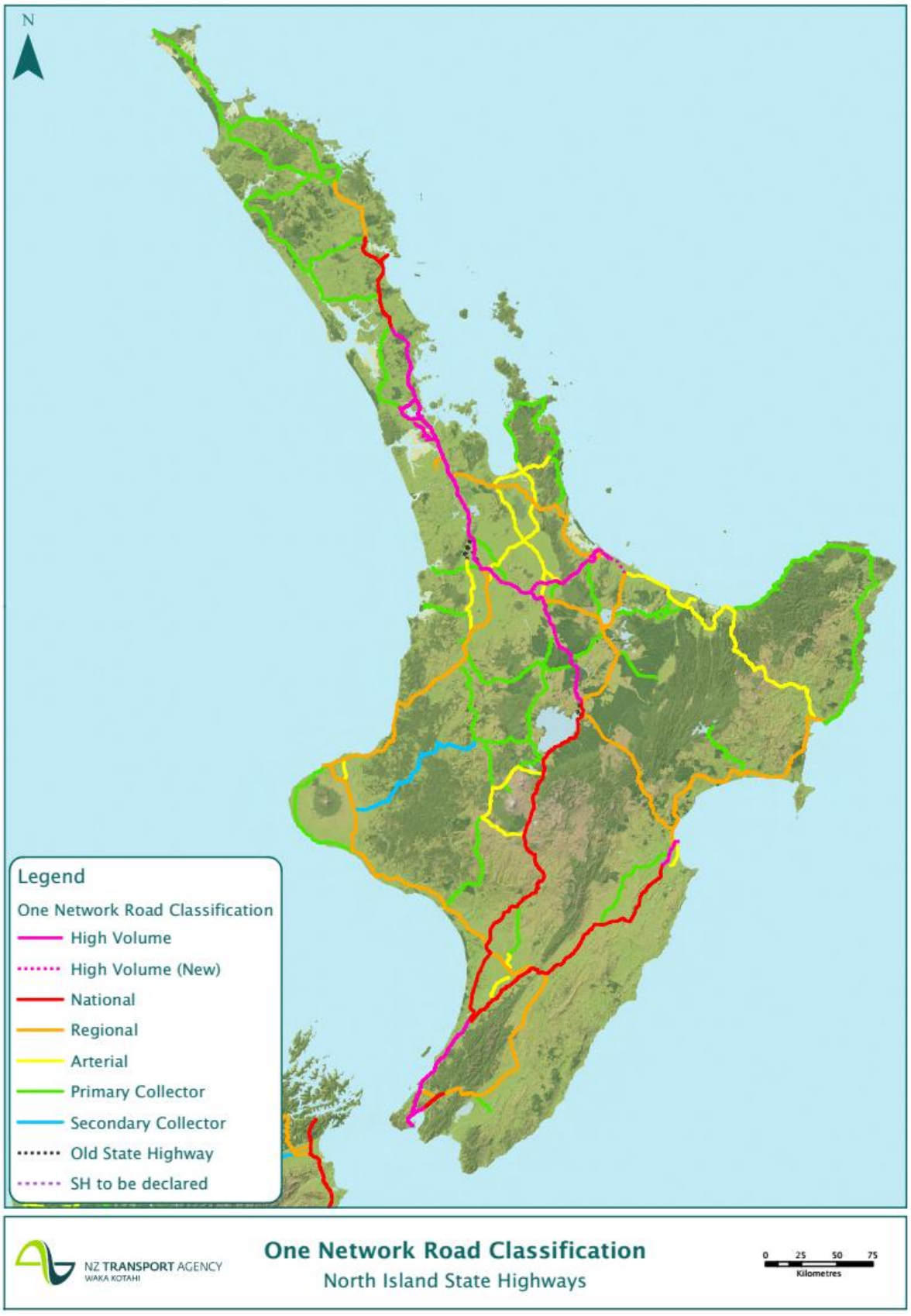
This confirms the strategic importance of this road as a connection between Northland and Auckland.

APPENDIX D –PUBLIC CONSULTATION REPORT

APPENDIX E – ILM MAP



APPENDIX F –ONE NETWORK ROAD CLASSIFICATION



APPENDIX G – OPTION DEVELOPMENT AND ANALYSIS

APPENDIX H – PROGRAMME ANALYSIS AND ASSESSMENTS

APPENDIX I – IMPLEMENTATION PLAN

Section	Investigation	Implementation	Lead	Support
Inland Freight Route	DBC 2017 – Determine scope and scale of upgrades to the route	2019 – Construction of upgrade completed	Transport Agency	WRC, WDC
Whangarei urban	IBC-DBC 2018/19 – Determine best option for multi-modal solution (SH14 to Toetoe)	2020/2021 – Construction of upgrade completed	Transport Agency	WRC, WDC
Toetoe to Oakleigh	IBC-DBC 2017/18 – Determine best option, including online consideration	2019/2020 - Construction of upgrade completed	Transport Agency	WRC, WDC
Oakleigh to SH15 (including SH15/1 intersection)	IBC-DBC 2018/19 – Undertaken with Toetoe to Oakleigh for best combined solution to SH15	2022/2024 - Construction of upgrade completed (intersection as required)	Transport Agency	WRC, WDC
SH15 to Brynderwyn Hills	DBC 2024/25	2026/2027 - Construction of upgrade completed	Transport Agency	KDC, WDC
Brynderwyn Hills	IBC-DBC 2018/19 – Determine most appropriate bypass option	2024/2026- Construction of upgrade completed	Transport Agency	KDC
Brynderwyn Hills to Te Hana – SHI Alignment	IBC-DBC 2023/24	2025/2026 - Construction of upgrade completed	Transport Agency	KDC, AT
Brynderwyn Hills to Te Hana – Kaiwaka town centre	IBC-DBC 2018/19	2020 – Construction upgrade completed	Transport Agency	KDC
Brynderwyn Hills to Te Hana – Detour routes	IBC-DBC 2017/18	2019/20 – Construction upgrade completed	Transport Agency	KDC, AT
Te Hana to Warkworth RONS	DBC 2017/18 – Route protection for preferred option	As per current implementation plans for RoNS	Transport Agency	AT, AC
Te Hana to Warkworth Dome Safety	DBC 2017 – Preferred option identification	2018 – Construction of upgrade completed	Transport Agency	AT

Section	Investigation	Implementation	Lead	Support
Warkworth to Puhoi Park and Ride	IBC-DBC 2019/20	2021 – Complete for opening of PPP	Transport Agency	AT, AC
Driver education and enforcement • Licence assistance • Alcohol education programme • Courtesy shuttles • Increased police enforcement	BC - 2017/18	2019 – Complete and operational	Police	Transport Agency, WDC, AT, KDC
Wayfinding • Tourist signage • Travel time signage • VMS detour advance warning	BC - 2017/18	2019 – Complete and operational	Transport Agency	AT, AC, AMA, KDC, WDC, NRC, WRC