

*Single-Stage Business Case*

# Wellington Metro Railway – Unlocking Network Capacity and Improving Resilience



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## Document Information

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# Executive Summary

## Introduction

This business case builds on the patronage growth success of previous Greater Wellington Regional Council (GWRC), NZTA and the Crown investments, in trains, rail infrastructure and metro services. The proposed investments provide the capability for the Wellington Metro Rail Network (WMRN) to deliver greater passenger carrying capacity during the busy peak period without purchasing additional metro trains.

Specifically, this business case supports Crown funded infrastructure network capacity improvements on the Wellington Metro Railway Network (WMRN) to:

- Improve peak service frequency and capacity and provide a higher quality passenger rail service
- Cater for forecast peak passenger demand through to 2030
- Ensure on-going balanced mode share between road and rail during peak periods and increase the resilience of the wider transport network

This is one of a series of related business cases which together will help form an integrated 12 year programme for the development of passenger rail in Wellington. The success of this Unlocking Network Capacity business case is dependent on delivery of the accompanying Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals business case.

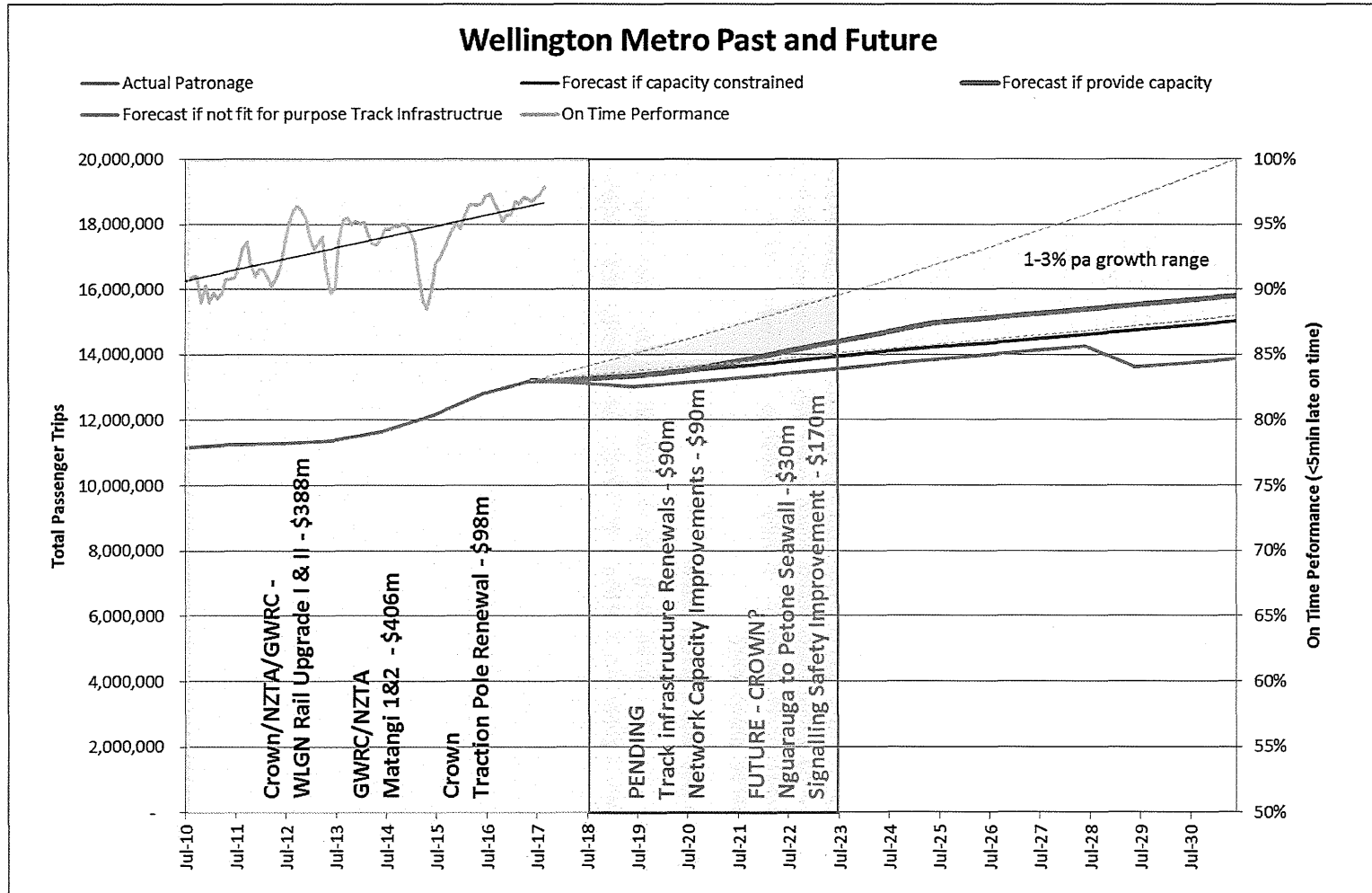
## Background and Current State

As a key part of establishing the Metropolitan Rail Operating Model (MROM) in 2009, the Crown agreed to continue to fund investments into upgrading the network, with steady state maintenance and renewals to be funded by user charges.

In order to provide the economic benefits expected of metropolitan train networks, and ensure a balanced mode share between road and rail, the WMRN is required to provide efficient and effective peak period services for workers into and out of the Wellington CBD. During peak periods, the WMRN transports 18,000 workers and students into and out of the city each day which equates to 23% of all CBD peak travel. Of the 18,000 passengers, 85% travel on two of the five WMRN lines, being the Hutt Valley and Kapiti Lines.

Previous successful investment into the WMRN by the Crown and Greater Wellington Regional Council (GWRC), plus latent population and CBD business growth, has resulted in peak period patronage growth at a greater rate than was previously forecast. Peak period patronage on the WMRN has grown a total of 13.6% over the last three years (refer Figure 1).

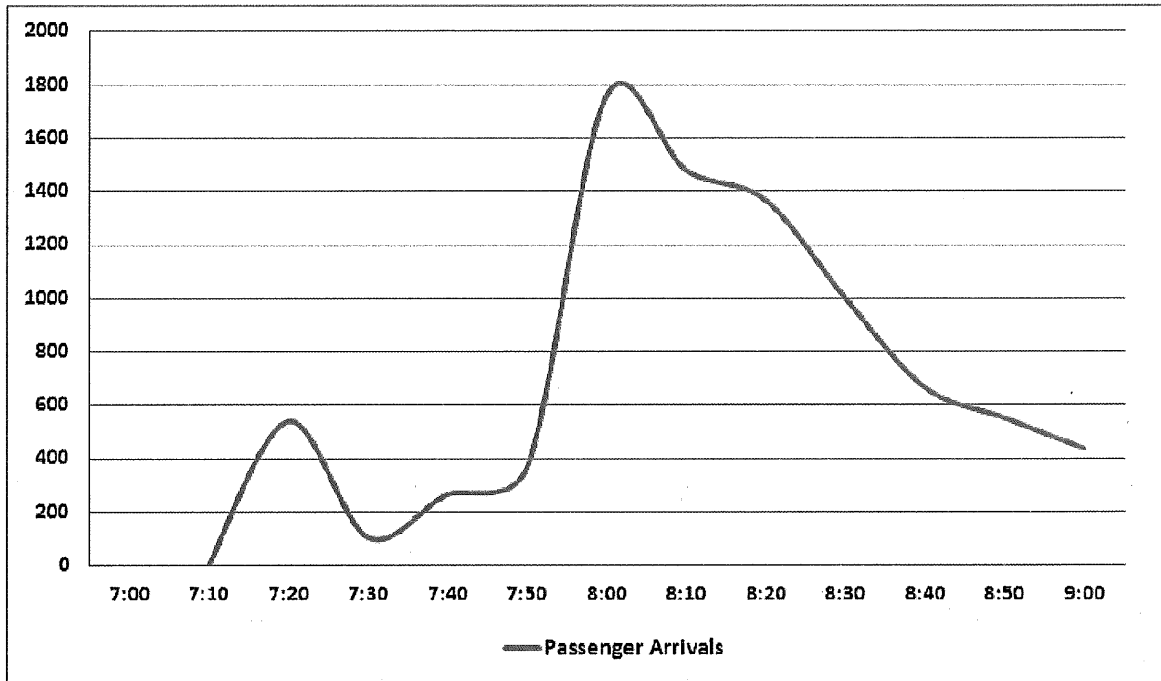
Figure 1 – Patronage trends, major investments, and future growth



33% of peak passengers arrive in Wellington within a 15-minute period (as seen in Figure 2), with only a limited number of services able to be scheduled at this time.

The recent peak patronage growth has placed increasing pressure on the capacity of train services around the time of this high 'peak of peaks', particularly in the morning.

Figure 2 – AM Peak Passenger Arrivals at Wellington Station (0700hrs to 0900hrs)



Having a high 'peak of the peak' is a product of infrastructure constraints preventing any material increase in the frequency of train services, which is particularly the case on the Hutt Valley Line. GWRC, as part of its Regional Rail Plan, is committed to increasing timetable frequencies which will help the WMRN provide:

- More choice of departure/arrival times during periods of the highest peak demand
- Services which meet the needs of users - helping improved customer satisfaction
- A rail system which encourages a 'turn up and go' customer behaviour
- A higher performing rail service which generates more customer demand and less reliance on private vehicle travel

**'TURN UP AND GO' BEHAVIOUR** – Passengers have confidence there are adequate peak services and do not consult timetables (i.e. frequencies less than 15 minutes at peak). Internationally and in Auckland, rail services which have changed to this timetabling philosophy have enjoyed significant increase in demand for services due to the increased reliability.

### Proposed Capacity Improvements and Network Resilience Investments

An independent transport network operations consultant was employed to review the current network constraints and develop preferred timetables for this business case to consider. This included an assessment of the capacity of the current network utilising the conservative growth scenario of 1.7% p.a. This is significantly less than the average growth of 3.6% p.a. seen over the last five years.

Various timetable and network configuration options were considered in the Business Case process against the overall investment objectives and critical success factors. The following was the resultant preferred timetable and infrastructure changes recommended as representing the best value for money option:

Preferred Peak Timetable and Service
<p><b>Timetable Option 3 - Moderate adaption</b> – Increase services at peak by approximately 30%</p>
<p><b>Benefits:</b> Increased peak frequency and capacity providing a 'turn up and go' timetable across the busiest part of the network. Greater spread of passenger demand due to increased frequency of services.</p>
<p><b>KAPITI LINE</b> (increase in capacity by 43% per hour)</p> <ul style="list-style-type: none"> <li>• <b>Inner-network stopping all stations service</b> - All inner-tier services go from/to <b>Plimmerton</b> (rather than the current mix of Plimmerton and Porirua stations) which will provide a greater number of trains at peak between Plimmerton and Porirua.</li> <li>• <b>Outer-network partial express service</b> – Enable longer trains to increase capacity.</li> </ul>
<p><b>HUTT VALLEY LINE</b> (increase in capacity by 33% per hour)</p> <ul style="list-style-type: none"> <li>• <b>Inner-network stopping all stations service</b> - This increases the capacity and frequency of the peak services to every <b>15 minutes</b> (was 20 minutes)</li> <li>• <b>Outer-network partial express service</b> – This increases the capacity and frequency of the peak services to every <b>15 minutes</b> (was 20 minutes)</li> <li>• <b>Melling single-tier service</b> – This changes the frequency to every <b>30 minutes</b> (was 20 minutes) to mesh with Hutt Valley Line frequency change, however longer trains will compensate for changes to the frequency.</li> </ul>



The following infrastructure initiatives were identified as required to deliver the preferred timetable which would unlock vital and productive network capacity, enable a delivery of a higher capacity timetable, and meet patronage demand:

	Cost	Estd. Comp
1) Doubling tracking between Trentham and Upper Hutt to reduce punctuality issues due to this last single track section on the Hutt Valley Line	\$46.2m	2021
2) A high capacity train turn-back facility at Plimmerton	\$12.8m	2021
3) A second lead track to Wellington train storage yards to facilitate faster platform clearance	\$5.9m	2020
4) Additional crossovers and connections in the busy Wellington station approaches to provide extra capacity and resilience	\$4.5m	2021/2022
5) Kapiti Line overhead power supply upgrades to enable more long (8 car) higher capacity trains	\$10.1m	2020
6) A new freight loop at Plimmerton, or an improved one at Porirua, to ensure freight trains can continue to operate between the more frequent passenger services	\$11.09m	2021/2022
7) Possible renewal of A Box signal interlocking with a computer based interlocking (instigated by item 4)	\$8m	2021/2022
8) Re-signalling of Woburn Junction to allow quicker access to and from Gracefield Branch (Hutt Railway Workshops)	\$2.08m	2020/2021
<b>TOTAL</b>	<b>\$100.7m</b>	<b>2022</b>

Operational increases in passenger train frequency, peak capacity and service reliability are not realistic or enduring without matching infrastructure investment.

Any attempt to increase passenger train frequency and capacity without supporting infrastructure upgrades will deliver a fragile level of service. This will deliver a level of service that frequently fails customer reliability and punctuality targets.

This in turn will erode the growth in passenger rail use of the last 10 years and subject the road network to increased demand, with resulting congestion and reduced resilience adversely impacting economic activity and likely requiring significant additional road investment.

**THE INVESTMENT COST FOR THESE IMPROVEMENTS IS \$100.7 MILLION WITH A BENEFIT COST RATIO OF 1.8.**

**OPTIONS TO INCREASE THE FREQUENCY OF THE PEAK SERVICES GREATER THAN THIS OPTION WERE NOT PREFERRED DUE TO THE SIGNIFICANT INCREASE IN CAPITAL COSTS RELATIVE TO THE BENEFITS.**

**THE DO MINIMUM OPTION WAS NOT PREFERRED AS IT WOULD NOT MEET THE INVESTMENT OBJECTIVES.**

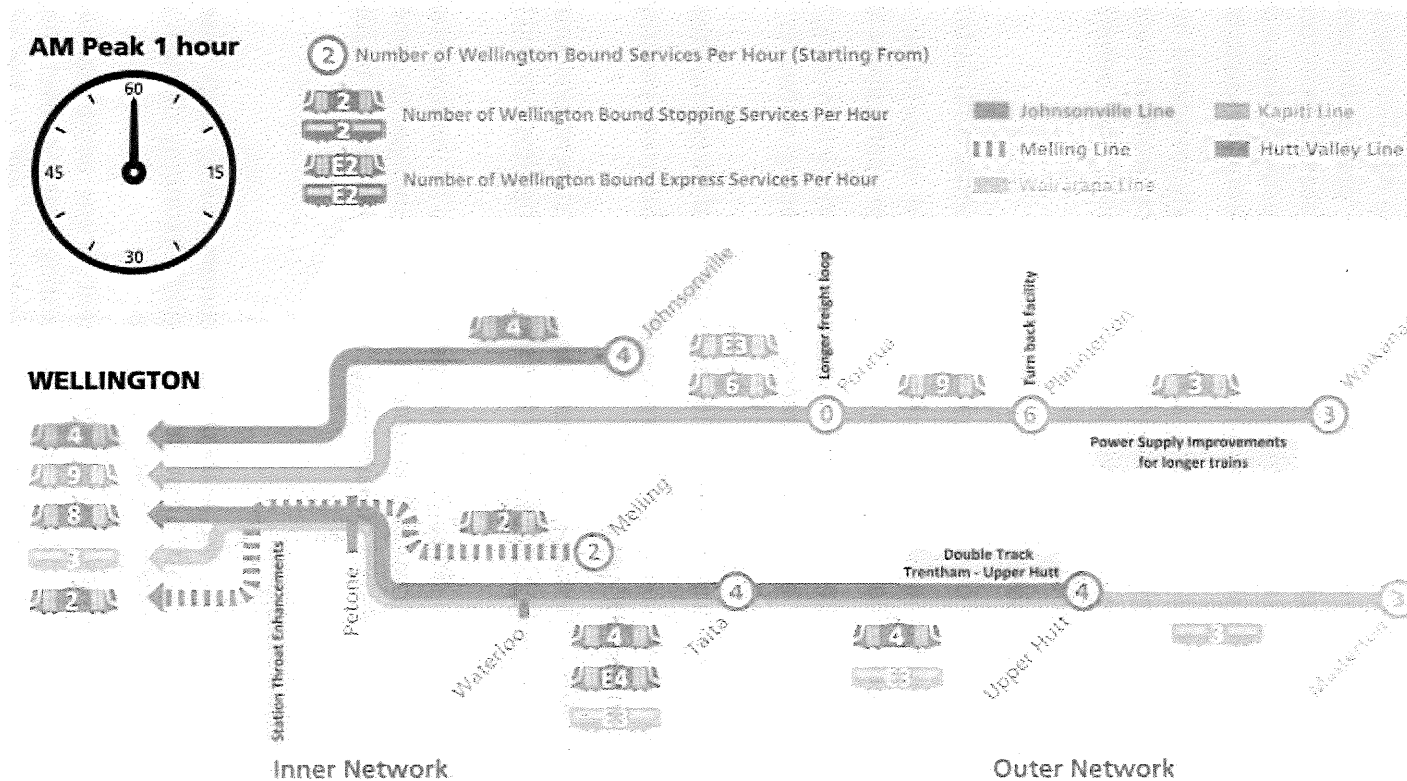
**THE INVESTMENT WILL UNLOCK VITAL AND PRODUCTIVE NETWORK CAPACITY, ENABLE DELIVERY OF A HIGHER FREQUENCY TIMETABLE, MEET PATRONAGE DEMAND AND ENSURE AN ENVIRONMENTALLY SUSTAINABLE TRANSPORT OPTION CONTINUES TO PROVIDE A VIABLE ALTERNATIVE TO ROAD TRANSPORT.**



**In one picture: the vital importance of Wellington metro rail for balancing mode share. The car drivers, passengers, and bus passengers in this picture would all fit into the first 2-car unit of the train**

A summary of the proposed train 'Peak Service Pattern' is provided in Figure 3 below. Two additional peak period services are proposed during the peak hour on both the Kapiti and Hutt Valley Lines to increase capacity and spread the demand.

Figure 3 – Proposed Wellington Morning Peak Service Pattern



### **The Business Case's Alignment to Crown Policy**

The WMRN forms an integral part of the wider transport system in the Wellington region.

The outcome of this business case is the recommendation that infrastructure upgrades are completed to remove key network constraints within the next five years. This will ensure the WMRN can run a higher capacity timetable, spread the 'peak of the peak', ensure customer satisfaction levels are high, and enable the service operator to meet forecasted demand out to 2030. This is a 'moderate investment' option and is justified using a conservative forecast demand scenario whilst still catering for a higher peak demand growth of up to 3.6% p.a.

The investment in rail as a mode of transport is strongly mandated in existing central and local government strategies, evidenced and supported by previous investments and accrued benefits. This investment initiative would ensure that the benefits of the previous investments are compounded and enduring.

These previous and proposed rail investments will:

- Meet transport level of service demands and significantly contribute to the economy
- Enable effective mode share between rail and road. In particular, capacity on the rail network will help relieve pressure on the road system - particularly at peak periods.
- Increase the resilience of the wider transport network by increasing the ability of the rail network to absorb additional demand when roading networks are constrained or disrupted
- Ensure investment is undertaken prior to rail demand exceeding capacity
- Provide economic, social and environmental benefits from ensuring a sustainable and effective rail network
- Reduce or delay the need for road capacity investment and providing a viable and environmentally favourable form of transport, helping New Zealand to reach its emission reduction targets

Given the length of time rail capital investment takes to be implemented, this business case supports immediate intervention to enable timetable changes to come into effect in 2021 and to enable a network that can meet forecast future demand up to 2030.

### **Rolling stock implications**

This investment increases the utilisation of current rolling stock assets and enables the WMRN to increase its contribution to the region's economy through provision of a more effective, efficient and reliable transport service.

This business case does not assume investment in any additional rail vehicles, rather it enables maximum use to be made of the existing Matangi fleet. Any business case for purchasing additional and replacement units/carriages will be the subject of a separate Greater Wellington Regional Council/NZTA indicative proposal.

### Parties to the Business Case and related Business Case

This Business Case has been jointly sponsored by KiwiRail, as the network asset owner, and Greater Wellington Regional Council, as the predominant network asset funder and user.

The benefits of this business case are significantly aligned with a fit for purpose track infrastructure system (see the separate business case titled *“Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals”*) and the already committed traction catch-up renewals (see Figure 4).

Also outlined in the main body of the business case are potential future investments required for the WMRN. This is included to provide visibility of the nature, quantum and interrelationship of possible future funding requirements. Separate business cases will be prepared for these future investments as required.

This business case is independent of and separate from current discussions with the Crown regarding KiwiRail Group funding and investment.



## ***Business Case Summary:***

**THIS SECTION BOTH RECAPS THE PREVIOUS POINTS AND SUMMARISES THE FULL BUSINESS CASE**

### **Background**

- Previous Crown investment has funded significant upgrades of rail infrastructure, with the 2008 to 2017 tranches of upgrades delivering the significant and enduring benefits visible in Figure 1. Combined with the benefits of equally significant joint investments from GWRC and the NZ Transport Agency (rolling stock, depots, stations, park & ride facilities, etc.) Wellington metro rail has seen record levels of performance, patronage and revenue growth.

### **Strategic Case**

- A resilient and reliable passenger rail network is critical to the connectivity and economy of the Wellington region. As capital city providing supporting functions for the whole of New Zealand, having an effective passenger rail system in Wellington is also in the national interest.
- Peak period patronage growth is exceeding forecasts and will likely start to exceed capacity in the next five years.
- Current network infrastructure constraints are holding back train service frequency and capacity increases that are required to meet customer comfort load standards already being exceeded on some services, and meet future demand.
- The absence of a confirmed funding programme to upgrade capacity of the WMRN in a timely fashion, will likely result in peak period mode shift from rail to already congested roads over the next 10 years.

### **Economic Case**

- Nine options were assessed. The recommended option is: ***Option 7 - Moderate Change to Timetable and Minimising Network Improvements*** permitting a mix of increased service frequency and longer trains.
- Improvements will be delivered over five years from a \$100.7 million investment with a Benefit Cost Ratio (BCR) of 1.8.

### **Financial Case**

- It is proposed that the both Crown and GWRC contribute to the investment.
- The business case includes an increase of operational costs for rail passenger services which will be funded by GWRC in accordance with the MROM.
- This business case also assumes improvements to GWRC station amenities such as shelters, signage and lighting. GWRC have budgeted investing \$3 million for these improvements.
- The recommended option is for the remaining investment of \$97.7 million to be funded by the Crown. This aligns with the commitment made by the Crown as part of the 2011 Wellington Metro Rail Package where the Crown (through KiwiRail) retain ownership of the rail network, and continues to fund investment to maintain the network at a resilient, reliable standard. This standard cannot be maintained without unlocking sufficient capacity.



- Previously in Auckland and Wellington the Crown has accepted the need to fund upgrades, due to infrastructure under investment from previous railway network funding models and changing demands by the communities they serve.
- Applying the MROM and tackling some asset deficiencies have resulted in GWRC's annual contribution to the network through on-going track access charges increasing from approximately \$15m per annum in FY12 to over \$19m in FY18, and draft budget of \$24m in FY19.
- There is no additional ability for GWRC to fund the upgrade under current arrangements.

### **Commercial Case**

- To upgrade the required track infrastructure to enable timetable changes to be enabled from 2021, planning and procurement will need to start in 2018/19.
- This timing will ensure the infrastructure is upgraded prior to capacity issues escalating and entrenching poor customer satisfaction with comfort, punctuality and overall service performance.
- More detailed timetable, network and power system modelling is underway and is expected to be completed in mid-2018. This will refine the infrastructure changes required to deliver the proposed capacity and performance improvements and inform detailed design.
- The business case incorporates sufficient flexibility to accommodate resulting changes in order, timing and exact specification of these infrastructure changes.
- A decision on the investment is required before May 2018 to align with budgeting cycles and provide certainty on having the infrastructure capacity improvements mostly or fully completed by 2023 (with initial timetable related constraints resolved in 2021).

### **Management Case**

- Assuming Crown funding is approved for these infrastructure upgrades, it is intended that KiwiRail procures and manages the works as per previous successful catch-up renewal programmes.
- This will incorporate competitive procurement, incentives to drive continuous improvement and comprehensive governance and reporting structures. A portion of the works, mainly track construction, will also be delivered by KiwiRail staff.
- Further significant benefits and synergies will accrue if these works are undertaken in conjunction with other programmed substantial works due to be completed over the next five years – specifically the traction pole replacement programme (\$98.4 million), and the proposed Track Infrastructure Catch-up renewal programme (\$95.8 million).
- These synergies include being able to employ a single programme management office, coordination of line closure blocks and the completion of certain packages simultaneously. A key example is the traction pole replacement between Trentham and Upper Hutt aligning with the double tracking capacity upgrade (see Figure 4).
- The KiwiRail Wellington Area management team will manage the delivery of work on a day-to-day basis to provide this seamless integration and co-ordination with routine maintenance and renewals and with the other initiatives.
- Appropriations to KiwiRail will be made based on actual costs. Budget forecasts will be regularly updated to assist with managing cash flow.



- The performance of the initiative will be monitored through KiwiRail and GWRC governance and reporting – with a focus on monthly and annual KPI reports against punctuality, patronage and customer satisfaction.

#### Decisions Sought

- **Agree** that Option 7: Moderate Change to Timetable (Kapiti and Hutt Valley) and Minimising Network Improvements is best outcome and best value for money under this business case.
- **Agree** Crown funding of Option 7 to the value of \$97.7 million
- **Agree** that KiwiRail procure and deliver the works with funding provided by the Crown through the Ministry of Transport.
- **Agree** that capacity upgrades (this business case) must be completed in conjunction with track infrastructure catch-up renewals (separate business case).



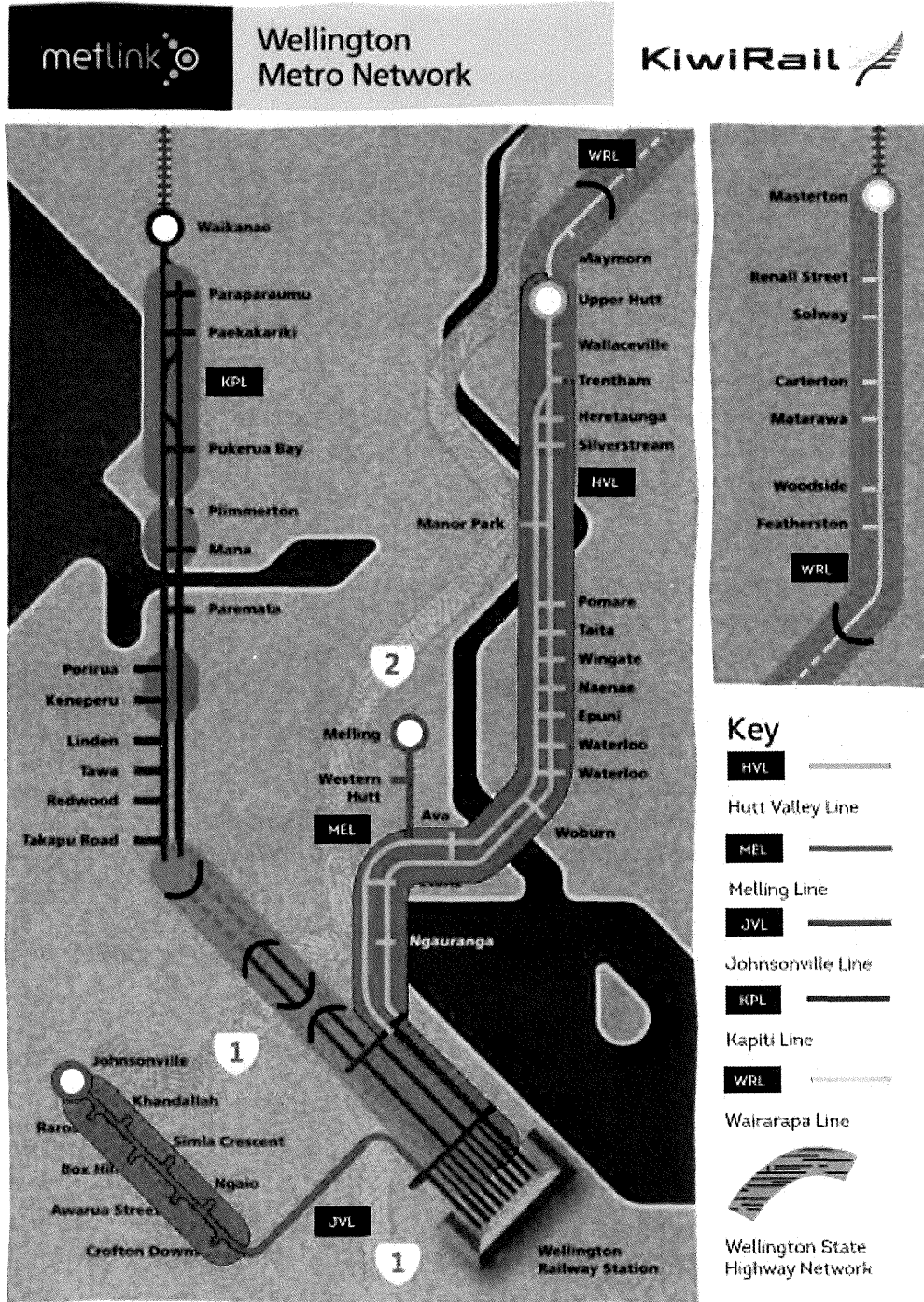


Figure 4 – Wellington Rail Network Investments (Proposed and Committed)

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**Appendix I – Benefits Realisation Risks**



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# Glossary

Abbreviation/ Term	Expansion/ Definition
ATAP	Auckland Transport Alignment Process
BBC	Better Business Case
BC	Business Case
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
Capex	Capital Costs
EMU	Electric Multiple Unit
FY	Financial Year
GTK	Gross Tonne Kilometres
GWRC	Greater Wellington Regional Council
ILM	Investment Logic Map
MoT	Ministry of Transport
MROM	Metropolitan Rail Operating Model
NIMT	North Island Main Trunk
NZTA	New Zealand Transport Agency
Opex	Operating Costs
PBC	Programme Business Case
PDS	Prematurely Decayed Sleepers
RLTP	Regional Land Transport Plan
RS1	Rail Scenario 1
SH1	State Highway 1
SH2	State Highway 2
SSBC	Single-Stage Business Case
STK	Single Track Kilometres
WMRN	Wellington Metro Railway Network
WMUP	Wellington Metro Upgrade Programme
WRRP	Wellington Regional Rail Project
WNA	Wellington Network Agreement

## Introduction

This business case supports enabling of the Wellington Metro Railway Network (WMRN) to remove current constraints on network capacity. It is jointly sponsored by Greater Wellington Regional Council (GWRC) (primary user) and KiwiRail (owner). This potential investment has been previously described as Rail Scenario 1 (or RS1) within GWRC's Regional Rail Plan.

Wellington metro railway services are provided by Metlink, GWRC's umbrella Public Transport brand, under which commercial providers operate rail, bus and harbour ferry services. Metlink rail services are provided by GWRC's partners, KiwiRail Networks and Transdev Wellington Ltd.

The WMRN provides over 13 million passenger journeys per year for the approximate 500,000 people who live in the region. The passenger trains provide peak period capacity for the required movement of people that would not be achievable on the roading network alone.

The WMRN is a key contributor to the region's economy through provision of an effective transport service to move people from where they live to their places of work, education and leisure.

It is emphasised that this business case is independent and separate from other Crown funding arrangements with KiwiRail Group relating to the wider freight network only.

This business case represents a programme of infrastructure capacity improvement works.

This document is divided into two parts:

**Part A: Background** - This section provides *the context of the passenger railway and rail services in the Wellington Region*. It also discusses the railway infrastructure and provides details of the infrastructure capacity issues. *It includes information that may be considered relevant to the Strategic Case.*

**Part B: Business Case** - These sections cover the *investment assessment and rationale*.



## Part A – Background

### 1 Purpose of the Wellington Metro Railway Network

#### 1.1 Overview of the Wellington Metro Railway Network

The WMRN’s five lines or routes connect regional suburbs and towns and the main centres of Wellington City, Lower Hutt, Johnsonville, Upper Hutt, Waikanae and Masterton. Four of these lines are electrified, providing efficient low environmental impact public transport. GWRC operates diesel hauled passenger trains on the Wairarapa Line between Wellington and Masterton.

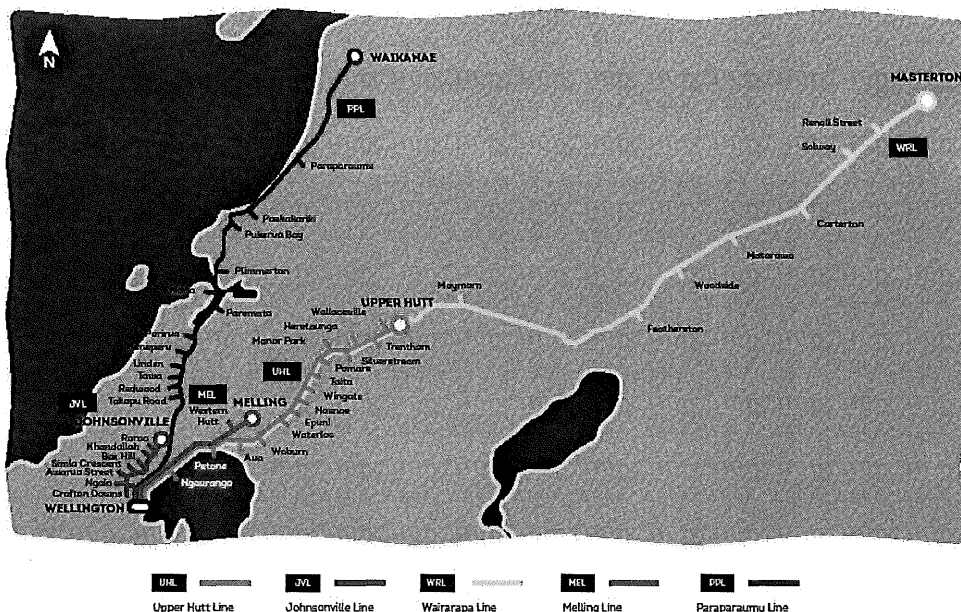
The WMRN consists of approximately 160 route kilometres. This includes:

- 10km Johnsonville Line
- 56km Kapiti Line (part of the North Island Main Trunk Line)
- 3km Melling Line (from Petone to Melling)
- 30km Hutt Valley Line (from Wellington to Upper Hutt)
- 60km Wairarapa (from Upper Hutt to Masterton)
- All passenger train storage yards and the train maintenance depot

The Wellington network also caters for KiwiRail’s Tranz Scenic services (long-distance passenger services) and freight services. The Tranz Scenic diesel-hauled passenger services connect Wellington with Palmerston North and with Auckland. The freight services connect various parts of the KiwiRail freight network. These services also rely on the shared infrastructure.

A description of rail infrastructure is provided in Appendix A.

Figure 5 – Wellington Metro Rail Network





## 1.2 Roles and Responsibilities of the Wellington Metro Railway Network

### 1.2.1 The Metropolitan Rail Operating Model (MROM)

The WMRN is administered by a group of organisations mandated by the Crown to undertake defined roles.

The Metropolitan Rail Operating Model (MROM) is the main framework for these organisations and is set out in Table 1 and Appendix B.

The current MROM was established in 2009. At this time, the Cabinet Economic Growth and Infrastructure Committee agreed that the key public policy transport objectives for the metro rail transport system should be to<sup>1</sup>:

- *Increase economic growth and productivity by reducing congestion on urban roads and by more efficient utilisation of the transport network*
- *Provide transport choice for users*
- *Integrate rail with other modes of transport*
- *Reduce the environmental impact of the transport system*

Underpinning the MROM is improved definition of the roles of the parties, the introduction of contestability, the use of performance based contracts and improved transparency<sup>2</sup>. It should be noted that the MROM is similar in both Auckland and Wellington.

Table 1 sets out the roles that stakeholders play<sup>3</sup>.



<sup>1</sup> Adapted from the following MOT webpage: <http://www.transport.govt.nz/rail/metro-rail/>

<sup>2</sup> Cabinet Economic Growth and Infrastructure Committee on the Metropolitan Rail Operating Model <http://www.transport.govt.nz/assets/Import/Documents/Metro-rail-Oct-09.pdf>

<sup>3</sup> Adapted from various sources including: <http://www.transport.govt.nz/assets/Import/Documents/Metro-rail-Oct-09.pdf>

**Table 1 – MROM Organisations, Roles and Responsibilities [Refer also to Section 2.2.2]**

MROM Organisation	Roles and Responsibilities
<b>GWRC (Metlink)</b>	<p>GWRC is the central stakeholder and funder, which sets commuter rail strategies and puts in place the mechanism to deliver them. GWRC responsibilities include:</p> <ul style="list-style-type: none"> <li>• Planning, specifying and purchasing metro rail services</li> <li>• Reviewing trends and options for upgrades as required</li> <li>• Public Transport subsidy obtained from rates and NZTA</li> <li>• Owning the metro rail rolling stock, depots and station buildings (except Wellington Station and Wairarapa diesel Locomotives)</li> <li>• Paying their share of the WNRN infrastructure operating, maintenance and renewal costs, in accordance with the Wellington Network Agreement (WNA) and intent of MROM. GWRC pay most of the costs (greater than 80%) towards the WMRN given their high use of the network.</li> </ul>
<b>KiwiRail (KR)</b>	<p>A State-Owned Enterprise consisting of four groups: Freight, InterIslander, Long Distance Passenger and Infrastructure.</p> <p>KR is the infrastructure owner (on behalf of the Crown) and provider for the WMRN. KR is are contracted to provide safe and reliable network services through the WNA.</p> <p>KR operated freight and long-distance passenger trains also use the WMRN. They pay their portion of railway infrastructure operating, maintenance and renewal costs in accordance with the WNA. Note: KR freight and passenger services have a stake in this business case albeit minor. However, future capacity constraints affecting the Wellington metro rail network will impact the KR services utilising it.</p>
<b>NZ Transport Agency (NZTA)</b>	<p>NZTA provides oversight, safety regulation and operating funding through GWRC towards the WMRN.</p> <p>Responsibilities include:</p> <ul style="list-style-type: none"> <li>• Public Transport Framework and Investment – setting the public transport procurement processes and administering subsidies</li> <li>• Transport Corridor Investment – investigation and development of recommendations to invest in land transport options</li> <li>• Rail Regulator – responsible for issuing rail licences, maintaining safety records and incident investigation.</li> </ul>



MROM	
Organisation	Roles and Responsibilities
<b>Transdev (Metro Service Operator)</b>	Transdev under contract to GWRC provide the WMRN passenger train operations and maintenance services. A 9 + 6-year service contract commenced in July 2016. They have central role representing operator interests and providing expertise in operations and rolling stock maintenance.
<b>Ministry of Transport (MOT)</b>	Have an overarching responsibility to represent the Crown's transport interests, ensure the MROM is working effectively and consider/provide investment advice to Treasury.
<b>NZ Treasury (Treasury)</b>	Responsible for assessing possible investments. If funding is approved, Treasury provides the funding through appropriations. Treasury have previously provided funding for rail infrastructure 'upgrade' works in Auckland and Wellington.

### 1.2.2 Wellington Metro Rail Package

After the establishment of the MROM framework, the Crown and GWRC negotiated the details of the Wellington Metro Package.

This Package, which was negotiated in 2011, saw GWRC taking ownership of and liability for passenger rolling stock and significantly lifting their contribution through the Wellington Network Agreement (WNA). The WNA sets out funding and maintenance obligations between the Crown (and KiwiRail) and GWRC.

The Government accepted the need to undertake catch-up renewals and upgrades on the rail network, and before agreeing to the MROM in 2011, Greater Wellington consulted with the public as part of its Proposed Annual Plan 2011-12, on the basis that *"an important part of the deal involves continued network upgrades by the Government. Significant work would be programmed in, with secured funding."*

**DURING THE NEGOTIATIONS FOR THE CURRENT METROPOLITAN RAILWAY OPERATING MODEL FRAMEWORK, IT WAS AGREED THAT THE GOVERNMENT WOULD FUND REQUIRED UPGRADES. THIS BUSINESS CASE LOOKS AT THE NEED FOR FUTURE UPGRADES.**

### **1.3 Wellington Rail Infrastructure Funding – Current and Previous**

#### **1.3.1 Overview**

The WNA sets out the funding types for the railway infrastructure, broadly grouped into the following categories:

- **Upgrades** – projects or programmes of work where extra capability is added to the railway network (for example double-tracking, signalling improvements, safety enhancements, etc.). This is not currently allowed for within the WNA contributions. This business case relates to this category of work
- **Maintenance** – day to day work to undertake fault repairs, preventative maintenance and inspections. This work is funded through the WNA contributions from GWRC and KiwiRail Freight
- **Renewals** – like-for-like replacement of railway infrastructure components when they reach the end of life. Steady state renewals are funded through the WNA contributions from GWRC and KiwiRail Freight

#### **1.3.2 Previous Crown-Funded Upgrade Works**

In recognition of the need to provide capacity and a reliable transport system to support the Wellington economy, the Crown has previously invested in upgrades of the WMRN<sup>4</sup>.

The most recent upgrade (the Wellington Regional Rail Project – WRRP – 2008-2011) prepared the network for the new Matangi trains, removed key choke points and extended network reach (to Waikanae).

The major infrastructure upgrade works were undertaken to remove historical constraints on the network which had persisted as a result of previous ownership and funding models.

The amount of Crown funding was approximately \$319 million.

THE WELLINGTON METRO RAILWAY NETWORK WAS MAINTAINED AND OPERATED UNDER A COMMERCIAL MODEL BETWEEN 1993 AND 2004. THIS LED TO UNDERINVESTMENT WITH SIGNIFICANT INFRASTRUCTURE UPGRADES REQUIRED - TOTALLING \$319 MILLION 2008 - 2011. THIS BUSINESS CASE SUPPORTS FURTHER UPGRADES TO REMOVE THE CURRENT IDENTIFIED NETWORK CONSTRAINTS

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<sup>4</sup> Refer to the GWRC Business Case to Land Transport New Zealand 'Request for Funding of Double-tracking and Electrification from McKay's Crossing to Waikanae', 11 June 2007.

WRRP delivered significant benefits for the WMRN including:

- A well-performing rail service which has increased passenger demand for metro rail. This has been particularly so for the Kapiti service, which has increased peak period patronage by a total of almost 20% since the upgrades to the line were completed
- A safe and reliable rail service providing a viable transport alternative to road transport
- An improved passenger experience and shorter journey times.

A summary of the WRRP 2008 -2011 works and the outcomes are outlined in Table 2. Similar upgrade investments were made to the Auckland Metropolitan Railway Network in a similar period.

Table 2 – Wellington Regional Rail Project (WRRP 2008-2011)

Item	Summary
<b>Double Track and Electrify from McKay's Crossing to Waikanae</b>	Increased catchment of the WMRN passenger system and improved rail reliability and capacity for this section of track. Decreased pressure on State Highway 1 resulting in less congestion and improved transport safety.
<b>Triple Track Entrance to Wellington Station</b>	Increase capacity and reduce passenger train delays resulting in improved efficiency and capacity.
<b>Lower Johnsonville Tunnels and Extend Passing Loops</b>	Works to increase the clearance in tunnels and platforms to accommodate the new Electric Multiple Units (EMUs), allowing GWRC to standardise on one type of train, increase passenger capacity with 6 car passing loops (up from four) and improve reliability and safety with modern rolling stock.
<b>Traction and Signalling Upgrades</b>	Essential works to the traction and signalling systems to accommodate modern electric rolling stock (Matangi EMUs).
<b>Platform and Station Upgrades</b>	Essential works to platforms to accommodate new EMUs, plus some enhancements to the poorest condition platforms to improve station amenities for rail customers.
<b>EMU Depot</b>	Construction of a new EMU and passenger carriage depot and related facilities for the introduction of the new fleet.

### **1.3.2.1 GWRC Investment in the Wellington Metro Railway Network**

Additional to the investment outlined above, there has been other significant complimentary investment by GWRC and others in recent times including:

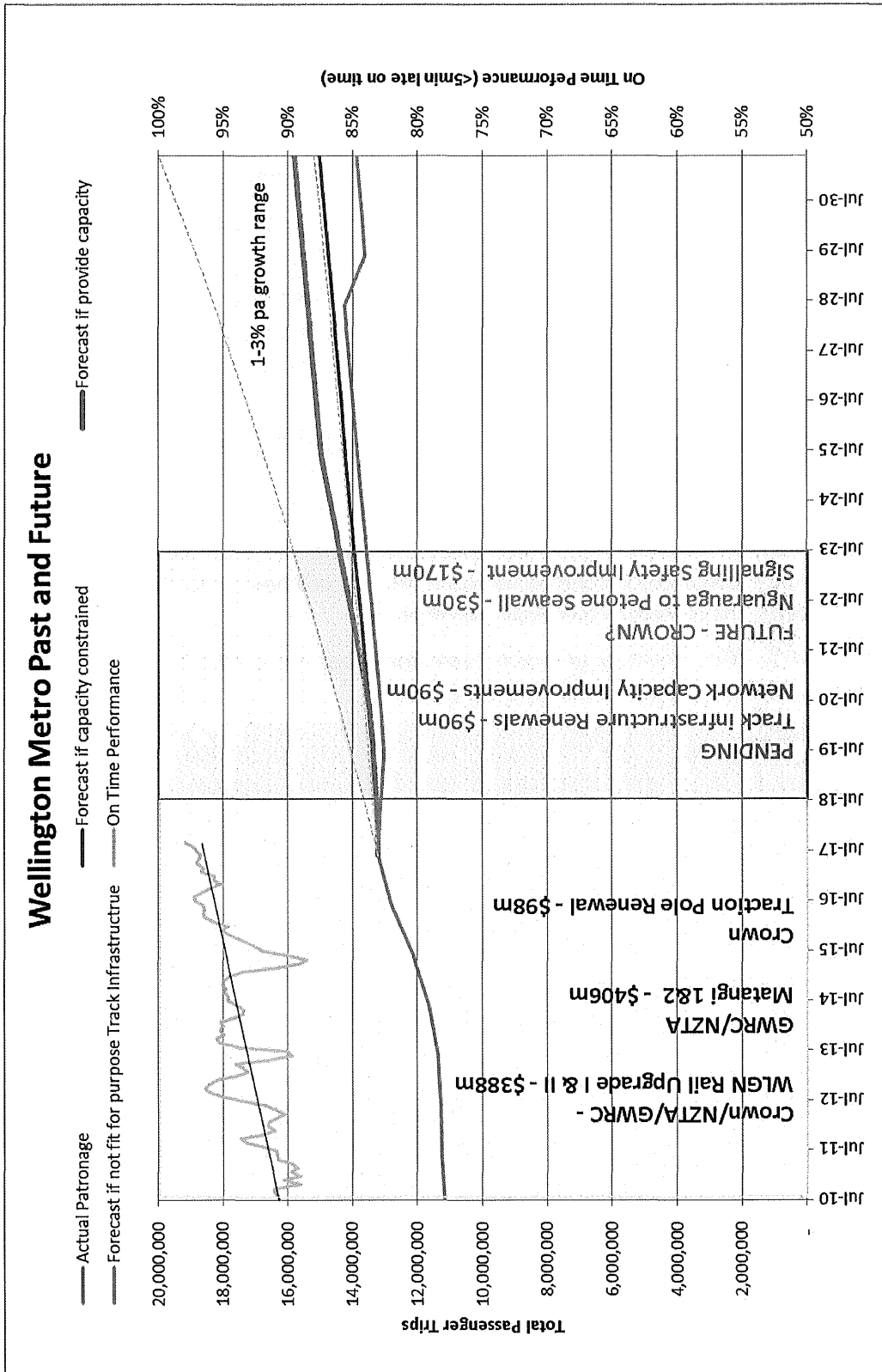
- Purchase and commissioning of 83 new EMUs in the last five years (\$405 million)
- On-going investment by GWRC into station buildings and shelter replacements and upgrades, pedestrian over-bridges and subways upgrades, and upgrades, and other WMRN rail systems (i.e. real-time train information) to improve customer service, the amenity and positive perception of passenger rail. (>\$3.5m annually)
- Park & ride expansions, which are increasingly in demand as car users living remote from stations choose the train service
- Improved service for the Wairarapa Line – 18 new SW carriages, a longer 4.25pm train to meet demand and deployment of modified cars onto this route.
- Better integration of train and bus timetables to make Wellington’s Metlink public transport network easier to use.

### **1.3.3 Summary of Wellington Metro Railway Network Investment Outcomes**

#### **BENEFITS ACHIEVED FROM PREVIOUS RAIL INVESTMENTS:**

- INCREASED RAIL PASSENGER TRIPS (PEAK PERIOD PATRONAGE ON THE WMRN HAS GROWN A TOTAL OF 13.6% OVER THE LAST THREE YEARS ALONE)
- INCREASED CAPACITY AND REACH TO MEET GROWING POPULATION AND TRANSPORT DEMANDS
- DECREASED ROAD CONGESTION AT PEAK TIMES BY PROVISION OF A RELIABLE AND FREQUENT PASSENGER RAIL SERVICE
- PASSENGER RAIL IS PROVIDING A VIABLE TRANSPORT ALTERNATIVE TO AVOID AND/OR DEFER MAJOR ROAD INVESTMENT
- REPLACEMENT OF ASSETS AT THE END OF THEIR SERVICEABLE LIFE TO ENSURE CONTINUITY OF SERVICES AND MINIMISE SAFETY RISKS
- INCREASED CUSTOMER SATISFACTION

Figure 6 – Trend in Patronage Against the Timing of Recent Major Investments. Bands of Future Potential growth are also shown.



## **1.4 Wellington Metro Railway Network Peak Patronage – Current and Forecast**

### **1.4.1 Current Peak Patronage Growth on the WMRN**

In order to deliver the economic benefits expected of metropolitan train networks, and ensure a balanced mode share between road and rail, the WMRN is required to provide efficient and effective peak period services for CBD workers into and out of the Wellington.

During peak periods, the WMRN transports 18,000 workers into and out of the city each weekday which equates to approximately 23%<sup>5</sup> of all CBD workers.

Most recent data show that monthly peak patronage on the WMRN has grown a total of 13.6% over the last three years. This is significant, given this is increasing pressure on the services and the network at the time of maximum demand. Fleet size and network capacity are set to meet peak demand, and this demand is increasing.

This patronage growth, especially during peaks, is exceeding previous forecasts. AM peak patronage on the Kapiti and Hutt Valley Lines grew by 1.3% and 6.3% respectively in FY17, despite the November 2016 earthquake and resultant delays due to slow running.

Population growth, combined with rising fuel prices and confidence in the performance and reliability of service provided by recent rail investments, are believed to be the key contributors towards the growth in passenger numbers.

Overall from 2010 to 2017, the total annual rail patronage has also grown from approximately 11 million to over 13 million trips per year.

**DAILY AM PEAK PATRONAGE ON THE WMRN INCREASED BY 13.6% IN THE LAST THREE YEARS WITH 4% IN FY17. THIS SUCCESS IS DUE TO LARGE CAPITAL UPGRADE AND RENEWAL INVESTMENTS BY THE CROWN, GWRC AND NZTA (VIA NLTF TO GWRC).**

### **1.4.2 Peak Patronage Distribution**

Consistent with other metropolitan commuter networks around the world, patronage demand for the WMRN is heavily skewed towards the peaks, with the AM peak more sharply defined, with a shorter, more intensive height of peak than the PM peak.

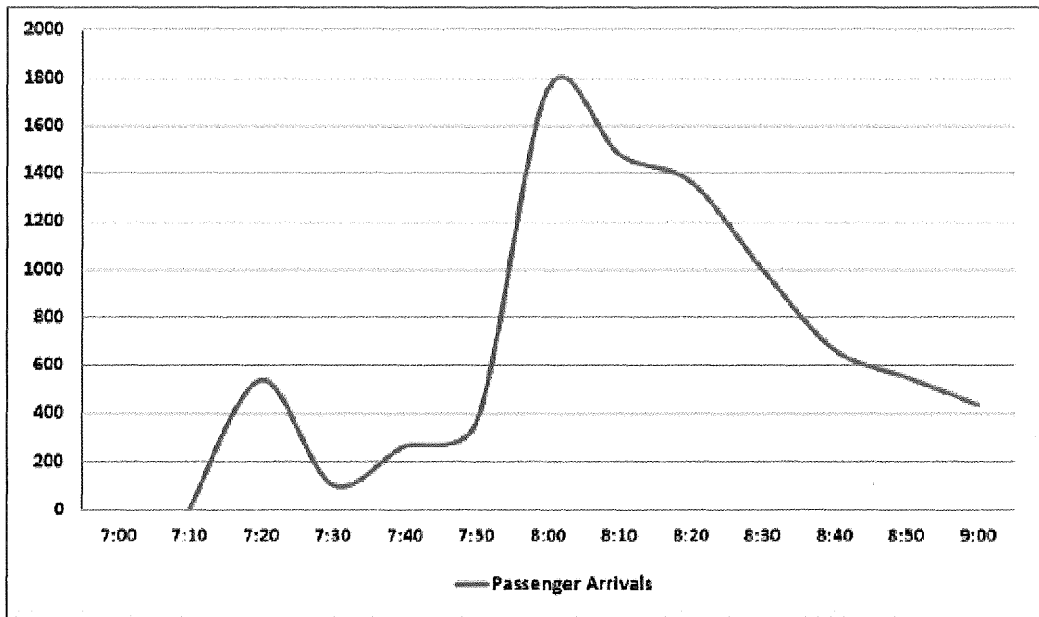
The recent peak patronage growth has placed increasing pressure on the services which already have to cater for a very high 'peak of the peak' patronage on train services, particularly in the morning. The 'peak of the peak' (see Figure 7) is sharpened by the current infrastructure and resulting timetabling constraints.

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<sup>5</sup> In 2013 census there was total of 79,812 workers who worked in the CBD and surrounding areas. (<http://m.stats.govt.nz/Census/2013-census/profile-and-summary-reports/commuting-patterns-wtn/working-in-wellington.aspx>)



Figure 7 – AM Peak Passenger Arrivals at Wellington Station (0700hrs to 0900hrs)



The high 'peak of the peak' is sharpened by (relatively) low frequency peak timetables, which is particularly the case on the Hutt Valley Line. Resolving the issue requires increasing peak service frequencies.

GWRC as part of its Regional Rail Plan is committed to increasing peak service frequencies to ensure:

- Improved customer satisfaction
- A train service which is less heavily reliant on a small number of peak period services
- A rail system which encourages 'turn up and go' customer behaviour
- A higher performing rail service which generates more customer demand and reduces reliance on private vehicle travel

Passenger rail forms part of an integrated transport service provision by providing capacity that complements the road network.

This is particularly evident in cities that utilise a 'turn up and go' timetabling philosophy. Trains (or buses) are sufficiently frequent (i.e. 10 to 15 minutes at peak times) to provide passengers with the confidence there are adequate peak period services to get them to their destination on time without checking timetables.

Internationally, as well as in Auckland, rail services which have adopted this timetabling philosophy have seen significant increase in demand for services, due to the increased confidence and ease of use. The Auckland metro network infrastructure was significantly upgraded to enable "turn up and go" service.

**'TURN UP AND GO' BEHAVIOUR** – Passengers have confidence there are adequate peak services and do not consult timetables (i.e. frequencies less than 15 minutes at peak). Internationally and in Auckland, rail services which have changed to this timetabling philosophy have enjoyed significant increase in demand for services due to the increased reliability.

Figure 8 – Auckland’s ‘turn up and go’ Service showing 10-Minute Peak Service Frequency. This has led to the ability for the Auckland metro system to spread demand and driven significant increased demand (an average 20% per year and growth from 3 million in 2002 to currently 20 million trips)



#### 1.4.3 The Drivers of Rail Peak Period Demand Growth

The WMRN has increasing patronage demand, particularly in peak periods. Generally, the key drivers for change in demand for public transport services in the AM and PM peak periods are:

- **The quality and performance of the public transport system** - Improvements in reliability, service frequency, travel time in comparison with other modes, convenience, access to information, quality of carriages, perceptions of safety and capacity, all increase the demand for public transport services. Fare policy, the price of public transport relative to other modes, and relative value for money to passengers also has an impact on demand.
- **Changes in the size and nature of the region’s population and employment** - A growing population increases the demand for public transport, particularly when growth includes CBD employment growth.
- **Economic growth (or decline)** – wider economic factors can influence the need to travel, car ownership, mobility choices, and congestion. Increasing car ownership can decrease the demand for public transport unless road congestion demotivates the use of cars. Increasing costs of fuel and inner-city parking increase public transport demand, as does increased congestion.
- **Alternatives to public transport** - Increased road capacity and/or reduced congestion decreases the demand for public transport, as do improvements in cycling and pedestrian infrastructure.

- **Community support for sustainability** - can influence the emphasis individuals place on using public transport as opposed to private vehicles, with increasing awareness of sustainability issues resulting in increased demand for public transport.
- **Technology changes** - Driverless vehicles and other technology disruption may change the way people choose to travel.

The combined influence of all or some of these factors can result in change in public transport demand.

#### 1.4.4 Why will Rail Peak Period Demand Continue to Grow?

GWRC are committed to ensuring the sustainable and on-going growth in the demand for peak period rail services.


CONTINUED GROWTH IN PEAK PATRONAGE DEMAND IS EXPECTED IN THE FUTURE. GREATER WELLINGTON REGIONAL COUNCIL IS COMMITTED TO IMPROVING THE QUALITY OF RAIL SERVICES AND ENSURING A BALANCED MODE SHARE WITH THE ROAD NETWORK. THIS IS CONSISTENT WITH LOCAL AND CENTRAL GOVERNMENT POLICIES.


The table below details both the GWRC strategies planned or underway to increase demand for rail, as well as the other expected external drivers and their forecasted effect on rail demand.






Overall continued growth in demand for rail is expected to continue, **with this business case assuming a conservative growth rate.**




It is however noted that continued growth is dependent on providing the quality train service which this business case is pursuing, through the removal of network constraints and improved peak service capacity and resilience.

Table 3 - Peak Rail Demand Drivers and Expected Impacts for Next 15 Years (to 2030)

Growth/demand driver		Description	Expected Demand Effect
Internal drivers	Service levels		
	Overall level of service	<ul style="list-style-type: none"> <li>• New timetables for morning peak rail services which improve the match between service capacity and demand from 2021 (<b>Capacity constraint release required – this business case</b>)</li> <li>• Increased car and cycle parking facilities at stations</li> <li>• Increased quality of infrastructure and safety/security provision</li> <li>• Travel convenience, including interchange facilities</li> <li>• Integration of fares and ticketing to improve ease and ability to transfer between modes and routes</li> <li>• Continue to maintain new trains and refurbish as required. Plan to renew the Wairarapa Carriage fleet with Diesel Multiple Units in approximately 2021. This will enable</li> </ul>	

Growth/demand driver	Description	Expected Demand Effect
	<p>increased capacity, service frequency and vehicle quality, which is likely to drive increased demand</p> <ul style="list-style-type: none"> <li>Catch up on deferred maintenance renewals, and undertake projected intergenerational renewals (<b>refer to separate business case titled "Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals"</b>)</li> </ul>	
Fare increases	Fare policy can have the effect of damping demand. The impact of any increases may be absolute (especially for off peak travellers) or relative to the costs of other modes (especially for peak commuters). Fair increases by GWRC will ensure a balanced approach with limited to no impact on demand.	

External drivers	Population and demographics		
	Increasing population, particularly in the regions and the Kapiti Coast	Minor increases in population are expected to continue, including the spread into outer suburbs, increasing demand for services.	
	Increasing inner-city dwellings	Increased density of inner city living is likely to be offset by general suburban population growth.	
	Vulnerable communities and aging population	People on low incomes and those who choose not to have a car (due to disability, affordability, etc.) rely on public transport and have no other viable options. Additionally, an ageing population may result in more off-peak travel, while people working later in life will also generate more peak time trips.	
	Economic growth		
	Modest economic growth in Wellington	Based on recent trends, growth in population is likely to have a greater impact upon population than economic growth. Economic growth is however expected to continue to be relatively stable over the long-term and thus should result in on-going increase in demand	
	Increased costs of alternative travel options	Increases in fuel price and shortages/costs of inner city parking encourage increased use of public transport. Generally, it is expected that these costs will continue at the rate of any fare increases and thus there should be no perceived effect. However, this is a conservative assumption	

<b>Road congestion</b>	In recent years road congestion levels have remained relatively static. It could be assumed increased travel demand will be offset by planned increases in road capacity. However, the Wellington road network at peak is reasonably constrained <sup>6</sup> and thus increased road congestions could have a multiplier effect on increasing rail demand. To be conservative, no effect on demand is assumed.	
<b>Environmental sustainability</b>		
<b>Awareness of the importance of environmental sustainability</b>	There is increasing awareness of the importance of environmental sustainability, which increases preference for environmentally-friendly and low-emission public transport.	
<b>Technology</b>		
<b>Technology changes</b>	There is the potential for a reduction in demand for Public Transport if there is a 'technological disruption'. The current known potential disruption is the emergence of driverless cars. Given that these cars will utilise the road network, the congestion and timeframes for travel will still limit the effect on rail. Therefore it assumed that a disruption that materially decreases demand for peak period services in the next 15 years is unlikely.	

#### 1.4.5 Forecast Patronage Growth at Peak

As discussed in the previous section, the effect of the demand drivers on public transport depends on a range of assumptions relating to population, employment, the economic environment, infrastructure projects, fuel prices and public transport fares.

The further into the future the forecast, the greater the uncertainty relating to these underlying assumptions. It is therefore important that forecasting utilises conservative estimates. The following scenario has been assumed when forecasting future peak demand growth:

- **Low Growth – 1.7% p.a** - This conservative scenario has been utilised in this business case. It is primarily to assess the long-term likely scenarios for this business case including economic analysis. It provides the scenario of general latent demand growth and is less than current trend seen of 3.6% p.a. However, this does not take into account

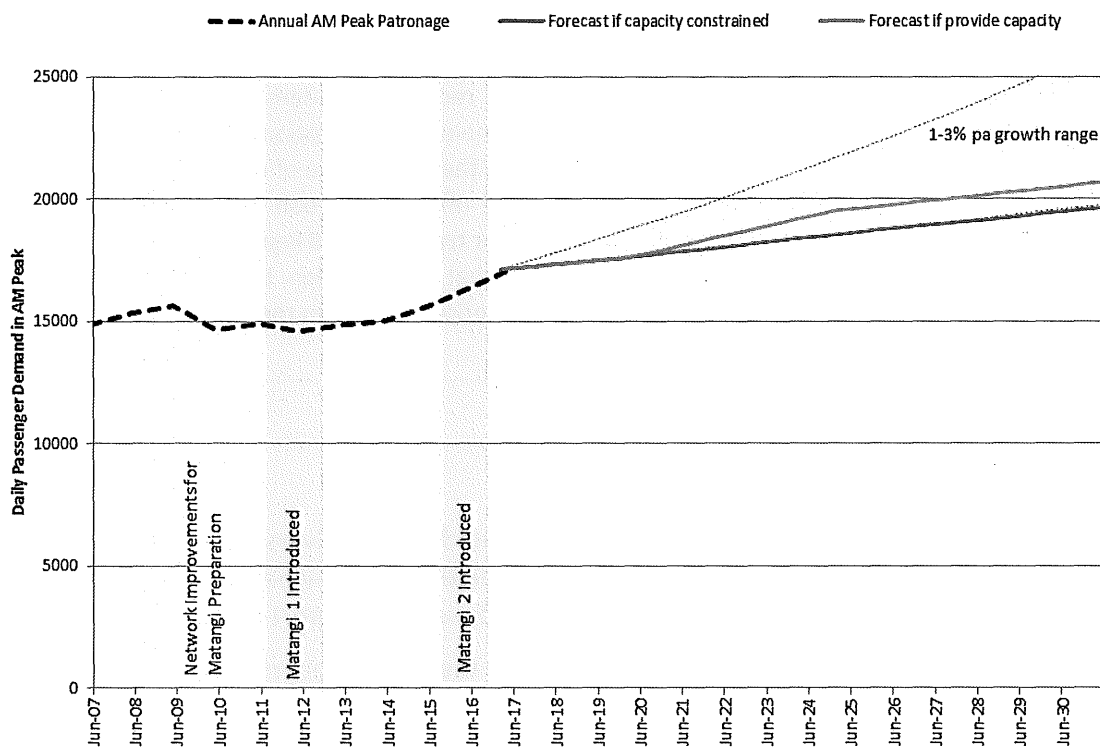
<sup>6</sup> Particularly in the critical terminal section south of Johnsonville and Petone, a corridor where significant capacity increases are unlikely to be practical.

increasingly constrained road networks or other factors that may drive the demand above this assumed conservative growth rate.

The graph below details both the current growth in peak demand and the band of forecasted growth scenarios from 1.0 to 3.0%, to test timetable options for capacity. The green line represents assumed daily passenger demand growth in the AM peak without capacity constraints. The red line represents assumed daily passenger demand growth in the AM peak, with capacity constraints and with a suppressed growth rate with reduced capacity.

Figure 9 – Wellington Morning Peak Patronage. This figure shows the trend in peak period patronage as well as the timing of the recent major investments. Bands of future potential growth are also shown.

**Wellington Morning Peak Patronage**



CONSERVATIVE ESTIMATES OF FORECASTED DEMAND HAVE BEEN USED TO ENSURE THERE IS NO OVER ESTIMATION OR OPTIMISM BIAS IN THIS BUSINESS CASE. HOWEVER, UNLOCKED CAPACITY PROPOSED WILL ENABLE CONTINUED 3.6% P.A. GROWTH AT PEAK THROUGH TO 2030.

#### 1.4.6 Current Train Utilisation at Peak Periods with Current Timetable

Train carriage utilisation (i.e. use compared to capacity) on the WMRN is assessed against both:

- **Load Standards (minimum level of service and passenger comfort)** – this is the minimum passenger standard that has been determined by GWRC. It sets the acceptable level of crowding, acknowledging that standing for 20 minutes or longer is undesirable (aligned with best practice).
- **Percentage Capacity** – This is the raw statistic and totals to 100%, which is made up of 60% seating capacity with remaining 40% being standing capacity. It does not however include full ‘crush capacity’ which would only be relevant for capacity of trains servicing large events (e.g. Westpac Stadium events) or short durations.

The following table summarises the current utilisation of train capacity in the morning peak with the current timetable. It highlights that already there are issues with the current morning peak timetable not meeting the desired load standards.

Table 4 – Current Train Utilisation at AM Peak Period with Current Timetable

Line	Summary
<b>Kapiti Line</b>	<p>The load standards on the Kapiti Line require all passengers boarding before Porirua having a seat, and from Porirua onwards to Wellington, seating and standing capacity must be available. This load standard is often exceeded at peak times.</p> <p>Utilisation of train capacity during the peak is usually approximately 70%, with a maximum of 85%.</p>
<b>Hutt Valley Line</b>	<p>The Hutt Valley Line’s load standards require all passengers boarding before Waterloo Station having a seat, and at Waterloo Station onwards, seating and standing capacity must be available. This load standard is regularly exceeded at peak times.</p> <p>Utilisation of train capacity during the peak is usually approximately 70%.</p>
<b>Johnsonville Line</b>	<p>The Johnsonville Line does not meet the threshold for triggering the load standard considerations due to its relatively short length (11.3km). Therefore standing is permissible across the entire line.</p> <p>Utilisation of train capacity during the peak has not reached 100% and is usually approximately 50%, with a maximum of 80%. Improvements introduced in October 2015 increased services on this line and these are still meeting demand. On this basis, no upgrades are proposed on this route as part of this business case.</p>
<b>Wairarapa Line</b>	<p>The Wairarapa Line’s load standards require all passengers boarding before Waterloo Station having a seat, and at Waterloo Station onwards, seating and standing capacity must be available. This load standard is frequently exceeded.</p> <p>Utilisation of train capacity during the peak has at times reached 100% and is usually approximately 80%. However, this line has only three AM and three PM peak services so rolling stock is the key constraint on this line rather than the network, therefore this line is not specifically part of this business case. However there are indirect timetable resilience benefits of the Hutt Valley changes (recovering from disruptions).</p>

Figure 10 – Commuters on a full Wellington Train at PM peak



## **1.5 Current Wellington Metro Timetable Options & Railway Network Network Infrastructure Constraints**

### **1.5.1 Overall study**

An independent transport network operations consultant<sup>7</sup> was employed in 2017 to assess:

- The optimum timetable that increases the capacity of peak services making a trade-off for the expected demand whilst balancing the extent of network changes.
- The current constraints of the network impacting the WMRN's potential for a higher frequency timetable.

The independent consultant assessed various timetabling options around the 10, 15 and 20 minute cycles for peak periods, focussing on the Kapiti and Hutt Valley Lines which equate to 85% of the WMRN's peak passenger loads. This included the following potential peak period timetable options which includes both reducing and increasing service frequencies to ensure a balanced approach:

- **Option A – 10-minute headway, single-tier<sup>8</sup> service** – This essentially would remove the current two-tier service on the Kapiti and Hutt Valley Lines.
- **Option B – 10-minute headway, two-tier service** – This would maintain the current two-tiered service and significantly improve frequency at peak periods.

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<sup>7</sup> Anthony Boston, Transit Strategies

<sup>8</sup> Definition of 'tiered service pattern' – single tier (or layer) is a stop all station service, a multiple tiered \*(or layered) service, has multiple stopping patterns, i.e. stopping then express, & stopping service for part of line. This improves passenger journey time, and maximises train utilisation.





- **Option C – 15-minute headway, two-tier service** - This would maintain the current two-tiered service and moderately improve the service frequency on the Hutt Valley Line and moderately reduce the service frequency of the Kapiti Line, between Porirua and Wellington.
- **Option D – 20-minute headway, two-tier service** - This would maintain the current two-tiered service and reduce the service frequency of the Kapiti Line (with no change to the service frequency on the Hutt Valley Line).
- **Option E – 20-minute headway for outer-tiers, 10-minute headway for inner-tiers** - This would maintain the current two-tiered service and moderately improve the inner-tier service frequency of the Kapiti Line and improve the service frequency on the Hutt Valley Line.

The independent networking consultant identified the following timetables as the preferred options:

- **Kapiti Line** – Option E
- **Hutt Valley Line** – Option C (preferred) – Option D is the do minimum option
- **Other Lines** – no significant change

A summary of the morning peak timetable options is provided on the following page in Figure 11 and Figure 13.

The following key initiatives were identified as being required to unlock the vital and productive network capacity to provide this preferred peak timetable and frequency:

**Table 5 – Network Constraints and their removal**

1) Kapiti Line overhead power supply upgrades to enable more long (8 car) higher capacity trains
2) A high capacity train turn-back facility at Plimmerton
3) A second lead track to Wellington train storage yards to facilitate faster platform clearance
4) Doubling tracking between Trentham and Upper Hutt to reduce punctuality issues due to this last single track section on the Hutt Valley Line (Required, for Hutt Valley option C, and Highly Desired to improve timetable robustness for Hutt Valley Option D)
5) Additional crossovers and connections in the busy Wellington station approaches to provide extra capacity and resilience (Not essential for Hutt Valley Option D – Do Minimum option)
6) A new freight loop at Plimmerton, or an improved one at Porirua, to ensure freight trains can continue to operate between the more frequent passenger services (not identified in independent report, but required to help longer freight trains through during the peak)
7) Re-signalling of Woburn Junction to allow quicker access to and from Gracefield Branch (Hutt Railway Workshops) to reduce delay to metro services. (not identified in independent report, but ideal in higher frequency off peak service)
8) Possible renewal of A Box signal interlocking with a computer based interlocking (instigated by item 3 & 5)

Any attempt to increase passenger train frequency and capacity without supporting infrastructure upgrades will deliver a fragile level of service. This will deliver a level of service that frequently fails customer reliability and punctuality targets.

This in turn will erode the growth in passenger rail use of the last 10 years and subject the road network to increased demand, with resulting congestion and reduced resilience

The analysis showed that the preferred options provide sufficient capacity for 3.6% p.a. peak growth through to 2030, with the current Matangi fleet size.

**REMOVING THE IDENTIFIED CONSTRAINTS WILL ENABLE THE FOLLOWING TIMETABLES:**

**KAPITI LINE (OPTION E)**

- **Inner-network stopping all stations service** - a 10-minute headway peak Plimmerton service (stopping all stations to Wellington)
- **Outer-network partial express service** - a 20-minute headway peak Waikanae service (stopping all stations Waikanae to Porirua, then express to Wellington)

**THIS OPTION IMPROVES ON THE EXISTING TIMETABLE BETWEEN PLIMMERTON AND WELLINGTON**

**HUTT VALLEY LINE (OPTION C)**

- **Outer-network partial express service** - a 15-minute headway peak Hutt Valley service (stopping all stations Upper Hutt to Taita, then express to Wellington, stopping at Waterloo)
- **Inner-network stopping all stations service** - a 15-minute headway peak Taita service (stopping all stations to Wellington)

**THIS OPTION IMPROVES ON THE EXISTING 20-MINUTE INNER AND OUTER-TIER TIMETABLE.**

A summary of the proposed minimum Morning Peak Service Pattern is provided in Figure 12 below (with Figure 11 showing the current pattern). A total of two additional services on the Kapiti and Hutt Valley Lines are proposed during the peak hour to increase capacity and spread the demand. This would provide significant benefits and increase the capacity on these lines by 30% in the peak.

Figure 11 – Current Wellington Morning Peak Service Pattern

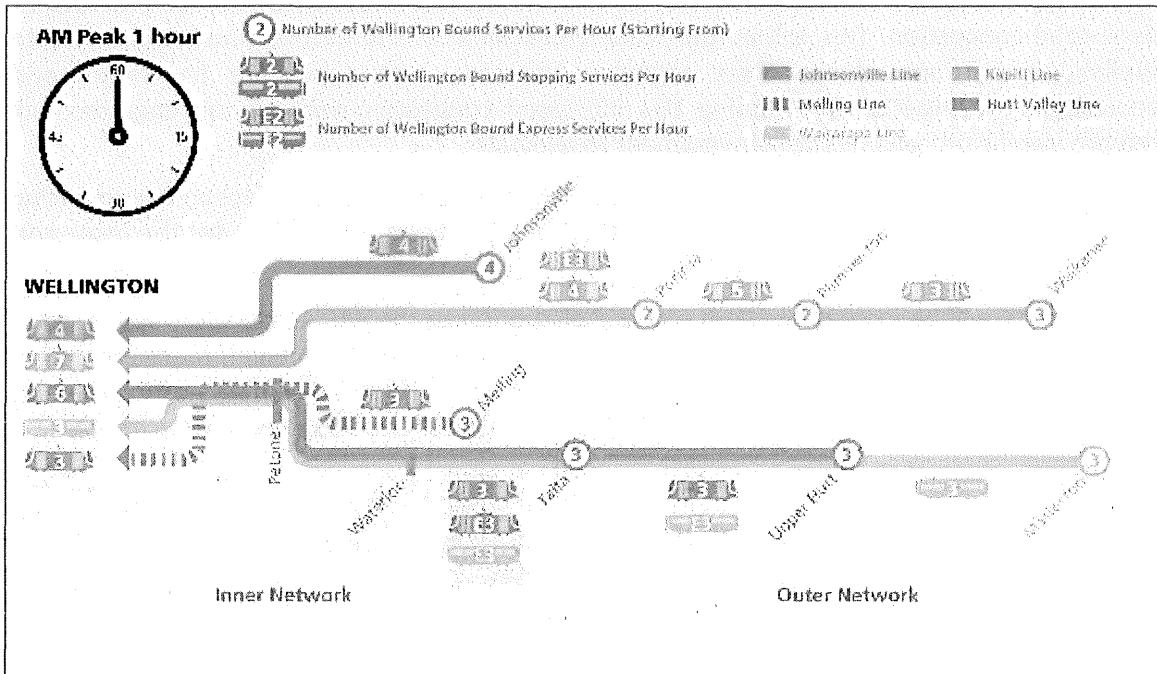
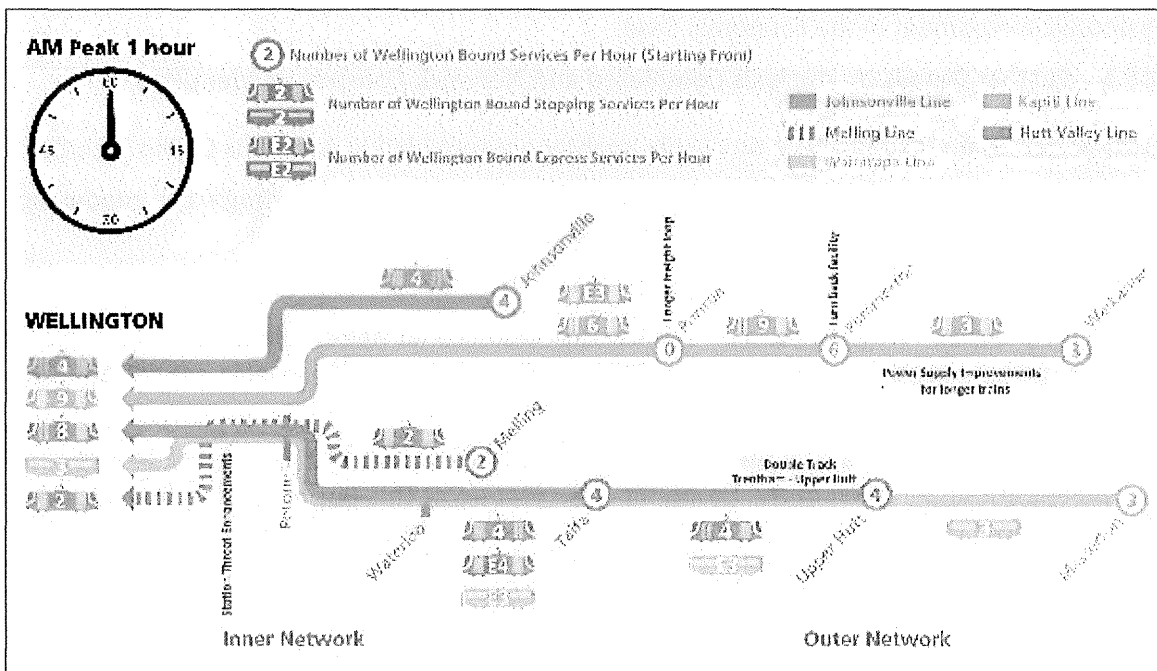


Figure 12 – Proposed Wellington Morning Peak Service Pattern



### 1.5.2 Implications of not resolving these current constraints

Without a number of infrastructure capacity constraints being resolved, the WMRN will not be able to provide increased peak period capacity or reliably cater for growth in future demand.

Failing to provide capacity will suppress forecast demand. Patronage growth will likely flat-line or may even decrease due to customer dissatisfaction.

Any unmet demand will likely be met by private vehicle commuting, contributing to further peak road congestion. This will be particularly prevalent in the Petone and Johnsonville to Wellington portions of the State Highway Network, with significant frustration and environmental impacts. Overcoming this increased congestion without rail upgrades will require significant road network investment to alleviate.

Failure to invest in network capacity upgrades will also result in less effective use of rolling stock assets, due to the reduced ability to offer an efficient service pattern for the inner and outer parts of the network.

Finally, there will be increased risk of a major disruption to the whole transport system, due to its inherent vulnerability and the inability of rail to carry additional load if roads are closed or at reduced capacity. Disruptions could include a major (or even minor) traffic accident, landslide on the SH2 Hutt Road or a landslide on SH1 road. Ngauranga gorge for example.

**THE ABSENCE OF SUFFICIENT INFRASTRUCTURE CAPACITY TO CATER FOR GROWTH IN FUTURE DEMAND WILL RESULT IN REDUCED PATRONAGE, CONGESTED ROADS, THE UNDER-UTILISATION OF THE TRAIN FLEET, ENVIRONMENTAL IMPACTS, AND RESILIENCE ISSUES ON THE REGIONAL TRANSPORT NETWORK.**

These constraints/issues and potential resolutions are required to be tested in the assessment of options, including Option 1: Do Nothing. This has been completed via the economic assessment in the Economic Case.

### 1.5.3 Further Details on Analysis Completed and Network Constraints Identified

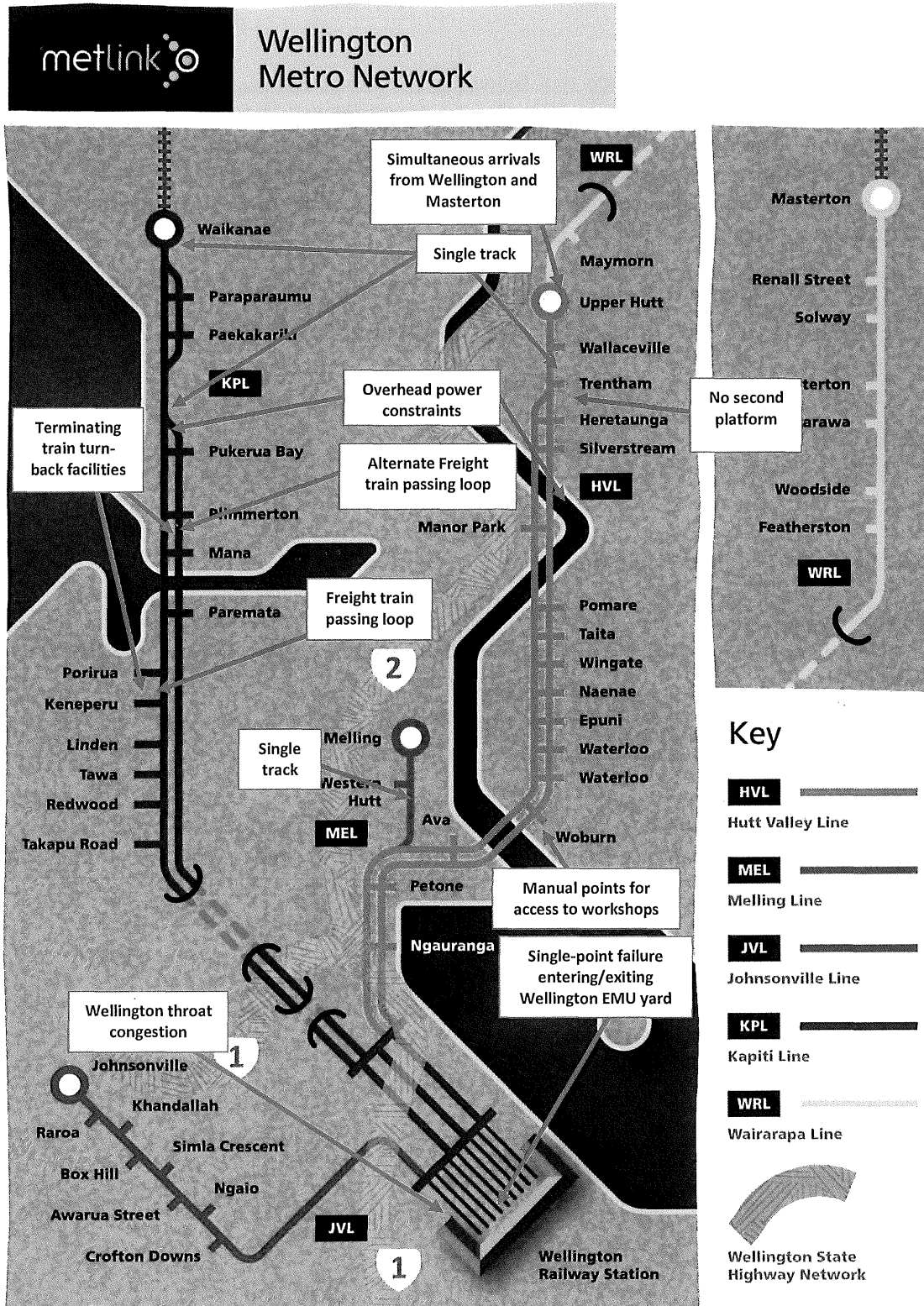
Further details on results of the timetable analysis are provided in Appendix C. This includes:

- A summary of all the relevant network constraints identified through the modelling, including if they are required to be removed for preferred timetable
- The full modelling report is available on request

Figure 13 provides further details on the key constraints that need to be resolved to unlock the productive network capacity to provide a viable and successful metro service to 2030 and beyond.

A full economic analysis of the timetable options and the results of the network assessment completed are undertaken in the Economic Case section of this Business Case. This includes the assessment of retaining the current timetable and network as is.

Figure 13 – Key Wellington Metro Railway Network Features Constraining Capacity Increases



## **1.6 Case Studies – Service Frequency causing Suppressed Rail Demand**

### **1.6.1 Auckland**

Rail patronage demand can quickly rise following successful rail capacity investment. This has recently been demonstrated by the rise in Auckland rail patronage. Patronage has consistently increased by about 20% each year since improvements were complete. Improved rail performance, combined with road congestion has fueled this increased usage. With growth at an unexpectedly high rate, Auckland Council granted \$207 million towards purchasing 17 new trains to meet this demand.

AUCKLAND ILLUSTRATES THAT INVESTING IN CAPACITY AND QUALITY OF TRAIN SERVICE (EVEN WHEN THERE IS UNCERTAINTY WITH FORECASTED DEMAND) CAN UNLOCK 'SUPPRESSED DEMAND'.

THIS IS ESPECIALLY A CONSIDERATION GIVEN THE WELLINGTON ROAD NETWORK PEAK CONGESTION ISSUES.

### **1.6.2 Wellington – Johnsonville Line**

In October 2015, GWRC introduced a regular 15 minute clock-face timetable on the Johnsonville Line. This timetable change enabled the spread of patronage across the whole peak period.

Following this timetable change to improve service performance; GWRC has seen a correlation between increased quality and performance of rail services and increased passenger numbers.

This is a very similar outcome to the investment proposed in this business case. However, current network constraints are limiting the ability to make similar changes on the Hutt Valley and Kapiti Lines.

### JVL On Time Performance Vs Morning Peak Patronage

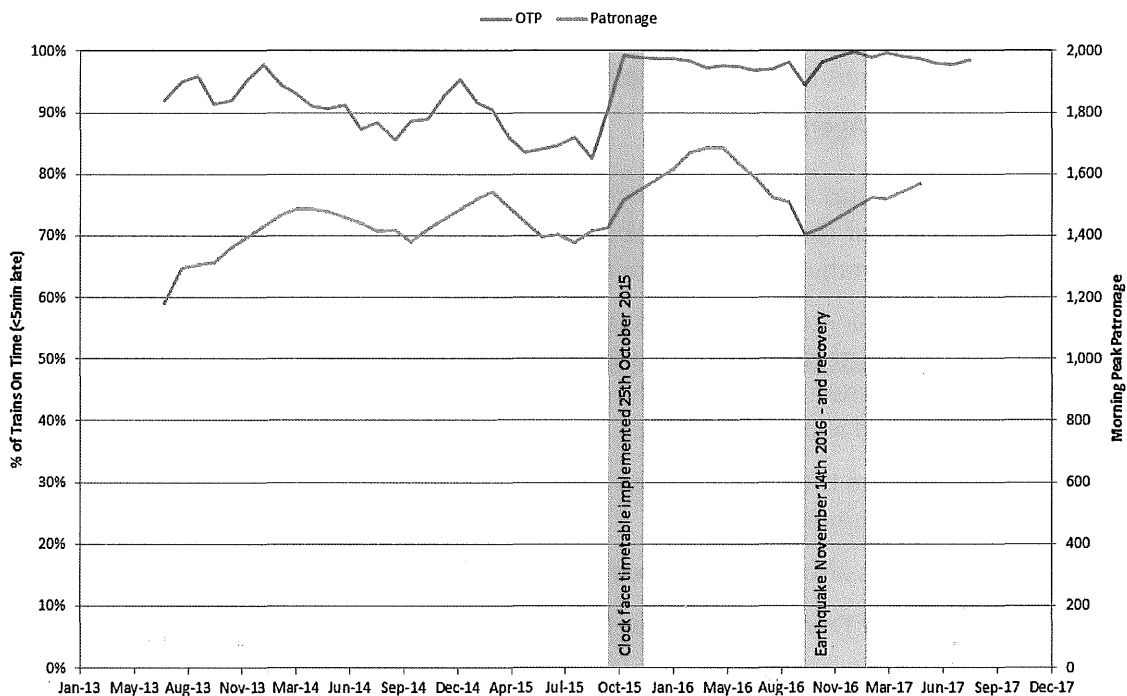


Figure 14 – Wellington Metro Railway Network and Infrastructure Capacity Constraints. Link between performance, timetable and patronage demonstrated on Johnsonville Line.

## 1.7 Other Investments affecting the Wellington Metro Railway Network under Consideration

### 1.7.1 Greater Wellington Regional Council-Led and Funded

GWRC understand the importance of a sustainable and efficient Wellington transport network. Following the introduction of the MROM, GWRC has invested significantly to improve services and the network. The result of this, alongside Crown-funded upgrades, has seen significant increases in patronage and customer satisfaction.

In parallel to this initiative, GWRC are looking to continue to improve the quality of service, with the following initiatives currently in planning:

- Encourage off-peak travel through the fare policy (i.e. discounted off-peak fares)
- Increase 'inter-peak' and evening off peak service frequencies (planned for mid-2018), so the service will be more convenient and accessible to passengers.
- Plan to renew the Wairarapa Carriage fleet with Diesel Multiple Units in approximately 2021. This will enable increased capacity, service frequency, vehicle quality, and increase regional connectivity.
- Continue to expand Park & Ride facilities to enlarge reach and accessibility of public transport.
- Changing fare policy to provide free feeder bus services to rail monthly pass holders.

- Promotion of walking and cycling to stations, including improved cycle parking facilities
- Plan to increase bicycle facilities at outer stations, and commence a bike hire scheme in Wellington to reduce cartage of bicycles on peak trains.
- Sustainable Transport team to work with workplaces to encourage flexible work hours

### 1.7.2 NZ Transport Agency

NZ Transport Agency has an interest in ensuring that the rail mode of transport is complimentary to their road transport objectives and vice versa. Passenger rail provides a viable transport alternative to avoid or defer major road investment.

NZTA policy and Wellington focussed Business Cases, (including NZTA's long-term strategic view - (<https://nzta.govt.nz/assets/Planning-and-investment/long-term-strategic-view.pdf>) all highlight the importance of rail within the wellington transport network given the road network's constrained ability to expand.

Section 2.6 expands on the dependencies and interdependencies of NZTA's road network with regard to this business case.

This business case has also been reviewed by key NZTA personnel.

### 1.7.3 Other Related Transport Corridor Investments

The main purpose of this business case is to enable WMRN to better meet the current peak demand and provide for growth in future demand.

Other planned investment being considered for both rail and road is summarised in Table 6 and Appendix D. This is included to provide visibility of possible future funding requirements. Separate business cases will be prepared for these possible future investments as or when required.

This business case to enable the WMRN to cater for growth in future demand is not coupled to these possible investments, with one exception.

Achieving the benefits of this business case are, however, dependent on a fit for purpose track infrastructure system. This prior or parallel investment is covered in the separate business case titled "*Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals*".

There will also be significant benefits and synergies if proposed works are undertaken in conjunction with other programmed substantial works due to be completed over the next five years – specifically the approved traction pole replacement programme (\$98 million) and the proposed Track Infrastructure programme (est. \$90 million).

These synergies include being able to employ a single programme management office, coordination of line closure blocks and the completion of certain packages simultaneously.

An obvious example is the traction pole replacement between Upper Hutt and Trentham aligning with the double-tracking upgrade.



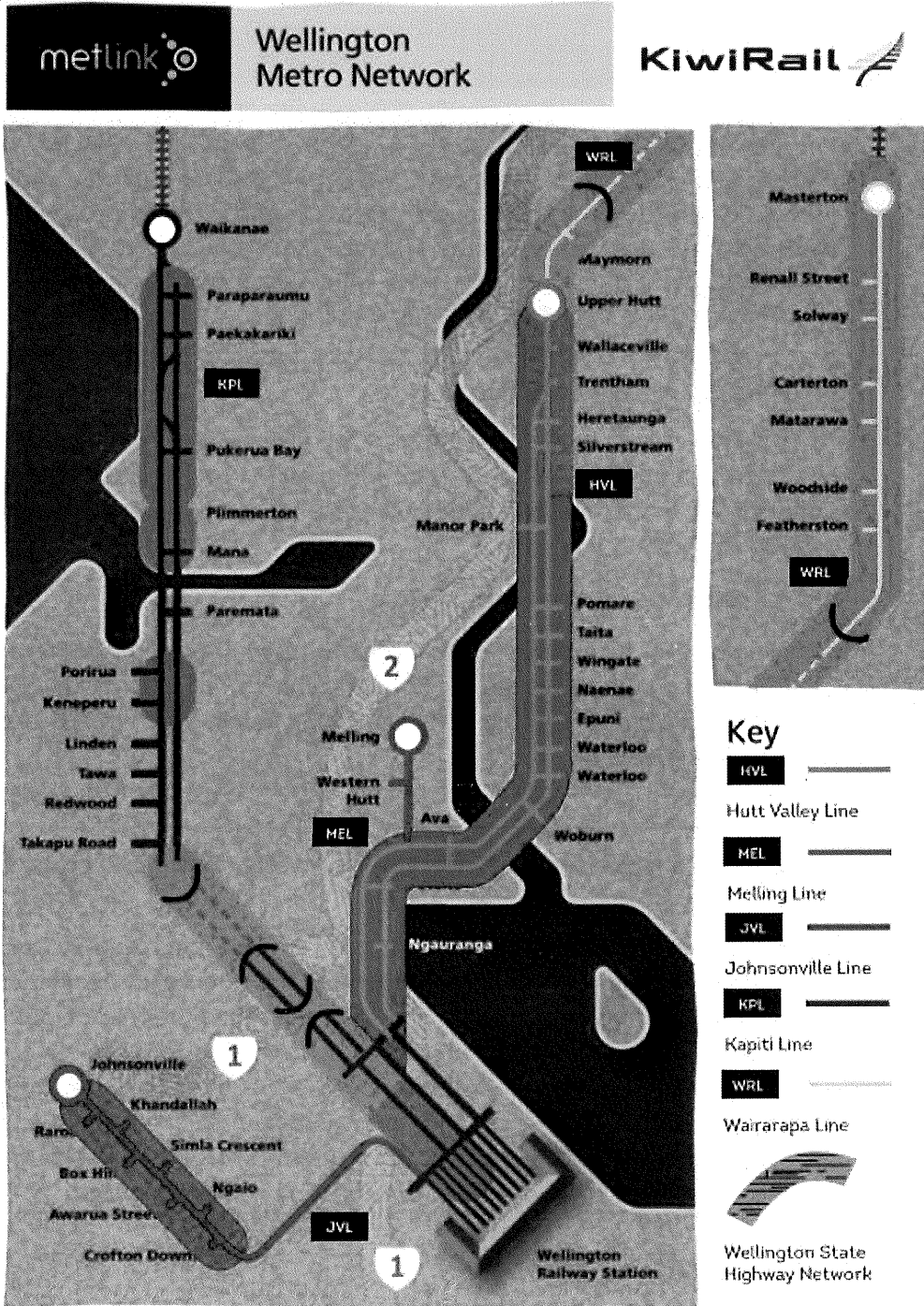


Figure 15 – Wellington Rail Network Investments (Proposed and Committed)

Table 6 –Other Related Transport Corridor Investments

Sponsor Organisation	Possible Other Investments and Studies
GWRC	<p>Refer to Section 1.7 and Appendix D for details. This includes the separate business case titled “Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals” which will deliver catch-up renewals required to provide a fit for purpose track infrastructure and enable this business case’s full benefits to be achieved (i.e. ensure punctual operations as track not subject to excessive and increasing temporary speed restrictions to mitigate deteriorating condition).</p>
NZ Transport Agency	<p><b>Melling Interchange Upgrade</b></p> <p>This project is specifically highlighted as it is likely that rail passenger demand to and from Melling Station will increase during planned road intersection works. This mode shift will arise from commuters wishing to avoid road works congestion.</p>
	<p><b>Port Access Programme Business Case</b></p> <p>Wellington Port Access investigated options for improving the movement of freight to and from Wellington Port. The study went so far as to consider rail as a viable option for displacing/relocating freight off the road network onto the rail network.</p>
	<p><b>Wellington to Hutt Valley Cycle and Pedestrian Link Detailed Business Case</b></p> <p>This business case investigated options to provide improved cycling and pedestrian facilities between Wellington and the Hutt Valley along the Hutt Road and SH2 transport corridor. The study identified the seaside option as preferred, as it provides an opportunity for a high-quality shared facility, and offers the opportunity to contribute more directly to the regional economy through resilience and tourism benefits. It also protects the railway and provides the option to straighten it, which will provide greater speeds. The project is currently at investigation and design stage.</p>
	<p><b>Other Business Cases:</b></p> <ul style="list-style-type: none"> <li>○ State Highway 2 Ngauranga to Te Marua Programme Business Case</li> <li>○ State Highway 2 Te Marua to Masterton Programme Business Case</li> </ul> <p>These are subject to NZTA board approval, are early stage only and may not be pursued.</p>



## Part B – Business Case

### 2 Strategic Case – Making the Case for Change

THE SECTION OUTLINES THE STRATEGIC CONTEXT AND CASE FOR INVESTMENT IN THE WMRN

#### 2.1 Recap of 'Part A Background' Section

**Key points from 'Part A Background' section are:**

- SIGNIFICANT BENEFITS HAVE BEEN ACHIEVED FROM PREVIOUS RAIL INVESTMENTS
- THE WELLINGTON METRO RAIL SERVICE IS RELIED UPON BY A WIDE RANGE OF PEOPLE, FOR WORK, STUDY AND LEISURE. ELECTRIC PASSENGER TRAINS PROVIDE CRITICAL CAPACITY AT THE AM AND PM 'RUSH HOUR' PEAKS (CURRENTLY APPROXIMATELY 18,000 PASSENGER TRIPS ON THE NETWORK DURING EACH AM AND PM PEAK) WHICH EQUATES TO 23% OF THE CBD WORKING POPULATION.
- PEAK PATRONAGE HAS GROWN 13.8% OVER THE LAST 3 YEARS PLACING INCREASING PRESSURE ON PEAK TRAIN SERVICES AND CAPACITY
- DURING PEAK HOURS, THE WELLINGTON METRO RAIL SERVICE HAS MODERATE ISSUES WITH CAPACITY, MEETING PASSENGER LOAD STANDARDS AND CUSTOMER EXPECTATIONS. OPTIONS TO INCREASE THE CAPACITY AND FREQUENCY OF THE PEAK PERIOD SHOULD BE PURSUED TO PROVIDE INCREASED RESILIENCE AND CAPACITY ON THE TWO MAIN TRANSPORT CORRIDORS INTO WELLINGTON
- GWRC ARE COMMITTED TO PROVIDING AN IMPROVED RAIL SERVICE TO ENSURE RAIL CAN MAINTAIN AN ADEQUATE MODE TRANSPORT SHARE ALONGSIDE SIGNIFICANT ROADING INFRASTRUCTURE INVESTMENT
- GROWTH IN THE DEMAND FOR PEAK PERIOD PASSENGER SERVICES WILL CONTINUE AND PLACE INCREASING PRESSURE ON THE PEAK PERIOD SERVICES INCLUDING THE 'PEAK OF THE PEAK'
- THE WMRN PEAK CAPACITY CONSTRAINTS MUST BE UNLOCKED IF PATRONAGE GROWTH IS TO CONTINUE

## **2.2 Strategic Context – Key Stakeholders and Strategies**

### **2.2.1 Key Stakeholders**

Key stakeholders were involved in the preparation of this business case.

Refer to Table 1 in Section 1.2.1 for a summary of the stakeholder roles and responsibilities.

### **2.2.2 Alignment to Existing Strategies**

National, regional and organisational strategies support the continued investment in rail infrastructure.

Table 7 provides a summary of relevant strategies that align with and/or support the case for having a resilient and reliable railway in the Wellington region.

The below table includes reference to GWRC's Regional Rail Plan 2010 to 2035 (2013 version) which first highlighted the need for infrastructure upgrades to enable an increased peak service frequency and release the current constraints on the network. This potential investment has been previously described as Rail Scenario 1 (or RS1). This business case reviews the current preferred long-term options for WMRN, including GWRC's RS1 option, against the current drivers for investment to ensure a balanced and considered approach.

Further detail of each strategy, relevant extracts and document sources are provided in Appendix E.



Table 7 – Strategies Identified Which Support Investment in the Wellington Metro Railway Network

Organisation	Strategy Identified	Description	Relevance to passengers / the business case
Ministry of Transport	Connecting New Zealand – summary of transport policy	The Crown’s objective for transport — an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our economy to deliver greater prosperity, security and opportunities for all New Zealanders.	An effective, efficient, secure, accessible and resilient regional transport system is a key enabler to help achieve this objective.
Ministry of Transport	Government Policy Statement on Land Transport, 2015/16 – 2024/25	Highlights the need, and provides investment guidance, for public transport. This is to help unlock the potential of our urban areas by providing additional capacity on key corridors and a choice of ways to move around, particularly during peak commuting periods.	Supports the Wellington Region in having a resilient and safe commuter rail system that complements the road system, provides choice, and mitigates effects on the environment.
Ministry of Business, Innovation and Employment	Business Growth Agenda Toward 2025	Encourages appropriate, resilient infrastructure which supports future investment, growth and quality of life in all parts of New Zealand.	Rail investment contributes to quality of life through provision of a fast, regular and safe passenger services. Confidence in wider regional investment is underpinned by robust transport networks. Improving infrastructure capacity will make the overall transport system more resilient by: <ul style="list-style-type: none"> <li>• making the railway more reliable/robust</li> <li>• providing overall transport system passenger capacity</li> <li>• providing an alternative transport mode to compliment adjacent road corridors</li> <li>• making the regional transport system more resilient</li> </ul>
GWRC	Wellington Regional Rail Plan 2010 – 2035 (2013 Revised Edition)	The RRP outlines the preferred long-term pathway to a better rail experience for users of Wellington’s regional rail network.	The plan forms part of GWRC’s long term strategic intent for the WMRN and provides the plan to ensure better experience by passengers, maintenance of a stable network and incremental improvements that deliver value for money. This includes the focus of service optimisation to meet peak demand whilst also considering network constraints that limit this optimisation.  The key outcome of the RRP is GWRC’s original preferred long-term pathway which has historically been known as Rail Scenario 1 (RS1). This business case reviews the current preferred long-term options for WMRN, including GWRC’s RS1 option, against the current drivers for investment.
GWRC	Regional Land Transport Plan 2015 (RLTP)	Priority is to improve rail’s reliability, capacity and frequency, and over the longer term to further improve journey times and reach.	Improving infrastructure capacity is essential to ensure a resilient and reliable rail network to achieve the goals of the RLTP.
GWRC	Wellington Regional Public Transport Plan 2014	The Plan notes the core rail routes provide high-capacity, long-distance, time-competitive commuter services connecting key urban areas across the region. Their primary functions are to reduce severe road congestion on State Highways 1 and 2 and meet the demand for travel from key suburban and town centres to the Wellington CBD during peak periods.	This business case supports this plan and the provision of a high capacity commuter service to avoid increased congestion on SH1 and SH2.
NZ Transport Agency	Government Policy Statement on Land Transport 2015/2016 – 2024/25	The GPS 2015 sees the need for public transport to help unlock the potential of our urban areas by providing additional capacity on key corridors and a choice of ways to move around, particularly during peak commuting periods.	This business case supports this GPS and the need to provide additional capacity on the WMRN.

Organisation	Strategy Identified	Description	Relevance to passengers / the business case
NZ Transport Agency	Draft Government Policy Statement on Land Transport 2018/2019 – 2027/28	The GPS 2018 recognises that maintaining high quality transport connections in some areas requires increasing network capacity (including the capacity for public transport and activity modes) or rail capacity and vehicle capacity.	This business case supports this GPS and increasing the capacity on the WMRN.
NZ Transport Agency	Integrated Planning Strategy 2010	Promote complementary land use patterns such as transit-oriented developments to support urban rail intensification.	Improving infrastructure capacity ensures rail passenger services continue to provide efficient commuter transport services and avoids the need for significant investment in additional road transport capacity.
KiwiRail	KiwiRail Network Strategic Plan	Be a trusted provider of safe, reliable and efficient railway infrastructure meeting KiwiRail and customer needs.	KiwiRail's obligation to provide a reliable and efficient WMRN is dependent on funding – the purpose of this business case.

### 2.2.3 Existing Strategies Conclusion

CENTRAL AND LOCAL GOVERNMENT STRATEGIES PROVIDE A STRONG MANDATE TO CONTINUE TO PROVIDE A HIGHLY FUNCTIONING AND CAPABLE RAIL NETWORK IN THE WELLINGTON REGION.

### 2.2.4 Environmental Considerations

The WMRN has undergone recent upgrades to enable it to run modern EMUs. The EMUs use electricity as the power source, this negates the need for fossil fuel combustion at the point of use and/or any combustion of fossil fuel. Electric trains have both excellent acceleration/deceleration performance characteristics and environmental benefits.

Railway operation provides a more sustainable mode of passenger travel compared with many other transport forms. The following environmental benefits are realised:

- **Low carbon emissions** – given that more than 80% of New Zealand’s power is from sustainable renewable resources, this means that gross emissions from Wellington’s suburban train fleet is very low
- **Regenerative braking** – as trains decelerate, electricity is fed back into the overhead power network further reducing energy demand
- **Air quality** – the trains have no exhaust, and they have no local diesel/burnt hydrocarbon based discharges making them a desirable form of transport in an urban environment
- **Quiet** – electric trains are relatively quiet compared to diesel trains making them attractive to passengers and people who live or work near the railway corridor

The Wellington electric train system results in a reduced environmental impact when compared to other transport modes. Furthermore, this increases New Zealand’s ability to reduce the effects of climate change in accordance with the Paris Agreement (ratified October 2016).

Should train services not be able to meet the forecast capacity and expected service levels, there will be a shift to motor car use as this is the only other transport option. This in turn will increase per capita carbon emissions.

### 2.2.5 Freight Trains on the Wellington Metro Railway Network

Freight trains are an important user of the WMRN (track, structures, signalling assets only – not the traction assets) and a key driver for the region and country’s economy.

The role and benefits of freight trains include:

- Provide vital capacity for the overall national freight task
- Reduce congestion on roads by being a high capacity and efficient alternative to trucks
- Provide a key part of the overall transport network including regional and inter-regional connections, and inter-island and international freight transport
- Increase road safety by removing heavy vehicles from the road network

The benefits of the proposed infrastructure capacity investments are not only to passenger rail, but also to freight services. If a passenger train is not able to keep timetable because of



infrastructure capacity constraints, there may be consequential delays to freight trains. This results in freight inefficiencies/costs and the potential for connections to be missed, such as the inter-island ferries.

Additionally, if the railway is closed, temporary road bridging of freight will either add to the road congestion or will not occur, with secondary economic consequences as a result.

The National Freight Demand Study 2014<sup>9</sup> forecasts that the freight task as measured in tonnage will increase by 58% over the next 30 years. The consequence of this increase is that the importance of both rail and road freight transport will only increase in the future, making it important that the overall transport corridors are available and reliable, and have the capacity for the future.



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<sup>9</sup> <http://www.transport.govt.nz/assets/Uploads/Research/Documents/National-Freight-Demand-Study-2014-executive-summary.pdf>

## 2.3 Investment Logic Mapping

Given the scale of investment, interdependencies and the number of key stakeholders, an Investment Logic Map (ILM) workshop was held on 5 September 2017.

Participants at the workshop included senior representatives from GWRC, KiwiRail, NZ Transport Agency, Ministry of Transport, Transdev and professional advisors.

NZ Treasury officials were unable to attend but were given a briefing after the workshop.

### 2.3.1 Problem Identification

Workshop discussion identified that with the current knowledge, infrastructure capacity improvements are required to enable WMRN to meet current customer requirements and cater for growth in future demand.

The ILM workshop then put further definition around the infrastructure capacity problem. The ILM output is shown in Appendix F. The relative importance of each problem to each other were considered and ranked (indicated by the percentage assigned to each problem).

The problems statements derived from the ILM are as follows:

1. **Peak demand:** Lack of peak time travel choices, together with very high demand on the current network service results in poor customer experiences (45%)
2. **Network capacity:** Limitations in rail infrastructure is holding back capacity increases required to meet growing demand, putting more pressure on the whole transport system (45%)
3. **Transport network resilience:** Inability of rail to take additional load if roads are compromised increases the risk of major disruption to the whole transport system (10%)





### 2.3.2 Potential Benefits

An analysis of the potential benefits of the investment proposal were developed as part of the ILM workshop and are detailed in Table 8.

**Table 8 – Benefits Assessment**

Benefit	Description
<b>Improve Rail Service Quality (35%)</b>	Benefits of intervention will be: <ul style="list-style-type: none"> <li>• Increased peak frequency of services</li> <li>• Reduced journey times across the transport network</li> <li>• Improved customer satisfaction</li> <li>• Increased capacity (space/seats)</li> </ul>
<b>Keep up with Demand (35%)</b>	Benefits of intervention will be: <ul style="list-style-type: none"> <li>• Increased rail patronage</li> <li>• Increased rail mode share</li> </ul>
<b>Better use of Transport Assets (20%)</b>	Benefits of intervention will be: <ul style="list-style-type: none"> <li>• Improved asset utilisation</li> </ul>
<b>More Resilient Transport Network (10%)<sup>10</sup></b>	Benefits of intervention will be: <ul style="list-style-type: none"> <li>• Additional load capacity across the transport network</li> </ul>

### 2.4 Investment Objectives

Investment objectives were derived following the ILM workshop. Each investment objective set a platform for assessing the options. Three investment objectives were identified for the WMRN being:

1. Removal of infrastructure constraints allowing for forecast growth in demand
2. Permitting proactive investment to ensure investment is undertaken prior to demand consistently exceeding capacity which can generate ad hoc short term investment decisions and generate peak private vehicle travel
3. Improving the resilience of the wider transport network by increasing the ability of the rail network to manage additional demand when roading networks are disrupted by unplanned events.

<sup>10</sup> This benefit was included at the ILM Workshop as there is increased resilience risks as the rail network is not able to accommodate significant overflow from roads if they get disrupted.

Further details of the investment objectives are provided in the subsequent three tables.

**Table 9 – Investment Objective 1**

<b>Removal of infrastructure constraints allowing for forecast growth in demand</b>	
<b>Existing Arrangements</b>	<ul style="list-style-type: none"> <li>• Current patronage growth, especially during the peaks, is exceeding previous forecasts. This is causing capacity issues and will likely start to exceed capacity in the peak demand periods on a regular basis in the next few years if patronage growth continues.</li> <li>• Refer to Part A of the document describing the extent of the infrastructure capacity constraints.</li> </ul>
<b>Business Needs</b>	Infrastructure capacity to cater for growth in future demand

**Table 10 – Investment Objective 2**

<b>Ensuring investment is undertaken prior to rail demand consistently exceeding capacity which can cause ad hoc/short term investment decisions and increase the relative attractiveness of peak private vehicle travel</b>	
<b>Existing Arrangements</b>	<p>There is risk that investment and implementation in easing network capacity will not be made before (peak) demand consistently exceeds capacity</p> <p>Refer to Part A of the document describing the impacts of the WMRN infrastructure capacity constraints.</p>
<b>Business Needs</b>	Infrastructure capacity to cater for growth in future demand.

**Table 11 – Investment Objective 3**

<b>Improving the resilience of the wider transport network by increasing the ability of the rail network to manage additional demand when roading networks are disrupted by unplanned events</b>	
<b>Existing Arrangements</b>	<p>There is risk that network capacity constraints will cause disruption to the whole interdependent transport system at great cost to the region.</p> <ul style="list-style-type: none"> <li>• Refer to Part A of the document describing the impacts of the WMRN infrastructure capacity constraints.</li> </ul>
<b>Business Needs</b>	A resilient railway network is required to provide a reliable regional transport system.

## 2.5 Risks

Table 12 below highlights the key high-level risks identified relating to this business case including the potential consequences of not pursuing investment.

The risk assessment summary shows that the consequences arising from the rejection of future funding are likely to have significant impacts on railway passengers, staff, the road transport system and the wider Wellington Regional economy.

Table 12 - Risk Assessment Summary

Main Risks	Consequence	Likelihood	Comments and Impacts
<b>Failure to invest results in patronage demand not met</b>	Medium	Medium	If funding is not available, network capacity upgrades will not take place and the WMRN will not be able to cater for growth in future peak demand. Patronage will likely stabilise or potentially reduce due to overcrowded trains, which will impact the wider transport network through increased road congestion.
<b>Constrained capacity of Wellington's transport corridors</b>	High	Medium	The overall passenger demand of Wellington's transport corridors relies on both the rail and road networks. If rail was unavailable or demand not met, the impact on the road congestion and overall transport corridor capacity is expected to be significant.
<b>Previous investment by the Crown will not be realised</b>	Medium	Medium	Previous funding provided by NZ Treasury has been successfully invested in railway infrastructure. If further network improvements are made, the benefits from previous investments will continue to be realised.
<b>Impact to vulnerable communities (low income, disabled, etc.)</b>	Medium	Medium	People who have limited options and rely on train services will be disproportionately impacted by loss of service level.

## 2.6 Constraints and Dependencies

### 2.6.1 Constraints

The following tables indicate the high-level constraints and dependencies of the existing WMRN.

Table 13 - Constraints

Constraints	Notes
<b>Contracted Railway Services</b>	<p>Transdev are contracted by GWRC for a minimum of nine years to provide passenger rail services in the region. This requires a functioning railway and associated upgrades by way of appropriate investment.</p> <p>Failing to provide railway infrastructure that can cater for growth in future demand will have financial and contractual consequences particularly if punctuality of the network worsens</p>
<b>Lead Time</b>	<p>There needs to be a large lead time before infrastructure capacity improvements can address critical capacity issues. It takes time to undertake infrastructure improvements in and around an operating railway network and get infrastructure fully commissioned. It can take up to five years from planning phase to completion to complete large-scale rail projects due to the need to maintain an operational train system.</p>



Table 14 - Dependencies

Dependencies	Notes and Management Strategies
<b>Customer Service</b>	<p>The WMRN is relied upon by a wide range of people, for work, study and leisure. Electric passenger trains provide critical capacity at the AM and PM 'rush hour' Peaks (currently approximately 18,000 passenger trips on the network during each AM and PM peak) which equates to 23% of the CBD working population.</p> <p>Customers across the Wellington Region require that the railway delivers a dependable level of service.</p>
<b>Road Network (NZ Transport Agency)</b>	<p>The overall passenger demand of Wellington's transport corridors relies on both the rail and road networks. If rail availability was restricted the impact on the road congestion and overall corridor capacity is significant.</p> <p>The NZ Transport Agency have completed several strategic business cases for the SH2 and SH1 corridors, and are working through business case stages. These business cases already highlight the need for a complementary rail corridor as part of providing regional resilience and transport choice in the short-term and long-term.</p> <p>Refer to Section 1.7.2 for other related transport corridor investments</p>
<b>Strategic Goals</b>	<p>All strategies identified in the research and background analysis of this business case identify an operating WMRN as being a key part of the transport system in the region.</p>
<b>Fit for Purpose Railway Network</b>	<p>A fit for purpose railway network is a key component to ensuring that the level of service expected of passenger rail in the Wellington region is delivered. Without a fit for purpose railway any benefits from upgrades may be negated by a poor performing track. The benefits of this business case are significantly aligned with a fit for purpose track infrastructure system (and thus the separate business case titled "<i>Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals</i>").</p>



## 2.7 Timeliness of the Investment Decision

Current and forecasted growth in peak demand indicates that the infrastructure capacity improvements needs to be completed in order to and both improve the current service and meet forecasted demand within at least 5 years (2023). An investment decision is required to make the necessary arrangements to complete the infrastructure capacity improvements within this timeframe. Table 15 below outlines the proposed strategic timeline.

Table 15 – Strategic Timeline

Approximate Date	Event
3 October 2017	Preliminary budget initiative scoping document submitted to Ministry of Transport Funding Review Panel
November 2017	SSBC submitted to the Ministry of Transport and NZ Treasury
November 2017 – May 2018	Discussions between NZ Treasury, project Sponsors and other relevant stakeholders
May 2018	Investment approved / declined
June 2018	Assuming funding is approved planning and works commences including further modelling and design of solutions
Completion of infrastructure capacity improvements	2023 (with timetable related constraints resolved to enable new service pattern to commence in 2021)

### **Investment delayed until after May 2018 or declined means:**

- Due to infrastructure constraints, patronage growth in the future will exceed capacity and result in unmet demand
- Loss of rail mode share due to decreasing customer satisfaction with overcrowding and poor punctuality
- Increased Wellington Regional Transport System vulnerability due to the limit on rail network capacity
- Lost opportunity of delivering alongside other projects

Investment approved by May 2018 means:

- Infrastructure capacity improvements commence and are procured and delivered efficiently by 2023 – a reliable and resilient Wellington Metro Railway Network, with sufficient peak capacity is operating for the next 10+ years
- Opportunity to deliver alongside current and proposed projects meaning cost efficiency and reduced disruptions to passengers



## **2.8 Strategic Case Overview and Conclusion**

A resilient and reliable passenger rail network is critical to the overall connectivity of the Wellington Region. Peak patronage has grown 13.8% over the last three years, placing increasing pressure on the capacity of peak train services and the growth is expected to continue.

Central and local government strategies provide a strong mandate to continue to provide a highly functioning and capable rail network in the Wellington Region. Review of the current infrastructure and constraints suggests there is a case for investment to:

- Meet transport corridor demands, ensuring appropriate mode share between rail and road, including relieving pressure on the road network particularly at peak periods
- Increase the resilience of wider transport network by increasing the ability of the rail network to manage additional capacity when the roading networks are disrupted
- Maintain and increase customer satisfaction
- Ensure capital investment decisions consider lead time constraints on the rail system which take considerable time until the capital programmes can be completed
- Ensure a sustainable and effective rail network to ensure the continuation of economic, social (including vulnerable communities) and environmental benefits from rail

An investment decision is required as soon as possible so planning and procurement can proceed and the infrastructure capacity improvements can be completed by 2023. Initial benefits will be seen in 2021 with the releasing of constraints and changing of timetables on specific railway lines. This will also avoid the negative impacts of patronage exceeding infrastructure capacity in the peak of the peak.

A decision on the investment is anticipated before May 2018 to align with budgeting cycles and provide certainty on having the infrastructure capacity improvements fully completed by 2023 (with timetable related constraints resolved in 2021).

## 3 Economic Case – Exploring the Preferred Way Forward

THE PURPOSE OF THE ECONOMIC CASE IS TO IDENTIFY THE INVESTMENT OPTION THAT OPTIMISES VALUE FOR MONEY.

### 3.1 Critical Success Factors

The critical success factors for this investment proposal have been identified based on the discussed in Part A and the Strategic Case, and confirmed by the project Sponsors. They are detailed in Table 16. The critical success factors have been derived using the NZ Treasury Guidance.

Table 16 – Critical Success Factors

Generic Critical Success Factors	Business Case Specific Critical Success Factors
<b>Strategic Fit and Business Needs</b>	Meets the requirements of the identified central and local government regional rail related strategies. Including: <ul style="list-style-type: none"> <li>• Improved journey time reliability at peak travel times, particularly in severely congested urban areas (enable rail to reduce road congestion through investment in rail performance);</li> <li>• Cater for growth in future demand on the WMRN;</li> <li>• Deliver an integrated land transport network that supports the region’s people and prosperity in a way that is economically, environmentally and socially sustainable; and</li> <li>• Deliver quality rail transport infrastructure that meets customer satisfaction expectations.</li> </ul>
<b>Potential Value for Money</b>	Economic benefits of the infrastructure capacity investment (or avoided economic dis-benefits) are higher than the costs to undertake the works; and  Potential value for money provides an increased focus on the comparative costs, benefits and risk.
<b>Supplier Capacity and Capability</b>	Competitive tenders can be sought from competent contractors.
<b>Potential Affordability</b>	Affordability has a specific focus on the likelihood of funding and/or the available funding mechanism. Affordability and funding is addressed in Section 4 of this business case (Financial Case).
<b>Potential Achievability</b>	The infrastructure capacity improvements can be implemented fast enough to ensure the benefits stated in this report are achieved.

These critical success factors will be used to inform the options assessment.

## 3.2 Options Assessment

### 3.2.1 Long-List of Options

GWRC, KiwiRail senior managers and advisors met to identify the possible options for both timetabling and infrastructure investment. A list of potential options were identified with a long-list created. The long-list of options are a combination of timetable and potential network changes. The options were driven from the outcomes of the Strategic Case, the independent timetable options, and network constraints analysis undertaken.

#### 3.2.1.1 Timetable Options

Timetable options include either no change or increased peak services on only the Kapiti and Hutt Valley Lines. The focus on Hutt Valley and Kapiti Lines is due to them being the most critical lines carrying at least 85% of peak period patronage with other lines not needing timetable changes. The Johnsonville line increased its timetable frequency in 2015 and the Wairarapa line capacity issues are being considered in a separate 'rolling stock increase' focused Business Case, to be undertaken by GWRC and NZTA separately.

Following a review of the independent network timetable option analysis, the four timetable options that have been selected are below, with further details on each option on the proceeding pages.

- 1) **Do nothing (Continue current peak timetable and service capacity)** – No change to the current peak service pattern and capacity.
- 2) **Minor Adaption to Current Peak Service (Kapiti Only)** – Minor change to Kapiti Line inner-tier service only, and increase number of services per approximately 25%. No change to Hutt Valley Line timetable (0% increase in service), but increase capacity through longer trains. This will result in the services on the Kapiti and Hutt Valley Lines increasing by approximately 10% from the current peak timetable. **This is one of the two recommended options based on the independent network timetable analysis.**
- 3) **Moderate Adaption to Current Peak Service (Both Kapiti and Hutt)** - Minor increase in peak period service frequency of the Hutt Valley Line's outer and inner-tier services, whilst undertaking minor changes to Kapiti Line's inner-tier service (same as Option 2 above). This will increase capacity, spread the morning peak demand and provide a timetable closer to a 'turn up and go' philosophy. This will result in the services on the Kapiti and Hutt Valley Lines increasing by approximately 30% from the current peak service. **This is one of the two recommended options based on the independent network timetable analysis.**
- 4) **Full 'turn up and go' timetable** – Revise current peak period service frequency on both Kapiti and Hutt Valley Lines to provide a full 'turn up and go' timetable. This will increase capacity similar to the 'moderate adaption' option but spread peak demand more. It could be enlisted in stages following successful implementation of the 'Moderate Adaption to Current Peak Service' timetable scenario. This option would however have greater potential issues navigating freight and loco hauled passenger services through the network during peak.

There are no realistic timetable options in between the above options and thus why there are 'step change' service increases seen above between each option. This is primarily due to the need to ensure the whole network functions; any 'in-between' options would result in networking issues and significant punctuality issues.

Table 17 – Peak Period Timetable Options

**Peak Period Timetable and Service Options**

**1. Do nothing (the current timetable)**

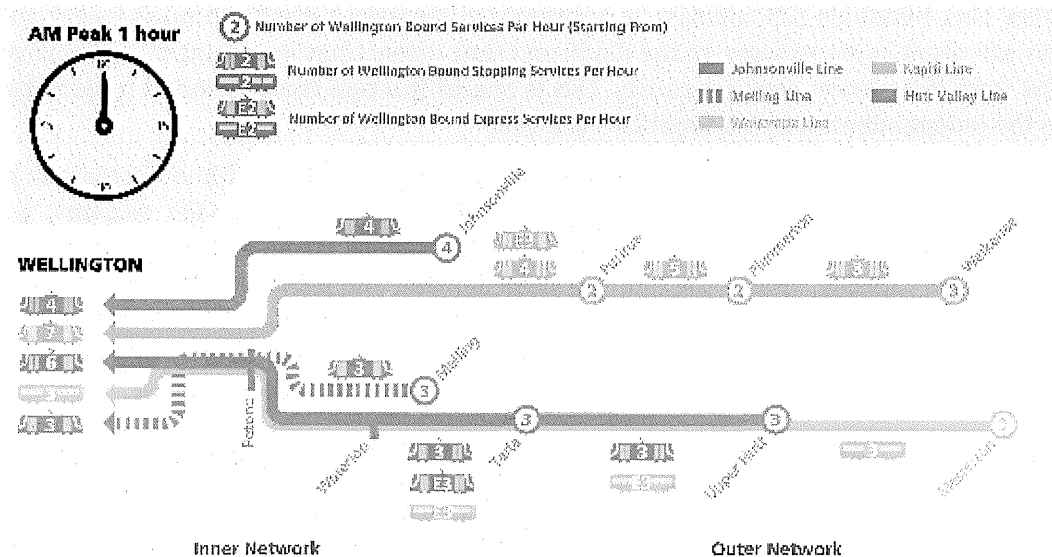
**KAPITI LINE:**

- **Inner-tier service stopping all stations service** - All stations services from a mixture of Plimmerton and Porirua (AM peak) and to Porirua (PM peak), which operate all stops. This tier generally operates **every 10 minutes in the morning peak**, and every 20 minutes in the afternoon peak.
- **Outer-tier service partial express service**- Limited stops services from Waikanae, which stop all stations between Waikanae and Porirua, then operate express to Wellington. This tier generally operates every **20 minutes in the peaks**.

**HUTT VALLEY LINE:**

- **Inner-tier service stopping all stations service** - All stations services from Taita (these services do not stop at Ngauranga for much of the peak, this being served by Melling line trains). This tier generally operates **every 20 minutes in the peak**.
- **Outer-tier partial express service** - Limited stops services from Upper Hutt, stopping all stations Upper Hutt to Taita, then express to Waterloo, then express to Wellington. This tier generally operates every **20 minutes in the peak**.

**Melling single-tier service** – All stations service from Melling **every 20 minutes in peak**



Peak Period Timetable and Service Options

2. Minor adaption to Current Peak Service <sup>11</sup> (Kapiti only) – Increase services at peak on Kapiti by approximately 25% and Hutt by 0%

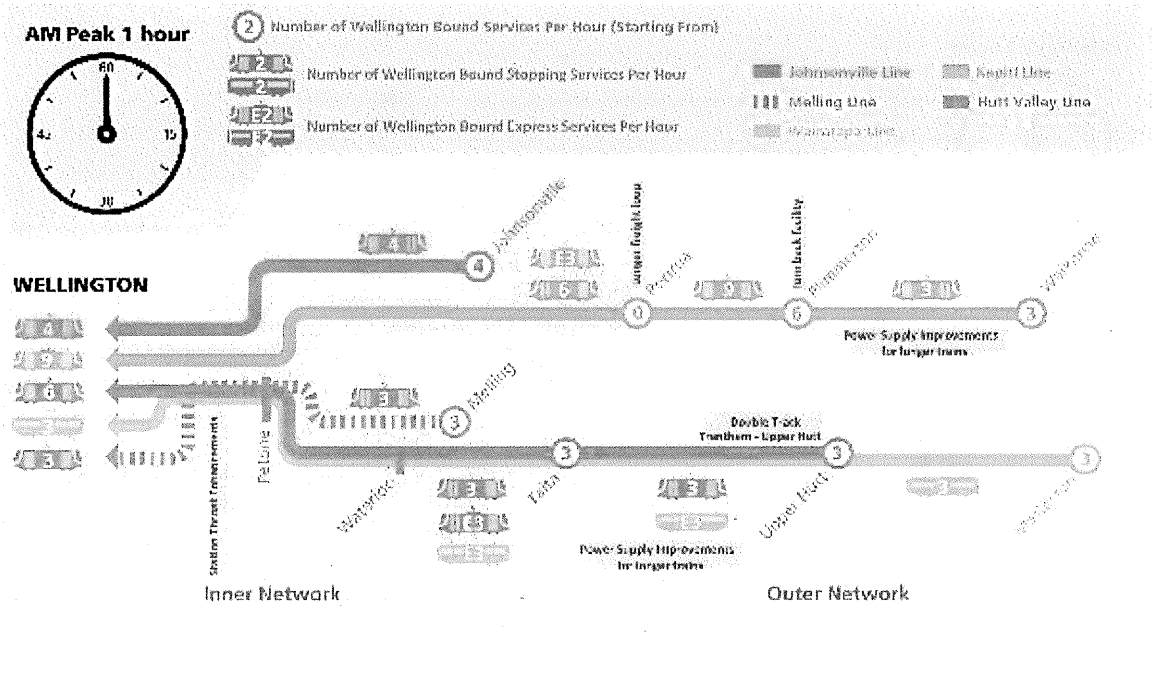
KAPITI LINE

- **Inner-tier stopping all stations service** - This is same as current peak service except that all inner-tier services go from/to Plimmerton (rather than the current mix of Plimmerton and Porirua stations) which will also increase the number of trains services at peak.
- **Outer-tier partial express service** - No change from current peak timetable

HUTT VALLEY LINE

- **Inner-tier stopping all stations service** - No change from current peak timetable
- **Outer-tier partial express service** – No change from current peak timetable

Melling single-tier service – No change from current peak timetable



<sup>11</sup> This is one of the two preferred timetable options as per network timetable analysis outcomes – refer Section 0 for further details

Peak Period Timetable and Service Options

3. Moderate adaption to current peak timetable<sup>12</sup> (Kapiti and Hutt Valley) – Increase services at peak by approximately 30% on each line

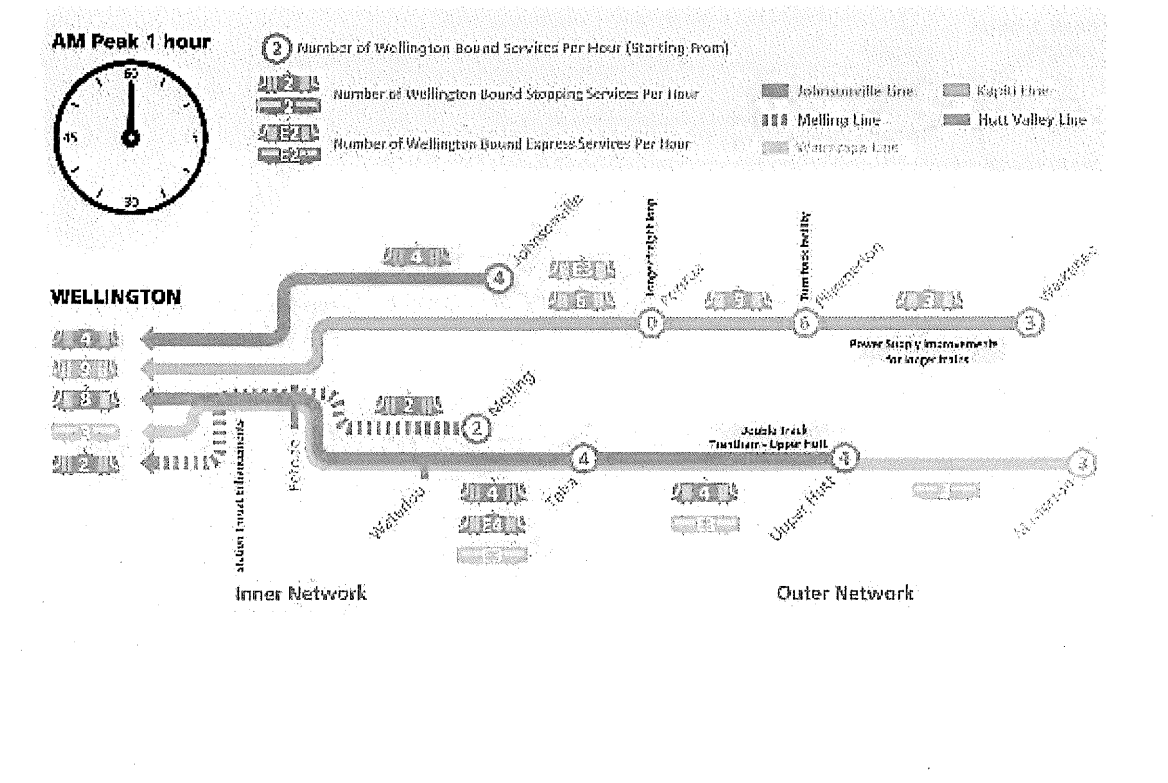
**KAPITI LINE** (increase in capacity by 43%)

- **Inner-tier stopping all stations service** - All inner tier services go from/to Plimmerton (rather than the current mix of Plimmerton and Porirua stations) which will allow a greater number of trains at peak.
- Outer tier partial express service – Longer trains will increase capacity.

**HUTT VALLEY LINE** (increase in capacity by 33%)

- **Inner-tier stopping all stations service** - This increases the capacity and frequency of the peak services every **15 minutes** (was 20 minutes)
- **Outer-tier partial express service** – This increases the capacity and frequency of the peak services to every **15 minutes** (was 20 minutes)

**Melling single-tier service** – This changes the frequency to every **30 minutes** (was 20 minutes) to fit in with Hutt Valley Line frequency change, however longer trains will compensate for changes to the frequency.



<sup>12</sup> This is the preferred timetable as per network modelling outcomes – refer Section 0 for further details

Peak Period Timetable and Service Options

4. Full 'turn up and go' timetable – Increase in services similar to Option 3, but with greater spread of demand

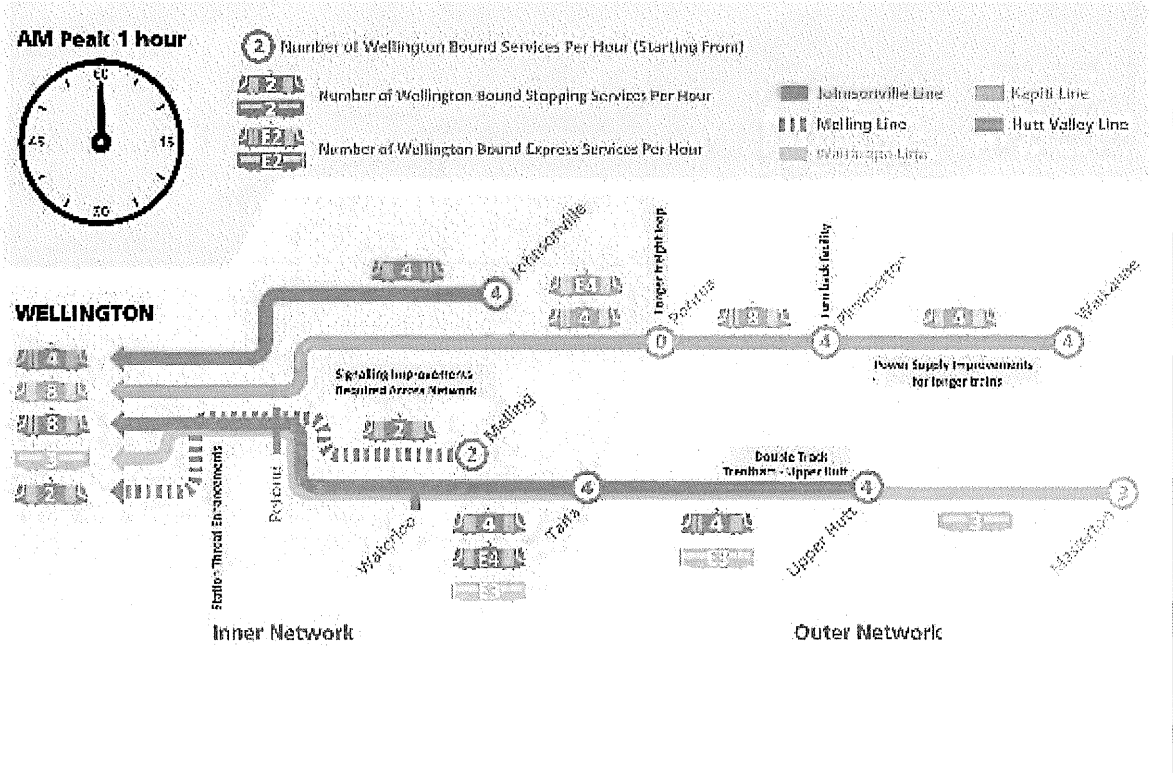
KAPITI LINE

- **Inner-tier stopping all stations service** - This changes the frequency to every 15 minutes (was 10 minutes) from current peak timetable to fit in with outer-tier change.
- **Outer-tier partial express service** - This increases the capacity and frequency of the peak services to every 15 minutes (was 20 minutes)

HUTT VALLEY LINE

- **Inner-tier stopping all stations service** - This increases the capacity and frequency of the peak services to every 15 minutes (was 20 minutes)
- **Outer-tier partial express service** – This increases the capacity and frequency of the peak services to every 15 minutes (was 20 minutes)

**Melling single-tier service** - This changes the frequency to every 30 minutes (was 20 minutes) from current peak timetable to fit in with Hutt Valley Line change, however longer trains will compensate for changes to the frequency.



TIMETABLE OPTION 3 PROVIDES A PARTIAL 'TURN UP AND GO' TIMETABLE AND OPTION 4 WILL PROVIDE A FULL 'TURN UP AND GO' TIMETABLE'. TIMETABLE OPTION 1 AND 2 DO NOT PROVIDE 'TURN UP AND GO' TIMETABLES.

### ***3.2.1.2 Full Long-List of Investment Options and Assessment***

The table on the following page provides the full long-list of investment options that have been identified. It considers the full mix of timetable and infrastructure upgrade options. It also provides an assessment of the options to be taken forward to the short list and reasons for this assessment.





Table 18 – Potential Options List and Long-List Assessment

Option	Option Name	Timetable Option	Description	Viable?	Peak Service Increase	'Turn up and go' timetable?	Taken Forward?	Commentary and reason taken forward (or not)
1	Do Nothing	Current	This option involves continuing with existing service pattern, and train consist constraints. It does not involve any infrastructure investment.	YES	NO	NO	YES	This is the Do Nothing option and has been taken forward as the base case. Although it is viable as an investment choice it may not be viable from the perspective of meeting forecasted peak demand growth.
2	Increase Train Consist Length Only <u>without</u> Power Upgrades	Current	This option involves retaining existing service pattern and attempting to increase train length to increase capacity but do not increase power supply capacity at sub-stations.	NO	N/A	N/A	NO	This option is not possible without power upgrades within 2 years (as identified in network modelling report) and thus has not been taken forward.
3	Do Minimum	Current	This option involves retaining existing service pattern but increasing train length (as per Option 2) and providing increased power supply capacity at sub-stations.	YES	NO	NO	YES	This provides minor power upgrade improvements but no change to frequency of service (and thus a network that does not provide 'turn up and go' timetabling). Capacity is increased only by increased length of trains and there is no increase in services. It is considered one of two 'minimal' investment options which has been taken forward for further assessment.
4	Minor Change to Timetable (Kapiti only) <u>without</u> Network Changes	Minor Adaption to Current (Kapiti only)	This option involves undertaking minor changes to existing service pattern (Kapiti only) but undertake no network improvements.	NO	N/A	N/A	NO	This is not possible without network improvements as noted in modelling report
5	Minor Change to Timetable (Kapiti only) <u>with</u> <u>Minimum</u> Network Changes	Minor Adaption to Current (Kapiti only)	<p>This option involves minor changes to the Kapiti timetable only (as per Option 4) and the undertaking of the minimum network changes that will allow the timetable to be run. The network changes do not include all the ideal improvements to ensure no punctuality issues. It is also conservative future demand option. If demand continues at a rate greater than 1.7% p.a, then there would likely be future further investment needed within the next 10 years for the Hutt Valley Line. It involves:</p> <ul style="list-style-type: none"> <li>• Increase power supplies to enable for growth on both lines (similar to Option 3)</li> <li>• Improve train termination and turn-back facilities at Plimmerton</li> <li>• Second lead to Wellington EMU yard</li> </ul>	YES	MINOR (~10%)	NO	YES	This is the second 'minimal investment' option compared to Option 3. It however does not provide a 'turn up and go' timetable for the majority of the network and is likely to have reduced customer benefits due to punctuality issues. It has however been taken forward for assessment.

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Option	3.2.1.3 Option Name	3.2.1.4 Timetable Option	3.2.1.5 Description	3.2.1.6 Viable?	3.2.1.7 Peak Service Increase	3.2.1.8 'Turn up and go' timetable?	3.2.1.9 Taken Forward?	3.2.1.10 Commentary and reason taken forward (or not)
6	Minor Change to Timetable (Kapiti only) <u>with Full Network Changes</u>	Minor Adaption to Current (Kapiti only)	<p>This option is the same as Option 5 except that the network constraints that would likely cause issues with punctuality are removed. It involves extra investment being:</p> <ul style="list-style-type: none"> <li>• Double-track between Trentham and Upper Hutt and platform upgrade at Trentham</li> <li>• Longer freight loop at Porirua</li> </ul> <p>It also however only allows for growth to 1.7% and further upgrades to Hutt Valley Line would be required before 2030 if the growth continues at the current rate (of approximately 3.6%). It also does not allow for rail to provide a greater mode share with road.</p>	YES	MIN OR (~10%)	NO	YES	<p>This is one of two preferred options from the independent timetable option analysis</p> <p>This option will provide a minor adaption to the current peak timetable whilst also ensuring there are no issues on the network that would affect customer benefits and punctuality. This option has been taken forward on this basis. It will provide all network upgrade investments forecasted as being required until 2030 under this scenario (completed by 2022).</p>
7	Moderate Change to Timetable (Kapiti and Hutt Valley) <u>and Minimising Network</u>	Moderate Adaption to Current (Kapiti and Hutt)	<p>This option looks at running a revised timetable which is more of a 'turn up and go' timetable</p>	YES	YES (~30%)	Partial	YES	<p>This is the second of two preferred options from the independent timetable option analysis</p>

Option	3.2.1.3 Option Name	3.2.1.4 Timetable Option	3.2.1.5 Description	3.2.1.6 Viable?	3.2.1.7 Peak Service Increase	3.2.1.8 'Turn up and go' timetable?	3.2.1.9 Taken Forward?	3.2.1.10 Commentary and reason taken forward (or not)
	Improvements		<p>which will also enable increased patronage to be catered for (up to 3.6% p.a). It however looks at the timetable that can do all this whilst minimising or not requiring further network improvement compared to Option 6.</p> <p>This option requires the same infrastructure investment as Option 6 with the following changes:</p> <ul style="list-style-type: none"> <li>• Increase power supplies to Kapiti only (removes need to upgrade Hutt as a result of increased frequency and less length of trains needed)</li> <li>• New Cross Over Wellington Station (small 4th main) (required to avoid congestion in the throat by the increased frequency of 15 minutes on the Hutt Valley Line</li> </ul>					<p>This option has been taken forward as the minimum investment scenario which will provide greater capacity, a timetable more in line with a 'turn up and go' philosophy, increased customer experience and ability to allow for increased share in rail demand at peak period. It will provide all network upgrade investments forecasted as being required until 2030 under this scenario (completed by 2022).</p>

Option	3.2.1.3 Option Name	3.2.1.4 Timetable Option	3.2.1.5 Description	3.2.1.6 Viable?	3.2.1.7 Peak Service Increase	3.2.1.8 'Turn up and go' timetable?	3.2.1.9 Take Forward?	3.2.1.10 Commentary and reason taken forward (or not)
			<p>and still mesh with the 20/10 minute frequency on the Kapiti Line)</p> <ul style="list-style-type: none"> <li>• Woburn Signalling into workshops</li> </ul> <p>This option will allow rail to provide a greater share of peak patronage demand compared to the current share with road due to improved service offering</p>					

Option	3.2.1.11 Option Name	3.2.1.12 Timetable Option	3.2.1.13 Description	3.2.1.14 Viable?	3.2.1.15 Peak Service Increase	3.2.1.16 'Turn up and go' timetable?	3.2.1.17 Taken Forward?	3.2.1.18 Commentary and reason taken forward (or not)
8	Option 7 with other Complimentary Capital Investment	Moderate Adaption to Current (Kapiti and Hutt)	<p>This option looks at completing both Option 7 and other complimentary capital investment. The complimentary investments, whilst not needed for network capacity improvements, have been estimated as needed replacement in the next 5 to 10 years and have significant benefits of being completed at same time (ie are in the same area of the network investments). These additional investments are due to be pursued in future business cases but are considered the most critical and complimentary with this business case (and thus included for consideration). These additional investments include:</p> <ul style="list-style-type: none"> <li>• Re-signal A box in Wellington yard</li> <li>• Ngauranga to Petone Seawall project and track realignment</li> </ul>	YES	YES (~30%)	YES	YES	This option has been taken forward to assess whether additional complimentary investment should be completed at same time as Option 7 investment (as a base option).
9	Full 'Turn Up and Go' Timetable and Network Changes	Full 'Turn Up and Go' Timetable	<p>This option involves increasing the frequency of the timetable on the current network to provide a full 'turn up and go' service. This essentially will provide the ability to change the frequency of the services on the Hutt Valley and Kapiti Lines to 15-minute frequencies. This requires significant other investment in the network (particular the Kapiti Line) to enable this option. In addition to Option 7, it would include:</p> <ul style="list-style-type: none"> <li>• Convert WMRN and the</li> </ul>	YES	YES (~30%)	YES	YES	This option would be an investment strategy to promote a significant increased mode share by rail in the future from its current share (by providing greatly increased service frequencies). It would however be an 'optimistic' option with likely high investment required. It has been taken forward to assess the scenario of

Option	3.2.1.11 Option Name	3.2.1.12 Timetable Option	3.2.1.13 Description	3.2.1.14 Viable?	3.2.1.15 Peak Service Increase	3.2.1.16 'Turn up and go' timetable?	3.2.1.17 Take Forward?	3.2.1.18 Commentary and reason taken forward (or not)
			<p>passenger trains to full ETCS Level 2, to deliver improved headways, and increased safety</p> <ul style="list-style-type: none"> <li>Potential for further double tracking of Kapiti Line from north junction to south junction if do not undertake upgrade of signalling on this portion of track</li> </ul> <p>The increase in service is expected to be similar to that of the 'moderate' timetable change option.</p>					<p>significant investment to promote demand in rail and whether there is an economic case for it utilising conservative passenger demand growth rates (ie approximately 1.7% p.a.). It would however also need to be completed with other complimentary investments not in this business case (ie increased 'park and ride' car parking facilities at stations).</p>

### 3.2.2 Short-Listed Options

Based on the long-listing process undertaken, the following are the short-listed options considered viable and taken forward for further assessment:

Table 19 – Short-List

Option	Name	Taken Forward	Short Description
1	Do Nothing	Yes	This option involves continuing with existing service pattern, and train consist constraints. It does not involve any infrastructure investment.
3	Do Minimum	Yes	This option involves retaining existing service pattern but increasing train length and providing increased power supply capacity at sub-stations.
5	Minor Change to Timetable (Kapiti only) with Minimum Network Changes	Yes	This option involves increasing service to Kapiti only whilst undertaking minimum network improvements (with punctuality issues likely). No change to Hutt Valley Line.
6	Minor Change to Timetable (Kapiti only) with Full Network Changes	Yes	<p>This option is the same as Option 5 except that the network constraints are removed that would likely cause issues with punctuality</p> <p>This is one of two preferred options from the independent timetable option analysis</p>
7	Moderate Change to Timetable (Kapiti and Hutt Valley) and Minimising Network Improvements	Yes	<p>This option looks at running a revised timetable which is more of a 'turn up and go' timetable which will also enable increased patronage to be catered for (up to 3.6% p.a). It however looks at the timetable that can do all this whilst minimising or not requiring further network improvement compared to Option 6</p> <p>This is the second of two preferred options from the independent timetable option analysis</p>
8	Option 7 with other Complimentary Capital Investment	Yes	This option looks at completing both Option 7 and other complimentary capital investment
9	Full 'Turn Up and Go' Timetable and Network Changes	Yes	This option involves increasing the frequency of the timetable on the current network to provide a full 'turn up and go' service



### 3.2.3 Options Assessment against Expected Attributes

Two assessments on the short-listed options were carried out which included:

- An attributes assessment (which outlines the function of each option) (Table 20)
- Assessment against the Investment Objectives and Critical Success Factors (Table 21)

Key advantages and disadvantages of each option are also briefly noted following these tables. The Benefit Cost Assessment highlighted in the table below (Table 20) but is described in more detail in Section 3.3.4 and Appendix G.

