Nelson Infrastructure Strategy 2018 - 2048

Revision History

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Executive Summary

Purpose and scope of the strategy

This strategy identifies critical challenges for our transport, water supply, wastewater and stormwater and flood protection assets over the next 30 years, and the options for responding to them.

The four infrastructure objectives to which these challenges relate are to:

- increase resilience to natural hazards
- maintain and renew existing assets
- provide infrastructure to enable growth and development
- maintain or improve environmental outcomes.

Affordability and the implications of technological advances are considered throughout the strategy.

The issues and options identified in this strategy will be further developed in a strategic plan to be completed in 2018/19, as well as through the work programmes outlined in the 2018-28 asset management plans.

Infrastructure objective 1: Increase resilience to natural hazards

Our key natural hazards are:

- earthquake risk
- sea level rise
- intense rainfall events
- land instability.

Climate change is likely to increase the impacts of coastal hazards and heavy rainfall events on our infrastructure, particularly in relation to:

- road closures
- the capacity of the piped stormwater system and rivers to contain flood waters
- rates of surface inflow and groundwater infiltration to the wastewater network
- the long term viability of the Nelson wastewater treatment plant, which is low lying and located in the coastal environment.

Infrastructure objective 2: Maintain and renew existing assets

We need to consider how we prioritise maintenance and renewal of our existing assets, taking into account critical assets and the implications of their failure.

Specific infrastructure challenges include:

- sufficient funding for renewal of the transport network
- demands on the Water Treatment Plant from increasingly using water from the Maitai Dam
- accidental discharges from the wastewater rising main into the Nelson Haven
- maintain appropriate funding to renew the ageing water and wastewater network

Infrastructure objective 3: Provide infrastructure to enable growth and development

The strategy considers how we will provide and pay for infrastructure to enable growth.

To support the growing city, Nelson needs infrastructure able to readily adapt to changes in demand.

The transport network needs to be safe, enable economic development and allow residents to travel efficiently day to day. Unfortunately increasing congestion due to limitations in the network is constraining growth, increasing travel times, limiting multi-modal options and causing safety concerns.

Increasing population and commercial/industrial development coupled with seasonal droughts are significant issues for the water supply activity. The wastewater network has quite good capacity for increased dry weather flows into the future but suffers from high levels of inflow and infiltration in wet weather. These flows will act to constrain growth as overflows from the network become increasingly unacceptable to the community.

Infrastructure objective 4: Maintain or improve environmental outcomes

The key focus is to minimise negative effects on environmental outcomes and as much as possible support initiatives and solutions to improve water quality in all waterways and in the coastal and marine environment.

Proposed approach to address challenges

Options for addressing these infrastructure challenges are discussed in section 3 of the strategy.

The proposed approach for transport includes:

- planning a works schedule to increase the level of transport renewals with a focus on those activities that also improve the network's resilience to natural hazards
- implementing projects that enable growth and improve travel time reliability on key journey routes
- investing in initiatives that provide and promote transport choice
- integration of the local network with any transport solutions flowing from the Nelson Southern Link Investigation
- adopting new technology where it helps us solve issues or meet objectives

The proposed approach for water supply network includes:

- renewal of older pipes and pressure reduction strategies to help reduce losses from the network
- aerating the Maitai Dam to improve water quality prior to its discharge to the Maitai River
- investigating a primary clarifier at the Water Treatment Plant to enable more reliance on water from the Maitai Dam, increasing resilience to droughts and enhancing flow levels in the Maitai River
- replacing cast-iron pipes in areas of the city where the existing pipes are discolouring residents' drinking water
- identifying risks to the water supply network from significant flooding and earthquakes, and carrying out protection works to reduce impacts as well as investing in insurance to assist with recovery
- replacing the existing water meters with new manual read meters to continue the benefits of efficient water use arising from user pays

The proposed approach for the wastewater network includes:

- reducing stormwater inflow to the wastewater pipes
- containing more wet weather flows within the wastewater system by either constructing several detention tanks or upgrading wastewater pipes and pump stations

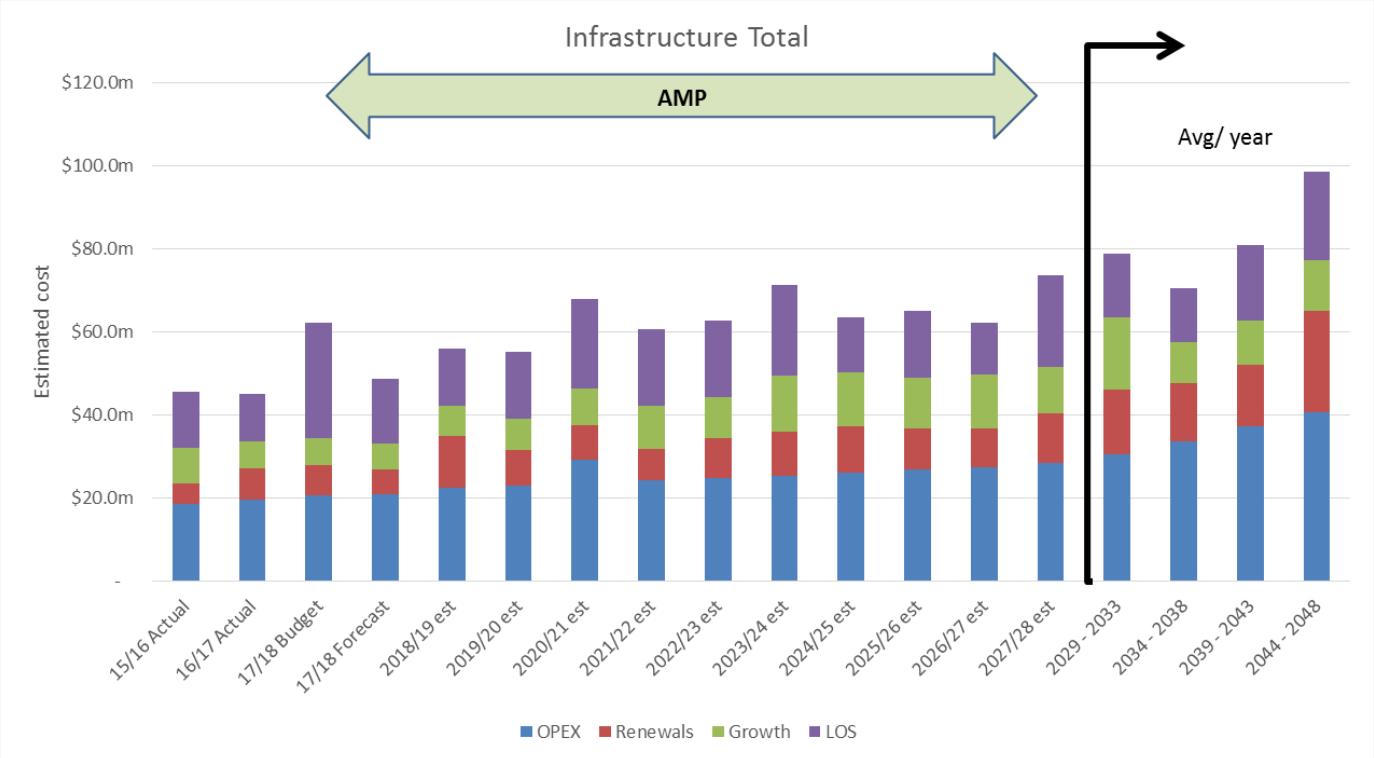
- increasing inspections of the Nelson Haven wastewater pipeline to fix leaks, and considering early replacement of the pipeline
- investigating long term options for managing natural hazard risks affecting the Nelson wastewater treatment plant (as part of the resource consent process)
- identifying risks to the wastewater network from significant flooding and earthquakes, and carrying out improvements to reduce impacts as well as investing in insurance to assist with recovery

The proposed approach for stormwater and flood protection includes:

- focusing flood protection works on areas which have a high likelihood of being flooded and/or being seriously affected by flood events using a risk based approach
- providing adequate stormwater disposal solutions that protect property while maintaining environmental outcomes
- developing strategies for future stormwater services that maximise the use of public land
- developing a resilient stormwater network that is able to withstand moderate earthquakes with minimal damage

Most likely scenario

Infrastructure costs for the next 30 years are shown in the graph below. These estimates are based on the preferred options outlined in this strategy and the work programmes included in the 2018-28 asset management plans.



Summary table of significant projects and programmes

Activity	Project or Programme	CAPEX Cost Estimate	Estimated Timeframe	Issue Table Ref
Transport	Integration of the local network with transport solutions resulting from the Nelson Southern Link Investigation	$15M	2029-2031	T5
Wastewater	Atawhai Rising Main Renewal	$25M	2024-2031	WW2
Wastewater	Treatment Plant Renewals	$25M	2029+	n/a
Wastewater	Treatment Plant Protection	$25M	2043-48	WW3
Wastewater	Wet weather overflow mitigation programme	$25M	2018+	WW1
Water	Primary Clarifier	$25M	2023-2030	WS3
Water	Water Pipe Renewal Programme	$95M	2018+	WS1/4
Stormwater	Extend Piped and Open Channel Network	$120M	2029+	SW2
Flood Protection	Urban Streams Flood Management and Enhancement Programme	$100M	2029+	SW1

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INTRODUCTION

Scope

To be successful we need to have a constant focus on the things that are the most important for us to do to support the wellbeing of Nelson's people, economy and environment. That's why this strategy doesn't cover all of our infrastructure services. It identifies the most critical challenges coming up in the next 30 years for our core services, what they mean for Nelson, and what we need to do to respond to them. Affordability is an essential factor and is considered throughout this strategy and in the 2018 Financial Strategy.

The timeframe for this strategy is 30 years. That doesn't mean we can predict everything that's going to happen between now and 2048. In particular, the full of extent of climate change impacts on our infrastructure over the next 30 years will become clearer over time. In order to be resilient, as well as open to opportunities, we need to both plan for the future and be agile in our response to what actually happens over this time. Future uncertainty is a good reason to review and update this strategy every three years, as required by the Local Government Act 2002.

Structure

Part One provides the strategic direction for our infrastructure. It consists of the following sections.

Section 1 — Strategic direction and outlook

This section outlines the strategic vision, priorities and key planning document.

The strategic outlook includes likely population changes, the effect of automation and technology on our economy, the increasing impacts of climate change, legislative changes and regional opportunities.

Section 2 — Significant challenges and opportunities for infrastructure

Nelson's challenges and opportunities in relation to our four strategic infrastructure objectives are discussed in more detail, including the specific implications for the transport, water supply, wastewater and stormwater networks.

Section 3 — Significant decisions for core infrastructure

The tables in this section identify the preferred options for addressing each of our significant challenges, and are grouped under each asset type (transport, water supply, wastewater and stormwater). The preferred options inform the 'most likely scenario' that follows.

Section 4 — Most likely scenario

This section shows the 30 year budgets for infrastructure services. More detail about individual projects is available in the 2018 asset management plans.

The financial estimates are shown by year for the first 10 years, then as average per year in 5 year increments for years 11-30.

Part Two outlines the key assumptions and risks relating to our infrastructure assets.

Infrastructure objectives

Our strategic infrastructure objectives are to:

- increase resilience to natural hazards
- maintain and renew existing assets
- provide infrastructure to enable growth and development
- maintain or improve environmental outcomes.

Natural hazards and resilience

Much of our local infrastructure is built across or close to fault lines and the coastal environment, and is exposed to natural hazard risks. Flooding and coastal inundation in some low lying parts of the central city also affects the functioning of our infrastructure, and infrastructure servicing some of the flat land at Tahunanui (and the airport and port) is subject to liquefaction risks.

We are comprehensively assessing the impact of hazards (including flooding, sea level rise and liquefaction) on infrastructure, particularly as Council receives updated information in relation to these hazards. Failing to respond to natural hazards risks would lead to poor infrastructure investment decisions with significant financial and environmental implications for the community in the future.

Over the next ten years we will work with our communities to understand, prepare for and respond to climate change impacts.

Existing assets and levels of service

Ensuring assets are maintained and renewed in an appropriate manner is essential for meeting our levels of service. Given the age and expected life of our infrastructure assets, decisions will need to include a sound understanding of criticality (risk), condition, and performance. Making effective decisions will require a balance between affordability and maintaining the agreed levels of service.

Cost-effective options to continue to deliver existing services are likely to involve the use of new technology and partnerships with others, including Tasman District Council and the New Zealand Transport Agency.

Growth in demand for infrastructure services

Providing enough new infrastructure at the right time is of critical importance to enabling economic growth and residential development. However, there are risks to manage related to over-investing in infrastructure, if growth does not occur when and where it is anticipated.

These issues need to be considered in conjunction with the likely growth in Richmond and the wider Tasman district.

The National Policy Statement on Urban Development Capacity (NPS-UDC) requires that Council provides sufficient infrastructure to serve projected urban growth with a 20% buffer over the next 30 years. The implications for the provision of infrastructure and proposed solutions are outlined in Section 2 of this strategy.

The Nelson Plan provisions relating to growth are relevant to the provision of new infrastructure to enable growth, and are summarised in Part Two.

The Waimea Dam proposal

Nelson has three sources of raw water that supply the water treatment plant- The Roding River, The South Branch of the Maitai River and the reservoir formed by the dam on the North Branch of the Maitai River. In addition Tasman District Council supplies water to a small residential area adjacent to the Champion Road territorial boundary, two large industrial users and the Wakatu Industrial Estate.

Tasman District Council have acknowledged the over allocation of water from the various Waimea Plains aquifers and the challenges this presents to both irrigators and the Council municipal water supply.

The solution promoted by the Tasman District Council and irrigators is the construction of a detention dam on the Lee River behind Brightwater. The construction cost to be met by contributions from those who are in the zone of benefit from the dam. Tasman District Council have approached Nelson City Council for a contribution as a likely beneficiary of the augmentation of the Waimea Aquifer.

Without the proposed Waimea Dam the possibility exists that the Tasman District Council will cease to supply the area within the Nelson City Council territorial area and Nelson City Council will have to take up the demand.

Recent updates to the Maitai Drought Study by OPUS International Consultants Ltd show that under a number of future population growth scenarios in the long medium term (out to 2053 the expected timeframe of the resource consent for water abstraction) and 2100 the Maitai Dam will not have sufficient storage capacity to meet likely consent conditions for environmental river flows plus the increasing demand from the customers in the current supply area. The wider impact of growth in the city is to reduce the drought security the Maitai Dam provides to the city. This situation will be exacerbated if the Tasman District Council cease to supply water across the boundary to Nelson.

Environmental outcomes

The key environmental challenges and opportunities for our infrastructure relate to improving the quality of freshwater and coastal environments. Water supply, stormwater, wastewater, and transport infrastructure all have potential to affect water quality and aquatic biodiversity in Nelson.

The Council is committed to further assessing the implications of its infrastructure on the natural environment and embedding environmental outcomes in the decision making process. We take a whole of organisation approach to delivering on our environment priority, so some environmental outcomes are also delivered through infrastructure projects.

The National Policy Statement for Freshwater Management (NPSFM) requires the avoidance of further over-allocation of water and the phasing out of existing over-allocation. If there is an existing over-allocation issue this has potential implications for how much water the Council can take from the Maitai and Roding Rivers for the city's water supply in future. The Maitai water supply consent conditions are currently being finalised, and it may be that the long term volume abstracted needs to be reduced at critical periods. More reliance on water from the dam is likely in that future scenario, and additional water demand measures may also be required.

The Nelson Plan will also include revised rules for stormwater discharges to freshwater and coastal water, and treated wastewater discharges to coastal water. The rules related to wastewater overflows during heavy rainfall events are also likely to become more stringent, and require increased investment in the wastewater network.

The current resource consent for discharge via pump stations and the wastewater network already requires reduction in overflow events. The discharge of untreated wastewater from the

wastewater network to land, freshwater and the coastal marine area requires nil dry weather discharge from any pump station by 2023; and reduction to a maximum of five wet weather overflow events from pump stations per 12 months by the date of expiry of the permit (2032).

Significant investment is proposed to reduce the risk of overflows of wastewater into streams and Tasman Bay during wet weather. Work to renew sections of the network found to be in poor condition began in 2017/18 and is proposed to continue over the next 10 years to tackle this problem.

More detail about the freshwater issues related to infrastructure and our proposed approach to meet these requirements is provided in Sections 2 and 3 of this strategy.

The Nelson Plan provisions relating to environmental outcomes are relevant to this topic, and are summarised at the end of Part Two.

Influencing factors

Affordability and technological advances influence all aspects of this strategy.

Affordability

Affordability of service provision is a key factor when making decisions about infrastructure, and will be discussed throughout this strategy. The specific costs and the benefits of the options to address infrastructure issues are outlined in section 3 of this strategy (significant decisions).

Our goal is to meet required levels of service in the most cost effective manner, through management of assets for current and future generations. This is essential in order for the Council to meet its responsibilities, as outlined in section 10 of the Local Government Act.

The 2018 Financial Strategy:
- limits annual rate rises to the Local Government Cost Index plus 2%
- limits the debt to total revenue ratio to 150%

Ultimately, it is the role of the Mayor and Councillors to decide on rates and spending priorities following consideration of public feedback through the Long Term Plan consultation process. (The LTP consultation document proposes prioritising infrastructure spending over social projects and is seeking feedback from the public on this approach.)

This infrastructure strategy provides recommendations and highlights the risks and implications of the different options for addressing infrastructure issues. Ways in which the Council can influence the cost of services include prioritisation of projects, identification and use of cost effective, innovative solutions, user-pays pricing models and service level changes.

Technological advances

Technological advances are highly likely to affect how we manage our core infrastructure in future. Nelson's vision to be "the Smart Little City" and the mission "to leverage our resources to shape an exceptional place to live and work" is well aligned with adoption of technology to improve the functioning of the city, and to show we welcome innovation and are actively looking for new ways of doing things.

Ongoing learning will be necessary as we assess and adopt new options such as the use of robotics to maintain assets and make the most of advances in 'big data' to assist with modelling and updating of local climate change impacts and monitoring of the performance of our underground assets.

New technology for wastewater treatment could also be significant for Nelson considering the proximity of several key assets.

PART ONE — STRATEGIC CONTEXT

Section 1 - Strategic direction and outlook

Strategic direction

Council has developed a vision and mission statement and decided on four overarching priorities for the ten year work programme. These will express the aspirations we have for our city, guide our decision making and help us better direct our resources.

Vision

Nelson is the Smart Little City: e tāone tōrire a Whakatū

Nelson is a vibrant place where we are deeply connected with, and committed to, our natural, social and cultural environment. Clever business and innovation help us thrive. We enjoy living fulfilled lives in smart, sustainable communities.

Mission

We leverage our resources to shape an exceptional place to live, work and play.

Key community outcomes which relate to this infrastructure strategy

- *Our unique natural environment is healthy and protected.*
- *Our communities are healthy, safe, inclusive and resilient.*
- *Our infrastructure is efficient, cost effective and meets current and future needs.*
- *Our urban and rural environments are people-friendly, well planned and sustainably managed.*
- *Our region is supported by an innovative and sustainable economy*

Infrastructure is also one of the four key priorities for the next 10 years

Infrastructure - te hanganga

Our city, community and environment all depend on our core infrastructure networks to provide safe and smart transport, water, wastewater, stormwater, and flood protection. Key city assets need ongoing maintenance and replacement so we can depend on these essential utilities. This work also enables and protects investment in our city and removes constraints on our growth. Council is putting essential infrastructure at the forefront to future-proof our city.

The following strategic objectives in the Draft Nelson Plan are also relevant to this infrastructure strategy

City development:

- creates a vibrant and attractive city
- coordinates growth and infrastructure
- connects community
- adapts to hazards
- looks after our heritage.

Natural resources:

- clean and accessible water
- healthy coastal and marine areas
- enhanced natural areas and landscapes
- clean air.

Key planning documents

2018 Long Term Plan

The Long Term Plan describes the projects and services Council intends to deliver in support of their community outcomes. The strategic priorities in the 2018 LTP are infrastructure, the environment, CBD development and to lift Council performance. The Long Term Plan is informed by the asset management plans and both are aligned to support Nelson's community outcomes.

2018 Asset Management Plans

The asset management practices and 10 year work plans which support the objectives included in this strategy are outlined in each of the relevant asset management plans. Many of the issues noted in this strategy can be directly linked to work in the 10 years. There is a mix of capital expenditure in support of the solutions described in the issues tables as well as funding for investigations to better define and understand the issues faced. All can be found on Council's website.

- Transport Asset Management Plan
- Water Supply Asset Management Plan
- Wastewater Asset Management Plan
- Stormwater Asset Management Plan

2018 Financial Strategy

The Infrastructure Strategy works within the requirements of the Financial Strategy.

The Financial Strategy demonstrates how Council will:

- Provide for growth in its region and manage changes in land use.
- Ensure that the level of rates and borrowing are financially sustainable and are kept within pre-set limits.
- Be accountable for maintaining the assets that it owns on behalf of the community.
- Fund network infrastructure and maintain levels of service.
- Obtain pre-set returns on financial investments and equity securities.
- Give securities on borrowing.

In preparing the Long Term Plan and the Financial Strategy, Council considered the balance of:

- Service levels, the costs of these services and the money required to achieve those levels of service.
- Priorities for expenditure across all activities.
- Setting rates and charges across the full 10 year period of this Long Term Plan and how to minimise these while achieving the targeted levels of service.
- The level of debt that current and future ratepayers would need to fund.
- The level of growth that is expected in the next 20 years and beyond.

Other planning documents which influence the infrastructure strategy

- The Nelson Resource Management Plan
- Draft Regional Policy Statement
- Draft Nelson Regional Land Transport Plan (2018 mid-term review)
- Draft provisions in the proposed Whakamahere Whakatu Nelson Plan

The Nelson area

Nelson is a coastal city occupying the river valleys, low hills and plains inland of Nelson Haven and Waimea Estuary. The Nelson area sits between hills and the coastline bringing both opportunities and challenges.

Nelson's unique identity seeks to drive success for the region in the attraction and retention of talent, investment and visitors who want to add value. Nelson is well situated as a place of surprising diversity, humming with arts and artisans and a place where clever urban and rural businesses thrive, all set in stunning natural landscapes.

Nelson is continuing to grow and our challenge is to manage this growth sustainably. Councils are unique in having a specific democratic mandate for "place-shaping", ensuring our communities are attractive, prosperous and safe and that growth is channelled in a way that supports places where people want to live, work and do business.

We will be working closely with Tasman District Council to provide for the predicted growth in the Nelson and Richmond areas, and beyond. As a result of Central Government's new National Policy Statement on Urban Development Capacity, we will also be reporting more frequently on land supply and demand.

Anticipated development and our increasing population requires improved or new transport and water supply systems, stormwater, wastewater and other public amenities such as parks, libraries, and community centres. Meeting our infrastructure requirements will require a well thought out strategic plan that aligns with our Financial Strategy and meets the needs of our community. As a result of Central Government's new National Policy Statement on Urban Development Capacity, we will also be reporting more frequently on land supply and demand.

Strategic outlook — what's likely to change over the next 30 years

Population, housing and economic growth

Population growth[1]

Between now and 2048 Nelson is likely to have:

- 12,400 more residents
- 7,660 new households
- a population where 34% of people are aged 65 years and older, compared to 20% at the moment.

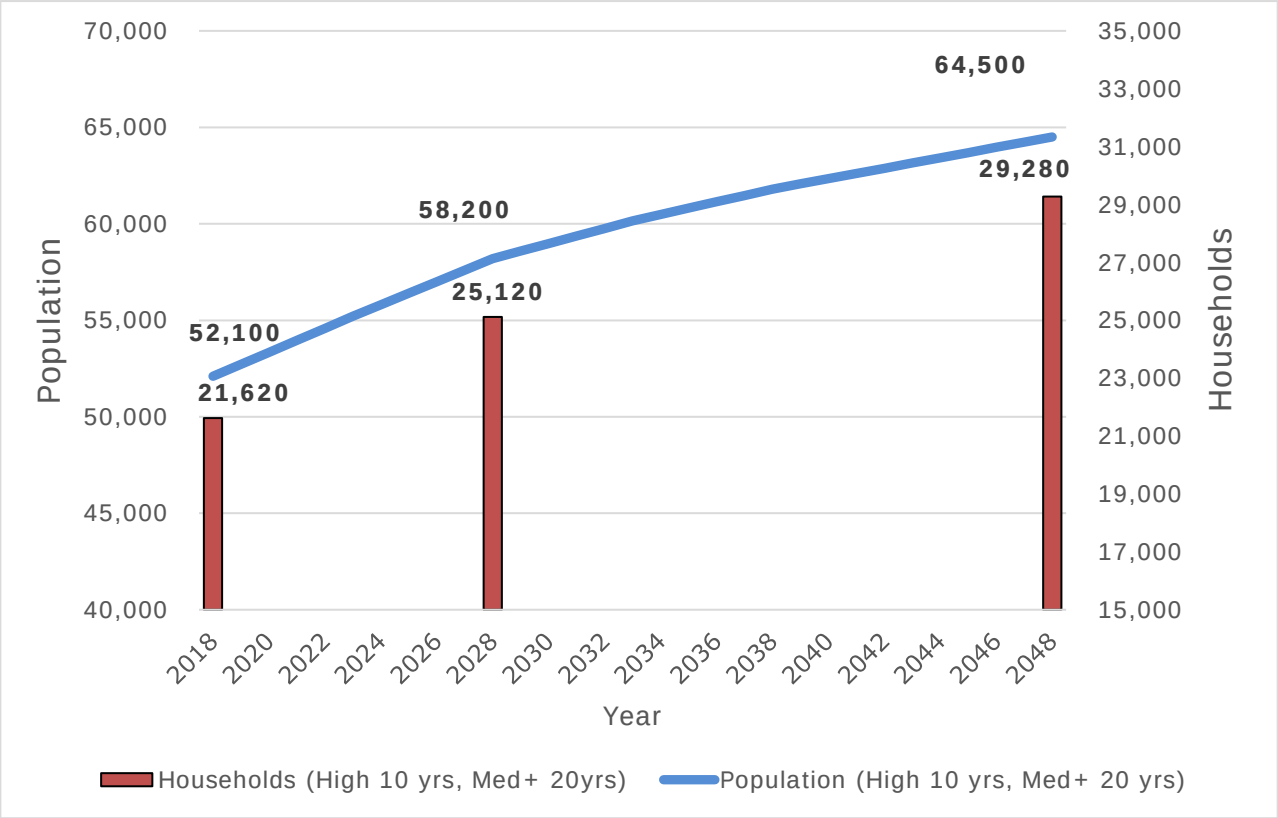
The increased number of older people living in Nelson means there are likely to be more one-person households and couple-without-children households. The Council also anticipates an additional 6% of housing will be required to meet demand for visitor/non-resident accommodation, such as holiday homes.

Table 1: Population projections (High for 10 years then medium plus adjusted net migration)

	2018	**2028**	**2048**
Population	52,100	58,200	64,500
Households	21,620	25,120	29,280
HH size	2.41	2.32	2.20

[1] Information in this section is sourced from 'Nelson Population and Household Projections: 2018–2048' (Document A1803950)

FIGURE 1: POPULATION AND HOUSEHOLD GROWTH 2018-2048



Housing growth

The arrival of 12,400 more residents and the establishment of 7,660 new houses or apartments in Nelson has implications for infrastructure, particularly transport (more vehicles on the road) and the stormwater and wastewater networks (more water to manage, increasing pressure on existing capacity).

As the number of older people in the community increases, the affordability of rates could be a growing issue. However the Council's background paper 'Nelson's Ageing Population' notes (on page 3) that despite having lower incomes than younger age groups, older people generally have higher net worth and higher material and financial wellbeing. This could change over time, particularly as home ownership rates are declining in New Zealand.

The background paper states that most older people currently own their homes, and generally prefer to age in their own homes as long as possible, and prefer smaller properties than younger age groups.

Some people are still choosing to move to retirement villages later in life, and the retirement village sector is currently booming, with two large new villages being developed in Nelson/Richmond.

The increase in the percentage of older people will have an effect on the transport infrastructure that is available to them. Mobility declines with increasing age, reflecting the onset of physical or mental infirmity, affordability of travel for those on retirement incomes, and the often poor design of the transport infrastructure and operational arrangements not suiting the aged cohort.

NZTA research in 2012 showed public transport is expected to continue to be a minor mode for older people unless planning and public transport policy changes substantially, with the present reliance on the car, either as driver or passenger expected to continue. However, the absolute

size of public and special transport activities will need to increase to cater for the greater older population, if only to keep pace with growth.

Most of Nelson's growth is predicted to be from migration as our city bucks the trend of declining growth in many areas around New Zealand, and our regional identity '*Extraordinary nelsontasman.nz'* was designed to help attract visitors, investment, and talent to our region. Between 2006 and 2016 migration (both in and out of Nelson) has resulted in 450 additional people per year choosing to live in Nelson, and this is the basis for Council's population projections being calculated using the Statistics NZ medium growth projections plus a net migration of 450 people per year (rather than the 300 per year in the Statistics NZ projections).*Economic growth*

Although older people are becoming more active in the labour market, sustained labour shortages are expected as Nelson's workforce ages (Nelson's Ageing Population, page 3). Health care and social assistance is a significant area of employment growth, with the highest number of employees of any sector in Nelson.

The second largest type of employment is providing professional, scientific and technical services (2,710 people) followed by accommodation and food services (2,020) and transport, postal and warehousing (1,440).[2]

Of most significance to our infrastructure is the growth in commercial, industrial and residential development and tourism, which significantly increases demands on the transport system. While tourism increases congestion over summer, the increase of heavy vehicle traffic (all vehicles over 3.5 tonnes) has the most impact on transport asset life.

In the wider Nelson–Tasman region warmer temperatures, a longer growing season and fewer frosts could provide opportunities to grow new crops, as a result of climate change. However, these benefits may be limited by water shortages, as well as the negative effects of climate change such as prolonged drought or greater frequency and intensity of storms. Climate change could also affect the region's fishing and seafood industries, as a result of increasing ocean acidification.

The implications of automation are predicted to be far-reaching throughout the world. It could affect a wide range of existing jobs in Nelson over the next 30 years, including professional and manual work.

Natural hazards and the effects of climate change

Like all people living in the South Island and lower North Island, the Nelson community has a heightened awareness of the potential for strong earthquakes to affect our lives. There is a 30% likelihood of a major earthquake of 7.1 magnitude or greater on the Alpine Fault over the next 50 years.[3]

After our own intense rainfall events in December 2011 and April 2013, as well as news of severe flooding from around New Zealand, we know that significant rainfall events are increasing in both frequency and intensity as a result of climate change, affecting risks associated with floods and land instability.

The implications of climate change for Nelson include:

- *Coastal hazards*. There may be increased risk to coastal roads and infrastructure from coastal erosion and inundation, increased storminess and sea level rise.

[2] Employment data sourced from http://www.mbie.govt.nz/info-services/business/business-growth-agenda/regions/documents-image-library/2016-regional-reports/nelson-region.pdf
[3] Page 124 of the draft Nelson Tasman Civil Defence Emergency Management Plan, September 2017.

- *Heavy rain.* The capacity of stormwater systems may be exceeded more frequently due to heavy rainfall events which could lead to surface flooding.

  River flooding can change the way stream channels are configured/protected and increase the need for alternative stormwater detention and management approaches.

  Urban hill country erosion events may also become more frequent, impacting on transport structures such as bridges and large culverts as well as failure of retaining walls from land slip events. The combination of wind and heavy rain causes tree fall events, blocking roads.

  More heavy rainfall events can also lead to a greater frequency of emergency overflows from wastewater pumping stations, and more inflow and infiltration of stormwater into the wastewater network. This puts a lot of pressure on the system and increases the likelihood of wastewater pollution events.

- *Drought.* By 2090 the time spent in drought ranges from minimal change through to more than double (compared to the climate experienced from 1986-2005). More frequent droughts are likely to lead to water shortages, increased demand for irrigation and increased risk of wildfires.

- *Disease.* There may be an increase in the occurrence of summer water-borne and food-borne diseases such as Salmonella. There may also be an increase in tropical diseases.

- *Biosecurity.* Climate change could increase the spread of pests and weeds. Warmer temperatures will make pests such as mosquitoes, blowflies, ants, wasps and jellyfish more prevalent in the region. There may also be a loss of habitat for native species.

Over the next 10 years the Council will work with the community to understand, prepare and respond to climate change impacts. The Council welcomes central government guidance, including the 'Coastal Hazards and Climate Change' guidance for local government published in December 2017. This outlines a ten step process for councils to follow in establishing a plan for adapting to coastal hazards and climate change.

Step 1 — Preparation and context
Set up a multi-disciplinary team, recognising a wide set of expertise, skills and knowledge is needed; make connections with potentially affected communities; and establish (and resource) a work programme.

Step 2 — Hazard and sea-level rise assessments
Identify the extent and magnitude of the hazards, including the effects of rising sea levels on coastal inundation and coastal erosion.

Step 3 — Values and objectives
Identify what and where private property, businesses, local infrastructure and community spaces will potentially be affected by coastal hazards and sea-level rise, and the people who will be affected by these changes.

Use this information to develop objectives to guide the Council's decision making processes.

Step 4 – Vulnerability and risk
Undertake two different assessments:

- how vulnerable people and assets are to being negatively affected by coastal hazards and sea level rise

- the level of risk (likelihood multiplied by the magnitude of the consequences).

Step 5 — Identify options and pathways
Engage with the community to consider the options for adapting to the coastal hazards and sea level rise, including:

- accommodate
- protect
- retreat
- avoid.

Step 6 — Option evaluation
Evaluate the options against criteria such as: flexibility, feasibility, ability to meet community values and provide co-benefits, value for money, and environmental impacts.

Step 7 — Adaptive planning strategy (with triggers)
Agree on triggers to be monitored, which will provide early signals that a change in approach is required. Examples of coastal signals that can be useful early alerts include:

- increasing frequency of clearing stormwater drainage systems
- measurement of saltwater in groundwater systems
- increasing cost and/or complexity of maintaining pumping systems
- the number of damaging or disruptive floods in the central business district over a specific time period.

Step 8 — Implementation plan
Prepare a plan which sets out the agreed approach, and the trigger points at which new decisions will be required.

Reflect this in all relevant council plans and strategies, including resource management plans, asset management plans and the long term plan (which will need to identify how implementation of the plan will be financed).

Step 9 — Monitoring
Develop new monitoring systems (at a regional rather than a district level) which focus on the impacts on coastal areas. Monitoring of the effectiveness of the climate change adaptation plan will also be required.

Step 10 — Review and adjust
Regularly review the plan to reflect both changing risk levels and any new tools for managing hazard risk.

Legislative changes

Tangata whenua participation

We recognise that we need to build capacity and capability to have effective and meaningful partnerships with Te Tau Ihu iwi. We are committed to:

- building effective, lasting, and genuine partnerships with all eight Te Tau Ihu iwi at both operational and governance levels

- supporting iwi and Māori to participate in local government
- delivering Council functions in a way that acknowledges the mana of Te Tau Ihu iwi
- enabling iwi aspirations, particularly for development following Treaty settlements.

The most recent changes to the Resource Management Act, via the Resource Legislation Amendment Act 2017, have formalised iwi participation in plan making processes. They include provision for Whakahono a Rohe (participation agreements between a council and iwi), which can be formed at the invitation of either NCC or iwi.

The Council established an iwi working group in 2015 to provide a forum for partnership working with the eight iwi o Te Tau Ihu through the development of the proposed Whakamahere Whakatu Nelson Plan, including the new freshwater management framework.

Statutory acknowledgements for the Maitai River and the Nelson coastal marine area are now in place for eight iwi, as a result of Treaty settlements in the Nelson area. Tangata whenua values related to abstraction from the Maitai River for the city's water supply, as well as treated and untreated wastewater discharges and stormwater discharges to coastal waters, will be given consideration in consent processes. Conditions might involve a requirement to ensure the minimum flow (the water level at which no water can be taken out of the river) provides for cultural values and mahinga kai.

The Treaty settlements also provide for the establishment of a Freshwater Advisory Group, which is likely to have a role in freshwater management across the Top of the South Island. The terms of reference for the Nelson Plan Iwi Working Group acknowledges that freshwater will be discussed in that forum until such time as an advisory group is established.

The Nelson Plan Iwi Working Group recently resolved to seek advice from the National Iwi Leaders Group and advisers. This group is likely to become increasingly better informed over time and to have aspirations aligned with New Zealand-wide aspirations relating to water management.

Public health risks

Contamination of water supplies is also an issue at the top of people's minds after recent issues in Havelock North and Dunedin. A specific outcome of the drinking water inquiry is likely to be a requirement for treatment of uncontrolled water sources. This is not significant for Nelson's urban water supply, as the water is already chlorinated at the treatment plant.

In Nelson there are two registered rural community supplies at Hira and Glenwood (serving residents in Lud Valley with the water sourced from the Teal River), and these are not owned or managed by the Council. Consents for community supplies at Unique Creek, Cable Bay Road and the Maitai should also be registered, and this is being progressed by the District Health Board. The Ministry of Health may require further actions by the owners of the Glenwood supply system (as the water supply authority) to ensure the safety of this water supply in future.

Of more potential significance to the Council is the consequent Government review on how to improve the management of drinking water, stormwater and wastewater to better support New Zealand's prosperity, health, safety and environment.

Given the national interests in water supplies throughout New Zealand, there is some uncertainty about whether water supply activities will remain as a local authority function in future. One of the outcomes of the Inquiry might be a transition to a more region-wide or nationwide approach to water supply, establishing organisations with a sole focus on delivery of these services. Any changes to New Zealand's approach to managing water supply services are likely to be signalled in 2018.

Regional opportunities

We work with our closest neighbour, Tasman District Council, on regional issues and shared services. Collaboration between the two councils benefits the wider region and results in better, more efficient, and affordable services. These are described in more detail in the Long Term Plan.

Combined services and planning with Tasman District Council currently include:

- shared services (Bell Island Wastewater Treatment Plant, and Tasman supply of water to residents and industries on the Richmond/Nelson border)
- funding from Tasman District Council which contributes to the Nbus and total mobility services managed by Nelson City Council
- a combined approach to growth and infrastructure planning for the Nelson urban area and Richmond, and creation of a future development strategy
- a memorandum of understanding for shared infrastructure at the boundary between Nelson and Richmond
- connecting cycleways to ensure contiguous and safe routes

The top of the south councils (Tasman, Marlborough and Nelson) developed a combined Regional Land Transport Plan. This provides a consistent approach to the context, issues and objectives for the wider region, and agreement on the highest priority projects, in terms of what is best for the top of the south as a whole.

Further co-operation is anticipated in future, and over the next 30 years there is a reasonable likelihood that amalgamation between Nelson and Tasman councils will receive serious consideration.

Section 2 - Significant challenges and opportunities for infrastructure

Introduction

The Local Government Act 2002 requires the Council to consider the following factors in this infrastructure strategy:

- resilience to natural hazards risks and making appropriate financial provision for those risks
- renewal or replacement of existing assets, and any proposed increases or decreases in levels of service to be provided by those assets
- growth or decline in the demand for services provided by infrastructure assets
- how to maintain or improve public health and environmental outcomes.

These requirements are the basis for the strategic infrastructure objectives that follow. As outlined in the previous section, public health risks are not a significant issue for our water supply infrastructure, so this is not discussed further.

The influencing factors of affordability and technology are also discussed, in terms of constraints and opportunities.

Infrastructure Objective 1: Increase resilience to natural hazards

a) *The challenges and opportunities*

Key challenges

We need to manage our exposure and our vulnerability to:

- earthquake risk
- sea level rise
- intense rainfall events
- land instability.

Key opportunities

The following advances provide opportunities for meeting our objectives.

- New technology allows us to more accurately model the effects of climate change predictions in flood modelling.
- New building techniques and materials are likely to assist with adaptation to climate change over the next 30 years.
- More real time data allows for quicker responses to network failures following natural hazard events, and more sharing of information with customers.
- New guidance and standards are available on strengthening the foundations of new buildings and structures in liquefaction prone areas following the Christchurch earthquakes.
- More public awareness and understanding of the effects of climate change will make more constructive community discussions about adaptation possible in future.
- The Government published guidance for local government on coastal hazards and climate change in December 2017 (as outlined in the previous section of this strategy).

- The Ministry for the Environment is also developing national guidance on managing the risks of significant natural hazards. This may provide nationally consistent guidance on applying a risk-based approach to natural hazards.

b) *Affordability factors*

Opportunities to reduce costs associated with natural hazards include:

- Carrying out proactive infrastructure protection works and a recent change to a more cost effective type of insurance for Council assets than the Local Authority insurance scheme focused on underground assets (LAPP). Claims from the Christchurch Earthquake led to the need to re-finance the scheme and a number of local authorities have opted to insure these assets through more mainstream insurance providers
- a risk based approach to flood protection, rather than a uniform approach across the city
- regulatory measures designed to avoid private development in or adjacent to hazard areas.

c) What this means for us

Our water-related natural hazards risks relate to Nelson's coastal location, land forms and soil types. Substantial parts of the central city area are built on land reclaimed from the sea and historical foreshore, which increases our exposure to flood risks. Because of the close proximity of the Nelson foothills and commercial and residential development on the flood plains and in riparian margins, the stream and river catchments are relatively short, narrow and steep, leading to rapid stormwater runoff and flash flooding in higher intensity rain events.

Nelson also has several active fault lines, which are part of the larger Waimea-Flaxmore Fault system. Although it's less likely during the next 30 years than an Alpine Fault earthquake, if an earthquake does occur along these local fault lines, there is potential for rupture of the land surface. The highest levels of earthquake shaking are also likely to occur near the fault lines. In addition, liquefaction-prone land has been identified in the Tahunanui area.

Alpine Fault System

The draft Nelson Tasman Civil Defence Emergency Management (CDEM) Plan states the probability of the alpine fault rupturing in the next 50 years is in the order of 30%. It has a 300 year recurrence rate, and the last one occurred in 1717 (from page 124 of the CDEM Plan 2017).

The Alpine Fault and Marlborough Fault system have accumulated enough strain for rupture to occur along a significant length close to or within the Nelson Tasman region. Such a rupture is capable of generating a major earthquake with a magnitude of 7.1 or greater. Ground shaking intensities of MMVIII are predicted for the Nelson Richmond urban area.

MMVIII refers to the 'modified mercalli intensity scale'. MMVIII intensity relates to severe shaking which causes slight damage in specially designed structures; and considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments and walls can occur, and heavy furniture may be overturned.[4]

Waimea Flaxmore Fault System

Page 126 of the CDEM Plan 2017 states the Waimea Flaxmore fault has a 6,000 year recurrence rate, and has ruptured at least three times over the past 20,000 years.

[4] Information sourced from https://earthquake.usgs.gov/learn/topics/mercalli.php

Rupture on the Waimea Flaxmore Fault system is estimated to result in an earthquake of magnitude 6.5 to 7.4. Severe ground shaking would result near the epicentre, potentially as high as MMIX, though a lesser level of ground shaking is more likely should only part of the fault rupture during an earthquake event."

MMIX refers to the 'modified mercalli intensity scale'. MMIX intensity relates to violent shaking where damage is considerable even in specially designed structures — well-designed frame structures will be thrown out of plumb. Damage will be great in substantial buildings, with partial collapse, and buildings will be shifted off foundations.[5]

"Reactivation of existing landslides as well as occurrence of new ones can be expected from earthquakes originating on the Waimea Flaxmore Fault System."

Water-related hazards

While earthquake events have the potential to have the greatest impact, they are geological and therefore will occur according to their own timetable. In contrast, we know the water-related hazard events will occur the most frequently, and will intensify over time in response to climate change.

A key longer term question is whether it is a good use of public money to maintain or enhance the functioning of infrastructure in its current location, and in what areas does it make better sense to reduce or remove services in areas where climate change will increase water-related hazards over time?

The planning and decision making process outlined in 'Coastal Hazards and Climate Change' (published in December 2017) recognises that the best options for adaptation (accommodate, protect, retreat or avoid) are likely to change over time. Triggers will need to be established and monitored, to enable a flexible decision making process to occur over time, as the impacts of climate change increase.

Most services follow city development, so in the case of new development a decision will be needed about its location before we consider the services to support that development.

A longer term approach to significant natural hazard risks will be considered in future updates of the infrastructure strategy, following the completion of the proposed Whakamahere Whakatu Nelson Plan and any additional guidance from the Ministry for the Environment.

This longer term planning will need to include consideration of the road between Tahunanui, the Port and Gentle Annie and how it may be impacted by sea level rise. This is a NZTA-owned state highway but there are many Council-owned assets within the state highway corridor and local roads coming off it. We will need to know what our future plan is for 20-30 years' time.

The Gloucester Street area is already subject to tidal influenced flooding that will impact a large portion of the CBD by 2100. There is a combined stormwater and transport budget to investigate options for responding to the effects of climate change on the stormwater and transport systems in this particular area, and the wider impact of sea level rise is relevant to growth planning decisions in the Nelson Plan.

d) What we're currently doing

As identified in the natural hazard-related tables in the next section of this strategy, we are at the stage of identifying and assessing the network risks from natural hazards. We have not yet worked through the other steps in the process recommended in the 'Coastal Hazards and Climate Change' guidance for local government, so we are not yet in a position to make decisions about specific assets. However, this will need to be addressed as soon as possible.

[5] Information sourced from https://earthquake.usgs.gov/learn/topics/mercalli.php

As a result of the extreme weather events in December 2011 and April 2013 the Emergency Fund is currently in deficit, and there is a risk that future disaster recovery costs during the next 10 years could be higher than anticipated. To manage this risk, the Council will need to consider the amount put aside on an annual basis. Nelson City Council intends to increase its Emergency Fund by the end of 2028. Even when the reserve has built up to the desired level, Council will continue to hold insurance for assets.

Work has already been carried out to identify the level of insurance required for the water supply and wastewater network in relation to natural hazards. Higher levels of insurance are necessary and this is now reflected in our asset management budgets.

Where transport activities that are subsidised by the New Zealand Transport Authority (NZTA) are damaged by natural hazards, NZTA pays 51% for small events and 71% for large events. Council needs to plan for contributing the local share of these costs, or take out sufficient insurance to manage this risk.

The same natural hazards data used in the insurance assessment is now being used to review what works can be carried out to increase the physical resilience of the water supply and wastewater networks. The timeframe for Natural Hazards Risk Assessment and remediation is:

- Stage 1 of the water supply involving investigation and identification of options to be complete by 2020/21
- Stage 2 of the water supply to implement the remedial works starts in 2028/29 and complete by 2042/43
- Stage 1 of wastewater involving investigation and identification of options to be complete by 2021/22
- Stage 2 of wastewater to implement the remedial works starts in 2027 and continues through to 2037/38
- Stormwater works will be ongoing through to 2037/38.

a) *What else do we need to do?*

Refine the risk-based decision framework for catchment management

The flood risk focus over the next three years will be on finishing major projects to increase the capacity for Saxton Creek, Orphanage Creek, York Stream and Little Go Stream to carry the flood waters from a 1%AEP [Annual Exceedance Probability] rainfall event (an event with a 1% likelihood of occurring in any one year). These projects have the potential to conflict with goals related to habitat creation and protection to support threatened species in these waterways. This is why the design of upgrades to accommodate both flood waters and ecological values is required.

The Council needs to balance the probability and consequences of flood events with community values for streams and rivers. This involves considering how much we are willing to alter waterways with flood banks and deeper river beds. A risk based approach to these competing values weighs up the risks and the impact of flooding with affordability and the impacts on the environment.

Given the realities of changing weather patterns, a city built on a flood plain and close to the coast, the Council considers it is time to have this conversation with the community and to make some difficult choices.

A risk-based approach to flood protection is referred to in the draft Whakamahere Whakatu Nelson Plan and in the 2018-28 Stormwater and Flood Protection Asset Management Plan. The Maitai is the first of the larger rivers to be looked at from a risk based perspective.

The practical details of this approach will evolve during the process of applying this approach to the Maitai catchment. It will involve council officers and consultants working together in a cross-

disciplinary way to develop a decision-making framework for determining where we need to reduce flood risk — and where intervention is considered to be required, how best to take into account social, economic, cultural and environmental values.

The approach developed for the Maitai catchment will then be applied for all subsequent waterways. The Council uses computer models to understand the probability (return periods) and the consequences (location and extent of property flooding) and will also be using 'Riskscape' software. This is a new tool for assessing the impact on people, business and other property from natural hazards which is supported by New Zealand's natural hazard experts (GNS and NIWA).

This project will also involve discussion with the wider community to identify acceptable options (for example stopbanks, raise bridges, or do nothing and accept the risk). Funding for the Maitai flood risk management project is allocated from 2018/19 through to 2023/24, with construction works (if they are required) to occur in future years.

This decision-making process and its outcomes will be outlined in more detail in Nelson's 2021 infrastructure strategy, and will provide the direction for future investment in stormwater infrastructure.

Respond to Nelson Plan provisions relating to infrastructure assets

New natural hazards rules in the proposed Whakamahere Whakatu Nelson Plan, which will be released for public feedback in August 2018, followed by a more formal notification and consultation process in 2019. The next infrastructure strategy will need to respond to any new requirements. At this stage the draft earthquake, liquefaction and flood risk provisions have been developed (see the end of Part Two of this strategy). Slope instability and the coastal erosion and inundation rules have not yet been developed, but they will be discussed in terms of any implications for infrastructure in the next version of this strategy, in 2021.

Natural hazards — specific infrastructure challenges

Transport

Lifeline role of the road network — One of the key findings of a recent Nelson Tasman Lifelines Project is that the transport asset of roads, bridges and retaining structures is vitally important to allow reinstatement of other services the community needs in order to rebound from natural hazard events. The road network gives access to the water supply, sewer and stormwater networks as well as the private but critical telecom and power reticulation. It also provides the means for food and fuel to be moved around the region, which are all critical elements to enable the community to respond and recover.

Earthquakes — Earthquakes are a considerable risk to the transport network, especially in areas of reclaimed coastal margin and steep hillside suburbs. The transport assets most at risk are bridges and retaining walls.

Flooding and landslips — Unplanned road network closures as a result of flooding and landslips also cause disruptions in the functioning of the city (as occurred in the December 2011 rainfall event). Service disruptions to the transport network associated with severe weather are typically due to flooding from under capacity or overwhelmed drainage and bridge structures, the road acting as the secondary flow path, slope and retaining wall failures blocking roads, and fallen trees due to the occurrence of high winds, which are often associated with major storm events.

Due to Nelson's hilly topography we have many high value retaining walls and structures which are required to support the transport network compared to other cities located on flatter

ground. Climate change (increased storm intensity), and local geology is increasing stresses on the retaining wall asset leading to more frequent failures.

After the Southern Link is completed, Council may need to take over ownership of Rocks Road so affordable solutions will be needed for managing the slips occurring during rain and seismic events, as well as sea wall failure in a seismic event, as well as the impacts of increased tidal surges from higher sea levels and increased storm intensity.

Proposed solution: See Table T1

Water Supply

Vulnerability of trunk mains and pipes — Because the Maitai Dam is a critically important asset, it was designed to withstand 1 in 1000 year seismic and flood events without damage. However, the pipes between the rivers, the Water Treatment Plant, and water users are more vulnerable to natural hazards, particularly the above ground trunk mains and pipes crossing earthquake faults, streams and rivers. In coastal areas liquefaction is a potential risk to the network.

Proposed solution: See Table WS5

Wastewater

Location of the Nelson Treatment Plant — The Nelson Treatment Plant is low lying and located in the coastal environment. That means it is particularly exposed to the effects of climate change, including flooding, sea level rise and storm surges. This is significant because the plant treats half of Nelson's residential waste, at around 8 million litres of wastewater per day (the other half goes to the Nelson Regional Sewerage Business Unit Bell Island wastewater treatment plant in the Tasman district).

The Council has developed a flood model to evaluate impacts on the Nelson wastewater plant, covering Hillwood Stream, Todd Valley Stream and the Wakapuaka Flats drainage area. This shows the Nelson wastewater treatment plant will not be inundated, but will be surrounded, by flood water in a 1% AEP[6] year flood event. Loss of road access to the wastewater plant is predicted to occur by 2050. Uncertainty remains about the effect of coastal water infiltration from below the plant when coastal groundwater rises, as well as the potential for high storm waves to come over the boulder bank in a 1% AEP year storm event.

Another issue with the current location of the treatment plant is the marine sediments on which it is constructed. This results in:

- corrosion
- settling (due to the lack of firm rock underneath the treatment plant)
- low survival rates of the wetland plants (which are in a wetter environment than is optimal for them).

The Nelson wastewater treatment plant resource consents for the operation of the wastewater plant and for the discharge expire in December 2024, and future climate change impacts will be scrutinised through this process. There is a significant risk that renewal of consents for the wastewater treatment plant will not be successful unless long term options to manage the coastal hazard risks are identified. Treatment quality, and iwi cultural values, also need to be taken into account when considering the location of Nelson's wastewater treatment plant

[6] Annual Exceedance Probability – probability of an event in any given year.

Funding has been allocated for early investigation into the future of the wastewater treatment plant, including:

- the ability of the treatment plant to withstand climate change impacts
- cultural issues related to discharges of treated wastewater
- the economic implications of locating an oxidation pond in this area, and what the best options are for the future.

Proposed solution: See Table WW3. The preferred approach is to keep this infrastructure in place and to gain a 35 year resource consent for its future operation. The resource consent planning process will consider where else a wastewater treatment plant could be located and treatment options. Our small population could make it easier to change our approach, but we also need to consider the small rating base, as this limits our ability to pay for the types of sophisticated technology used in larger centres.

Bell Island wastewater treatment plant

The wastewater treatment plant operated by the Nelson Regional Business Unit (NRSBU) is located on a coastal island (Bell Island) that is subject to natural hazards, particularly earthquakes and sea level changes. The NRSBU is aware of the potential issues that may arise from these particular hazards. Currently the facilities on Bell Island are located approximately 1m above the highest recorded datum and the other assets are located higher than this. Sea level changes will be monitored and contingency plans developed in future asset management plans. The risk of liquefaction arising from strong earthquakes and has been identified as a significant risk and further work to consolidate all known natural disaster events information and reporting to the joint committee is considered necessary.

Stormwater

Earthquake risks — The risk of earthquake damage to the stormwater network will largely be managed through insurance.

Proposed solution: See Table SW4

Flooding — Flooding occurs when rainwater cannot drain away quickly. The rate of drainage is affected by the size of stormwater pipes, the capacity of rivers and streams to contain the flood waters within their banks, and coastal tide levels.

i) *Under-capacity stormwater pipes* — Some areas of the city have ongoing stormwater drainage issues due to the lack of a consistent standard of stormwater protection. The Land Development Manual states the level of service for the primary pipe system should be 6.67% AEP throughout the city (this provides a pipe capacity to cope with a storm event that has a 6.67% probability of occurring in any one year). Current stormwater projects are designed for rainfall intensities that are expected out to 2100 as a way of allowing for climate change effects. Stormwater infrastructure constructed prior to 2010 will increasingly be of lesser standard as climate change develops. An under-capacity stormwater network can contribute to increased groundwater levels, wetter soil and surface ponding. These effects can result in landslides, wastewater infiltration, and damage to buildings.

Proposed solution: See Table SW2

ii) *More intense storms* — Detailed computer models have been developed for eleven of the urban streams in the city. The flood plans from these models show that significant areas of the city are likely to be impacted by more frequent and more intense rainfall events in future, as a result of climate change.

Proposed solution: See Table SW1

iii) Coastal influences

Coastal tide levels will increase as a result of sea level rise, and wave surges will be higher during storm events. Coastal water covering the stormwater outlets and flowing up the stormwater pipes blocks the ability of stormwater to drain away to sea.

Proposed solution: See Table SW1

Infrastructure Objective 2: Maintain and renew existing assets in a cost effective way

On average, Nelson's infrastructure assets are considered to be in good condition - they are able to deliver the expected levels of service and don't show significant signs of unexpected deterioration.

Where visual or formal assessments aren't readily accessible, evaluations are made based on other factors (eg staff knowledge, operational performance, frequency of failure, usage patterns, age, etc) to help predict deterioration and estimate remaining useful life.

The more critical assets are expected to meet a higher standard so their condition and performance is monitored more closely. As the criticality of the asset increase, the asset management activities also increase to reduce the risk of failure.

In general, the transport assets are performing as expected for most areas. Road pavements are starting to show some signs of age and a small renewal backlog is resulting. Budgets have been requested to address this back log over the next 10 years. Improving our understanding of pavement performance through appropriate analysis and modelling methods will help form the rehabilitation pavement forwards works plan.

The understanding of the performance of retaining walls is improving as effort and funding is directed to undertake more regular detailed condition assessments.

None of the water utilities have a significant backlog of deferred renewals but both the water supply and wastewater utilities have specific operational issues that can be improved by renewal of parts of the network.

In the water supply network Council has recognised the AC Black pipe (a bituminous coated asbestos cement pipe) is showing a larger number of failures than expected. These pipes are currently the focus of the renewal programme and have been funded to ensure replacement in the next 10years. As this material is known to be prone to failures the rate of failures will be closely monitored and renewal adjusted through future Long Term Plans if required.

The funding requested reflects the assessed need based on current information and Council will adjust are required to ensure LOS are met.

a) Opportunities and Challenges

We need to consider:

- how we prioritise maintenance and renewal of our existing assets, taking into account critical assets and implications of their failure
- the impacts of increasing or decreasing capital expenditure, rates and/or debt
- the information we need to support decision making on when to continue to maintain assets and when it is more cost-effective to replace them
- what data is critical to understanding network limitations, expected future needs, and prioritising improvement opportunities.

b) Affordability factors

The following technological advances provide opportunities for cost-effectiveness:

- improved condition and performance assessments due to advances in 'big data' providing reliable evidence the infrastructure is lasting longer than anticipated
- new technology such as robotics to enable us to efficiently maintain the pipe networks

- extending the life of assets with new materials and technology (such as relining of existing pipes).

c) What this means for us

Infrastructure costs are increasing due to a number of factors including environmental requirements, climate change impacts, an increasing quantity of assets as a result of growth, and rising construction costs for local government infrastructure.

These costs and commitments need to be considered within the context of our financial strategy, which is to limit rates increases to 4% per year, and total debt to not exceed 150% of total revenue. That means we can't do everything we would like to do and must prioritise.

d) What we're currently doing

Transport

We are improving our pavement knowledge by modelling useful life/renewal options, and increasing retaining wall and structure inspections to better understand the upcoming work and investment required to increase our resilience to natural hazard risks. In terms of structures, our improvement register is used to prioritise projects based on need using a number of ranking criteria. We expect visual inspection, analysis of cost maintenance, and maintenance records as the primary means of pavement and surfacing renewal programmes in the meantime, also maintaining coordination with utilities providers to maintain alignment of programmes as much as possible.

Water supply

Figure 2 shows the theoretical renewal dates for pipe materials based on our average expected service life. The current renewal strategy adapts the theoretical renewal dates by balancing the industry resourcing limits, apparent through number of tenders and tendered prices received by Council, against the need to renew parts of the network that have met the end of their service lives or are not meeting expected service lives. Assets are prioritised based on criticality. Effort is also made to ensure pipe life is maximised as much as possible and aren't renewed too early.

Council is also investigating ways of extending the service life of assets through measures such as pressure reduction and pipe lining.

The theoretical life expectancy is one indicator to help guide renewal funding and is helpful for assessing the longer term funding needs but has limitations.

Over the next five years these investigations are expected to allow figure 2 to be re-cast to reflect the renewal criteria based on the more accurate assessment of service lives.

The renewal programme will start to ramp up in future years to accommodate the estimated need.

FIGURE 2: WATER SUPPLY THEORETICAL RENEWAL DATES

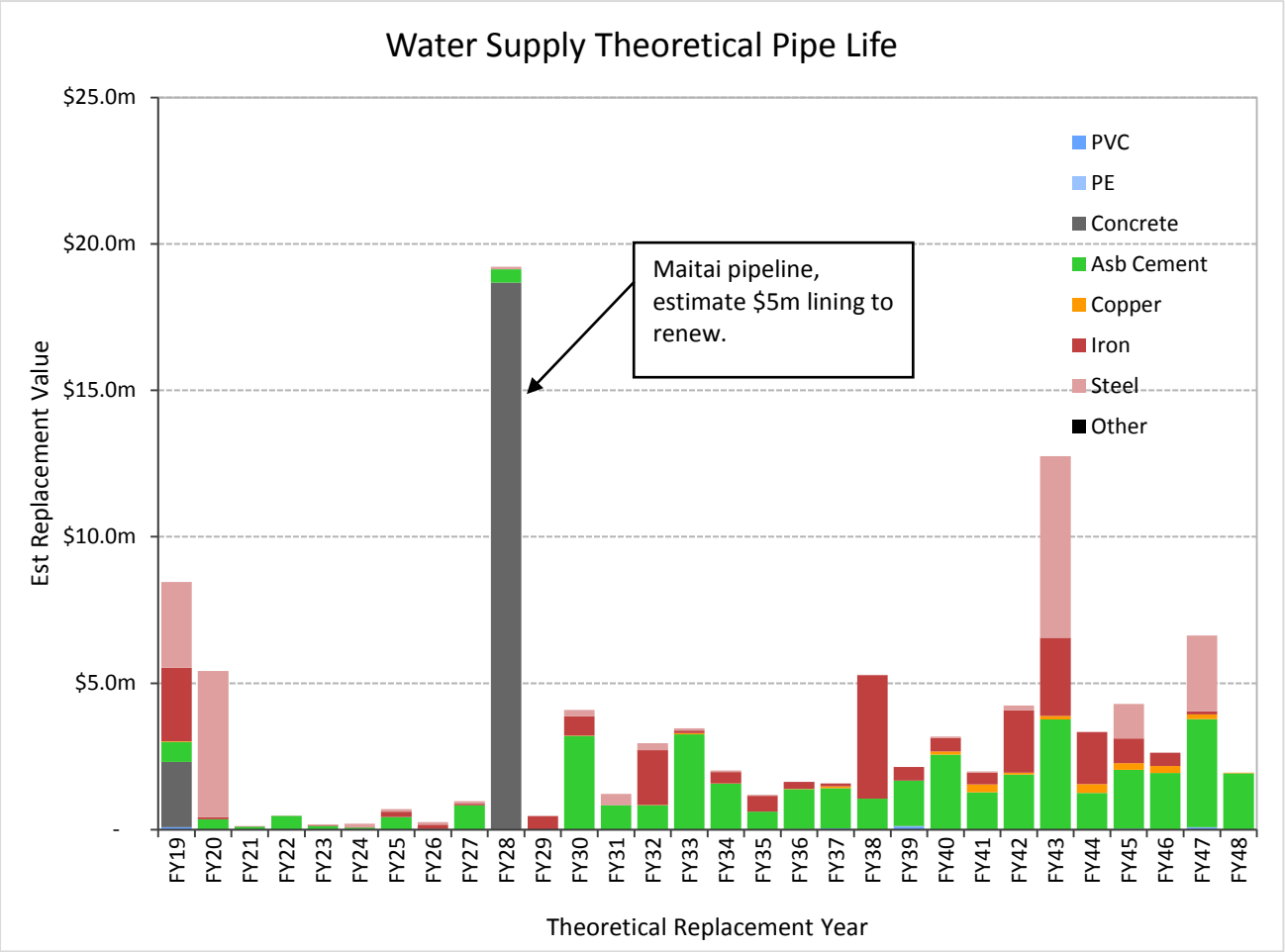
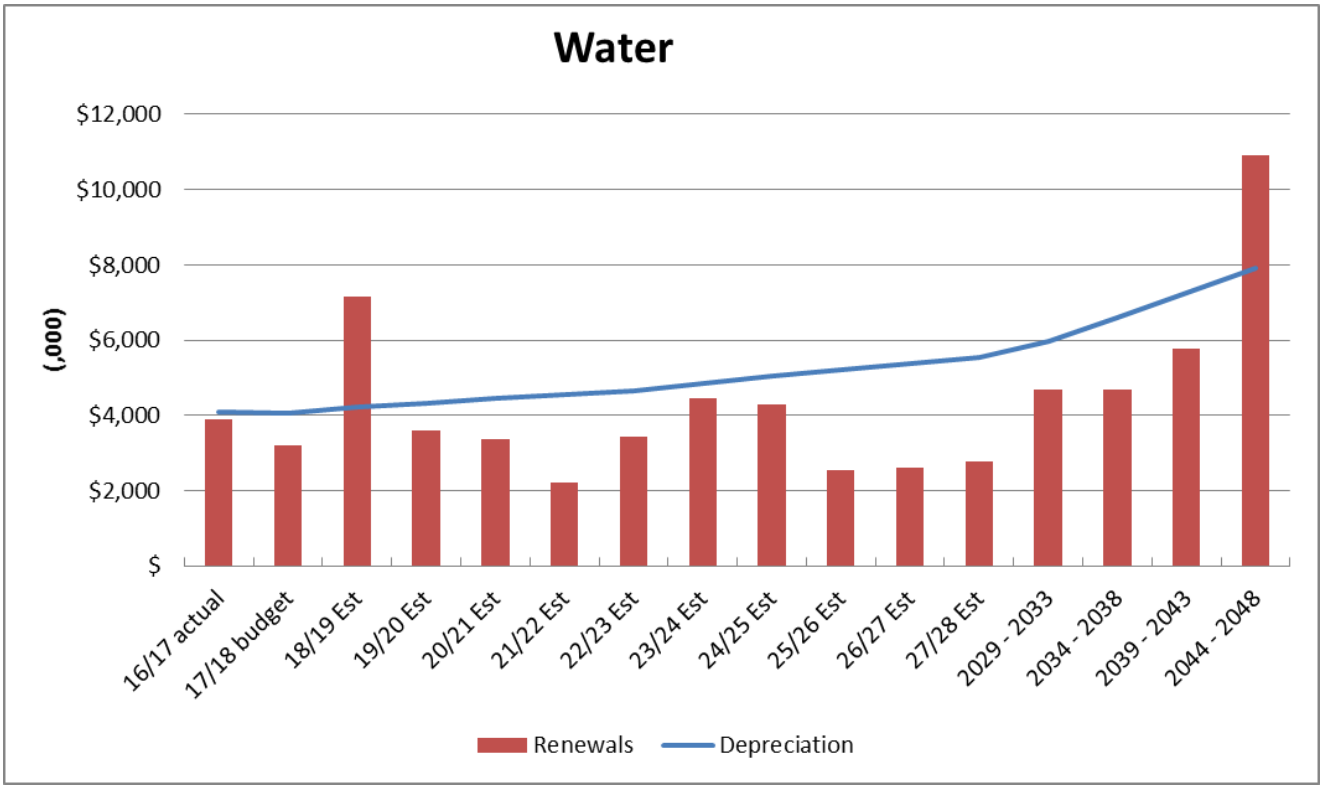


Figure 3 highlights the issue that has lead Council to focus on condition assessment of assets and greater investigation of rehabilitation techniques. The renewal strategy based on industry generic service lives necessarily establishes a level of depreciation to match and predicts either a shortfall in renewal activity or fails to identify the need for renewal of assets that do not meet their predicted service lives. This approach also does not take into account short term industry resourcing constraints that lead to higher renewal costs and a reduction in the overall renewal programme to maintain affordability.

Figure 3 will also be reviewed to match changes to Figure 2 and better align renewal expenditure to the more accurate service lives.

Years 2029-2048 are the average of each of the respective five yearly blocks.

FIGURE 3: WASTEWATER DEPRECIATION COMPARED TO RENEWAL EXPENSE



Wastewater

As with the stormwater activity the theoretical renewal dates in Figure 4 are based on industry generic expected lives.

The current renewal strategy is based on improving our knowledge of the actual service lives of the network components through CCTV records, fault analysis and the inflow and infiltration project. The latter highlights areas where the reticulation is allowing ground water into the network and wastewater to escape through the same faults (ex-filtration) out of the network. The current renewal strategy is supporting the inflow and infiltration project by renewing areas of pipe that have high levels of faults allowing infiltration. This additional information is used to amend the theoretical renewal dates in figure 4 and target those parts of the network where service lives have been reached. Additionally Council is trialling medium scale rehabilitation of existing pipework by installing pvc ‘sleeves’. While this technique is quick and cost-effective and allows existing pipes to remain in place it will not be suitable for all pipes. Risks remain as the long term life of the technique is unknown, the sleeve is not able to bridge sections that have broken or dislocated and the sleeve reduces the capacity of the existing pipe.

Figure 4 will be reviewed in the first three years and adjusted to match the latest information prior to the Long Term Plan 2021-31.

The renewal of the Atawhai rising main is expected to commence in 2024/25 and extend into the early 2030s.

FIGURE 4: THEORETICAL WASTEWATER PIPE RENEWAL DATES

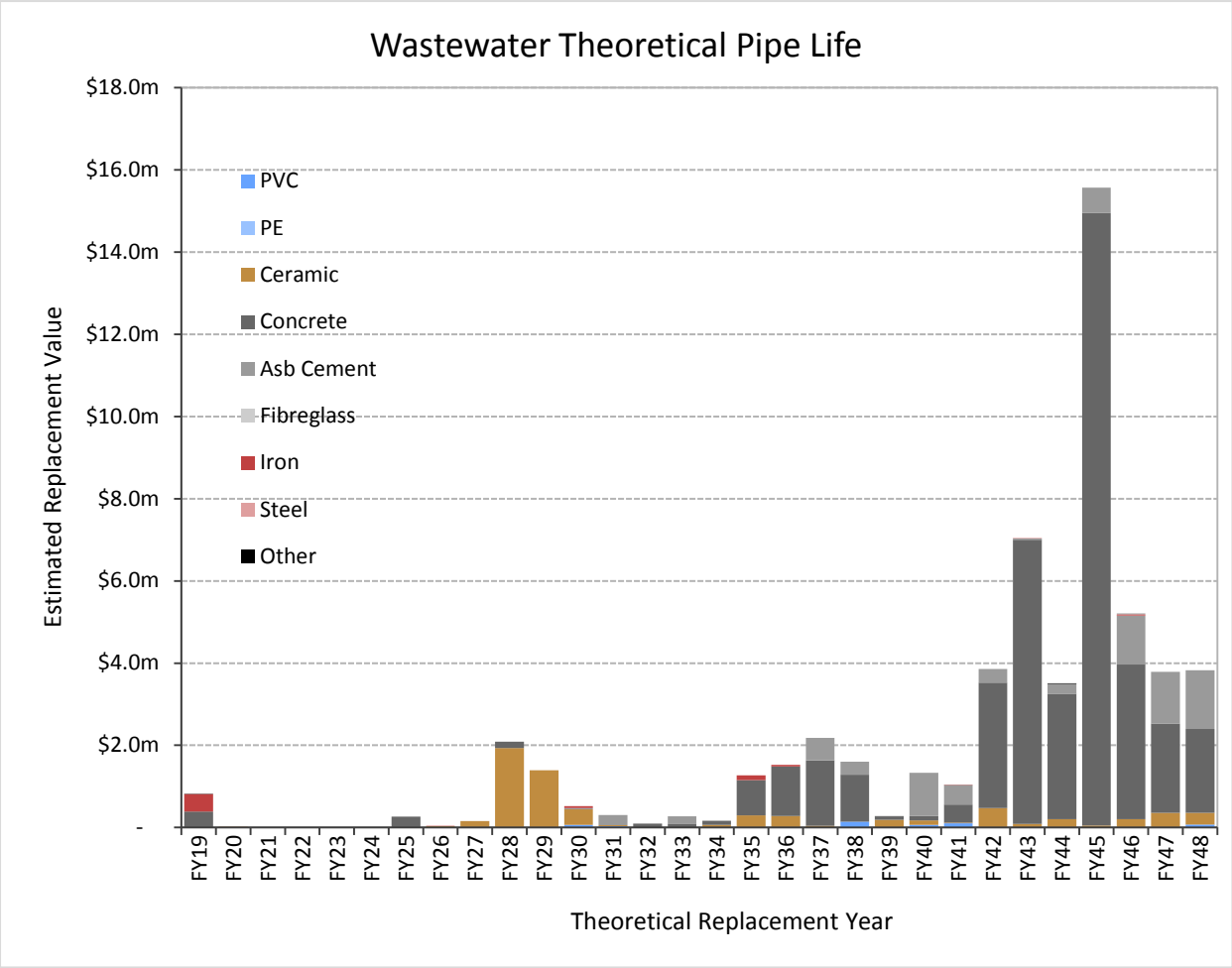
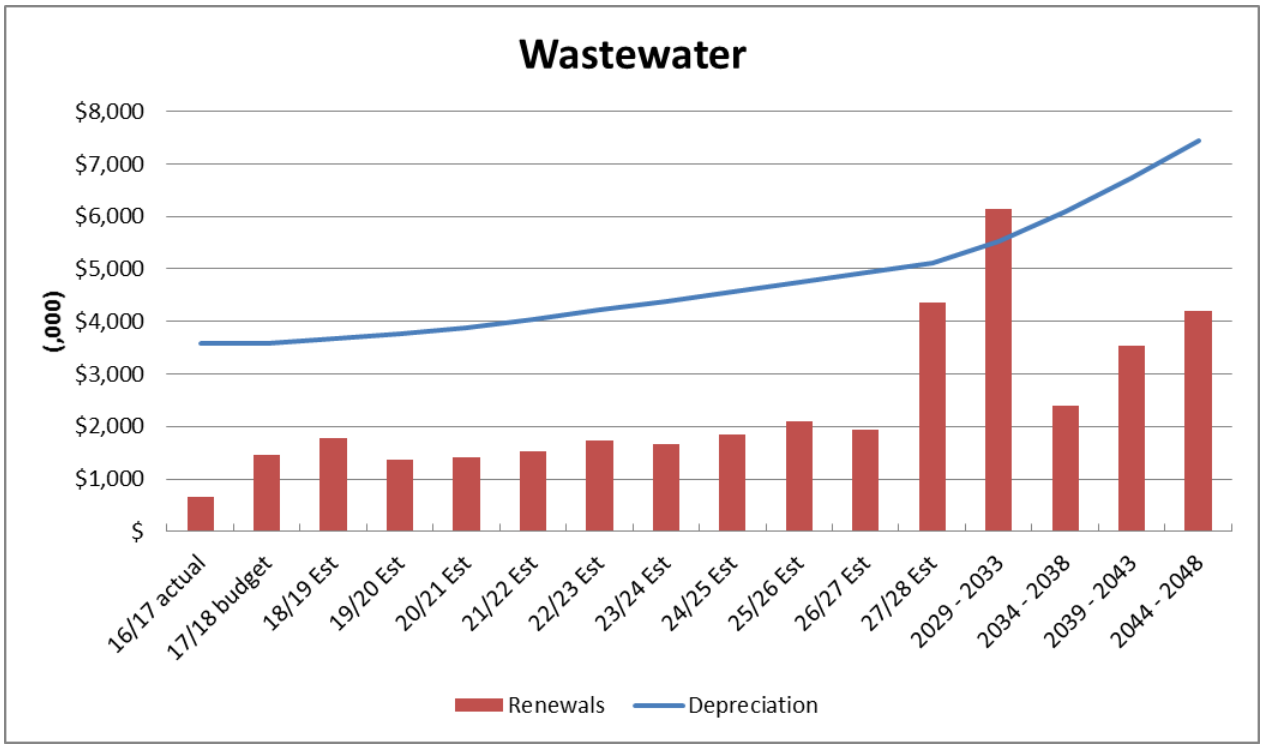


Figure 5 reflects Councils expectation that renewals in the first ten years will be strongly based on 'sleeving' existing pipes in areas subject to high levels of inflow and infiltration and developing better experience with their application.

Figure 5 will also be reviewed to match changes to Figure 4 and better align future renewal expenditure to the more accurate service lives.

Years 2029-2048 are the average of each of the respective five yearly blocks.

FIGURE 5: WASTEWATER DEPRECIATION COMPARED TO RENEWAL EXPENSE



Stormwater

As with water and wastewater piped stormwater assets are renewed when they fail to provide the required level of service. The majority of stormwater assets are relatively new and are not subject to the same pressure or integrity requirements that influence decisions on the other water utilities. As a result pipe renewals are expected to remain at a low level ($15k-$60K) for the period of this strategy. Specific renewal budgets are in place for vulnerable assets such as pump stations, tide gates and larger culverts. The other most vulnerable parts of the stormwater asset are the remaining sections of brick culverts in the city that are becoming difficult to repair owing to an enhanced health and safety awareness of confined spaces. These will be inspected by cctv to confirm condition prior to developing a renewal strategy.

Assets are increasingly renewed as part of an upgrade to address inadequate capacity. The 2011 storm event highlighted issues with the size and debris control of many of the intake structures around the city. A programme of upgrading key intakes is underway and is expected to be completed by 2027/28.

e) What else do we need to do?

Some of the options to enhance affordability of the maintenance and renewal of our existing assets are:

- achieving efficiencies through shared services with Tasman District Council for all assets
- continuing to minimise stormwater inputs from new developments, particularly higher up the catchments by using detention methods and requiring compensatory storage for new areas of hard surfaces
- investigating alternative on-site storage/detention facilities city wide to better manage stormwater peaks
- extend our use of remedial 'sleeving' techniques for the wastewater network to retain the original pipework
- better understanding of trends and future predictions of community needs
- Knowing what the impacts of Travel Demand Management will be in the future.

In addition to maintaining and renewing our existing assets, the Council is committed to ensuring consistent levels of service throughout the city.

This involves continuing to develop stormwater and flood protection strategies for the city. These strategies will identify areas with inadequate stormwater and flood protection services, both built (eg pipes, flumes and concrete channels) and natural (eg smaller hillside gullies, overland flow paths, streams and rivers).

Much of Nelson still uses a network of small open drains to channel stormwater from hillsides to public drains or streams. These channels are largely on private property but serve a wider public purpose. Council receives regular requests for assistance from property owners to maintain these channels. A more strategic, risk-based approach is required to identify stormwater and flood requirements across the city and develop appropriate responses.

Secondary flow paths
Generally roads are the preferred secondary flow paths in the city. There will also be a large number of flow paths on private property that will carry stormwater from storm events that need to be identified and landowners made aware of the importance of keeping them clear (city wide). A budget for identifying these is proposed for 2018/19–2019/20, and they will be identified in the proposed Whakamahere Whakatu Nelson Plan.

Existing assets and levels of service — specific infrastructure challenges

Transport

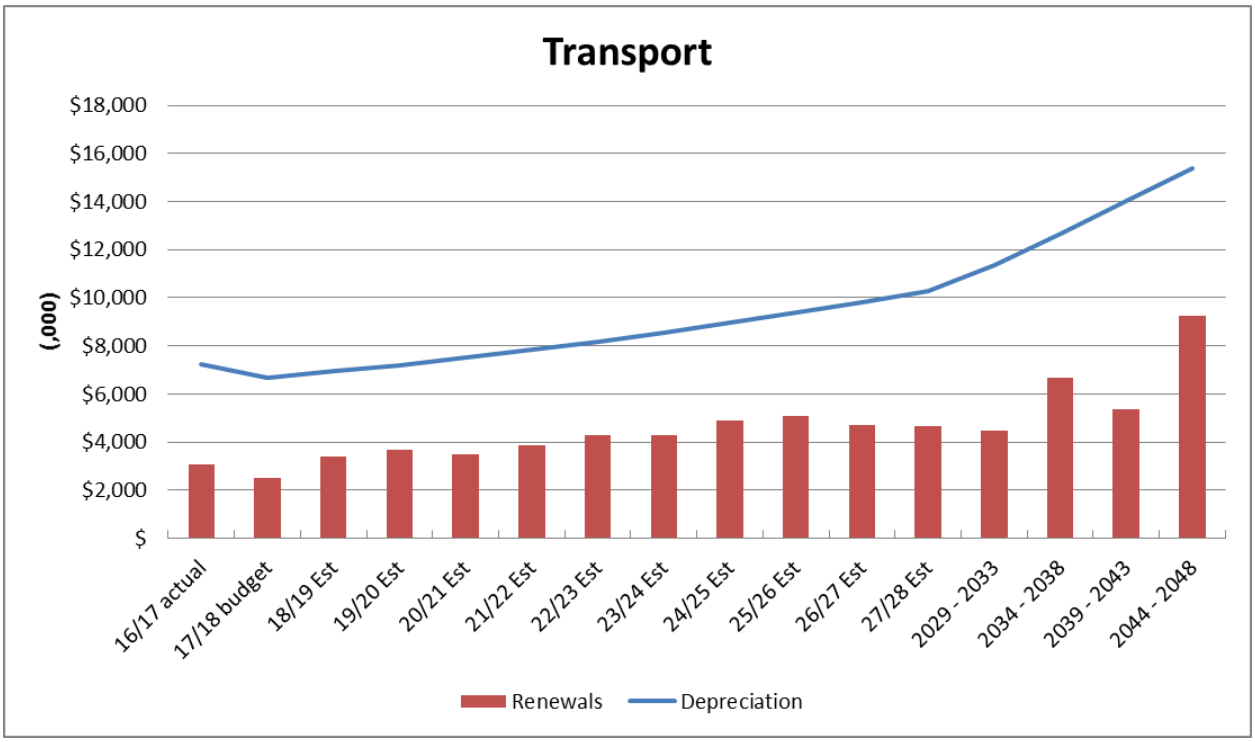
Delayed renewal programme — Insufficient funding to deliver the current renewals programme has led to a backlog of required renewals. For example, under-investment in the sealed surfaces over the past two decades has resulted in a backlog of sites that have degraded under ultraviolet (UV) light and the action of traffic.

Lack of complete network knowledge also creates uncertainty about the level of renewal investment that is actually required, especially in the case of retaining walls. Structure ownership is also a challenge.

The graph below plots the deprecation based on the book value of the transport assets (blue line) and their expected life, whilst the red bars represents the actual proposed renewal spend based on observed asset performance.

There is a body of work planned to better understand if the current observed asset performance (red bars) allows us to extend the expected lives and thus reduce the depreciation shown by the blue line. Or, if the gap is simply asset consumption due to the asset age being less than the asset life.

FIGURE 6: TRANSPORT RENEWAL FUNDING COMPARED TO DEPRECIATION EXPENSE



Proposed solution: See Table T3

Water supply

Water losses from the network — Water leaks out of broken or impaired pipes, in both the public network and through privately owned water pipes, resulting in water losses. The total unaccounted for water is the difference between what is supplied to the water treatment plant and from Tasman District Council (7,207,900 + 106,300 = 7,314,200m^3) and what is recorded through customer water meters (5,313,100m^3). The difference is just over 27%.

After making assumptions on loss of water through pipe bursts, scouring water out to keep the water supply pipes clean, and testing by both the Fire Service and the Council, the water balance equation suggests that actual water losses are about 23% of the overall water take. This figure would place the Council at the higher end of reasonable actual losses for a water supplier. Before the Council can commit resources to address actual losses, improvement in the accuracy of the assumptions made for the water balance model will be necessary, as a priority.

Actual losses means:

- more water is being taken from the Maitai and Roding rivers than is actually needed to meet the community's needs, resulting in lower river levels and therefore poorer freshwater habitats
- we are more likely to be affected by the limits on how much water we can take from the Maitai and Roding rivers as the population grows
- we are not using water efficiently, as required by the National Policy Statement for Freshwater Management (NPSFM) objective B3.

Proposed solution: See Table WS1

Impacts of the Maitai Dam water on the Water Treatment Plant — During storm conditions the Roding river intake and the south branch water are often too full of sediment to be used, so water is taken from the Maitai Dam instead. The Water Treatment Plant doesn't work as efficiently when processing this lower quality water as the membranes become clogged with high levels of organic material from the dam water. The organic material needs to be removed to ensure chlorination is successful.

In order to be able to rely on water abstracted from the Maitai Dam more often in future, the Council is considering investing $18-20 million at the 10 year period for primary clarification. An alternative to using a primary clarifier is to place more demand on the membranes used in the Water Treatment Plant process. Council has received advice that working the membranes hard for 6-8 years may be a more cost-effective approach.

Proposed solution: See Table WS3

Discoloured drinking water quality — Some of the water supply network consists of cast-iron pipes that contain iron and manganese oxide build up. The colour of water can be affected by passing through these pipes, and while there currently is no specific service level regarding water colour, this leads to customer dissatisfaction with the water supply service.

There are significant financial costs ($10-$20 million) involved in replacing the cast-iron pipes.

Proposed solution: See Table WS4

Replacement of the existing residential water meters — The current water meters have reached the end of their service lives. Meters which aren't functioning correctly tend to under-read the amount of water used, meaning they contribute to un-accounted for water use that can't be charged for.

Proposed solution: See Table WS6

Wastewater

Stormwater and groundwater entering the wastewater pipes — If households' stormwater pipes have been connected to the Council's wastewater system instead of into the stormwater system, rainwater runoff from roofs and driveways ends up flowing into the wastewater system. (These above ground effects are called inflow.)

Stormwater and natural sources of groundwater also enter the wastewater system if underground stormwater and wastewater pipes are broken. (These underground effects are called infiltration.)

These are significant because inflow and infiltration of groundwater can lead to peak wastewater flows which are 4-6+ times greater than average dry weather flow.

All of the increased flows into wastewater pipes put pressure on the wastewater pipes and the capacity of the wastewater network as a whole, and results in wastewater overflows during wet weather. This has the potential to result in non-compliance with consent conditions and to constrain growth.

If the issues with stormwater entering the wastewater system are not addressed, wastewater overflows will become an even bigger problem in future, as a result of the predicted increase in the frequency and intensity of future rainfall events. That means wastewater contamination of

land or water would cause ongoing and increasing impacts on cultural wellbeing, public health and the environment and make it difficult to achieve the outcomes required by the National Policy Statement for Freshwater Management (NPSFM).

The height of the tide also influences groundwater levels, and therefore the amount of groundwater infiltration into the wastewater system. For example, daily flows of wastewater increase by approximately 1000 m^3/day from a 4.4m tide (compared to a 3.4m tide).

Reduction of the amount of stormwater that is directed into the network is seen as the most effective way of reducing wet-weather overflows from the network as it addresses the source of the issue.

A significant proportion of the inflow (up to 80%) that leads to the rapid increase of flows in the wastewater network in wet weather comes from private properties. To effectively address this issue both education and regulation are required. Both of these approaches require a significant investment by Council in dedicated staff or contractor resources.

Proposed solution: See Table WW1

Discharges to Nelson Haven — There is one pipeline (rising main) between Nelson and the Nelson wastewater treatment plant, which is located along Atawhai Drive. Some failures of this pipeline have led to low volumes of untreated wastewater discharges directly into the Nelson Haven.

The rising main suffered significant damage from acid attack after approximately 30 years of service, and extensive repairs were carried out in the 1990s. However, further failures have since occurred.

These untreated wastewater discharges impact on coastal water quality, cultural values, and public (including visitors') perceptions of the quality of the environment.

Proposed solution: See Table WW2

Stormwater

Maintenance of pipes and open drains which are not owned by the Council — Lack of maintenance of all of the pipes and drains which are not owned or maintained by the Council can result in ponding and flooding, causing property damage and land instability.

Developers and Council officers need clarity on what Council can enforce and what it can maintain. Currently there is some inconsistency between the approach to public and private drains in the current land Development Manual, the Drainage Ownership Policy and legal advice. Council is working to resolve this through the new Proposed Land Development Manual (LDM) being developed with Tasman District Council, to clarify what Council owns and what Council has responsibility to maintain.

The issue has resulted from different definitions of public and private drains, which can lead to confusion.

Proposed solution: See Table SW3

Infrastructure Objective 3: Provide infrastructure to enable growth and development

a) The challenges and opportunities

Key challenges

Over the next 30 years, we need to address:

- where new development occurs
- how we provide and pay for infrastructure related to this long term growth.

Key opportunities

Funding opportunities related to growth include:

- access to national funding including the National Land Transport Fund, the Housing Infrastructure Fund, and the Tourism Infrastructure Fund
- access to local funding through development contributions.

b) *Affordability factors*

Opportunities to reduce costs associated with growth and development include:

- ensuring the development contributions policy accurately identifies the costs of growth, so that a user-pays approach applies
- prioritising the intensification of development in existing, serviced areas compared to extension of services to new areas.

c) What this means for us

The National Policy Statement for Urban Development Capacity (NPS-UDC) requires councils to ensure there is sufficient land available to meet demand for housing and business needs in the short term (within three years), medium term (3–10 years) and the long term (10–30 years).

This is relevant to the infrastructure strategy because infrastructure services must be in place for the next three years of growth, and must be planned for the next 30 years (which is the time period covered in this strategy).

Policy PA1 in the NPS UDC

Local authorities shall ensure that at any one time there is sufficient housing and business land development capacity according to the table below:

Short term	Development capacity must be feasible, zoned and serviced with development infrastructure.
Medium term	Development capacity must be feasible, zoned and either: • serviced with development infrastructure, or • the funding for the development infrastructure required to service that development capacity must be identified in a Long Term Plan required under the Local Government Act 2002.
Long-term	Development capacity must be feasible, identified in relevant plans and strategies, and the development infrastructure required to service it must be identified in the relevant Infrastructure Strategy required under the Local Government Act 2002.

d) What we're currently doing

The Council worked with Tasman District Council to complete a capacity assessment (as required by the NPS-UDC) for the combined Nelson and Richmond area. This enables us to predict where and when growth is likely to occur and at what time infrastructure projects across the Nelson Urban Area need to occur to support this growth.

The capacity assessment provides an opportunity for Nelson and Tasman councils to prioritise infrastructure projects across the territorial authority boundaries and to achieve efficiencies in infrastructure planning and development of housing and business growth areas.

The infrastructure priorities identified through this work inform our asset management plans, long term plan and this infrastructure strategy. Performance against the capacity assessment will be monitored quarterly and reviewed every three years.

The Nelson and Tasman councils are also working together to create a Future Development Strategy to achieve integrated land use and infrastructure planning for the Nelson Urban Area.

Nelson City Council, Tasman District Council and NZTA staff are jointly developing a Network Operating Framework for Richmond because this will have implications for the transport network near the Champion Road and Stoke South areas.

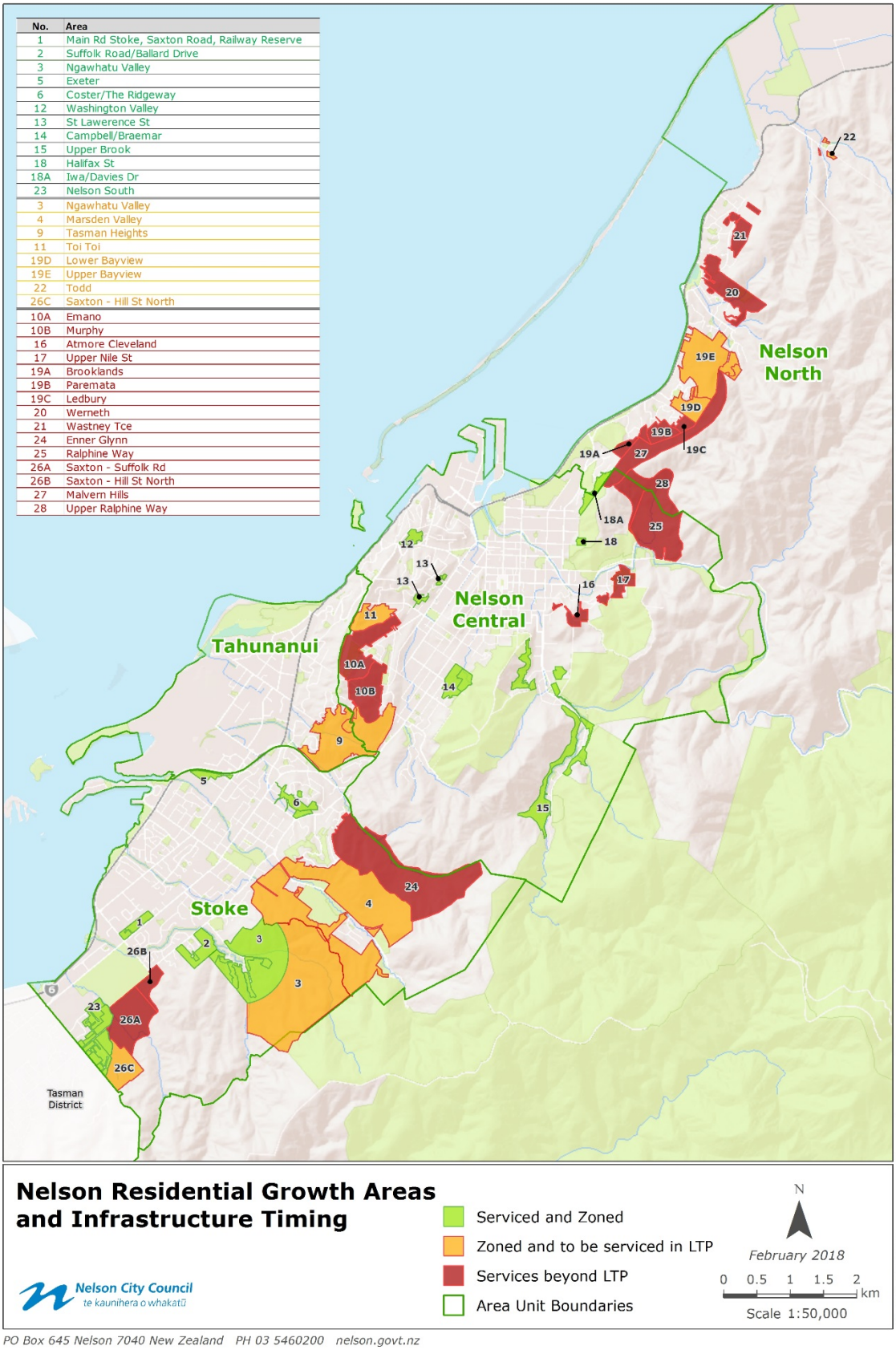
Special Housing Areas

The general rule of thumb for Special Housing Areas is that if there isn't sufficient infrastructure network or capacity to serve them and it's not a project in the LTP, then the developers are responsible for providing sufficient capacity and connection.

e) What else do we need to do?

The map on the following page identifies the areas in which provision of new infrastructure for development is being planned for the next 30 years, and the order of priority for servicing. This represents the first capacity assessment Council has undertaken under the NPS-UDC, and refers to areas which are already zoned for urban development. A different approach may be required prior to zoning of new areas.

FIGURE 7: NELSON RESIDENTIAL GROWTH AREAS AND INFRASTRUCTURE TIMING



Change in demand for services — specific infrastructure issues

Transport

Constraints on the transport network are leading to delays affecting freight, tourism, business and residential growth.

Constraints on the urban roading network in Nelson result in it operating at or near capacity causing peak hour delays at selected locations. These peak delays are likely to increase in volume and time as travel demand increases (with population and freight forecasts) and demand for private vehicle use continues.

Transport capacity in the high growth areas of Nelson and Richmond will be needed to meet the projected demand. The National Policy Statement on Urban Development Capacity requires an additional 4542 residences in the short to medium term and the transport system that is already constrained will need to respond to this demand.

Increases in pressure on the road network is also related to where we locate new development and the design of transport corridors to provide for access and transport choice (walk, cycle and bus). The Council intends to continue enhancing Nelson's walk and cycle network including cross town links, the Tahunanui cycle link, Stoke East/West connection, and Gloucester Street cycle facilities. A new bus exchange is also proposed.

In the long term, predicted growth in population in both Nelson and Tasman has the potential to further increase congestion on the road network. The increase in volume is reflected in a significant increase in peak hour travel time during the busiest time of the year when comparing 2015 and 2016 travel time data. For the Waimea Road route, there was an increase of 4.5 minutes in mean travel time during the two summer quarters.

Transport modelling indicates demand is likely to flatten off over the longer time scale of this 30 year strategy. More details are available in the demand section of the Transport Asset Management Plan.

Arterial road congestion is already resulting in travel time delays. This has a flow on effect for other areas, as some motorists are rerouting via residential streets to avoid arterial road congestion, reducing amenity and increasing safety risk in the affected residential areas.

Proposed solution: See Table T2

Nelson Southern Link Investigation

To support this growing city, Nelson needs a transport network that is safe, resilient, enables economic development, supports our tourism industry and provides our residents with choices on how they travel day to day. Unfortunately, increasing congestion is limiting our ability to create a liveable city and to see our region thrive. Our monitoring data shows the problems experienced during peak times are now extending into off-peak times in the morning and afternoon.

Port Nelson is the region's maritime gateway but the movement of freight to and from this key economic hub is hampered by delays due to congestion. Our waterfront has the capacity to be a world class visitor attraction, but is compromised by the heavy vehicles and traffic it currently has to accommodate. Furthermore, Rocks Road functions as a vital lifelines route but is at risk from increasingly frequent severe weather events.

It is important that residents and visitors to the city can enjoy the waterfront, including if they wish to walk or cycle. Cycling is increasingly important as more and more people come to the region to experience the Great Taste Trail and begin or end their cycling experience with time in

our city. Council wants to encourage these environmentally friendly modes of transport and needs a network that supports this.

Council supports the Nelson Southern Link Investigation continuing and indeed it is essential that we make progress on this project if we are to address problems in the transport network and make the most of the opportunities to support businesses, residents and visitors.

Accordingly the Draft Regional Land Transport Plan includes funding for the preparation of the Detailed Business Case (years 2018/19 and 2019/2020) as well as pre-implementation work (years 2020/21 and 2021/22). This is a New Zealand Transport Agency project but Council is seeking progression of the Nelson Southern Link Investigation and SH6 Rocks Road Walking and Cycling projects as soon as practical. $574k in 20/21 and $117k in 21/22 has been budgeted as the Council's contribution to the SH6 Rocks Road Walking and Cycling Project.

Proposed solution: See Table T5

Water Supply

Drought Security and the Waimea Dam proposal

Our existing water sources are expected to provide sufficient water for the city in the short to medium term and a share in the Waimea Community Dam is not required for the water supply activity in the short-medium term.

However, through a service agreement, Tasman District Council supplies water to the residential areas in south Nelson adjacent to Champion Road, as well as the Wakatu Industrial Subdivision, Alliance Freezing Works and ENZA in Nayland Road. Although the demand from these areas is not a large volume of water (500,000 – 600,000m^3/year) Council does not have the appropriately sized reticulation in place to be able to supply the required fire flows. Additionally the supply of these extra volumes in dry summers will reduce the drought security provided by the Maitai Dam.

The ongoing supply of water to these areas is currently dependent upon TDC securing the long term viability of water from the Waimea Plains via the construction of the Waimea Community Dam.

Without the proposed Waimea Dam the possibility exists that the Tasman District Council will cease to supply the area within the Nelson City Council territorial area and Nelson City Council will have to take up the demand.

Tasman District Council have acknowledged the over allocation of water from the various Waimea Plains aquifers and the challenges this presents to both irrigators and the Council municipal water supply.

The solution promoted by the Tasman District Council and irrigators is the construction of a detention dam on the Lee River behind Brightwater. The construction cost to be met by contributions from those who are in the zone of benefit from the dam. Tasman District Council have approached Nelson City Council for a contribution as a likely beneficiary of the augmentation of the Waimea Aquifer.

Recent updates to the Maitai Drought Study by OPUS International Consultants Ltd show that under a number of future population growth scenarios in the long medium term (out to 2053 the expected timeframe of the resource consent for water abstraction) and 2100 the Maitai Dam will not have sufficient storage capacity to meet likely consent conditions for environmental river flows plus the increasing demand from the customers in the current supply area. The wider impact of growth in the city is to reduce the drought security the Maitai Dam provides to

the city. This situation will be exacerbated if the Tasman District Council cease to supply water across the boundary to Nelson.

While Council has recognised the complexity of the issue and the many assumptions and uncertainties that impact on calculations of future demand and drought security an additional water source will inevitably be required at some stage in the future (some limited increase in storage capacity of the Maitai Dam is also possible by raising the spillway level by approximately one metre which will extend the timeframe by which an additional source will be required).

Another benefit of the Waimea Dam, if it does go ahead, would be to future proof Nelson City Council's water supply, providing valuable access to a fourth water source during very dry summers. This would increase our resilience.

As part of the LTP2018-28 Council has included a budget of $5M for a contribution towards the construction of the proposed Waimea Dam. This contribution would secure Council's right to access up to 22,000m^3/day from the Waimea aquifer once the dam is constructed. If this supplemental supply is deemed necessary in the future, additional budget would be required for the infrastructure to abstract, treat and distribute water. This will be further considered over the next few years and included in the next Strategy if required.

Wastewater

Impact of inflow and infiltration on wastewater capacity — Extensive investment is required to reduce inflow/infiltration in the areas served by the Council wastewater network, which will need to be considered through the 2018 Long Term Plan process. Council currently has a level of service regarding compliance with resource consents. The relevant resource consent requires no dry weather overflows from pump stations by 2023 and a maximum of 5 wet weather overflows from pump stations per 12 months by 2032. If the levels of service increase, further expenditure will be required to meet the new requirements.

The current levels of wet weather inflow and infiltration impacts on growth by using up the network capacity that could otherwise meet the needs associated with new development, as well as causing wastewater overflows.

Much of the proposed residential growth in the city can be accommodated for the next 5-10 years without major network upgrades, provided inflow and infiltration is addressed. As the network is renewed some opportunity for increasing the pipe diameters is also available.

Proposed solution: See Table WW1

Infrastructure Objective 4: Maintain or improve environmental outcomes

a) *Opportunities and challenges*

The key environmental challenges and opportunities for our infrastructure over the next 30 years relate to improving the quality of freshwater and coastal environments.

The environment is one of the Council's top three priorities for the next 10 years, with a particular focus on coastal issues, freshwater monitoring, data management and city development.

b) *Affordability factors*

Opportunities to reduce costs associated with maintaining or improving environmental outcomes include:

- more efficient environmental monitoring and analysis through electronic entry of data in the field and data management programmes to automate reporting, freeing up staff time for assessment of the results
- sharing of environmental data between council departments to avoid duplication of data collection and analysis
- residential and industrial uptake of technology which makes reuse and recycling of grey water easier and safer in urban environments, reducing demand for water supply and wastewater services.

c) What this means for us

We take a whole of organisation approach to delivering our environmental priority, so some environmental outcomes will be delivered through infrastructure projects.

The infrastructure discussed in this strategy has some of the biggest impacts on Nelson's water quality and quantity, and aquatic biodiversity. This is both a problem and an opportunity. The Council's service delivery teams are able to work collaboratively, together with Tasman District Council, to deliver core services while also implementing practical, affordable actions to improve environmental outcomes.

The Resource Management Act 1991, the National Policy Statement for Freshwater Management and the New Zealand Coastal Policy Statement all require sustainable management, improvement in water quality (so that it is suitable for human recreation more often) and elimination of over-allocation of water.

Locally, these requirements will be reflected in the proposed Whakamahere Whakatu Nelson Plan that is to be publicly available in August 2018, and in Council commitments such as Project Mahitahi/Maitai and Nelson Nature, which includes enhancing aquatic biodiversity.

d) What we're currently doing

We are currently assessing the implications of the draft freshwater rules for delivery of infrastructure services (see Part Two of this strategy).

The Land Development Manual includes requirements for detention and low impact design methods to manage the quality of stormwater discharges. Developers establish and maintain these systems for the first 2-5 years to prove they are functioning well, and then Council takes over ownership and maintenance. There will be more of these over time (over the next 30 years) which need to be budgeted for, as this change will result in different levels of service for stormwater maintenance — requiring different skills and more money.

e) What else do we need to do?

We also need to implement the sustainable development improvement actions identified in the 2018 asset management plans, as outlined below.

Water supply

- Continue the water loss identification and reduction programme.
- Develop demand management options, including monitoring use of improved plumbing and appliance technology, reduced supply pressures in the public network, more stringent hosing restrictions, and possible Council support for greywater and rainwater storage on site for reuse and pricing incentives.

Wastewater

- Continue to investigate high *E.coli* readings in water samples and repair any damage in the public network.
- Comply with current consent requirements by reducing stormwater flow into the wastewater system to reduce sewer overflows. (A co-benefit of reduced stormwater flows into the wastewater system is reduced wastewater pumping costs.)

Stormwater and flood protection

- Collaborative action by the Council and the community to improve freshwater quality.
- Enhancement of freshwater environments. Examples include natural gravel management in beds where practicable, protection of natural river banks, river bank shade through vegetation, protection of fish spawning areas, protection of natural 'pool and riffle' stream bed form, and maintaining or reinstating natural meanders where possible.
- As for wastewater, make additional effort to reduce stormwater flow into the wastewater system by expanding the public stormwater network.

Transport

- Refinement of sump cleaning and street sweeping frequencies to balance amenity and water quality objectives.
- Encourage through delivery of education, promotion and technology programmes greater use of active transport modes public transport, ride and car sharing.

Environmental outcomes — specific infrastructure challenges

Water supply

Maitai water quality — Usually water is taken directly from the 'run of the river', from the Roding River and the south branch of the Maitai River. To compensate for this loss of water (particularly during times of low flow), water is released from the Maitai Dam to the Maitai River, to increase river flows to at least the level required by the Council's resource consent.

As with most large reservoirs the water quality within the Maitai dam can be of varying quality depending on the time of year and the position in the reservoir at which water is being monitored. The Maitai dam does retain higher levels of organic material than run of river flows, and there are some slightly elevated levels of minerals as a result of the close proximity of the Nelson hills mineral belt. However the greatest impact on water quality comes from the tendency of the reservoir to stratify over the summer months leading to anoxic (oxygen-depleted) conditions at the base of the reservoir

The lack of oxygen in the colder water (from the lower levels of the dam) creates a number of issues, outlined below.

- It creates a challenging environment for freshwater aquatic life.
- Elevated levels of iron and manganese occur in the water as these chemicals become soluble. Using this water to supplement flows in the Maitai River has the potential to lead to adverse environmental impacts in the river.
- The water from the lower parts of the dam needs to be conditioned before it can be used as part of the drinking water supply.

Discharging this water can lead to a poor quality environment in the river until the water becomes oxygenated. In recent years Council has limited the discharge of this water to storm events where the impact is greatly reduced.

As the frequency and intensity of droughts are predicted to increase over the next 30 years it's likely there will be more reliance on the release of dam water to maintain flow levels. This increases the need to address water quality in the Maitai Dam, and the biggest new requirement to result from the 2017 water supply resource consent for the Maitai River is likely to be aeration of the Maitai Dam.

Proposed solution: See Table WS2

Transport

A benefit of widespread uptake of electric cars (expected to occur over the next 15-30 years) is they have no tail pipe emissions, and no brake dust — so this will reduce the effect of transport on water quality. This means savings for the Council in avoiding the need to install stormwater filters around intersections, where the most idling and braking occurs. In the meantime, we will increase road sweeping frequency on busy intersections, with the goals of improving amenity and water quality (currently amenity only).

Influencing Factors

Affordability and technological advances will affect all aspects of infrastructure management over the next 30 years.

Influencing Factor 1: Affordability

Two key drivers which affect affordability are:

- rates level and annual changes
- level of debt.

Development contributions are another source of income which are linked to the cost of infrastructure services provided for growth.

Ways in which the Council can influence the cost of services include prioritisation of projects, identification and use of cost effective, innovative solutions, user-pays pricing models and service level changes.

The options

- The prioritisation of projects, including choosing what not to do, is ultimately the decision of the Mayor and councillors following their consideration of public feedback on the Long Term Plan consultation document. The role of Council staff is to clearly identify the costs and benefits of different options for consideration. The financial and non-financial implications of the different options for addressing the challenges described in the strategy are provided in Section 3.

- Identification and use of cost effective, innovative solutions includes recognising the uptake of technology has the potential to reduce costs related to transport, including less demand for capacity on arterial roads and parking technology linked to smart phones.

- User-pays pricing models are particularly relevant for provision of infrastructure to enable growth, and is closely linked to the development contributions policy which must identify what infrastructure costs are directly attributable to a development. Trade waste

charges and water metering and charging are other situations where pricing incentivises residents and businesses to reduce their demands on infrastructure services.

- Service level changes also need to be assessed, taking into consideration the long term financial implications for Council and ratepayers.

Influencing Factor 2: Technological advances

Technological advances

There have been huge changes in technology over the past 30 years, heavily influencing our working lives. It's particularly important for how we use technology to provide cost-effective services. It is also important to consider how our customers use technology and what that means for the services we provide.

The rate of change is likely to be even faster and more significant over the next 30 years. While there is uncertainty about what this will look like and how it will change our lives, there are some things we do know:

- autonomous vehicles will change how we travel and park
- electric-powered vehicles will be far more common, reducing carbon dioxide emissions and water pollution
- automation and robotics will result in both job losses and job creation, as well as changing business opportunities, potentially affecting where people choose or need to live
- LED lighting has proven to offer a more cost-effective approach to meeting community needs.

Automation will also affect how we manage our core infrastructure. Smart uptake of new technology, particularly that which is visible to residents and visitors such as new transport technology, helps to build Nelson's reputation as the Smart Little City, focused on making the most of technology to enhance the functioning of the city. Being a city which is regarded as tech savvy has the potential to attract investment and talent to the region, as outlined in the regional identity project (*Extraordinary nelsontasman.nz*) being led by the Nelson Regional Development Agency. New learning, and an agile approach will be necessary as we assess and adopt newly available technology.

All infrastructure assets

How the Council can use technology to improve overall cost-effectiveness

There are likely to be efficiencies through more use of robotics to maintain assets. Advances in use of 'big data' are likely to assist with accurately modelling and updating the local effects of climate change (such as flood risk and coastal inundation) as more information becomes available.

Changes in demand for services

Here are some of the ways technology could assist with demand management:

- driverless cars, reducing the need for parking spaces in urban centres and improving road safety. This would help to reduce risks associated with drivers who are unfamiliar with our roads
- water recycling will become readily available

- smart metering will enable people to use water and electricity more efficiently.

Transport

Technological changes may affect design requirements for the road network

The overall goal is to be alert to the new technology and to adopt it when it is cost-effective to do so. The transport-related challenge is that the timing of the uptake of new technology in Nelson is uncertain. If we have a network of autonomous, self-drive cars, and electric vehicles, it is likely to improve the efficiency of the road network, reducing the need for additional capacity. This means it is difficult to know how much to invest in the existing demand for more capacity and how much to 'sweat the assets' and save this money for investment in the future transport technology and demand.

Electric vehicles

There is already a high demand for pure electric cars and with increases in battery power and vehicle efficiency the range will increase normalised their use. Some pure electric vehicle can now travel 300–400 km without recharging and overnight charging costs $4. Economics will drive their uptake.

Parking technology

Another saving due to technology relates to the potential to install parking technology that works with smartphones where Council will only be required to administer the service rather than maintaining and renewing the physical meters. Parking enforcement would be more efficient, as parking enforcement officers would know which vehicles had overstayed electronically, rather than having to go around searching for them.

Proposed solution: See Table T6

Water Supply

- More water efficient household appliances and more use of demand management technology could reduce per capita use of water.

- There is also potential for water supply technology to be used to improve drinking water quality.

- Information about increasingly smaller areas of the water network will enable improved detection of leaks, for gradual reduction of water losses.

Wastewater

- The SCADA systems used to electronically manage the wastewater network will become more sophisticated, and better able to monitor valves and pump stations and check wetwells.

- There is potential to use different technology for wastewater treatment in future, instead of using oxidation ponds which rely on natural processes.

Section 3 - Significant decisions for core infrastructure

This section details Nelson's key infrastructure issues and identifies response options to manage them. The issues and responses are a varying stages of development and will be updated in more detail in future strategies and asset management plans. Note: Estimated costs are not inflated in these tables but have been inflated in the roll up for key project tables and graphs.

Transport

TABLE TRANSPORT 1: RESILIENCE TO NATURAL HAZARDS

Issue	**Ensure the transport network is resilience to natural hazards** The transport network is critical to enable all other utilities to get up and running.		
Desired Benefits **Investment objectives**	Essential service vehicles are able to access the parts of the network which are critical for recovery from natural hazard events. Reduction in the number of vehicles affected by closures.		
Most Viable Options **[preferred listed first]**	Implications/ Risk	When	How much?
Preferred Option Structural inspections programmed in 2018 to inform a future resilience works schedule and the strategic infrastructure plan: • using lifeline route status as a factor when prioritising structure renewals and resilience capex works • considering if alternative routes or sole access is available to customers when prioritising structure renewals and resilience capex works. Ensure new infrastructure and new developments are constructed in a manner that increases resilience, such as providing connections to adjacent networks so there are multiple access/egress points for each community. Ensure Civil Defence Emergency Response Plans are in place and routinely updated, and mock events practised, to ensure lifeline infrastructure is back up and running as quickly as possible following natural hazard events.	Public opposition to other (non-lifeline/alternative available locations) not being prioritised for renewal. Developers will prioritise additional lots over increased infrastructure cost. It may not be feasible to reduce the impacts of rare and significant natural hazard events.	Annual work for the next 30 years Exact timeline unknown as this work needs to be co-ordinated with developments Annual work for the next 30 years	$15-$30M over the next 30 years The required Council contribution is unknown and dependant on specific development circumstances, at a cost of $1-5M over 30 years Part of business as usual costs
Alternative option Ensure Civil Defence Emergency Response Plans are in place and routinely updated and mock events practised to ensure lifeline infrastructure is back up and running as quickly as possible following natural hazard events.	Rare and significant natural hazard events may not be mitigated against	Annual work for the next 30 years	Part of business as usual costs
Investigative work required, CAPEX decision?	Structural inspections programmed for 2018 to better understand long term renewal requirements.		
Key Assumptions [Level of uncertainty]	Lifecycle management (renewal) — once an asset has matured, its current value is kept constant (i.e. significant expenditure is not passed to future generations). Demand for increased residential lots continue in isolated valleys, generating the need to develop multiple access/egress points for each community.		

TABLE T2: CAPACITY AND SAFETY PRESSURES

Issue	**Transport — the capacity and safety of the road network is under pressure** Growth in the number of car users, and slow uptake of alternative transport options, has increased the demands on the existing road network.		
Desired Benefits **Investment objectives**	Level of traffic congestion on the arterial routes of 85% or less. Arterial Road capacity meets LOS C (stable traffic flow but with restrictions to freely select desired traffic speed. Delays at intersections of 15-20 seconds per vehicle) or better and road safety is managed in growth areas.		
Most Viable Options **[preferred listed first]**	Implications/ Risk	When	How much?
Preferred Option More road capacity on arterial routes as mentioned below plus travel demand management (TDM) activities, more attractive bus service (including a new bus exchange), more cycle paths (enhancements to Nelson's walk and cycle network including cross-town links, the Tahunanui cycle link, Stoke East/West connection, and Gloucester Street cycle facilities), education, be a technology enabler, and a rideshare programme. This option is preferred because development may be constrained or delayed if the traffic generation from development has more than a minor impact. Investigations are currently underway regarding the Nelson Southern Link (by NZTA) which are investigation the problem statement of "the form and function of Nelson's two arterial corridors results in congestions and delays". The Programme Business case have been completed and has recommended progression to the Detailed Business Case in 2018.	Increasing road capacity via road building has long lead times and gaining resource consent is difficult. TDM activities typically require social change, which can be hard to effect without significant incentives such as increased parking charges.	Annual work for the next 30 years	$20 million over 30 years.
Alternative [Option 2] Travel demand management (TDM) activities only, as listed above.	$10 million over 30 years. The disadvantage of this option is its potential impact on road congestion and travel delays in Nelson and Tasman as a result of population growth.	Annual work for the next 30 years	$10 million over 30 years
Investigative work required, CAPEX decision?	Investigations currently underway via Nelson Southern Link and Richmond Network Operating Framework to pinpoint priority areas of need. 2018 Transport AMP includes funding required to address this issue.		
Key Assumptions [Level of uncertainty]	• Travel demand stays at the same level or increases over time. • The aged population will still rely on motor vehicles for a significant proportion of their trips. • Technology advances do not significantly alter forecast traffic volumes or eliminate safety risks in the short to medium term.		

TABLE T3: RENEWAL BACKLOG

Issue	**Delayed renewal programme** NZTA co-investment is not sufficient to provide matching funding for the Council's preferred road surface and retaining wall renewals programme, and lack of complete network knowledge creates uncertainty about the level of renewal investment that is actually required.		
Desired Benefits **Investment objectives**	The total cost of ownership (operating, maintaining, replacing) the asset is minimised over time. ie is considering costs from 'cradle to grave'. Better understanding of network knowledge.		
Most Viable Options **[preferred listed first]**	Implications/ Risk	When	How much?
Preferred Option Flexibility in the budget to allocate additional (or reduced) renewal budget as network gaps are identified. Optimise levels of service as appropriate using a pavement deterioration model and the One Network Road Classification framework as a guide. It is expected the modelling will help understand existing, underlying issues in the pavement that traditional methods don't always identify.	The renewal budgets are based on theoretical modelling and may not represent reality over the longer term. Delaying renewals increases risk that co-funding from NZTA for renewals may not be available for carrying out these renewals if they become urgent at a later date. Failure of roads or poor levels of service may be experienced in the period during which modelling and NZTA funding is being requested. Heavy Commercial Vehicles (HCV) are increasing in their gross mass and overall numbers that have impact on pavement lives.	Annual work for the next 30 years	This option may cost $10M over 30 years
Alternative Reduce levels of service to match available funding and increase reactive maintenance budgets.	Resurface and retaining wall backlog will grow, increasing the renewal liability and resulting in increased unplanned closures.	Annual work for the next 30 years	Not known, but this option would be informed by theoretical modelling
Investigative work required, CAPEX decision?	Model development and ongoing asset optimisation as part of the Transport AMP improvement plan. Decision on investment without NZTA co-investment may be required in order to reduce long term asset risk.		
Key Assumptions [Level of uncertainty]	• Lifecycle management (renewal) — once an asset has matured its current value is kept constant (i.e. significant expenditure is not passed to future generations). • Sealed surface LOS follows national best practice, i.e. asphaltic concrete (AC) only applied where volumes are greater than 10,000 per day and high stressed pavement areas.		

TABLE T4: FUNDING GROWTH PROJECTS

Issue	**Costs of growth for the road network** This issue relates to uncertainty — for example, under the National Policy Statement on Urban Development Capacity (NPS-UDC) the Council is required to provide three years of zoned and serviced land for residential and business development, and 10 years of zoned (and planned to be serviced) land for residential and business development. However, these services could be provided and then the landowner decide the time is not right for them to subdivide or sell their land. This raises a question of how to tie the developer to this commitment before providing the servicing. There is a risk that growth doesn't occur at the rate projected (or adopted). More funding (in addition to the money given to the Council through development contributions) is required to cater for the transport demands associated with new growth and development. More congestion on the existing road network is anticipated if these services are not provided.			
Desired Benefits Investment objectives	Local road capacity meets LOS D (Approaching unstable flow where all drivers are severely restricted in their freedom to select desired speed and manoeuvre within the traffic stream. Delays at intersections of 25-35 seconds per vehicle) or better and road safety is managed in growth areas.			
Most Viable Options [preferred listed first]		Implications/ Risk	When	How much?
Preferred Option Prioritise areas to deliver the agreed capacity and safety level of service 'just in time' to match or slightly lag actual development.		There is a risk the Council could invest in infrastructure in areas that don't end up being developed. Unplanned/unforeseen development areas would be delayed by the lack of roading infrastructure until this can be planned, funded and implemented. To manage this risk, investigations are currently underway to pinpoint priority areas of need. The city wide TRACKS model can be used to understand the impact of any large proposed developments at a macro scale. However, localised modelling using micro-simulation or similar is also necessary to understand the localised impacts.	Stage over next 30 years	See Table T2 ($30 million over 30 years)
Alternative [Option 2] Deliver capacity and safety level of service improvements across the city to enable distributed development.		This option would almost certainly result in Council investing in infrastructure in areas that don't end up being developed.		More than $30 million over 30 years
Investigative work required, CAPEX decision?	Development Contributions Policy will provide partial funding (approximately 30%), with the remainder budgeted in the 2018 Transport AMP.			
Key Assumptions [Level of uncertainty]	• Demand (growth) occurs as forecast by the Council. • Travel demand which is not related to new, isolated development continues at current levels.			

TABLE T5: NETWORK DEMAND GROWTH

Issue	**Demand exceeds existing network capacity to maintain acceptable levels of service for travel time and safety** Increasing congestion on main arterials and the State Highway is limiting our ability to create a liveable city and to see our region thrive. Monitoring data shows the problems experienced during peak times are now extending into off-peak times in the morning and afternoon.		
Desired Benefits **Investment objectives**	Maintain existing levels of service for travel time, safety, efficiency. Provides resilience for life line routes. Enhancement of the waterfront.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Integrate the Nelson Southern Link with the local road network, additional measures to maintain LOS: • Minimise arterial road severance; • Provide for active travel via a separated pathway between the central city and Bishopdale; • Manage car parking demand; • Provide a clear road hierarchy, especially in the northern Stoke area.	Uncertainty over Council/NZTA cost split for the Southern Link Uncertainty about the exact the timing of the project. Uncertainty over the Council's responsibility and costs associated with the revoked State Highway consisting of Haven Rd, Rocks Rd and Tahunanui Drive.	likely staged over next 10 - 15 years	$10 million over 15 years (excludes OPEX and renewal costs associated with the revoked State Highway consisting of Haven Rd, Rocks Rd and Tahunanui Drive)
Alternative Option Progression of the Nelson Southern Link with minimal integration of the local road network.	Arterial road severance and parking demand increases. Central city traffic patterns/volumes change resulting in congestion/travel time delays/increased safety risk. Network hierarchy is not clear and doesn't incentivise using the arterial network when travelling through the city. Uncertainty over responsibility and costs associated with the revoked State Highway consisting of Haven Rd, Rocks Rd and Tahunanui Drive.	Uncertain — likely staged over next 30 years	$5 million over 15 years. (excludes OPEX and renewal costs associated with the revoked State Highway consisting of Haven Rd, Rocks Rd and Tahunanui Drive)
Investigative work required, CAPEX decision?	As the Nelson Southern Link Investigation is progressed, then: • micro-simulation modelling on the interaction with the central city transport system • inclusive decision making on integration with the local road transport system. • Decision will be made upon completion of the NSLI		
Key Assumptions [Level of uncertainty]	• Government and / or NZTA progress Nelson Southern Link. • Uncertainty around the delivery timeframe of the Nelson Southern Link project creates uncertainty in the form and function of the growth projects in the Marsden/Stoke area. • Travel demand (growth) stays at the same level or increases over time.		

TABLE T6: TECHNOLOGICAL CHANGE

Issue	**Technological changes may result in different demands on the transport network** Technological change will result in new, currently unknown, demands on the transport network.		
Desired Benefits **Investment objectives**	Reduced travel time, vehicle operating costs and road safety risk. Contribution to national climate targets by facilitating alternatives to fossil fuel powered vehicles		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Put a nimble structure in place to allow rapid adoption of technology advances where they can respond to transport issues or objectives; and provide seed funding to the commercial sector for demonstration projects that raise public awareness.	There may be significant savings if other demand and growth-related projects (such as construction of new roads) are not necessary as a result of changes in technology. There is some uncertainty with this option — future technology advances may not result in transport benefits in the Nelson Tasman region. Another possibility is that future transport technology advances turn out to be largely driven by market forces, with little investment needed by the Council.	Uncertain — likely within next 30 years.	The cost is estimated to be $10 million over 30 years.
Alternative [Option 2] Let market forces drive technology change.	Not investing in new transport-related technology may result in lost opportunities for network efficiencies.	N/A	N/A
Investigative work required, CAPEX decision?	The 2018 Transport AMP proposes increased staffing to enable Council to keep abreast of technology advances and respond to technology change where it can deliver on travel time, vehicle operating costs and road safety risk reductions.		
Key Assumptions [Level of uncertainty]	• The timing of benefits from technological change is highly uncertain. • Nelson won't seek to be at the cutting edge of technological changes but will take a pragmatic approach and ensure benefit-cost-risk is considered appropriately for new innovations		

Water supply

TABLE WATER SUPPLY 1: WATER LOSSES

Issue	**Water losses from the network** Water leaks out of broken or impaired pipes in the public network and un-metred user's results in a 25-30% difference between the volume of water leaving the Water Treatment Plan and the amount actually identified by the community water meters. In addition, leaks occur in private lines throughout the city. Water losses impact environmental flows in the Maitai and Roding rivers and reducing demand will improve these flow levels.		
Desired Benefits **Investment objectives**	Ensuring the water take from the rivers is the minimum necessary to meet the reasonable demands of the city.		
Most Viable Options **[preferred listed first]**	Implications/ Risk	When	How much?
Preferred Option 1 An ongoing programme of investigating water leaks, and repairing and renewing the public network of water pipes. Investigating other uses of water from the network such as fire flows, construction uses by contractors and pipe scouring by Council.	Identifying leaks and un-metred uses will help improve water use reporting. Some income could result from monitoring contractor usage. Monitoring needs to be ongoing to ensure compliance with backflow and metering requirements and any drought restrictions.	Ongoing over the next 30 years.	Renewal of water pipes — $44 million over 30 years. Targeted water loss reduction programme — $3.6M over 30 years.
Option 2 Placing a stronger emphasis on community responsibility for water taken from the network and water leaks in privately owned pipes through a charging regime that requires people to pay for all water taken from the public network, therefore incentivising the economical use of water and fixing of leaks in privately owned water pipes.	Finding and repairing leaks can be costly. This may create an affordability issue for some customers.	Ongoing over the next 30 years.	Charging regime based on recovering network costs.
Investigative work required, CAPEX decision?	Investigations currently underway to pinpoint priority areas of need. The 2018-28 Water Supply AMP will include funding required to address this issue.		
Key Assumptions [Level of uncertainty]	• The current level of service, which sets a limit of real water loss of less than 25%, will be retained. Demand will increase as population increases. Current sources of raw water will be subject to resource consent conditions. Expected demand will be met by current sources out to 2050 if TDC continue to supply south Nelson. • Private landowners and contractors will support increased focus on the issue and will comply with NCC policy. • NCC will enforce private leaks and the contractor use policy.		

TABLE WS2: WATER QUALITY

Issue	**Maitai water quality** During drought conditions raw water is sourced from the Maitai Dam and also released to the Maitai River to increase river flows to the level required by the Council's resource consent. This water has higher organic content and the water at the bottom of the dam is of a lower quality than surface water in the river.		
Desired Benefits Investment objectives	Improve the quality of the environment in the lower levels of the dam, and in the Maitai River when this water is released.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Aeration of the Maitai Dam and mix the water to prevent the loss of oxygen in the bottom layer.	Improved environment in the base of the full reservoir is the ultimate goal. Some risk exists as to the effectiveness of the aeration proposal.	Construction in 2022/23	The expected cost is $2.3M with construction programmed in 2022/23.
Alternative [Option 2] Pending indicative business case for additional information on possible solutions			
Investigative work required, CAPEX decision?	Detailed investigation and design is required to confirm viability and cost. Final construction is dependent upon detailed design and any consents required.		
Key Assumptions [Level of uncertainty]	• The current level of service requires compliance with resource consents for the abstraction of raw water. New consents will likely set a limit on oxygen content of water released as back feed into the river. Water demand will also increase as the population increases. Expected demand will be met by current sources out to 2050, if TDC maintain supply to south Nelson, but will be impacted by climate change and expected increased use of the Maitai dam over dry periods. • The community will support an increased focus on the quality of the environment in the dam. • Nationwide freshwater policy will not result in significant changes to water supply consent conditions.		

TABLE WS3: TREATMENT PLANT LIMITATIONS

Issue	**Impacts on the Water Treatment Plant from events causing water supply to be drawn from the dam for longer periods of time.** Usually water is taken directly as a 'run of the river' from the south branch of the Maitai River and the Roding River. However, during storm conditions the river water is often too full of sediment to be used, so water is taken from the dam instead. The higher levels of organic material in this source means the Water Treatment Plant doesn't work as efficiently when processing this lower quality water, as the membranes work harder processing the material and the very fine particles not removed by the membranes reduce the efficiency of the chlorination stage. This becomes important when the Maitai Dam is used for long periods as the raw water source. The issue is linked to river health and operational efficiency of the treatment plant. The appropriate solution will depend upon the source of raw water.			
Desired Benefits Investment objectives	Ensuring the treatment plant is capable of meeting the demand for water to the required LOS irrespective of raw water source in the most cost-effective manner. Maintain promised LOS for customers.			
Most Viable Options [preferred listed first]		Implications/ Risk	When	How much?
Preferred Option 1 Invest in a primary clarifier at the Water Treatment Plant.		A primary clarifier will require changes to the layout of the site. Additional sludge will be produced that will require extra settlement lagoons or a lamellar thickener.	This investment may be required if the Maitai Dam becomes a dominant raw water source. Detailed investigations, options, design and consents are programmed for years 5-10	Treatment Plant primary clarifier would cost $20M- $25M.
Alternative Option 2 More regular replacement of the water treatment plant membranes.		Regular replacement of membranes will lead to replacement before the end of their service lives and some economic inefficiency.	Replacement will be required when membrane efficiency begins to reduce.	More regular replacement of membranes is estimated to cost $7.5M every 6-8 years.
Investigative work required, CAPEX decision?	Detailed investigation of options and cost benefit analysis will be the first stage of the project. It is possible that the preferred option may change as a result.			
Key Assumptions [Level of uncertainty]	• The current levels of service require compliance with drinking water standards and resource consent conditions. • Current sources of raw water are expected to meet demand out to 2040-2050 • Climate change will occur at a gradual rate and allow time for the community to adapt to longer drought periods. • Nationwide freshwater policy will not result in significant changes to water supply resource consent conditions.			

TABLE WS4: DISCOLOURED WATER

Issue	**Water supply — discoloured drinking water** Some of the water supply network consists of cast-iron pipes containing iron and manganese oxide deposits which affect the visual quality, leading to customer dissatisfaction with the water supply service.		
Desired Benefits **Investment objectives**	Meet reasonable requirements for water clarity and reduce customer dissatisfaction.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Renewal of cast-iron pipes in problem areas with the modern equivalent earlier than renewal plan indicates.	Most of the cast-iron pipe tested have been found to be structurally in good condition. Increasingly expensive to replace pipes by trenching. May have to delay renewal of lower priority asbestos cement (black bitumen coated) pipes	Likely to begin after year 10.	Renewal of 48km of cast-iron pipes would cost $10-$20 million over 10 years.
Alternative [Option 2] Re-lining of the cast-iron pipes in problem areas depending upon accreditation of products for potable water.	Re-lining options are limited and higher risk. These need detailed investigation to confirm options for potable water exist. May have to delay renewal of lower priority asbestos cement (black bitumen coated) pipes	Likely to begin after year 10.	Relining of cast-iron type pipes could cost approximately $12M.
Investigative work required, CAPEX decision?	Options for re-lining need to be investigated and proven for potable water. Focus would be the removal of iron and manganese oxides from the inside of the pipes and the sealing of the wall if possible to prevent regrowth.		
Key Assumptions [Level of uncertainty]	• The current levels of service require monitoring of complaints about water clarity and compliance with the drinking water standards. • Renewing Asbestos Cement (black bitumen coated) water mains contains more risk and is more critical over the next eight years. • Suitable products for re-lining of potable water supply pipes are available in New Zealand but uncertainty remains on their performance and success on a large scale		

TABLE WS5: RESILIENCE TO NATURAL HAZARDS

Issue	**Risks to the water supply network from significant natural hazards.** Flooding and earthquake damage (ground shaking and liquefaction) can cause significant and long term disruption to the community, and loss of services to affected areas.		
Desired Benefits **Investment objectives**	Improving the resilience of the network and the speed of post-disaster recovery.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Identify and assess risks to the water supply network from significant flooding and earthquakes (this investigation is underway) and invest in insurance as a means to assist with recovery costs.	Repairing significant damage to infrastructure from natural hazards is part funded by insurance. Council has investigated alternative insurance arrangements which are more cost effective than the Local Authority Protection Plan (LAPP) and has put in place insurance arrangements with the private insurance industry. Risks associated with natural hazards are currently being assessed. A better understanding of the likely impacts on the city should allow improvements in future construction. Costs of enhancing the network resilience will be better identified upon the completion of the investigation. Significant resilience to natural hazards will be 'built-in' through the renewals and capital upgrade programme for the dams and treatment plant.	Timeframes will not be determined until the investigation is completed.	Costs will not be known until this investigation is completed. $0.8M is identified for hazard mitigation to the Maitai raw water pipeline in years 8-15. A budget of $1.5M over 30 years has also been included to allow for any natural hazards risk remediation.
Alternative [Option 2] Solutions pending until investigation is complete			
Investigative work required, CAPEX decision?	The investigation costs will be approx. $450k. The work in years 1-4 will inform future Long Term Plans.		
Key Assumptions [Level of uncertainty]	• No specific level of service for recovery from natural hazards. Current level of service continues for recording number of complaints about continuity of supply. Water supply demand will increase with population growth. Protection from damage from some natural hazards will be embedded in renewals and capital works. • Climate change will be monitored and growth controls adjusted to respond to the latest information. • Earthquake risk will be reviewed as any future investigations provide additional information.		

TABLE WS6: METER REPLACEMENT

Issue	**Replacement of the existing water meters** The great majority of the residential meters have reached the end of their useful life (both physical condition and asset performance). Physical deterioration means they are not recording properly (out by more than 4% accuracy) leading to inconvenience for customers if they need to report discrepancies and an increase to staff time spent resolving errors.		
Desired Benefits **Investment objectives**	Correctly recover and record revenue, assist with identifying water leaks Reduction in meter failures will reduce customer complaints and save staff time resolving issues		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Manual read mechanical meters	Manual read mechanical meters have approximately 20 year service life. Replacement with new manual/mechanical meters could delay access to the benefits of electronic meters by 20 years.	2018/19 - 2020/21	$3.2 million
Alternative Option Mechanical meters with automated readings	Untested in New Zealand on a large scale, technology still not there to warrant cost and risk	N/A	$6.5 million (replacement required every 10 years)
Investigative work required, CAPEX decision?	Complete – manual read mechanical meters will be used as they provide the most cost-effective solution.		
Key Assumptions [Level of uncertainty]	• Current level of service for average consumption of drinking water per day per resident to be less than 500 litres. No specific level of service for water meters. Mechanical meters last for approximately 20 years. Currently, the lifespan of automated meters is governed by battery life, which is approximately 10 years. • Water charges will continue to be based on metered supplies. • Mechanical meters life is 15 years; electronic meters life is 12 years		

Wastewater

TABLE WASTEWATER 1: UNWANTED NETWORK DISCHARGES

Issue	**Wastewater — stormwater and groundwater entering the wastewater pipes** If households' stormwater pipes have been accidentally connected to the Council's wastewater system instead of the stormwater system, rainwater runoff from roofs and driveways ends up flowing into the wastewater system. Stormwater and natural sources of groundwater can also enter the wastewater system if underground stormwater and wastewater pipes are broken. All of the increased flows into wastewater pipes put pressure on the wastewater pipes and the capacity of the wastewater network as a whole. These additional inflows into the system can result in wastewater overflows during wet weather leading to potential environmental, cultural and health issues.		
Desired Benefits Investment objectives	Minimise risk of negative environmental impacts and public health issues due to wet weather overflows from the wastewater network. Reduce costs for pumping and treating extra volume and for clean-up post overflow.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Continue site investigation programme to identify areas of high inflow and infiltration. Increase resources for investigating discharge of stormwater to wastewater pipes on private properties, to avoid inflow of rainwater to the wastewater system. Undertake public education campaign to encourage appropriate disposal of stormwater. Support regulatory response where necessary and investigate options for upgrading private wastewater reticulation where high levels of infiltration are identified. Increase the pipeline renewal programme in areas with high water tables (where groundwater levels are high, and close to the wastewater pipes). System improvements (eg detention tanks) in multiple locations to accommodate rapid increases in stormwater inflow to the wastewater system during heavy rainfall.	Additional resources are required to follow up results of property investigations. Site investigations and public education are important opportunities for community engagement. Detention tanks or network upgrades are 'end of pipe' solutions and do not treat the source of the problem. Significant issues on private property will require land owner support and possible funding to resolve	Investigation next 3 years; system improvements next 20 years; Public pipe renewals ongoing; private property issues tbd	Direct investigation of sources and construction of detention tanks or network upgrades $22.1 million over 30 years. Also costs for private issues resolution still to be assessed
Alternative [Option 2] Rely on pipeline renewal to reduce infiltration	Wet weather overflows will continue into the foreseeable future	Ongoing over the next 30+ yrs.	No detailed costs available but could be in excess of $50M.
Investigative work required, CAPEX decision?	Work currently underway but increase focus starting 18/19, decision on CAPEX needs and community requirements for private property issues expected 19/20.		
Key Assumptions [Level of uncertainty]	• Increase LOS to improve environmental outcomes and reduce public health risks • 80% of stormwater entry to wastewater system from private connections • Community generally in support of resolving the issue • Growth may be constrained where wet weather capacity is insufficient		

TABLE WW2: DISCHARGES TO NELSON HAVEN

Issue	**Wastewater — discharges to Nelson Haven due to asset failures** There is one pipeline (rising main) in the foreshore and partly under the sea bed between Nelson and the Nelson wastewater treatment plant, which is located near the Glen, to the north of the city. Some failures of this pipeline have led to low volumes of wastewater discharges directly into the Nelson Haven. Recent failures have been from access points on the pipeline rather than pipewall or joint failures.		
Desired Benefits **Investment objectives**	Avoid wastewater discharges to Nelson Haven due to asset failures.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Increase resources for pipeline inspection. Check all fittings and access hatches along the pipeline. Carry out spot repairs as required.	Investigations focused on access points such as air valves and people hatches. Ongoing investigation of pipeline will be required as opportunities arise. Risk of pipewall failure still remains.	Years 1-4.	The investigation and spot repairs will cost $0.65 million.
Preferred Option 2 Consider early renewal of the pipeline.	Early renewal needs further investigation to avoid replacing sections that are still in good condition. Potential failure locations are not able to be identified without analysis of the pipewall condition.	Renewal investigation and options are to start 2024/25 with construction scheduled to commence in 2027/28 and take 2-3 years. Depending on the outcome of the pipeline/fittings condition investigation in years 1-4 the renewal work may be brought forward.	The renewal of the pipeline will cost approx. $17.8 million.
Investigative work required, CAPEX decision?	Pipeline internal condition to be investigated as opportunities arise. Investigation of renewal options to include a duplicate pipeline located to minimise impact of climate change or relining/sleeving the existing pipeline.		
Key Assumptions [Level of uncertainty]	• There is no current level of service specific to the Atawhai rising main. The existing rising main is expected to have capacity for dry weather flows out to 2050-2060. • Access for repairs and maintenance alongside the state highway will continue to be available.		

TABLE WW3: CLIMATE CHANGE IMPLICATIONS - WASTEWATER TREATMENT PLANT

Issue	**Impact of climate change on the Nelson wastewater treatment plant** The Nelson wastewater treatment plant is low lying and located in the coastal environment. That means it is particularly exposed to the effects of climate change, including sea level rise, flooding and storm surge. This is significant because the Nelson wastewater plant treats half of Nelson's residential waste, at around 8 million litres of wastewater per day (the other half goes to the Bell Island treatment plant).			
Desired Benefits Investment objectives	As a critical asset with significant capital investment Council wishes to ensure it continues to operate effectively in this location for as long as practicable.			
Most Viable Options [preferred listed first]		Implications/ Risk	When	How much?
Preferred Option Investigate long term options for managing natural hazard risks affecting the Nelson wastewater treatment plant as part of the resource consent process.		The cost of any actions required in response to this investigation are not yet known, but could be considerable, particularly if relocation is the most cost effective option in the long term.	The resource consent for the Nelson treatment plant expires 1 Dec 2024. Preparation for the replacement consent begins 2019/20. Lodgement of the consent application is proposed by Jan 2024.	The investigation and resource consent costs will be $0.8 million over six years. A budget of $15.5M over 30 years ($12M in 2043-48) has been included to allow for protection/upgrading/investigating relocation options as required.
Alternative [Option 2] Investigate alternative locations or treatment options.		An options report will be part of the investigations in year 2-3. Any decision on the long term future of the plant is likely to 3-4 years away. Rogue events can still damage the plant in the interim.	Investigations and options study 2019/20-21/22.	The investigation and options study will cost approx. $100k.
Investigative work required, CAPEX decision?	Investigations and options are required for the protection in place of the treatment plant or the relocation to a new location. One option is to treat all wastewater at Bell Island through the NRSBU. Capex decisions are expected after the resource consent processing is complete in 2024.			
Key Assumptions [Level of uncertainty]	• The existing treatment plant will have capacity for dry weather flows out to at least 2050-2060. • Replacement resource consents will be granted for the operation of the plant out to 2050. • Climate change will be monitored and growth controls adjusted to respond to latest information.			

TABLE WW4: RISKS TO WASTEWATER FROM NATURAL HAZARDS

Issue	**Risks to the wastewater network from significant natural hazards.** Flooding and earthquake damage (ground shaking and liquefaction) can cause significant and long term disruption to the community, and loss of services to affected areas.		
Desired Benefits Investment objectives	Improving the resilience of the network and the speed of post-disaster recovery.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option Identify and assess network risk (this investigation is underway) and have insurance as a means to assist with recovery costs. Undertake improvements where possible.	Repairing significant damage to infrastructure from natural hazards is part funded by insurance. Council have investigated alternative insurance arrangements which are more cost effective than the Local Authority Protection Plan (LAPP) and put in place insurance arrangements with private insurers. Risks associated with natural hazards are currently being assessed. A better understanding of the likely impacts on the city should allow improvements in future construction. Costs of enhancing the network's resilience will be better identified upon the completion of the investigation. Significant resilience to natural hazards will be 'built-in' through the renewals and capital upgrade programme.	Investigation years 1-4 and then year 10 with updates every five years thereafter. Construction of network upgrades to follow investigation.	Investigation $400k. Accurate construction costs will not be known until this investigation is completed. A budget of $7.2M over 30 years ($6M in 2038-48) has been included to allow for any protection that is not provided in other works.
Preferred Option 2 Have Civil Defence Emergency Response Plans in place for getting lifeline infrastructure back up and running as quickly as possible following natural hazard damage.	This provides a response only rather than protection of the network and focuses on the lifeline utilities.	Ongoing over 30 years.	Plans likely to be developed in-house. Costs of re-instatement to be met from emergency funds and insurance.
Preferred Option 3 Ensure new infrastructure avoids hazard prone areas where feasible and is constructed in a manner that increases resilience to hazard events.	Only addresses new infrastructure. Risk to existing infrastructure remains.	Ongoing over 30 years.	Cost will be part of any new capital project.
Investigative work required, CAPEX decision?	The investigation costs will be $0.4 million over 30 years. Individual projects will be identified as part of the investigation.		
Key Assumptions [Level of uncertainty]	• There is no specific level of service regarding impacts of natural hazards. Demand will increase with population growth. Protection from damage from some natural hazards will be embedded with renewals and capital works. • Climate change will be monitored and growth controls adjusted to respond to latest information. • Earthquake risk will be reviewed as any future investigations provide additional information.		

Stormwater and flood protection

TABLE STORMWATER & FLOOD PROTECTION 1: LEVEL OF FLOOD PROTECTION

Issue	**Level of flood protection** Unless improvements are made, the existing flooding issues in areas impacted by the 13 larger urban streams are likely to be exacerbated by more frequent and more intense rainfall events in future, as a result of climate change.		
Desired Benefits Investment objectives	No fatalities directly attributable to up to 1% AEP flood event. No flooding of habitable floors from 2% AEP event. Minimise disruption to business and day to day activities from 1% AEP events.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option The preferred option is a risk based approach to flood protection which means focusing flood protection works on areas which have a high likelihood of being flooded and/or being seriously affected by flood events.	Risk profile can change annually as property valuations change and land use changes through redevelopment. Potentially the flood risk will need to be reviewed regularly. Assessing	Over 30 years	The cost of implementing a risk-based approach will not be known until the analysis for each stream and river has been completed. A very rough estimate is likely to be in the order of $100 million over 30 years.
Alternative [Option 2] An alternative option is to upgrade all streams and rivers to ensure flows from a 1% AEP event are contained within the river channel.	The cost of upgrading channels to meet a 1%AEP event will be expensive and in some areas the cost may be found to outweigh the cost of damage from the event.	Over 30 years	The cost of implementing a consistent standard of 1% AEP to the 13 major urban streams would require preliminary design for each stream /river to be undertaken. A very rough estimate is likely to be in the order of $150 million over 30 years.
Investigative work required, CAPEX decision?	Complete development of computer flood models of the largest 13 urban streams. Complete development of a risk based framework for flood protection. Investigations for the Maitai are in years 1-6 with budget $550k. Any subsequent construction works will be identified in future LTPs.		
Key Assumptions [Level of uncertainty]	• Current levels of service focus on maintaining major flood protection and control works and ensuring there is limited damage to habitable floors from a 50% AEP event. Development in flood prone areas of the city is controlled by the district and regional plans under the Resource Management Act. The flood models are expected to support future controls for new developments, to ensure property damage is avoided. • Climate change will be monitored and development controls adjusted to respond to latest information. • A risk based response to flood protection will underpin the stormwater and flood protection activity for the life of this plan.		

TABLE SW2: LEVEL OF STORMWATER PROTECTION

Issue	**The capacity of the stormwater network is not able to meet expected levels of service when considering heavy rain events and rising sea levels** Some areas of the city have ongoing stormwater drainage issues due to the lack of a consistent standard of stormwater protection. An under-capacity stormwater network can contribute to: landslides, wastewater infiltration, and damage to buildings.		
Desired Benefits **Investment objectives**	Properties in the city are protected from the effects of uncontrolled stormwater discharge in up to events with a 6.67% AEP. No disruption to business and day to day activities from 6.67% AEP events.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option The preferred approach is to provide a piped stormwater network to a 6.67%AEP event for the entire city.	Many parts of the existing network have been installed prior to the recognition of climate change and will not cope with increasing flows into the future. Until climate change is better understood there is a residual risk that construction may be either undersized or oversized.	Ongoing for 30 years.	Piped stormwater network for the entire city would cost in the order of $80 million over 30 years.
Alternative [Option 2] An alternative option is to utilise ground discharge and secondary flow paths to collect and convey stormwater to a safe discharge point.	Some areas of the city are prone to slippage and additional surface water could initiate or exacerbate slips. Secondary flow paths can pass through private property, development would have to be carried out in ways that leave flow paths clear. Identifying slip prone land is likely to be undertaken as part of the proposed Whakamahere Whakatu Nelson Plan but may not be to a fine enough level of detail for property specific advice.	Identify secondary flowpaths years 1-2. Any consequent work will be identified after this first stage.	Investigation of secondary flow paths $150k. Any necessary works will be identified in future LTPs.
Alternative [Option 3] An alternative option is to rely on stormwater detention and eventual discharge to ground	As with option 2 those areas that are sensitive to slips would need to be considered carefully. Sizing of detention tanks would need to be able to change to meet any change to expected future rainfall. Likely to only be available for new development.	Ongoing over 30 years.	Cost of tanks likely to be borne by property owners.
Investigative work required, CAPEX decision?	Stormwater strategies are required for the whole city assessing current disposal provisions and setting out appropriate disposal options for each area. Future projects will be identified in LTPs.		
Key Assumptions [Level of uncertainty]	• Current levels of service focus on maintaining the serviceability of the existing infrastructure and ensuring appropriate disposal options are available across the city. All new developments within the city are required to provide appropriate stormwater disposal through connection to public services, disposal to ground or detention as appropriate. Renewal budgets have been established. • Climate change will be monitored and development controls adjusted to respond to latest information. • Stormwater disposal options will protect other utilities and adjacent property and be carefully matched to geotechnical constraints.		

TABLE SW3: PRIVATE DRAINS MAINTENANCE

Issue	**Maintenance of stormwater pipes and open drains, including secondary flow paths, which are not owned by the Council** There is an extensive network of pipes and open channels (drains) across the city that the Council does not own or maintain but may be legally considered to be public drains. Additionally many secondary flow paths cross private property. There are associated issues related to private drains within road reserve and across multiple private properties that are also not maintained by the Council.		
Desired Benefits **Investment objectives**	Protection of property from damage by poorly or non-maintained stormwater networks.		
Most Viable Options [preferred listed first]	Implications/ Risk	When	How much?
Preferred Option The preferred option is to develop strategies for future stormwater services across the city that maximise the use of public property.	Residual risk will continue as strategies are developed. Construction of new public drains will also take some time.	Develop four separate strategies to cover the city in the first ten years. Implementation will follow each strategy.	The cost to investigate and carry out minimal upgrades of public drains is $4.6 million over 30 years.
Preferred Option 2 Develop a drainage ownership/maintenance policy as part of the Land Development Manual to clarify when Council or landowners are responsible for drains.	Drainage ownership/maintenance policy will provide more clarity of responsibilities for operational staff. Some risk of not being able to define every possible scenario affecting a timely response to queries. Policy will be dependent on adoption of LDM.	Policy can only be developed once Land Development Manual is adopted by Council. Likely 2019/20.	To be undertaken by Council staff. No external cost expected beyond that required for the LDM.
Investigative work required, CAPEX decision?	Develop an inventory of drains that are owned by Council or could be considered to be public drains requiring maintenance by Council. Develop strategies for the provision of stormwater services across the city.		
Key Assumptions [Level of uncertainty]	• Current levels of service focus on the reliability of the network as measured by blockages and the response to issues as measured by contractor response times. Future demand for stormwater services are primarily considered through subdivision consents and city growth planning. Renewal planning matches the rate at which assets reach the end of their service lives. • New developments will ensure ownership of drains is clear.		

TABLE SW4: NATURAL HAZARD RESILIENCE

Issue	**Risks to the stormwater network from natural hazards.** Earthquake damage as a result of ground shaking and liquefaction can cause significant and long term disruption to the community, and loss of services to affected areas. Climate change with possible increases in rainfall intensity and sea level rise, will impact services.		
Desired Benefits **Investment objectives**	A resilient network that will continue to provide property protection during and after the action of natural hazards.		
Most Viable Options **[preferred listed first]**	Implications/ Risk	When	How much?
Preferred Option Identify and assess network risk (this investigation is underway) and develop a resilient network to withstand moderate earthquakes with minimal damage. Have insurance as a means to assist with recovery costs.	Council has investigated alternative insurance arrangements which are more cost effective than the Local Authority Protection Plan (LAPP). Actual costs are yet to be determined.	Insurance ongoing. Risk assessment of assets years 1-5 and every ten years thereafter. Construction of network upgrades to follow investigation.	Accurate costs will not be known until this investigation is completed and climate change implications are better understood. A rough order cost of $7.8M over 30 years has been included.
Alternative Option Identify and assess network risk (this investigation is underway) and rely on insurance as a means to assist with recovery costs.	Significant damage to the network, and slower recovery.	Risk assessment of assets years 1-5 and every ten years thereafter.	$400k over 30 years
Investigative work required, CAPEX decision?	Complete investigation and risk analysis of key components of the network. Develop response plan to inform priorities for network upgrades.		
Key Assumptions [Level of uncertainty]	• Current levels of service focus on the reliability of the network as measured by blockages and the response to issues as measured by contractor response times. Future demand for stormwater services are primarily considered through subdivision consents and city growth planning that considers natural hazards as one of the assessment criteria. Renewal of assets incorporates design to minimise the impact of natural hazards. • Climate change will be monitored and growth controls adjusted to respond to latest information. • Earthquake risk will be reviewed as any future investigations provide additional information.		

Section 4 - Most likely scenario

This section shows the estimated financial implications of the most likely scenario resulting from addressing the key issues and maintaining planned service provision over the next 30 years. This includes the estimated costs for the projects and initiatives identified in the previous section. More detail about individual projects over the next 10 years is available in the 2018 asset management plans.

As described throughout this strategy the objective of core network infrastructure is to support achievement of the desired outcomes for the community. Each specific infrastructure objective aligns with the outcomes and will contribute to the city's success.

The future brings uncertainty in many areas but Council has shown the ability to remain flexible and adapt to change. While this strategy has identified the significant infrastructure issues over the next 30 years, it is based on existing information and thinking. It is understood that as new opportunities and challenges arise, future strategies will need to consider those changes.

The waters and transport networks will continue to grow to meet user demand and the existing network will be managed to provide the expected service levels. Based on current assessments this is manageable within the funding estimates.

Levels of service will probably change over time but the extent and direction is not always clear so ongoing monitoring of customer preferences and asset utilisation will continue. Regardless of what transpires, the focus remains on meeting the required levels of service in the most cost-effective manner.

Improving mechanisms to collect and analyse data on performance and condition is underway. This will help ensure whole of life costs are fully understood, assets life is maximised, and funding requirements are based on sound evidence.

Technological advancements are already showing signs that useful lives may be extended on certain assets and brings the potential to reduce maintenance and renewal costs (eg sleeving pipes). As confidence grows in these technologies, asset lives could be extended and costs of replacements could decrease. There will be more focus on understanding and seizing these opportunities in the next strategy.

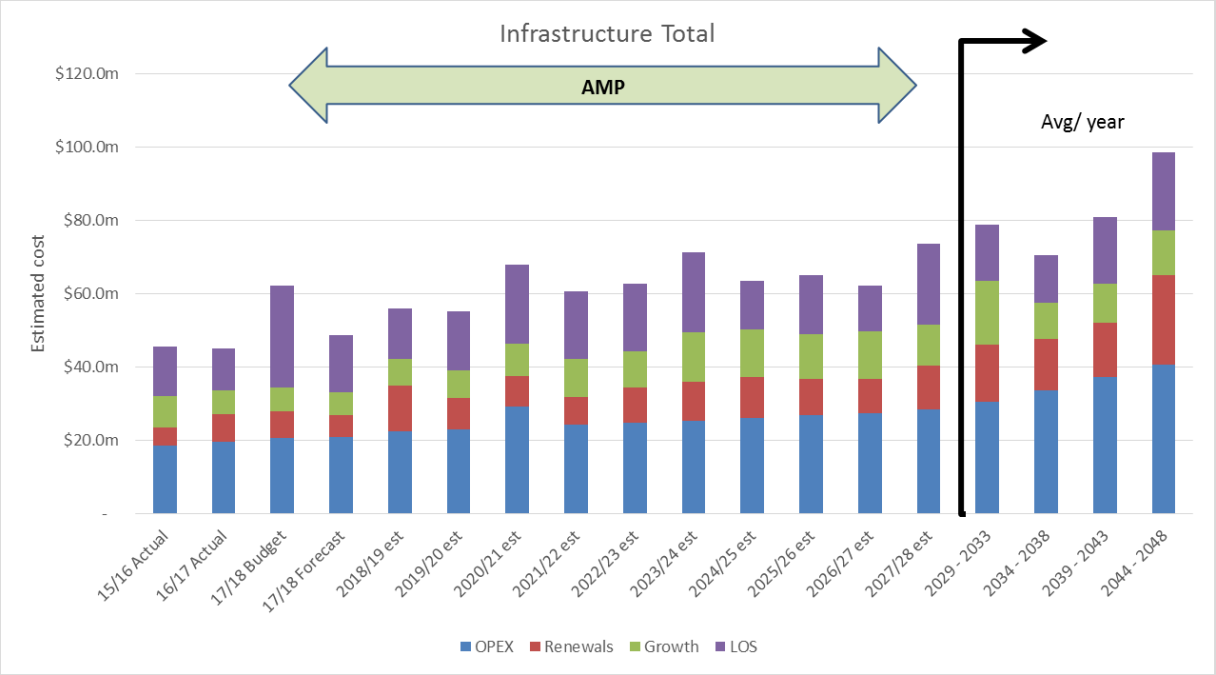
Key to success is not only maintaining and understanding current community needs and how our assets meet those corresponding service levels but to also keep an eye on the horizon for changes that may require a response. Community faces competing priorities and each decision requires a balance of whole of life benefit vs cost vs risk across all activities. The decision process needs to remain robust so trade-off implications are understood when future changes require a re-allocation of funding.

The proceeding sections have shown our approach is to ensure that over the next 30 years Nelson's infrastructure assets are managed to continue to deliver expected levels of service. The networks will become more resilient and environmentally friendly. They seek to provide accessible and safe transport options which allow efficient travel around the city, quality water supply to households and businesses, wastewater disposal that remains in the network until treatment, and storm water disposal options that are right sized to protect properties from flooding.

This graphs show the financial estimates (each year is shown for the first 10 years, then spending in years 11-30 is shown in five year increments as the average per year) for all infrastructure and by activity.

Estimates are adjusted for inflation using BERL forecasts.[7]

Infrastructure Total Estimates



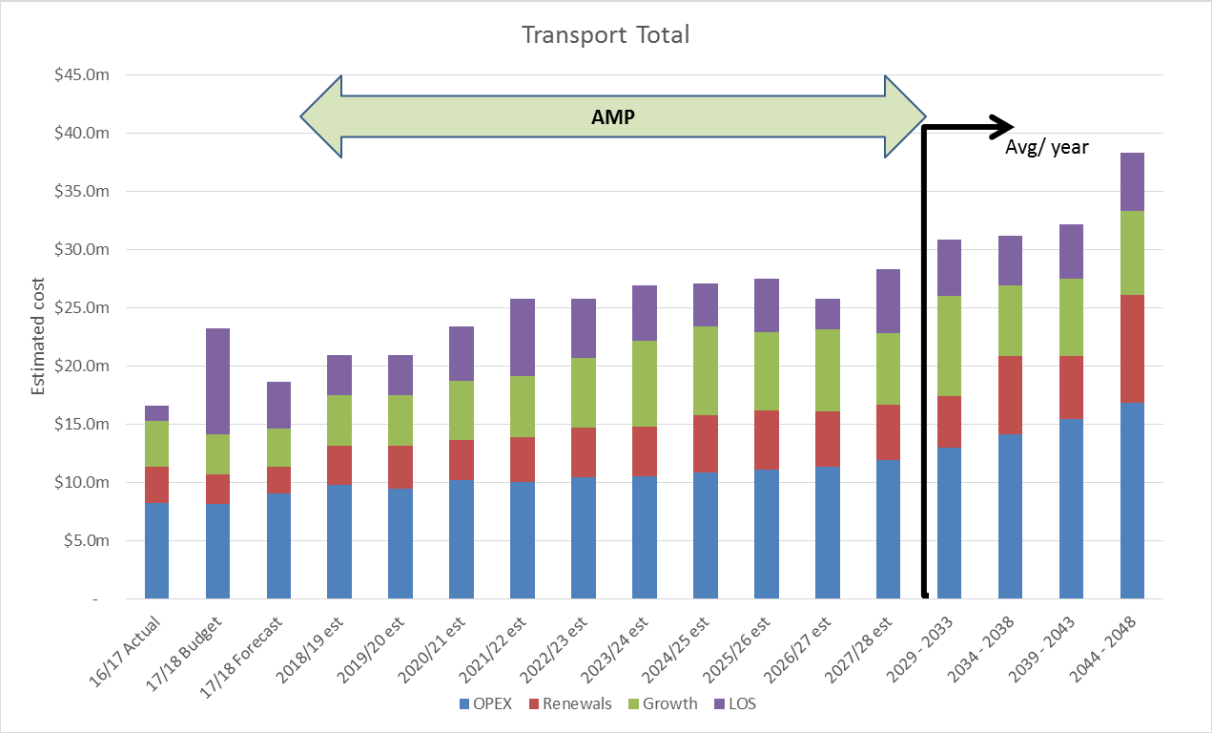
Summary table of significant projects and programmes

Activity	Project or Programme	CAPEX Cost Estimate	Estimated Timeframe	Issue Table Ref
Transport	Integration of the local network with transport solutions flowing from the Nelson Southern Link Investigation	$15M	2029-2031	T5
Wastewater	Atawhai Rising Main Renewal	$25M	2024-2031	WW2
Wastewater	Treatment Plant Renewals	$25M	2029+	n/a
Wastewater	Treatment Plant Protection	$25M	2043-48	WW3
Wastewater	Wet weather overflow mitigation programme	$25M	2018+	WW1
Water	Primary Clarifier	$25M	2023-2030	WS3
Water	Water Pipe Renewal Programme	$95M	2018+	WS1/4
Stormwater	Extend Piped Open Channel Network	$120M	2029+	SW2
Flood Protection	Urban Streams Flood Mgmt and Enhancement Programme	$100M	2029+	SW1

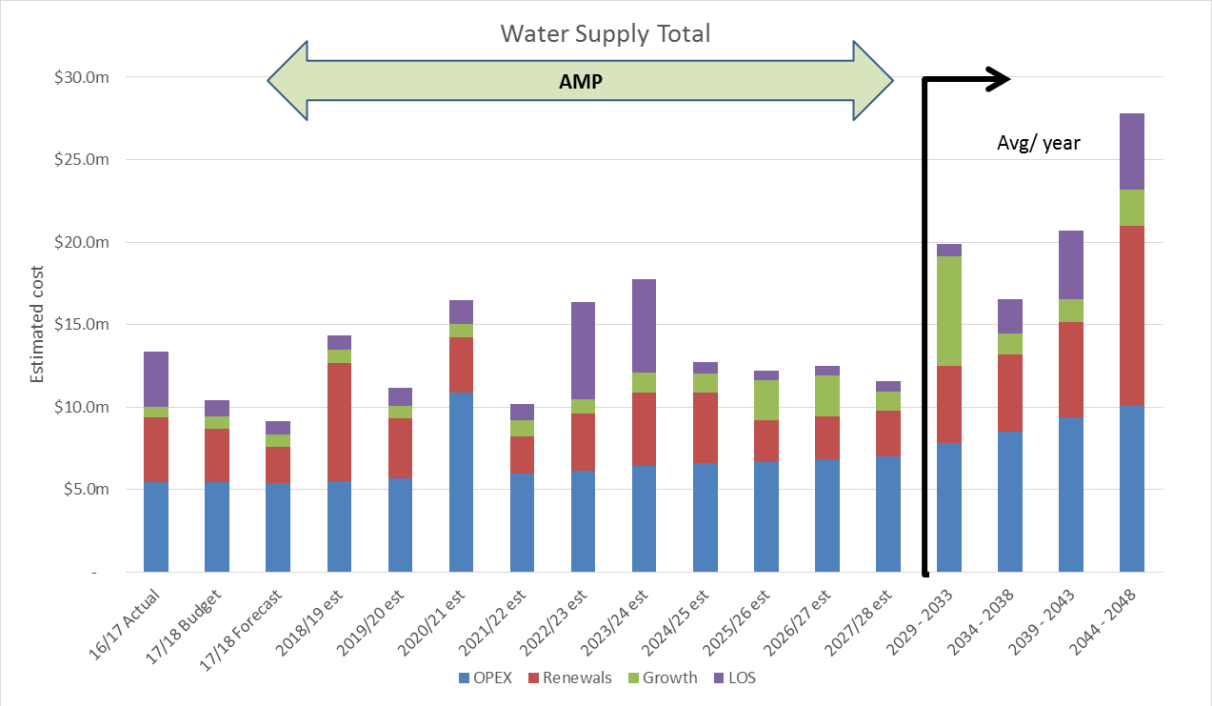
[7] Forecasts of Price Level Change Adjustors – 2017 Update (Sep17). Ref: A1836024

Activity Estimates

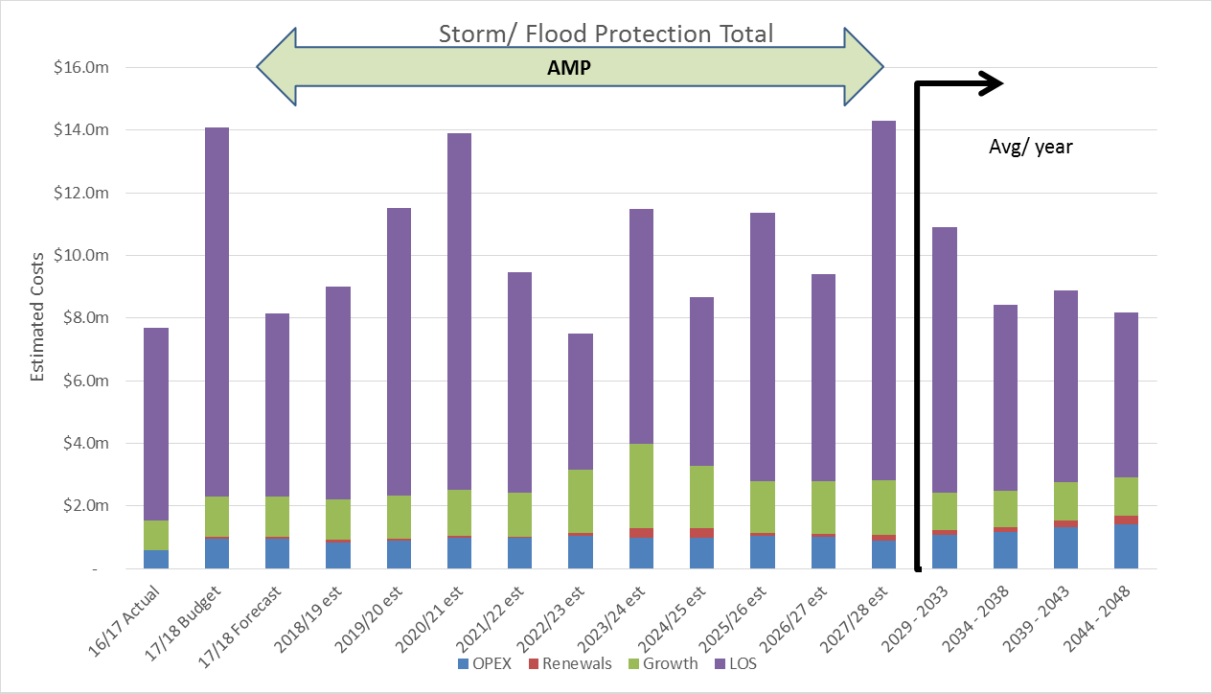
Transport



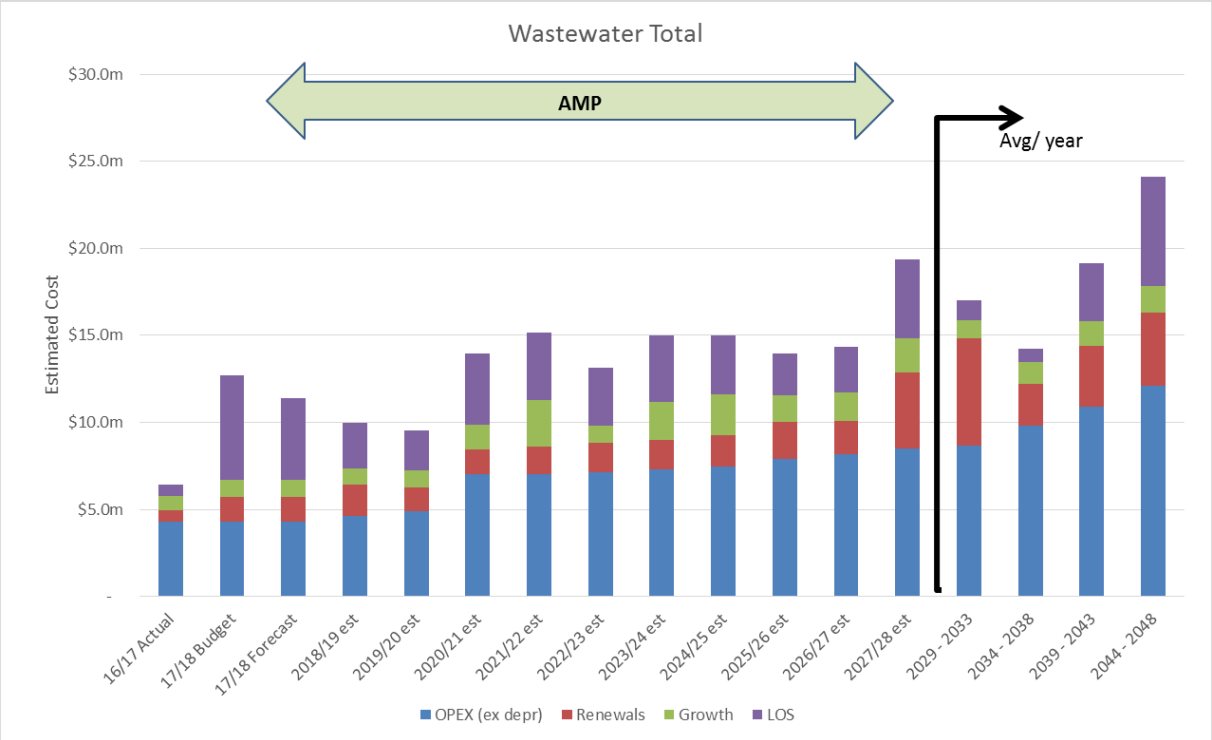
Water Supply



Stormwater and Flood Protection



Wastewater



PART TWO — ASSUMPTIONS AND RISKS

Infrastructure

It is assumed that the service delivery strategy will be sustained for the term of the strategy, where Council manages maintenance, renewal and asset replacement through an internal business unit and hires specialist consultants and contractors as required.

Transport

Assumption	Risk	Impact
Customer happy with existing service levels given the rate impact	Increasing standards / expectations of services	Significant LOS changes and cost implications would be consulted with the community.
Technological change is managed pragmatically and significant changes managed during subsequent AMPs	High – technology is fast moving and new initiatives need to be considered	Whole of life cost savings could be realised depending on the initiative. Significant LOS changes would be consulted with the community.
Heavy commercial vehicle movements don't deviate significantly more than planned	Growth is higher than expected	Increased loading from Heavy Commercial Vehicles resulting in rapid and not forecast pavement failures
Retaining walls on road reserves not built by Council are privately owned	Not formally defined retaining wall ownership and	Extra funding required to cover repairs and renewal of private assets

Water Supply

Assumption	Risk	Impact
No significant legislative changes affecting current water supply services	Low - Havelock North Drinking-Water Inquiry may lead to a nationwide or region-wide approach to water supply services.	Additional projects and funding required to meet standards
Tasman District Council will continue to supply the Wakatu Industrial Estate and Champion Road area.	Med - TDC is likely to be dependent on the proposed Waimea Dam proceeding to provide sufficient water to supply areas in Nelson.	Council will have to make provision to supply those areas with water. Likely to reduce the drought security that the Maitai Dam provides.
Drought period demand does not exceed storage volume of the Maitai dam in the next 30 years	Medium. Impacts of climate change can reduce this drought security.	Water restrictions could become regular and increasing in severity.
No new high water demand industries establish in Nelson until water losses are reduced.	Low.	Processing industries are becoming more water conscious and are locating in areas with good reliable water supplies. Increasing fish processing at sea.
Water supply activity will continue to be funded from water charges.	Low.	Limited funding mechanisms.
Water conservation and the demand for water continues to primarily be managed through Council's water charging system.	Low.	Cost of water supply does influence water use.

Assumption	Risk	Impact
Waimea community dam (TDC) — It is currently not known whether this dam will go ahead or not. Nelson could be asked to contribute to this dam (total cost approximately $82.5 million — any possible Nelson contribution is not yet decided).	Med – monitoring progress	Capital works will be required to service areas in the city currently supplied by TDC. Drought security will be impacted.
Pipe lives are between 80 and 100 years depending on material and pressure. Critical assets lives (eg WTP membranes) have been assessed separately	Low - Significant variance in actual vs theoretical lives	Would require change to phasing of renewal plan

Wastewater

Assumption	Risk	Impact
Existing Atawhai Rising Main continues in operation until renewal	Med - more frequent breaks could necessitate earlier renewal	Would require change to programme and funding needs
Inflow and Infiltration initiatives reduce peak wet weather flows to 4 x average dry weather flows.	Low - Mitigation work slower than expected or doesn't produce expected results	Additional funding or phasing of programme

Stormwater and flood protection

Assumption	Risk	Impact
No **significant** effects on stormwater structures occur within the next ten years from climate change-induced sea level rise.	Low - However, such effects may arise in the longer term.	Any change could affect phasing of 10 year work programme
New stormwater reticulation will be designed for a 6.67%AEP event with roads and overland flow providing the secondary flow path for larger events.	Low - Existing LOS could change as events become more frequent	Any LOS change will be consulted and considered against affordability factors
New flood protection works will be designed using a more flexible risk based approach.	Low - Updated decision framework in progress	Changes to funding requirements & customer expectations

Council is required to identify all the significant forecasting assumptions and risk underlying the financial estimates. Assumptions are necessary to allow Council to plan for expenditure and costs over the next ten years. They are the best reasonable assessment made on the basis of currently available information.

Any assumptions that apply only to specific activities will be included in the discussion on that activity.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
Population growth The Nelson population is assumed to continue to grow based on the high series Statistics New Zealand projections. The population is expected to grow by 6,100 between 2018 and 2028 to 58,200. Population growth is expected to slow down over time, based on the assumptions that deaths will increase while births decrease slightly, and that migration rates also remain relatively constant.	That growth is higher than projected, putting pressure on Council services and infrastructure or that growth is lower than projected, putting pressure on ratepayers. Changes nationally may lead to changes in the rate of migration to or from Nelson, affecting population growth.	Low	Low	Council is careful when applying population growth estimates to its infrastructure planning, given the uncertainties, so that there is generally a good margin for error should growth outstrip projections. New infrastructure is also usually built for the medium to long term so there is the ability to draw on that future capacity if population growth is higher than projected. This limits the risk exposure.
Affordability – an ageing population Nelson's population is ageing, and the proportion of the population aged 65 years and over is projected to increase from 20% in 2018 to 27% in 2028. Conversely, the proportion of the population aged under 15 years is projected to decrease from 18% in 2018 to 16% in 2028. A growing pattern of "sunbelt" migration is attracting increasing numbers of over 65 year olds to the Top of the South, with all net future growth in Nelson projected to be within that age group. As the population ages, it is assumed that the proportion of our population on a fixed income will increase and that there will be a corresponding downwards pressure on rates increases. The ageing population will also require a different balance of services/facilities/activities which will lead to changes in spending patterns across Council activities.	The age profile could vary from forecast, with accelerated ageing putting pressure on certain services and/or facilities.		Medium	Risks can be mitigated by Council working with the community to prepare for these changes and appropriately modifying investments in assets and provision of services to maintain rates affordability.
Affordability – the economy The Nelson Tasman economy has generally experienced slower growth than the national average over the last five years. However more recently the	A less well performing regional economy may increase affordability issues in the community with some		Medium	A focus on affordability and support for initiatives such as the work of the Nelson Regional Development Agency

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
region has seen strong growth in tourism, horticulture, viticulture, construction and retail sectors. It is assumed that the Nelson economy will continue to grow over the 10 year period, with stronger growth than the previous 10 year average expected for at least the first three years of the Long Term Plan 2018-28.	residents finding it more difficult to meet commitments, including rates.			combined with ongoing Council investment in maintaining Nelson's attractiveness as a destination for talent and investment can help to support the regional economy. It is also expected that rates of older adults remaining in the workforce will continue to rise improving incomes at older ages and mitigating against forecast workforce shortages.
Inflation/Price changes Council uses inflation forecasts from Business and Economic Research Limited (BERL) to estimate inflation over time. These figures were updated in October 2017, and are prepared specifically for Local Government. It is assumed that inflation rates are as predicted and modelled in budgets. Year ending CPI % BERL LGCI Opex % BERL LGCI Capex % BERL LGCI Total 30-Jun-19 1.8 2.0 2.0 2.0 30-Jun-20 1.6 2.0 2.2 2.2 30-Jun-21 1.6 2.2 2.2 2.2 30-Jun-22 1.7 2.2 2.2 2.2 30-Jun-23 1.7 2.3 2.3 2.3 30-Jun-24 1.8 2.3 2.4 2.3 30-Jun-25 1.8 2.4 2.4 2.4 30-Jun-26 1.9 2.5 2.5 2.5 30-Jun-27 1.9 2.5 2.6 2.6 30-Jun-28 2.0 2.6 2.7 2.7 2028-2048 2.4% - 20 year rolling average of 2007-2027 CPI = Consumer price index LGCI = Local government cost index Opex = Operating expenditure Capex = Capital expenditure	Inflation higher than expected, increasing costs for Council.		Medium	Likely to be some variation in actual rates of inflation from predictions and this will impact on the financial results of Council. Changing costs may mean the timing of projects needs to be adjusted. Council has relied on the current parameters the Reserve Bank is required to operate under in terms of inflation being held with the range of 1-3%.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
Capital project costs A competitive market means tenders are being received well above expectations. Assume that this escalation in prices will continue over the first 2-3 years of the Long Term Plan.	More expensive projects means less can be achieved in the capital works programme or upwards pressure on rates and debt.		High	Increased flexibility in the capital works programme around timing of projects could help mitigate this trend.
Interest rates In preparing the Long Term Plan Council has assumed the following interest rates: Year ending 30-Jun-19 4.36% 30-Jun-20 4.22% 30-Jun-21 4.19% 30-Jun-22 4.51% 30-Jun-23 4.61% 30-Jun-24 4.67% 30-Jun-25 4.71% 30-Jun-26 4.80% 30-Jun-27 4.88% 30-Jun-28 4.94%	Higher interest rates will increase costs for Council. Lower interest rates will decrease costs.		High	Interest rates used are based on advice from Price Waterhouse Coopers and includes the cost of both funds already borrowed and anticipated new debt at anticipated future interest rates. If actual interest rates are higher than the assumed rate, this cost would be rated for or future borrowing requirements adjusted. A degree of protection against fluctuating interest rates has been provided through the use of interest rate swaps. Council is also a member of the Local Government Funding Agency which provides access to loans at a lower rate than Council could obtain directly from banks.
Useful lives of significant assets It is assumed that there will be no reassessment of the useful lives of assets during the ten year period covered by this plan. The detail of useful lives for each asset category is covered in the Statement of Accounting Policies.	Assets wearing out earlier than predicted and funding needs to be found for replacements.		Low	This may result in changes needing to be made to the underlying capital expenditure programme.
Vested Assets Vested Assets are engineering assets such as roads, sewers and water mains, paid for by developers and vested to Council on completion of the subdivision. It is assumed that vested assets increase by $7million per year adjusted by inflation. Council assumes that the impact of vested assets will be neutral, in that the costs associated with the additional assets will be offset by a proportionate increase in rates revenue.	That Council will have more assets vested thereby increasing the depreciation expense in subsequent years that is not offset by a proportionate increase in rates revenue.		Low	Vested assets must be maintained by Council and depreciation provided for, therefore if growth is higher than forecast Council will need to increase its budget to maintain those assets. The impact of higher or lower growth is not considered significant.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
Insurance costs It has been assumed that insurance premiums continue at current levels plus inflation and that Council can get 100% of the cover it is required to hold (40% for infrastructure assets/60% covered by Central Government). It is also assumed that the 40/60% split continues.	Premiums increasing above inflation and/or Council cannot get 100% cover.		Medium	Any increase in premiums above the level assumed will have an impact on rates or the level of cover that Council adopts.
Accounting Policy Nelson City Council's accounting policy provides for its most significant asset classes (infrastructure assets and land, excluding land under roads) to be revalued with sufficient regularity that the carrying value does not differ materially from fair value. Infrastructure assets are revalued annually and land is reviewed annually and revalued at least every five years or if there is a material movement. For the purposes of this Long Term Plan, land revaluation is assumed to occur in years 2, 5, and 8. Council's investment property is revalued annually in accordance with generally accepted accounting practice. Revaluations have been based on the Business and Economic Research Ltd (BERL) forecasts of price level change adjusters and revaluation movements will be shown in the prospective Statement of Comprehensive Revenue and Expense.	Actual revaluation results differ significantly from those forecast in this Long Term Plan.		Medium	If the revaluations are different from those forecast it will affect fixed asset values and impact levels of depreciation expense and the rates funding requirement. Future Annual Plans and Long-term Plans will reflect the outcomes of actual revaluations.
Growth in rating units Further information on household growth will be provided by Statistics New Zealand later this year and will be combined with data on building and resource consents to update this assumption.				
NZ Transport Agency funding NZTA will provide an update to this assumption before the Long Term Plan is finalised.				
Loan arrangements It is assumed that Council's bankers will continue to renew the existing loan facilities.	Access to committed loan facilities less than expected.		Low	The Local Government Funding Agency should allow Council to diversify funding sources away from the local banks as well as being able to borrow for longer terms.
Co-funding arrangements It is assumed that for projects where other partners are contributing part of the funding, this funding will still be available.	Partners will no longer be in a position to provide funding which will result in an increased level of input from Council, or the termination of the project.		Medium	Viability of projects would be threatened and Council would need to consider its ongoing funding commitment.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
It is assumed that where Council could be eligible for Government funding (e.g. Housing Infrastructure Fund, Tourism Infrastructure Fund), Council will seek this funding.				
Development contributions It is assumed that Council will collect $18.9 million from development contributions during the ten years of the Long Term Plan 2018-28.	The level of development contributions collected and the timing could results in insufficient income to cover the costs of required growth infrastructure.		Medium	Costs for infrastructure would need to be met from other sources.
Sources of funds for the future replacement of assets It is assumed that funding for the replacement of existing assets will be obtained from the appropriate sources as detailed in Council's Revenue and Financing Policy.	That a particular funding source is unavailable.		Low	Depreciation is used to fund renewals and is funded mainly through rates and user charges. Should other sources of capital funding such as subsidies or development/financial contributions differ from levels forecast in a particular activity, Council is able to access borrowings through its central treasury function.
Relationship with iwi It is assumed that the staff resource allocated to work with iwi and Māori post Te Tau Ihu settlements will increase. Partnership with Te Tau Ihu iwi will necessitate a different way of working and it is important that Council understand iwi expectations and aspirations. To support this new way of working will require provision of training to relevant staff, increased emphasis on recognising Council responsibilities to Maori and iwi under relevant legislation, understanding opportunities for iwi investment in our region and may require changes to consultation processes to allow for sufficient engagement. In some instances, external assistance may need to be employed. Working with iwi will result in the need for additional time and resources to engage meaningfully on particular projects. Likewise changing engagement with iwi will have implications for governance time and resources.	Establishing ways of working with Māori requires greater Council resource than anticipated. May result in the need to build additional time into project timelines or delay project start dates.		Medium	The financial impact of dedicating resources to meet Treaty, settlement and legislated commitments may impact on rates and time may impact on project delivery rates.
Resource consents It is assumed that any resource consents held by Council due for renewal during the life of the plan will obtain consent. It is assumed, however, that the	Conditions of resource consents altered and significant new		Medium	Budgets are in place for resource consents and it is assumed consents can be obtained.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
consents will be subject to a more rigorous process, given national direction in areas such as freshwater. Note that a new consent will be required for the Nelson Wastewater Treatment Plant in December 2024.	compliance costs or consents cannot be renewed as expected.			
Amalgamation Council's budgets for the Long Term Plan 2018-28 will be prepared assuming that Council will continue to be responsible only for the Nelson District through the term of the Long Term Plan and that there will be no amalgamation. However regional cooperation with Tasman District Council will continue to be a critical element in maximising benefits to the region, including through collaboration on projects such as the Regional Growth Programme.	A reorganisation process would require a significant amount of planning and consultation before an outcome was confirmed.		Medium	Amalgamation would require the Long Term Plans of both councils to be combined. Council will continue to work with Tasman District Council to develop shared services, where appropriate.
Climate change and natural hazards It is assumed that natural disasters may occur in the Nelson area during the life of the Long Term Plan. The frequency of some types of natural disaster eg flooding, may increase due to the impact of climate change. This has been the experience of recent years and is consistent with predictions of climate change impacts. Exposure of low lying land to the risk of inundation from sea level rise is another assumption related to climate change. Council relies on Ministry for Environment guidance in estimating sea level rise and reviews assumptions when the Ministry for the Environment releases updated guidelines. The Nelson Tasman Civil Defence Emergency Management Group Plan provides a regional risk assessment which illustrates the difference in our natural hazards, for example earthquakes (infrequent but high consequence) versus flooding (likely but less consequence).	Increased numbers or severity of events lead to increased costs for Council in both responding and building greater resilience into infrastructure.		High	A characteristic of the Nelson community is the concentration of lifelines infrastructure (roading network, port, airport, sewage treatment ponds etc) on low-lying areas. Council has been increasing its contributions to the Emergency Fund as one method of mitigating the risk of natural disasters. Another mitigation is the work identifying hazards in the draft Nelson Plan and advising affected landowners. There is also work to mitigate climate change contributors through investments in public transport, use of solar technology and maximising walking and cycling as modes of transport.
Government Policy Changes It is assumed that with the change in government there will be significant policy changes which will impact on the Council work programme. Changes to legislation impacting on local government are likely to take place during the period of the Long Term Plan. It is assumed that Central Government will work with councils to ensure that any legislative changes are managed appropriately and to ensure benefits from its commitment to partnership with the local government sector are realised.	Government policy shifts may be more significant than assumed or not allow reasonable implementation/transition.		Medium	Financial impact resulting from a need to respond to significant legislation and /or policy changes would impact on rates or fees and charges.

Forecasting assumption	Description of Risk	Likelihood of risk	Impact if assumption not correct	Mitigation
National Policy Statement for Urban Development Capacity (NPS-UDC) It is assumed that Council can meet the requirements of the National Policy Statement for Urban Development Capacity (NPS-UDC) which requires local authorities to ensure there is sufficient development capacity to meet demand in the urban environment in the short term (within 3 years), medium term (3-10 years) and long term (10-30 years)[8]. The Nelson Urban Area is currently classed as a medium growth area. This classification may change upon revisions to the NPS-UDC[9] definitions or to the Statistics New Zealand Urban Area population projections.	Meeting the requirements of the NPS-UDC may result in changes to timing of infrastructure projects. Growth classification may change.		Low	Nelson City and Tasman District Council are collaborating to ensure both can meet the requirements of the NPS-UDC.

A summary of the proposed Whakamahere Whakatu Nelson Plan provisions is included for context, as a draft version of this Plan will not be available for public and stakeholder feedback until later in 2018. This version of the infrastructure strategy has considered draft provisions to ensure alignment but recognises the 2021 strategy will need to be reviewed and update against the final Nelson Plan in case any gaps arise.

Draft Nelson Plan provisions

Natural hazards

The relevant provisions relate to fault hazard and liquefaction risks. Draft flood hazard, coastal inundation, coastal erosion and slope instability rules are not yet available for review.

The draft earthquake risk provisions in the Nelson Plan are as follows.

- Network utilities are to be included in the rules related to the fault rupture risk overlay, which is a change from the Nelson Resource Management Plan. That means 10m setback from fault traces is required.
- In other cases, installation of network utilities within the Fault Rupture Overlay will be a restricted discretionary activity.

[8] Short-term capacity must be feasible, zoned and serviced while long-term capacity must be feasible, with servicing planned but does not need to be zoned yet. Local authorities with a medium or high growth urban area also need to provide an additional margin of feasible development capacity over and above projected demand of at least: 20% in the short and medium term; and 15% in the long term.

[9] The Nelson Urban Area includes all of the area units of Nelson, except for Whangamoa and it also includes Area Units within Tasman District Council boundaries of Aniseed Hill, Hope, Best Island, Bell Island, Ranzau, Richmond West and Richmond West. Note that the Nelson Urban Area boundary is also under review.

The draft liquefaction provisions in the Nelson Plan are as follows.

- A liquefaction overlay area will be included in the plan.
- Network utilities within this overlay will be a permitted activity if a geotechnical report for the new activity or development has assessed the liquefaction hazard risk and provided recommendations on network utilities, and these recommendations have been met.
- In other cases, network utilities will be a discretionary activity, and discretion will be restricted to the proposed remediation or ability of the network utility design to mitigate the liquefaction risk.

The draft flood hazard provisions in the Nelson Plan are as follows.

- A high risk flood overlay will be mapped in the Plan, which identifies areas with more than 30cm or fast flowing water during a flood event with a 1% chance of happening in any one year (taking into account the effects of climate change by 2100).
- A general flood hazard overlay will also be mapped in the plan, for areas which are predicted to experience some flooding (less than 30cm and not involving fast flowing water) in a flood event with a 1% chance of happening in any one year (taking into account the effects of climate change by 2100).
- Subdivision, use and development is to be avoided in greenfield areas within the High Flood Hazard Overlay.
- Controls on development apply in existing urban areas, with both types of flood hazard overlay. The controls include minimum floor levels, building design and earthworks.

Growth in demand

The draft Regional Policy Statement will also include growth and servicing targets as required by the National Policy Statement on Urban Development Capacity (NPS-UDC). These have not yet been drafted.

The following method in the draft Regional Policy Statement part of the draft Nelson Plan will need to be taken into account in the 2021 infrastructure strategy.

“Adopt a 30 Year Infrastructure Strategy that identifies the following on maps, including provision for a regular update mechanism:
- growth and redevelopment areas that have sufficient existing infrastructure capacity
- growth and redevelopment areas that do not have sufficient infrastructure strategy to support growth
- growth and redevelopment areas that are provided with infrastructure by Tasman District Council solely or jointly with Nelson City Council
- infrastructure and networks that are subject to hazards risk (high, medium and low).”

The draft RPS also includes these methods:

- undertake a project to investigate existing infrastructure capacity across the city, starting with centres and other identified intensification areas
- undertake a prioritisation exercise for the roll out of infrastructure to growth areas and make this publicly available.

The draft RPS anticipates that information on the existing capacity of infrastructure networks will be publicly available and used by developers to inform the timing and location of development/growth. This requires a capacity analysis of transport, water, stormwater and wastewater networks to be completed and outlined in the 30 Year Infrastructure Strategy.

Environmental outcomes

The relevant provisions relate to stormwater discharges, treated and untreated wastewater discharges, low impact design requirements (through the LDM) and activities in the beds of rivers (through the draft code of practice).

Note these are draft provisions only, and are subject to change.

- Under Policy RP.1.27 of the draft Nelson Plan, reviews of consents to coincide with the common catchment expiry dates — this may have significant implications for water supply abstraction and stormwater discharges.

- Under draft Regional Plan Policy RP.1.6 where overflow discharge to surface water from a community wastewater network is unavoidable, require the network to be managed in accordance with an overflow mitigation plan.

- Policy RP.1.12 of the draft Nelson Plan is to require community stormwater networks to be sized to accommodate the probable maximum stormwater volume from the network catchment, having regard to planned development intensity and reasonably foreseeable areas of impervious surfaces.

The Council's global consent for work in rivers expires when the Nelson Plan becomes operative. The intention is for this to be replaced by the 'Code of Practice for Activities in the Beds of Rivers' to be an externally referenced document to the Nelson Plan, linked to a permitted activity rule. The Code of Practice consists of best practice, followed by permitted activity standards. Other bed disturbance by NCC would be a discretionary activity.