Horizons Regional Council

Infrastructure Strategy
2018 – 2048

Flood Protection

and

Land Drainage Assets

Executive Summary

Horizons Regional Council manages flood protection and land drainage assets across the Region that are essential in reducing risks to communities associated with flood hazards, enabling and protecting economic productivity, and contributing to community wellbeing.

The assets and schemes that they make up have been developed since catchment board establishment in the 1940s (and in some cases pre-dating catchment boards) and primarily consist of stopbanks, bank protection works (such as rock lining and tied tree works), detention dams, pump stations and floodgates across 35 river and drainage schemes. Collectively, the schemes manage approximately 1,270 km of river channel and provide flooding and/or erosion benefits to approximately 750 km^2 of land. In addition, approximately 550 km^2 of productive land receives drainage benefits from an extensive network of drains and pump stations.

This Infrastructure Strategy outlines Council's approach to managing and maintaining these assets over the next 30 years, which is crucial to supporting Horizons' vision of being an organisation recognised for its expertise, innovation, science and leadership in making the Region a great place to live, work and play. Council's approach to infrastructure management is guided by the following overarching principles:

- Levels of service provided to communities through schemes and other measures are fit for purpose;
- The reliance that good renewal and replacement decision-making has on both optimised decision-making and good data;
- Funding models have at their core equity, simplicity, flexibility and sustainability;
- Ensuring an emphasis on reliability and resilience;
- Being responsive to the demands for higher levels of service or new works/services;
- Ensuring everything we do considers both the effects of climate change and the inherent variability of the Region's climate; and
- Residual risks are adequately managed and clearly communicated to those potentially affected.

The following significant issues regarding the management of Council's flood protection and land drainage assets have been identified:

- Future population growth in urban centres;
- The need to prioritise operational effectiveness and reliability;
- Climate change; and
- Sedimentation effects on levels of service.

Strategies and actions have been identified in relation to these issues. All involve a mix of continuing current asset management practice and policy in combination with the requirement for specific steps to be taken and the roll-out of new initiatives (refer to Section 3).

1 Purpose of the Infrastructure Strategy

Horizons Regional Council manages flood protection and land drainage assets across the Region with a replacement value of approximately $467 million. Those assets and the wide array of other activities provide services to the Region that are essential in managing risks associated with natural hazards, enabling economic productivity and providing for community wellbeing, outcomes that are essential components to Horizons' vision of making the Region a great place to live, work and play. Consequently it is important that these assets are managed in a way that ensures that the required outcomes and levels of service[1] are delivered in the most cost-effective manner to present and future generations.

This strategy updates the existing 30-year Infrastructure Strategy for Horizons Regional Council (February 2015).

The purpose of the Infrastructure Strategy is to:

- Identify the likely key drivers of change;
- Consider and assess the range of effective responses to those drivers;
- Identify a preferred way to respond;
- Outline the potential service and financial implications of those responses; and
- Outline these implications, the assumptions made and the level of long-term investment required to respond.

1.1 Scope

This strategy has been prepared for the flood protection and control works infrastructure as required under Local Government Act 2002, section 101B 6(a)(iv). It covers the following infrastructural assets:

- Flood protection schemes;
- Land drainage schemes; and
- River control (noting that some activities under this category, such as the clearance of willows from river and stream channels, do not involve the creation or maintenance of an asset).

See section 2.4 for more detail on the river management schemes in the Region.

1.2 Statutory requirements

In August 2014 the Local Government Act (LGA) 2002 Amendment Act 2014 introduced a new requirement for infrastructure strategies and asset management planning. The Act includes provisions that require councils to prepare an infrastructure strategy for at least a 30-year period, and to incorporate this into long-term plans from 2015.

In complying with the Act, Council has outlined how it intends to manage its infrastructure assets, taking into account the need to:

- Renew or replace existing assets;
- Respond to growth or decline in the demand for services reliant on those assets;
- Allow for planned increases or decreases in levels of service provided through those assets;
- Maintain or improve public health and environmental outcomes or mitigate adverse effects on them; and

[1] 'Level of Service' means the defined service quality for a particular activity (eg. roading or flood protection) or service area (eg. catchment or sub-catchment) against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental acceptability and cost.

- Provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provision for those risks.

The legislative requirements for infrastructure strategies are set out in Appendix A.

2 Regional Context

2.1 Geographic and historical context

The Horizons Region extends from the Ruapehu District in the north to Horowhenua in the south, and from the Whanganui District in west to the Tararua District in the east.

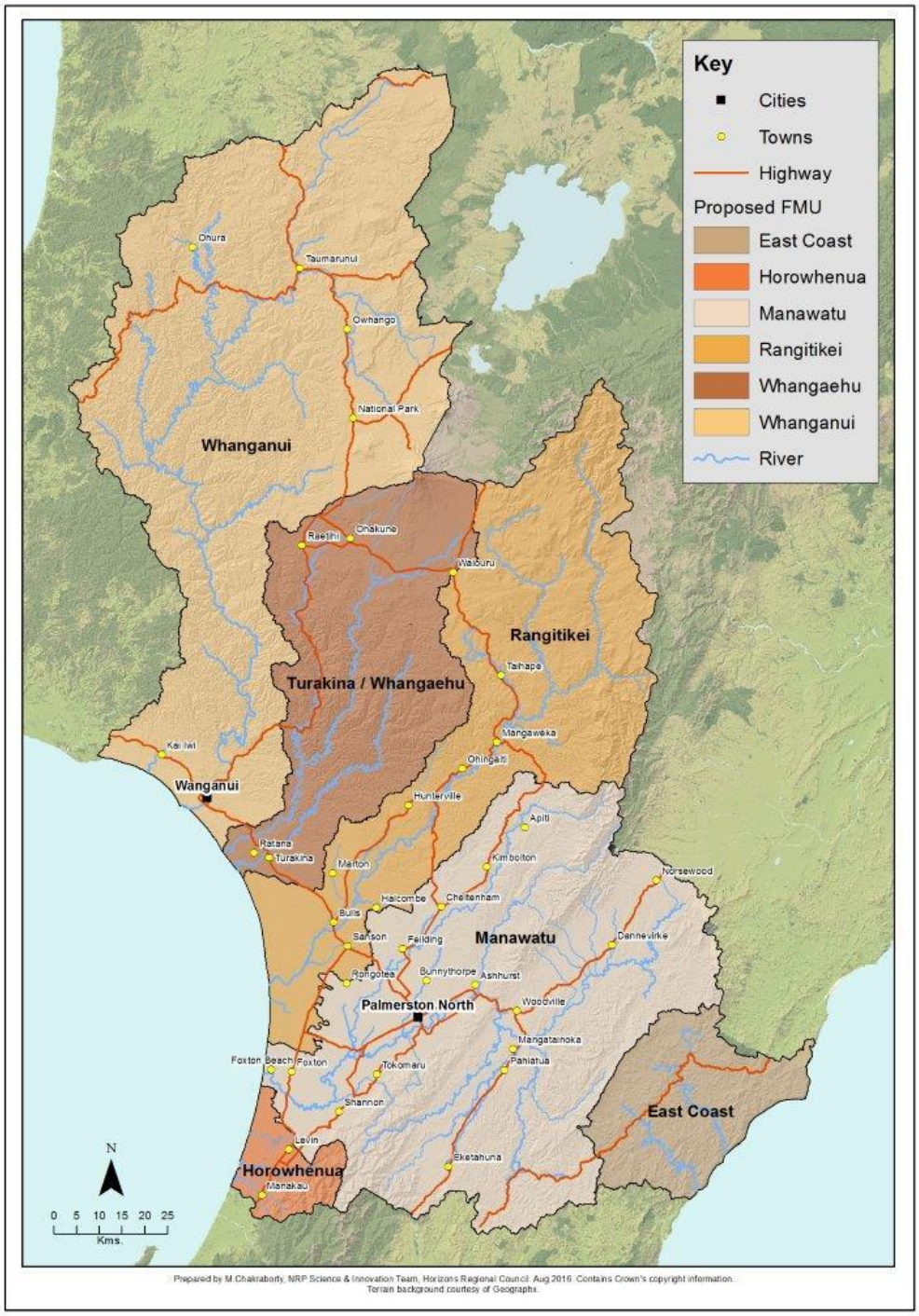
The Region has seven territorial authorities, which are:

- Ruapehu District Council;
- Whanganui District Council;
- Rangitīkei District Council;
- Manawatū District Council;
- Palmerston North City Council;
- Tararua District Council;
- Horowhenua District Council;
- Part of Waitomo/ Stratford District Councils; and
- Part of Taupō District Council.

The Horizons Region comprises six primary catchments (defined as freshwater management units) covering over 2.2 million hectares. The freshwater management units are shown in Figure 1.

Note that Figures 2 and 4 are projections made by the New Zealand Institute of Economic Research (NZIER), work specifically commissioned by Horizons in 2017 for the Infrastructure Strategy update. Neither figure includes the part of the Region that lies within the Taupō District Council as this part of the Region is not inhabited.

Figure 1: Freshwater management units in the Horizons Region



Council has developed schemes in these catchments over the last 50 to 60 years for flood control and river management that:

- Reduce risks to communities from natural events;
- Protect and enhance the economic productivity of the Region; and
- Contribute to community wellbeing.

Infrastructure to provide these services predominantly consists of stopbanks, rock linings, tied tree work, detention dams, pump stations and floodgates, with a replacement value estimated at $467 million. The early schemes (those developed between the 1940s and the late 1980s) received substantial Central Government funding assistance. After that time communities at a

local and regional level have been left to fund operating costs. Moreover, provision was not made until the late 1990s for the replacement of assets with fixed lives, adding a considerable burden on current (and future) ratepayers.

Table 1 provides an overview of the flood protection and river management assets that Council is responsible for.

Table 1: Catchment asset summary

Zone	**Area** (000 ha)	**Assets**				**Replacement Value** (All Assets)
Whanganui	761	12.56	1.00	5.00	8.18	$13,557,718
Turakina/Whangaehu	295	7.16	0.00	2.00	8.79	$2,866,649
Rangitikei	426	19.91	1.00	45.00	40.21	$61,327,656
Manawatu	712	436.54	23.00	1.00	958.82	$375,266,111
Horowhenua	39	12.69	0.00	0.00	91.39	$13,726,378
TOTAL	**2,233**	488.86	25.00	53.00	1107.39	**$466,744,512**

STOPBANKS (km) PUMPSTATIONS (no.) DETENTION DAMS (no.) DRAINAGE CHANNELS (km)

The most formative event for river management occurred in February 2004 when a severe storm impacted much of the lower North Island. That event caused widespread flooding in the Region and led to some major shifts in organisational approach to flood management and erosion control in the Region. Although an upgrade of Palmerston North's flood defences had started in the 1990s, that event proved the catalyst for a further increase in the standard of flood protection for the city.

In addition, the 2004 flood led to a 12-year capital expenditure programme known as the Rural Upgrade Project, raising Lower Manawatū Scheme stopbanks outside Palmerston North to achieve a consistent 100-year return period containment standard. A similar capital works programme was initiated to lift the protection standard of the Rangitīkei River stopbank network, a relatively lengthy programme with modest annual capital expenditure to accommodate the Rangitīkei River Scheme's financial circumstances and modest ratepayer base.

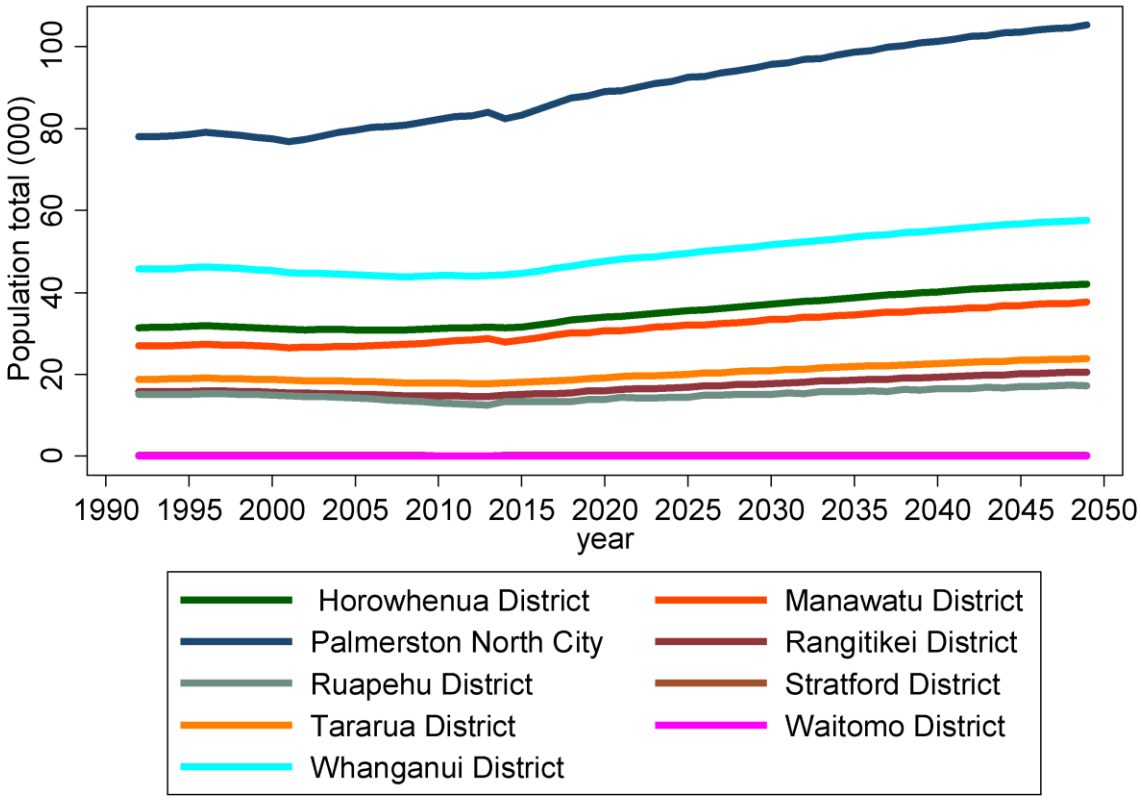
As well as generating extreme flood flows, the 2004 storm also caused widespread hill country erosion, resulting in the deposition of large quantities of silt and soil on river berms, further exacerbating flooding hazard. Horizons' response was the establishment of the Sustainable Land Use Initiative (SLUI) programme to enhance the stability of erosion-prone hill country land through the production of farm plans, grants for afforestation and other measures.

As a result of Treaty settlements in recent years, iwi are now taking a much more active role in the management of rivers and their catchments in the Region. There are now three different co-management regimes in the Region: in the Whanganui, Whangaehu and Manawatū catchments. While the form that co-management takes varies in each case, in all cases there will be increased participation of iwi in decision-making on waterways management, including flood protection.

2.2 Demographic context

The population of the Region is projected to grow steadily over the next decades – to over 300,000 by 2050 (by an average of about 0.9 per cent annually). However, this growth will not be distributed evenly over the Region. As shown in Figure 2, Palmerston North will see the strongest growth, followed by the Whanganui, Manawatū and Horowhenua Districts.

Figure 2: Projected population growth across the Region



Accompanying these projected changes, the populations of towns such as Marton, Whanganui and Taumarunui are projected to continue to age, with a corresponding increase in the proportion of residents on fixed/retirement incomes. This poses challenges for funding the renewal, expansion or upgrade of infrastructure through rates. Although this challenge rests predominantly with district and city councils, due to their much broader infrastructure responsibilities and proportionately larger rate requirements, it is also something that Horizons needs to be cognisant of in respect to river management infrastructure.

In developing this strategy it is important to consider population projections as they can give insight into future challenges such as:

1) Where development pressures may be expected in order to accommodate population growth. This results in a need to liaise and collaborate with the relevant territorial authorities to ensure that growth is appropriately located and that infrastructure needs and pressures are understood and planned for, well in advance; and
2) Declining populations have the potential to signal long-term affordability issues. Understanding affordability and sustainability issues will support key decisions about infrastructure renewals.

While population is an important consideration, the demand for and management of river management assets is also driven by:

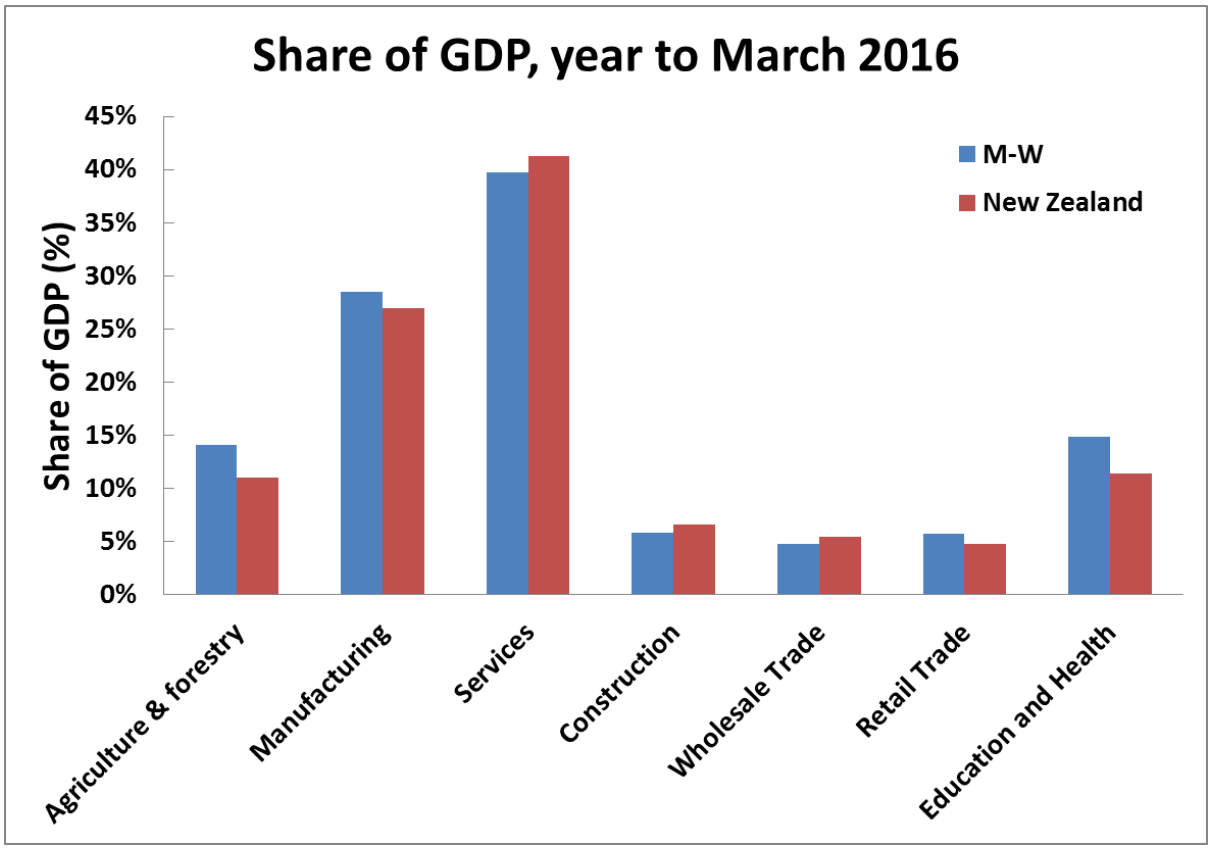
- Location of growth/land use change – for example, growth outside areas prone to flooding or poor drainage is unlikely to drive the need for additional flood protection or land drainage infrastructure. However, increasing urbanisation may have an impact on the requirement for those types of infrastructure as increasing the amount of impervious surface may exacerbate existing flood issues;
- Tourism and recreational use – ensuring that both visitors and the Region's communities continue to be able to enjoy the mixture of environments that Horizons has to offer; and
- Connections with other key infrastructure, such as transportation networks, which are crucial to both the Region and country as a whole.

All of these drivers have a relationship to flood protection and river management assets services.

2.3 Economic context

The Region generated $9.6 billion of gross domestic product (GDP) in the year to March 2016, 3.8 per cent of New Zealand's total GDP.[2] The Region's GDP has grown by an average of 4.6 per cent since 2001, compared to 5.9 per cent for New Zealand as a whole.

Figure 3: Sector shares of regional GDP



Source: Statistics New Zealand

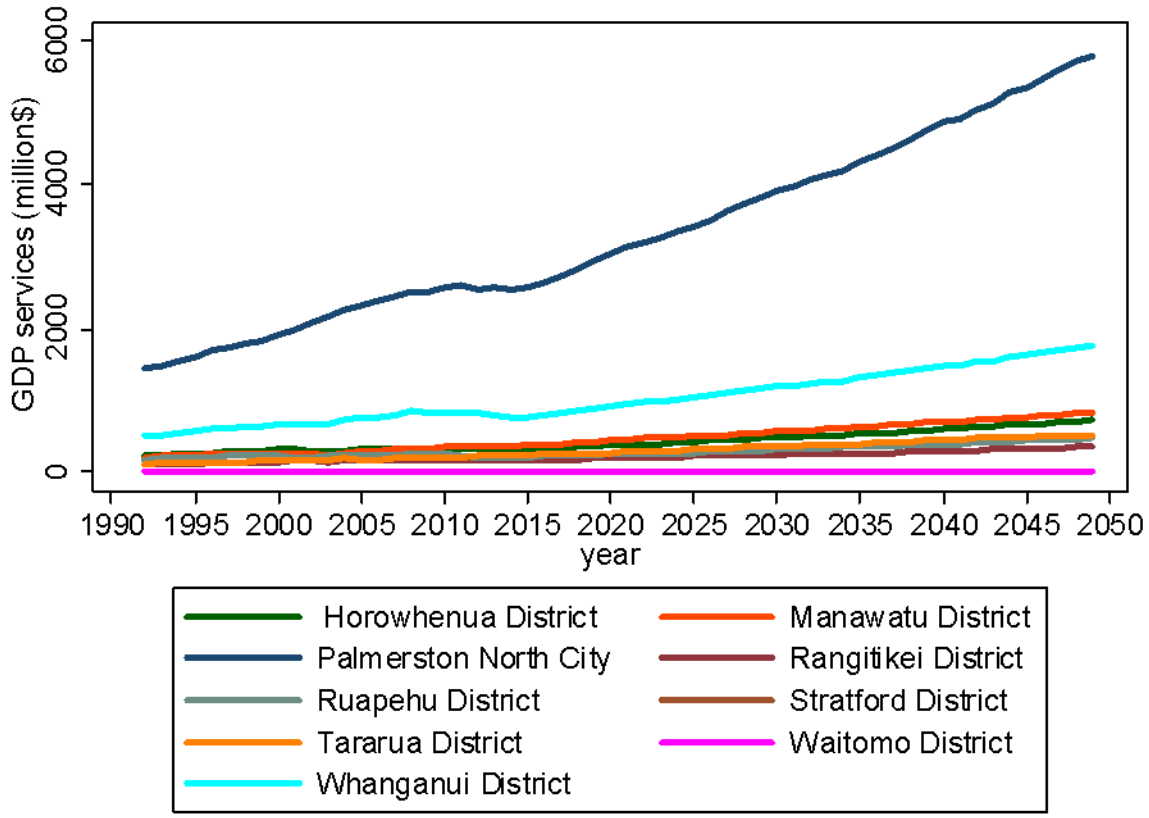
Regional GDP per capita in March 2016 was $40,645, around three-quarters of the national average. This is the third-lowest of the regions, ahead of Gisborne and Northland. This

[2] Latest available official data.

comparatively low GDP per capita is primarily due to the composition of the regional economy, which tends towards relatively lower-wage occupations in the agriculture, retail, construction, health and education sectors.

NZIER projections suggest that the Region's economy will grow to $15 billion in 2050, from $8 billion in 2016.[3] It also projects a structural shift in the regional economy, a continued strengthening to the services sector, and a diminution of the manufacturing sector, (with the primary sector remaining steady in terms of its contribution to the regional economy). This structural shift is likely to have land use and zoning implications across the Horizons region.

Figure 4: Projected economic growth in the Region



Future challenges for the Region will relate to two key trends evident globally: demographic change and urbanisation. The Region's population is ageing, which places greater pressure on the working age population to generate income, and families and workers will continue to move from rural regions to the larger population centres such as Palmerston North and Whanganui. This will pose challenges for infrastructure funding, both in terms of spreading rural infrastructure costs over a smaller ratings base, and ensuring infrastructure keeps up with population growth in city centres.

The services provided by the flood protection and land drainage schemes have a variety of quantifiable benefits that contribute to the Region's economy, including:

- Protection of land and property, which reduces associated potential damage and increases the value of the land;
- Improving the productivity of land, which adds value to the regional economy;

[3] NZIER presentation to Horizons, June 2017.

- Protection of regionally and nationally important infrastructure associated with activities such as transport (eg. roads including state highways and rail) and electricity transmission; and
- Avoided costs from flood damage that would otherwise result if the schemes were not in place (or maintained to the necessary standard).

2.4 Regional infrastructure

Horizons Regional Council undertakes a wide range of river management activities across the Region covering three broad categories of flood protection, river control and land drainage. Much of the flood protection activity is concentrated in the lower Manawatū floodplain, utilising stopbanking to provide a range of service levels that are context-dependent. Horizons also inherited from predecessor catchment boards 53 detention dams, mainly clustered around the towns of Hunterville and Marton.

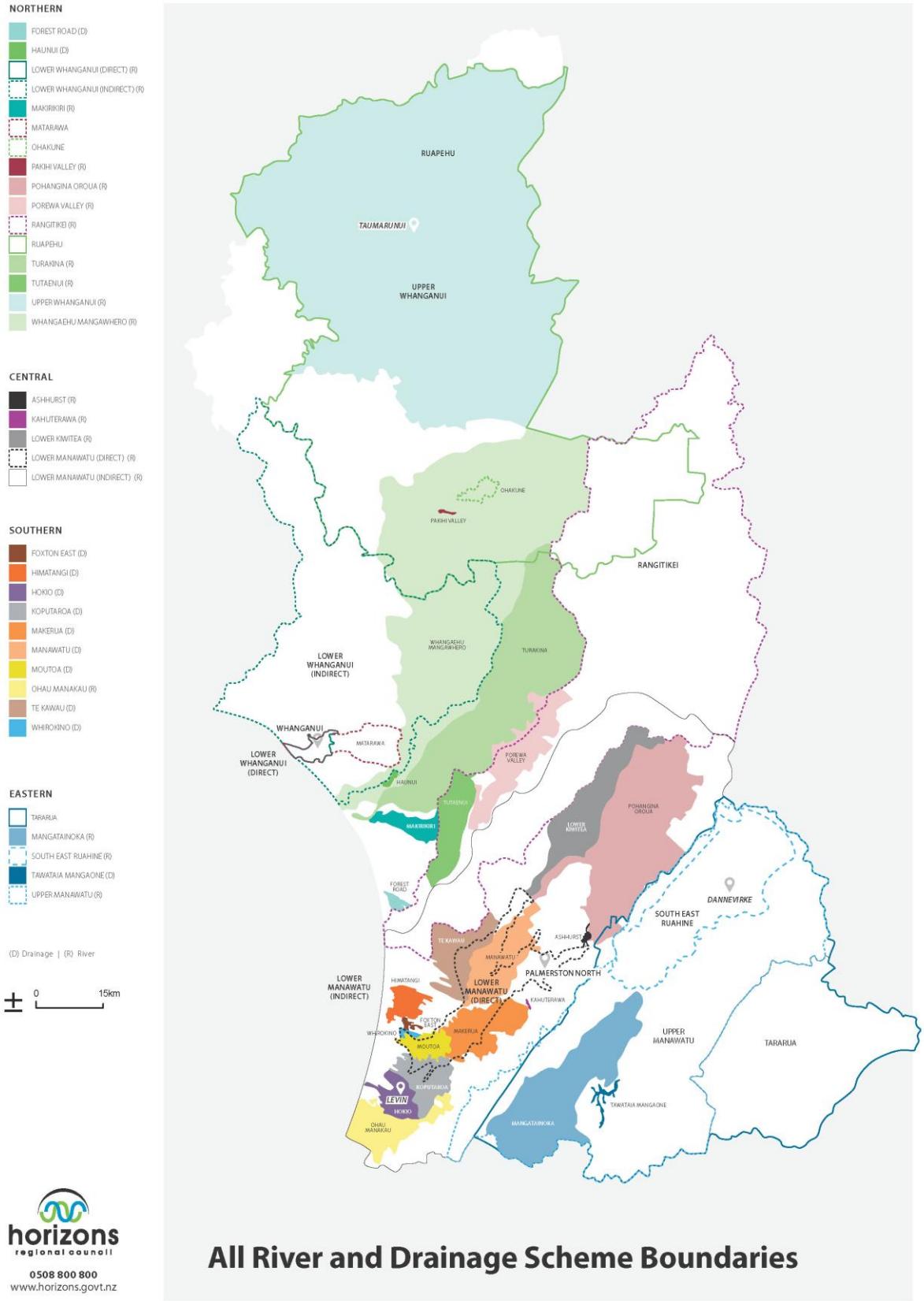
River control activities are the group of activities that seek to either regulate or control the alignment of a given reach of river and/or manage willow congestion and debris blockages. Alignment regulation has a range of purposes, in some cases undertaken solely to ensure that the integrity of flood protection infrastructure (mainly stopbanks) is not compromised. Schemes such as the Rangitīkei and South-East Ruahine Schemes are also designed to minimise the loss of productive land to river erosion. Other schemes, such as the Whangaehu, Eastern Manawatū and Taringamotu, were solely established to manage willow congestion and flood debris.

Land drainage is the third broad activity group, with 11 schemes solely or mainly focussed on the provision of land drainage and all schemes encompassing rural land. Urban drainage (stormwater management) is the responsibility of territorial local authorities, although in some contexts (eg. Foxton) precisely delineating that responsibility is not possible. Some of the land drainage schemes in the Region have the sole purpose of maintaining an open drain network (ie. gravity drainage schemes). Others have more complex operations and maintenance activity; most lower Manawatū networks require some form of pumping to provide an adequate level of service. Approximately 55,000 hectares of productive land receives drainage benefits from extensive gravity and pumped drainage infrastructure.

The river management schemes that Horizons administers (which encompass both flood prevention and/or river control functions) cover approximately 1,270 km of river channel, providing flood control and/or erosion mitigation benefits to approximately 750 km^2 of land plus 25 townships, including the major urban areas of Palmerston North, Whanganui, Taumarunui, Feilding and Marton.

Figure 5 below shows the location of each of the 35 schemes. Seven of these schemes have been established solely to address vegetation management issues and as such have no infrastructure assets. It is the remaining 28 schemes that are the subject of this Infrastructure Strategy.

Figure 5: Location of river management schemes in the Horizons Region



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3 Significant Infrastructure Issues over the Next 30 Years

This section summarises the significant infrastructure issues facing the Horizons Regional Council over the next 30 years, the potential consequence of these issues and the Council's proposed approach to managing the issues. The section also outlines alternative approaches and their implications.

The significant issues identified are as follows:

- Future population growth in urban centres;
- The need to prioritise operational effectiveness and reliability;
- Climate change; and
- Sedimentation effects on levels of service.

Identifying those issues as significant relies on a number of assumptions. Those include assuming that the strong growth the Region is currently experiencing will continue; expert advice obtained (summarised in Section 2) suggests that this is likely to be the case. Another key assumption relates to the physical environment, specifically whether climate change effects will be manifest at the rate that current scientific consensus suggests. Clearly Horizons has little alternative but to assume that this will be the case. The third related assumption is that climate variability (more specifically the frequency with which storms will impact the Region) over the next 30 years will generally follow the patterns that have taken place over the last 30 years, excepting the February 2004 event (an event regarded as atypical for the Region).

In all of those identified areas the likelihood of the Region experiencing something different to what has been assumed is difficult to quantify. Each assumption is a function of very complex processes limiting any meaningful quantification around the chance of them not eventuating. One consequence of the Region growing more quickly or slowly (or in a different way spatially than assumed) is the linkage between scheme activities/levels of service and the needs of the communities they serve; the divergence between the two will either occur more rapidly or more slowly as a result. In that instance the treatment strategy is to reassess regularly the scheme review programme to maintain that service delivery alignment.

Should climate change effects be manifest at a rate slower than current scientific consensus, the adaptation required by Horizons is fairly elementary. A more rapid rate of change would seem to be both more likely and more challenging; the timescales are however sufficiently large that the three-yearly updates to this strategy will allow for any required realignment. Uncertainties around effects at a regional scale combined with (in some cases) significant cost implications make it prudent for Horizons not to be overly pre-emptive in this area.

3.1 Future population growth in urban centres

3.1.1 Issue

As outlined, Horizons' population is projected to grow by a third to over 300,000 by 2050. Most of this growth will be concentrated in Palmerston North, Feilding, Horowhenua and Whanganui, necessitating the expansion of residential areas in these centres. In some instances, this could have flood protection implications. A better understanding is needed of the likely distribution of this growth and what additional demands this will place on river management infrastructure. Further engagement with territorial authorities is required to plan for future needs.

This growth in population combined with improvements in transportation links for the southern part of the Region, and in particular the Horowhenua District, is also likely to see some acceleration of land use change outside urban areas. Some of the southern river management

schemes, particularly the area encompassed by the Ohau-Manakau Scheme, have already seen land use changes, with the rate of future change likely to accelerate as transport links to the Kapiti Coast and Wellington continue to improve.

3.1.2 Response strategy

Some of the response strategy to his issue is already embedded in Council's Long-term Plan - provision made around improvement to the Reid Line floodway and for additional drainage infrastructure for Foxton. We are working more closely with territorial authorities to gain a more comprehensive understanding of the anticipated extent and distribution of urban growth. We can then assess the hazards for those areas and determine what mitigation might be appropriate. This will enable territorial authorities to make informed decisions about where to enable growth, and enable the Council to incorporate future needs into the design of our flood management network. Subject to further discussion and agreement with the relevant territorial authorities, this may lead into development of a sub-regional spatial plan, outlining our joint strategy for urban growth, land use, infrastructure development and hazard management.

The main body of Horizons' Long–term Plan contains a summary programme that, amongst other things, outlines the timing of the various scheme reviews planned over the next 10 years (costing approximately $400k). One of the primary drivers for the timing identified in that schedule is the need for service delivery to remain aligned with the needs of the community, of which land use is a significant influencing factor. Reviews such as that planned for the Ohau-Manakau Scheme will consider (amongst other things) how changing land use is likely to change the community and the services the community requires.

3.1.3 Alternatives

The alternative is to take a more reactive approach to future growth, ie. improve or extend the flood management network once the development is underway and we are certain of its extent and nature. However, planning, designing, funding and constructing infrastructure improvements takes time; this alternative approach may consequently expose communities to an unacceptably high level of risk in the interim period before adequate flood protection is in place.

3.2 The need to prioritise operational effectiveness and reliability

3.2.1 Issue

Much of the traditional focus in defining levels of service for flood protection and land drainage activities has been to reference network capacity against a maximum containment standard. This is the maximum flood size the network is capable of containing without overtopping, commonly expressed in the form of 'return period', a measure that takes little account of network reliability.

Reliability in this context is the ability of the network to contain and convey flood flows with minimal failures, encompassing both operation up to the maximum containment level and also performance beyond that point (eg. that a section of stopbank maintains its structural integrity when overtopped by floodwaters). Defining reliability standards for a network in continuous operation, such as a water supply network, is relatively simple – it could be determined by the number of breakages per year. Defining reliability standards for stopbank networks is a much more complex exercise, a function of the long timescales involved (many years can elapse between flood events that 'tax' flood defences) and the wide range of factors that influence operating reliability (reflected in the wide range of failure modes).

The flooding of Edgecumbe in 2017 highlights the need for regional councils to better tailor operational activity to address likely operating risks, rather than utilising condition assessment/asset management frameworks more suited to 'three waters' infrastructure (town water supply, wastewater and stormwater). There is a need to better reflect criticality (the consequences of a failure in the flood management network) in management practices for parts of the stopbank network that have a high criticality (eg. Manawatū and Mangaone stopbanks protecting Palmerston North, the Reid Line stopbank protecting Feilding and the Balgownie stopbank protecting part of Whanganui City).

Finally, there are a number of deficiencies in asset condition information, particularly around some of the high value depreciable assets such as pump stations and major gravity outlet structures. Most were constructed in the 1960s and 1970s and many have reached an age where reliability is decreasing and maintenance costs are escalating. Good decisions rely in part on good information including comprehensive information about asset condition and remaining life.

This information would also inform a wider renewal and replacement strategy - in a number of cases station/network configuration has been superseded by changes in land use and changes in technology, providing scope for some rationalisation. An example of technology change is the prevalence of the MacEwans pump type in many stations. While it is a robust design, a number within the existing inventory are used in situations better suited to submersible pumps.

3.2.2 Response strategy

The response strategy is to adopt reliability as a central focus for scheme management. By way of example, river managers nationally have recognised a need for a standardised, systematic framework that focusses on improving operating reliability for flood protection schemes. The result is a Flood Protection Assets Performance Assessment Code of Practice, a risk-based approach to performance that focusses on both failure modes (ways the network may fail) and criticality.

The overall response strategy is as follows:

1. Evaluating each scheme in the Region with a focus on aspects of scheme operation that may have reliability considerations;
2. Improve asset condition information particularly for high-value mechanical and electrical assets with fixed lives (pump stations). For this purpose, Horizons is intending to purchase new asset management software in the current financial year (2017-18).This, combined with the development of operations and maintenance manuals for pump stations and schemes, will drive a more systematic approach to asset management;
3. Developing operation and maintenance manuals and activity plans for all schemes in the Region with risk and criticality as central considerations. As each will require a level of resourcing to develop, a prioritised implementation plan is required, applying the assessment framework developed for dams to sections of the network that have a high level of criticality; and
4. Completing a comprehensive application of the Flood Protection Assets Performance Assessment Code of Practice to the Lower Manawatū stopbank network. The Flood Protection Assets Performance Assessment Code of Practice has already been successfully trialled on a section of the Lower Manawatū network. Work now needs to focus on better mapping and characterising the geometry of the Lower Manawatū Scheme network, utilising new technologies such as drones and remote sensing. The information will be used to undertake a more complete and detailed rollout of the Code of Practice, with the intent of completing that exercise in time for it to inform a capital works programme for inclusion in the next Infrastructure Strategy/Long-term Plan in 2021.

The overall financial impact of adopting this response strategy is difficult to quantify. Aspects such as the new asset management information system are already committed, with an implementation cost to Council of around $500,000. In addition, the development of an operations and maintenance manual for the Lower Manawatū Scheme (in combination with the application of the Dam Safety Guidelines to those high-criticality parts of the network) is estimated to cost $260,000 in Year 1. However much of the response is around building a reliability-focussed operating culture.

Equally difficult to quantify is the interim risk – the marginal difference in risk between the status quo and the new risk environment that the improvement measures will lead to. In general operational areas that have high criticality also have very high protection standards eg. The 500 year Return Period flood protection standard for Palmerston North; the interim risk (essentially a three to five year timeframe) is assessed as being relatively low.

3.2.3 Alternatives

The consequences of not having sufficient focus on operating reliability have already been demonstrated both within the Region and in other parts of the country. Expectations that the community has around reliability will continue to increase – not responding to those drivers is not seen as a viable alternative.

3.3 Climate change

3.3.1 Issue

A 2016 report by the National Institute of Water and Atmospheric Research (NIWA) indicates clear implications for flood management and protection against sea level rise in the Region as a consequence of climate change.[4] In addition to a projected increase in annual average temperatures (of between 0.7 and 1.1 degrees C in 2040), NIWA projects a change in precipitation across the Region – not only in terms of how much rain falls, but also when and where it falls (temporal and spatial patterns). Rainfall is likely to increase across most of the Region west of the ranges in winter and spring, while decreasing in autumn and in summer. Eastern areas are projected to have decreased rainfall. It cannot be predicted with certainty what this will mean for flood frequency and magnitude in the Manawatū Catchment, which falls on both sides of the ranges. It may give rise to more frequent small-to-medium scale flood events, with more limited impact on large flood events caused by catchment-wide rainfall.

In the west of the Region, it is likely that floods will increase in both frequency and magnitude for both the Rangitīkei and Whanganui catchments, with implications for levels of service, scheme operations and maintenance activities, such as having to deploy barriers more frequently and higher repair costs. Higher rainfall is also likely to have similar effects on operating costs for the land drainage schemes that cover the lower Manawatū floodplain.

In terms of sea level rise (and in lieu of revised guidance from the Ministry for the Environment), NIWA recommends planning for a minimum sea level rise scenario of 0.5 m by the 2090s relative to the 1980-1999 average for coastal planning, plus an assessment of sensitivity to possible higher mean sea levels.

Climate change effects are likely to be most pronounced for those communities along the western coastline as a result of the combined effect of increased rainfall and sea level rise, and also other consequential effects such as increased frequency of storm surges.

[4] NIWA, 2016, *Climate change and variability – Horizons Region* (prepared for Horizons Regional Council, September 2016).

3.3.2 Response strategy

The first part of the response strategy to this significant issue involves addressing some of the 'gaps' that the 2016 NIWA assessment identified for the Region. Those gaps included 'region-specific modelling of climate-induced sea level and coastal hazard drivers such as storm surge and waves' and the absence of work around climate change effects for river systems other than the Manawatū.[5] Horizons plans to commission NIWA to undertake this additional research. The Long-term Plan includes provision to address those gaps identified.

The second component to a response strategy addresses the absence of a national climate change response strategy, making it incumbent on Horizons to draw on the best science and information as it evolves to formulate a response strategy for the Region. Because of the level of uncertainty inherent in climate change and its implications for New Zealand and the Region, this will need to be an agile strategy that is refreshed as our understanding of how it might impact the Region becomes clearer. As a priority, Horizons will work with territorial authorities to identify those areas and communities most vulnerable to a changing climate. These communities are likely to be coastal ones, which will become increasingly susceptible to sea level rise and its various effects (rising water table, increased flood risk, etc).

It should be noted however, that our response to the implications of climate change must be integrated throughout all our planning for flood and natural hazard protection – not seen as a separate 'strategic response'. For instance, appropriate measures may include making the 'footprints' of stopbanks wider to facilitate raising heights in the future, making provision for the easy installation of additional pumping capacity, or the installation of pumps that have the ability to work at a greater head than what is required currently.

Examples of how that adaptation philosophy applies in practice is the Balgownie stopbank in Whanganui, which incorporates an allowance (a small amount of additional height) for future climate change effects, appropriate given the high criticality of the structure and relatively small marginal cost of including that allowance. Other projects such as the relief pipeline for Foxton will have similar future-proofing, ensuring construction includes provision to allow for pumping to be added at a future stage.

Clearly how Horizons responds operationally to climate change will continue to evolve in parallel with the science at a global, national and regional level. There remains an underlying risk (page 15) that climate change will either occur at an accelerated rate and/ or effects at a regional scale will (for some reason not currently apparent) be more acute for the Region. A range of funding options are available that will permit Horizons to adopt a stronger response should circumstance require that.

While acknowledging the risk from climate change, in line with our financial assumption in Section 5.2, no specific allowance has been made for climate change (other than the science initiatives identified), as climate change is such a dynamic phenomena what might be reasonable allowance today might be inadequate in three years' time. Detailed investigation and design on a project-by-project basis will consider climate change eg. The Reid Line floodway upgrade will include an allowance for climate change.

3.3.3 Alternatives

The alternative approach is not to consider the impacts of climate change at a strategic or operational level. However, given that the science on climate change is irrefutable and the data (particularly relating to sea level rise) shows a clear trend, this would be an abrogation of Horizons' responsibility to the communities it serves, aside from being an ultimately much more expensive path to take. Accordingly it is not considered to be a viable option.

[5] ibid., p.11.

3.4 Sedimentation effects on levels of service

3.4.1 Issue

Sedimentation is a significant and growing issue in a number of the catchments in the Region. Sedimentation refers to the deposition of silt on the berms of lower-lying river systems, either from eroding hill country or riverbanks in the upper catchment. This leads to a reduction in the flood-carrying capacity of river systems, particularly in times of high flow. Sedimentation is a significant issue in three areas within the Region: the Rangitīkei River southwest of Bulls, the lower reach of the Oroua River (Awahuri to the Manawatū River confluence), and the lower reach of the Manawatū River from the Oroua River confluence to the river mouth at Foxton – the latter showing the most severe effects.

In all three river systems, flood protection standards are likely to be reducing over time as a consequence of sedimentation. These reductions in flood protection standards are most marked following large floods, which carry a much greater volume of sediment than smaller floods. How to address the consequent loss of flood-carrying capacity is an issue that Horizons has grappled with over a number of years and it will continue to be a significant issue in the future.

A short-term response has been to remove silt accumulations over selected reaches of the Oroua River (the response strategy identified in the previous 30-year Infrastructure Strategy), but further technical work currently underway will almost certainly show that this intervention is merely reducing the rate at which flood-carrying capacity is being lost. That is, silt removal alone is not an effective response strategy.

3.4.2 Response strategy

The effects that sedimentation has on levels of service is not a new phenomenon, one that the 2004 floods graphically illustrated. Accordingly, Horizons already has some substantial initiatives in place, such as the Sustainable Land Use Initiative programme and some dedicated operating budget ($100,000 per year to target sections of the Oroua River corridor where sediment accumulations are particularly pronounced).

However it is clear that a better understanding is needed to determine whether that expenditure is being directed in the most effective manner, specifically:

1. Better quantification of the issue and understanding of the processes;
2. Assessing the likely rate at which levels of service will diminish over time; and
3. Identifying the range of possible interventions, which may include reflecting the loss of capacity due to sedimentation through the depreciation of some sections of stopbank (noting that depreciating stopbanks would have financial implications for the Lower Manawatū Scheme, which has a significant debt burden with a relatively long repayment horizon).

The development of such a strategy will require substantial community involvement and engagement, and is likely to have strong linkages with the Horizons Sustainable Land Use Initiative. In response to this issue, an additional provision is made of $50,000 per annum in the fluvial research and monitoring programme to further study of rates of sedimentation, and the sources of the sediment; to better understand the issue and accordingly what interventions will provide the best return on investment. We envisage this work will inform future investment in catchment management and river management and could have financial implications in the next long-term plan process (2021). Flood frequency over the next few years will have a significant influence on just how quickly we will need to roll out this intervention plan.

Note that no allowance has been made relating to the potential level of service reduction associated with sediment deposition on river berms. The further investigation outlined in this strategy is intended to provide that quantification i.e. how quickly flood protection standards are being eroded.

3.4.3 Alternatives

The alternatives to the response strategy outlined are to either continue with the current initiatives or to do nothing and accept the loss of service over time. Without sufficient science behind it, continuing with the current initiatives risks being a sub-optimal response strategy. Given the sizeable cost over time, there is an onus on Horizons to ensure that expenditure is targeted to maximum long-term effect.

The latter alternative (do nothing and accept the loss of service over time) is a difficult path for Horizons due to the size and complexity of the processes and the timescales involved. While a do-nothing option might look attractive to those ratepayers in the short-term (particularly if relatively benign flood conditions prevail over the next few years) it potentially compounds the future challenge, one that climate change has the potential to exacerbate.

Having a do-nothing approach as a response strategy would require very involved and definitive consultation to ensure those potentially affected had an accurate understanding of both the risks and consequences of such a strategy. The June 2015 flood highlighted that challenge – the disconnect amongst some ratepayers between willingness to pay and levels of service expected, and an event perceived as being likely to happen at some distant point in the future rather than today.

3.5 Overall risk from issues identified

The maintenance, renewal and capital expenditure is based on the best information available to council about its flood protection and land drainage assets. However, given the issues and responses identified in Section 3 and 5.5.1, updated information could result in unbudgeted changes to costings and timings of expenditure.

Section 5.2 identifies the expenditure assumptions and the options available to Council to fund unbudgeted expenditure.

4 Approach to Infrastructure Management

Horizons Regional Council undertakes flood protection, river control and land drainage services within the Manawatu-Whanganui Region, activities that are discretionary under the Soil Conversation and Rivers Control Act 1941, the enabling legislation. Those activities have been undertaken by Horizons and its predecessor organisations dating back to the early 1950s – activities that make a substantial contribution to the Region's productivity. Infrastructure assets associated with these services are valued at $466 million and include stopbanks, detention dams, floodgates and pump stations.

Management of these infrastructure assets is an important component in giving effect to Council's vision *"to be an organisation recognised for our expertise, innovation, science and leadership in making the Region a great place to live, work and play."* These activities also serve to achieve two of Council's goals:

- Facilitating regional economic growth; and
- Increasing community resilience to natural hazards.

The approach taken by Council in managing its infrastructure assets is based on the key principles outlined below. These underpin Council's overall objective for infrastructure planning and practice – ensuring continuous improvement that improves operational reliability and reduces residual risk over time, with particular emphasis on critical assets.

4.1 Infrastructure management principles

Levels of service provided to communities through schemes and other measures are fit for purpose

Flood protection and land drainage infrastructure across the Region has developed over many years, making a direct and substantial contribution to the economic growth and prosperity of the Region. This infrastructure underpins the regional economy, keeping communities safe and helping to enable the productive use of areas that would otherwise have poor drainage or be at risk of flooding. Most scheme development occurred in the 1960s and 1970s, an operating environment considerably different from today.

In the same vein, that operating environment will continue to change – those changes are likely to follow a wider societal trend, occurring more rapidly in the future. This will require more responsiveness and a greater degree of connectedness with those communities to ensure that the services that Horizons provides best meet the needs of those communities.

The reliance that good renewal and replacement decision-making has on both optimised decision-making and good data

Operational reliability is a key theme of this strategy and that in turn requires good decision-making. Important components to good decision-making are a good understanding of asset condition, failure risk, criticality and remaining life. Those aspects in turn rely on good data; accordingly, Council places high importance on things like regular river surveys, condition and performance surveys of fixed assets, and structural auditing to inform work programmes and associated activities. Continuously improving the quality of that data and the systems employed in using that data to make good decisions is an ongoing activity that Council is committed to achieving.

Funding models have at their core equity, simplicity, flexibility and sustainability

The way in which Horizons funds river management activities is largely consistent with the way in which other regional councils fund this type of activity. However, there is considerable variation in the way in which operating costs are apportioned; some targeted rate classifications have a degree of complexity that is unnecessary and confusing to ratepayers. We intend to reduce that complexity over time and also introduce other changes in order to

make what we do easier to understand and more adaptive, better meeting the needs of the Region's communities.

Ensuring an emphasis on reliability and resilience

As noted above, operational reliability is identified as a significant issue. Much of the improvement planning relating to river management activities centres on initiatives intended to make the services we deliver more reliable and more resilient. The combined effect of those initiatives will be assets that are less likely to fail over time and schemes that are able to recover more quickly (both physically and financially) from a major flood or other climatic event. That resilience has a range of threads to it, relating not only to what we do but also how we plan, including making sure each scheme has a sufficient level of financial resilience through adequate reserves and insurances.

Being responsive to the demands for higher levels of service or new works/services

Over the three years since the first Infrastructure Strategy a range of possible new operational areas have been identified – areas where communities are (or have the potential to be) affected by natural hazards or processes. Council will consult with those communities around the provision of those new/added services and how they might be funded based on Council funding policy, a requirement of the Local Government Act. In general terms, this means that those who benefit from or contribute to the need for the work or service will meet the majority of the cost.

Ensuring everything we do considers both the effects of climate change and the inherent variability of the Region's climate

We expect that over the life of this strategy the effects of climate change will impact on our infrastructure and the way we manage it, progressively elevating sea levels and introducing a greater level of variability to our climate. Climatic phenomena such as El Nino Southern Oscillation (ENSO) and the Interdecadal Pacific Oscillation (IPO) also affect the Region's weather, adding to that variability. Our work programme accounts for that variability and the baseline change that will result from climate change, a subset of the wider resilience initiative.

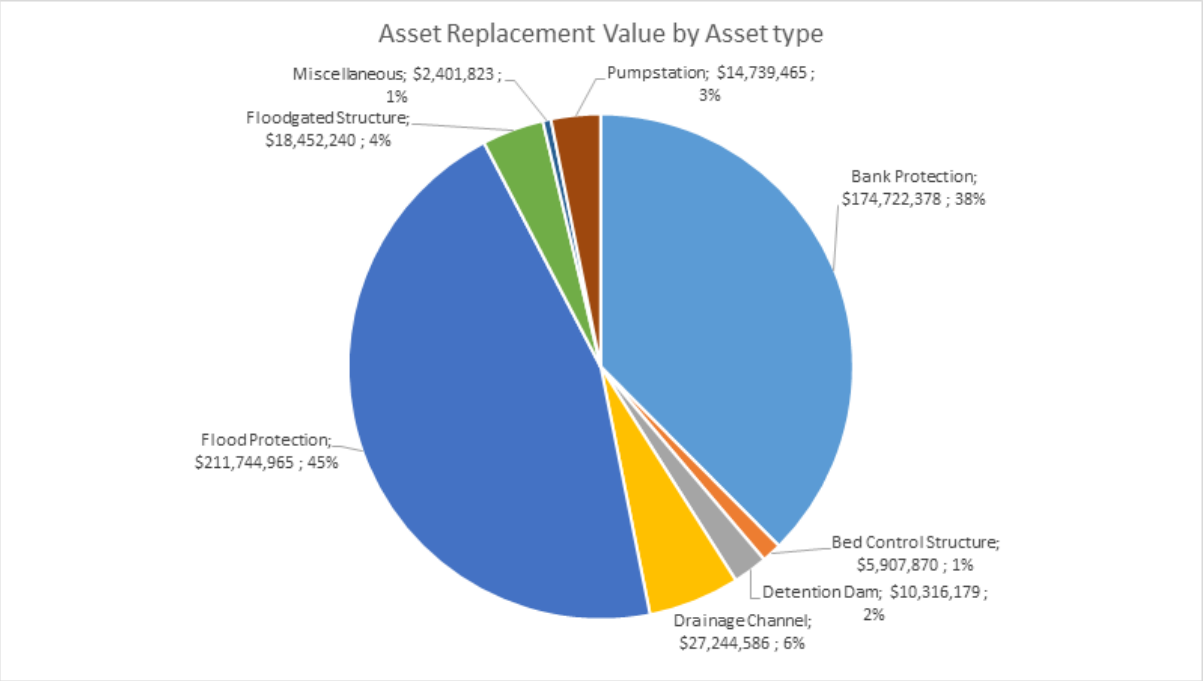
Residual risks are adequately managed and clearly communicated to those potentially affected

River management activity is, by definition, risk management. It is also implicit that such risks cannot be mitigated fully – residual risks are inevitable. In other words, it is not possible to say definitively that a particular section of stopbank cannot fail. The concept of risk in the context of natural hazards is difficult to convey to a community, particularly when it could be interpreted as some shortcoming with what we do. We intend to continue our work in communicating those residual risks to the community and encouraging those potentially impacted to understand those risks and respond accordingly when circumstance requires it.

5 Infrastructure Investment Programme

5.1 Planning asset renewals

Figure 6: River management asset replacement value by category



Council inspects it's assets on a regular basis to a schedule that reflects both the criticality of the asset and the potential for the asset to deteriorate in condition over time. The schedules are detailed in the individual scheme asset management plans. The inspections allow an assessment of likely performance and the remaining life of the asset to either be confirmed or adjusted. The assessed asset lives are contained in asset management plans for each individual scheme and in Council's Asset Management System.

Council commissioned in the 2017-18 financial year a detailed assessment of the 53 detention dams that form part of the river management infrastructure asset inventory. This assessment includes current condition, remaining life (both reservoir capacity – whether sediment accumulations are reducing that capacity – and those elements that have a finite life, eg. reinforced concrete spillways), the development of renewal and replacement strategies, and the production of operations, maintenance and surveillance manuals.

For the first 10 years of the infrastructure investment programme, confirmed works programmes and project estimates are the dominant influence on the forecast expenditure associated with asset renewals. Beyond the 10-year horizon, the combination of current asset values (determined through asset revaluation) and remaining asset lives are used to estimate longer term renewal forecasts.

It is important to note the relatively small proportion (less than 10 per cent) of Horizons' river management asset inventory that has a life assigned to it; most are maintained in perpetuity. That in part reflects both the nature of the assets (earth embankments in the form of either stopbanks or detention dams, rock rip-rap and open drains) and the nature of the operating environment. Where an asset has been assigned a useful life (where gradual deterioration in condition and performance over time is expected), it is generally not critical that the asset is renewed or replaced in a particular year. This management approach does however require

careful consideration around whole of life cost and operating risks – in essence the application of optimised decision-making principles at a high level to ensure cost-effective service delivery, noting that 'sweating the assets' doesn't necessarily produce the most cost-effective outcomes for communities.

5.2 Infrastructure expenditure assumptions

Horizons' infrastructure investment programme is based on the following assumptions:

- Asset lifecycle costs are based on useful remaining lives, condition assessments and replacement values as at the 1 July 2017 revaluation;
- All capital renewal expenditure is based on the continued provision of current levels of service;
- The provisions of the One Plan will produce their intended outcomes around limiting growth and development in areas exposed to a high level of flood risk;
- Inflation tracks as assumed (refer to the Financial Strategy);
- A generally positive economic climate over the next 30 years will mean that existing level of service will remain affordable;
- Regional climate change effects will be largely (on average) linear and not exponential;
- Detailed condition/ remaining life assessments of those significant depreciable assets that form part of the Lower Manawatū Scheme asset inventory will place significant renewal/ replacement expenditure at or beyond a point where debt repayment relating to stopbank upgrades is a significant operational expenditure component;
- Horizons will be able to access sufficient funding, through a combination of infrastructure insurance reserve, financial assistance from central government, scheme reserves and borrowing to adequately respond to unbudgeted expenditure, flood events and other natural disasters;
- The relatively benign lending environment will remain. Debt levels relating to Horizons' river management activities are high relative to other regional councils, giving the Lower Manawatū Scheme a degree of exposure around interest rates over roughly the first 10 years of the strategy period;
- Weather patterns over the strategy period will largely be typical for the Region. River management expenditure is (logically) tied to flow regimes in the main river systems; and
- Service demand will continue to grow. This has a range of threads to it, relating in part to the projections around economic activity and population growth, but also customer expectations. While the Edgecumbe floods in 2017 most graphically illustrated this, the relatively wet 2017 for the southern part of the Region taxed most drainage schemes, most of which have relatively low levels of service. Climate change effects are likely to accentuate this challenge.

Further detail on the underlying assumptions, associated uncertainty and the potential implications is provided in Part A of the Asset Management Plan and the Council wide assumptions included in Section 10.

5.3 Improvement programme

Part A of the Asset Management Plan outlines the frequency with which assets are inspected and how that translates to both maintenance and renewal spend. While the proportion of depreciable assets is relatively small, there are information deficiencies with Councils' higher value/more critical depreciable assets. As noted earlier, Council is about to modernise its asset management information system, the new platform providing a much greater level of sophistication than the existing bespoke system. In parallel, operating budgets include provision to obtain better asset condition information and determine more accurate

assessments of remaining life, enabling a much greater level of precision around those renewal spends than currently exists.

However, for those large/high value depreciable assets, renewal cannot merely assume replacing like with like – in many cases scope exists for rationalisation, requiring consideration ahead of any substantial renewal programme. This is particularly the case for Horizons' pump stations, structures mainly built in the 1960s and 1970s. Although most are approximately half-way through their assigned useful lives of 100 years, none have had a comprehensive technical assessment of current condition and remaining life. Current operating environment differs substantially from what existed at the time the stations were designed and constructed, eg. the law relating to health and safety, related maintenance costs and costs attributable to general age are rising.

More fundamentally however is ensuring that significant renewals, eg. pump replacement, are not occurring where there is the potential that a particular station might not need to be retained in the future. Accordingly, a critical component to asset renewals planning is to first examine what spatial station configuration and individual station capacity is needed to meet current and future levels of service commitments. For example, the Ashlea Road and Boundary pump stations in the Makerua Scheme sit less than 1 km apart – constructing a linking drain and committing to investing in only one site would retain levels of service but provide long-term cost savings.

5.4 Total expenditure

Council expects to spend a total of $85 million on capital expenditure between 2018 and 2048. Over the same period, $450 million is expected to be spent on non-capital related cost including ongoing operating and maintenance, labour and depreciation. These figures are aggregated below based on the six freshwater management units that make up the Horizons Region as shown in Table 2.

Table 2: Expected infrastructure expenditure 2018-2048 (millions)

Freshwater Management Zones	Operational Expenditure	Capital Expenditure	Total Expenditure
Whanganui	$39.7	$15.8	$55.5
Turakina/ Whangaehu	$7.9	$0.01	$7.9
Rangitīkei	$33.3	$2.5	$35.8
East Coast	$9.0	-	$9.0
Manawatū	$337.9	$65.5	$403.4
Horowhenua	$20.0	$1.3	$21.3
TOTAL	$447.8	$85.1	$532.9

The capital expenditure consists primarily of expenditure associated with new capital expenditure and the modification of existing assets to provide increased levels of service, totalling $85.1 million. Forward capital expenditure envisaged in this strategy is relatively low compared with what Horizons has invested since the 2004 flood (the main investment driver over the last 10–15 years).

There are however a number of factors likely to be new drivers in the future when Horizons next updates its Long–term Plan in 2021. Logically those drivers relate back to the significant issues outlined in Section 3 of this strategy, specifically:

- The development of a response strategy that looks to combat the erosion of flood protection levels of service due to sedimentation (berm siltation). One outcome could be depreciating sections of stopbank where levels of service are likely to continue to reduce over time. It is worth noting that this may be largely academic with the Lower Manawatū Scheme given the significant debt levels this scheme has (policy of repaying debt over contributions to renewal reserves);
- Implementing the Flood Protection Assets Performance Assessment Code of Practice for the Lower Manawatū stopbank network, a key component of the focus on operating reliability; and
- Further developments in climate change science and a better understanding of the likely impacts on the Region.

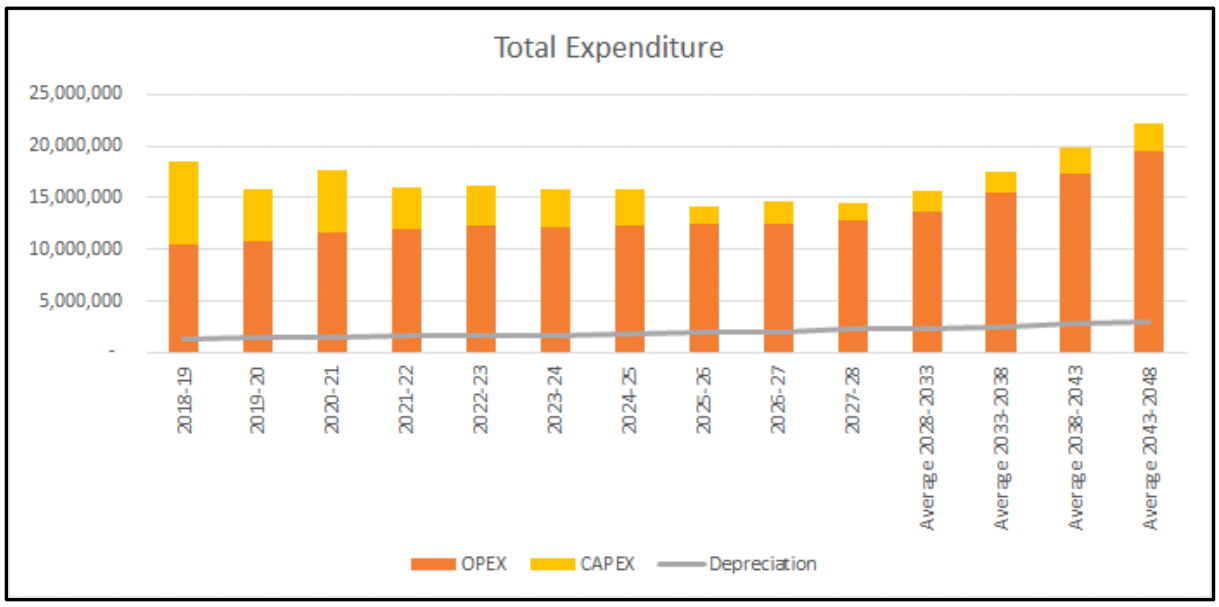
Consideration of efficiencies relating to pump station configuration and better condition information and remaining life assessments associated with the floodgated structure category could also add to future capital expenditure (above what's already outlined in the Long-term Plan).

Operational expenditure consists primarily of expenditure associated with maintaining a substantial proportion of Council's infrastructural assets, including 488 km of stopbanks and 53 detentions dams, to their design standard in perpetuity. In a similar vein to capital expenditure, future operating expenditure is also likely to be influenced by a range of initiatives related to the significant issues identified in this strategy.

By way of example, the compilation of an operations and maintenance manual for the Lower Manawatū Scheme in combination with the application of the dam safety guidelines to high criticality sections of the stopbank network could well identify an increased operating expenditure requirement. The programme of scheme reviews could equally identify the need for increased operational activity in areas with population growth and land use change.

The total expenditure profile over time across the capital and operating expenditure categories is shown in Figure **7**, with depreciation shown separately. The total annual expenditure is shown from 2018-19 to 2027-28, and then an average spend over five-year periods is shown between 2028 and 2048.

Figure 7: Total expenditure summary

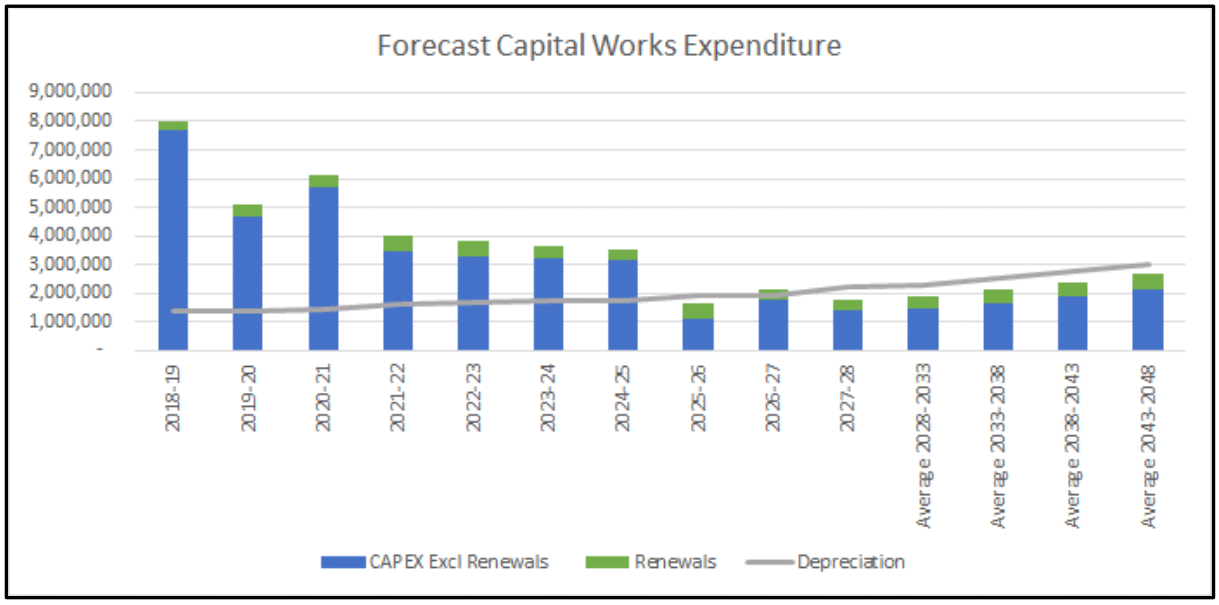


5.5 Capital expenditure

The most significant driver of capital expenditure is the construction of new assets and/or the modification of existing assets to increase levels of service. Of the $85.1 million of proposed capital expenditure over the next 30 years, $71.3 million is the construction of new assets. The remaining expenditure ($13.8 million) relates to renewal of assets.

Figure **8** shows the expected capital expenditure, divided between capital (new) and renewal expenditure. This expenditure forecast is developed in line with the assumptions outlined earlier as highlighted at the beginning of section 5, with regards to remaining useful life of assets.

Figure 8: Capital works expenditure



5.5.1 Significant capital expenditure

There are a number of significant individual expenditure programmes and projects that make up this forecast. The table below identifies new capital expenditure projects planned to deliver increases in levels of service. Additional new capital projects will be identified once this strategy is finalised and these will be developed and included during regular revisions to this strategy and other relevant planning documents.

Table 3: Significant new capital expenditure 2018-2048

Project	Expenditure	Timing	Project Assumptions
Whanganui			
Lower Whanganui River Control Structures	$4.9 million	Ongoing	This expenditure assumes community support and adoption of a funding policy to enable this project.
Manawatū			
Reid Line Floodway Upgrade	$7.6 million	Years 1–7	This expenditure assumes community support and adoption of a funding policy to enable this project.
Foxton Drainage Improvements	$1.8 million	Years 2–3	This expenditure assumes community support and adoption of a funding policy to enable this project.
Rural Upgrade Project	$7.4 million	Year 1 & 3	This is the completion of the Rural Upgrade Project in year 1 ($5.3 million), as well as an additional piece of work to be added in year 3 ($2.1 million)

As noted previously, in regard to capital renewals and the significant decisions associated with those renewals, most of the asset inventory is maintained in perpetuity. The two main asset categories where useful lives are assigned are pump stations and floodgated structures.

The schemes that have pump stations as part of their asset inventory have begun to build renewal reserves in recent years. While the forecasts presented in this strategy include renewal expenditure associated with pump stations and smaller ancillary structures, no significant renewal spend is identified. Those stations have an assessed useful life of 100 years, meaning significant renewal expenditure falls outside the period covered by this strategy. As noted earlier however, better condition information in combination with an overarching strategy is likely to mean future updates will contain larger chunks of pump station renewal spend.

Almost all of the floodgated structures owned by Horizons are located within the extents of the Lower Manawatū Scheme. Most are shared (as an operating expense) between the various Lower Manawatū drainage schemes and the Lower Manawatū Scheme, with the exceptions being the Makino gates and the Moutoa gates. The Moutoa gates are the largest single river management asset that Horizons owns.

No significant renewal spend has been identified with any of the floodgated structures over the period covered by this strategy. For most of the structures, this relates to relatively poor information around asset condition and a largely nominal assessment of remaining life. Improvements identified to Horizons' asset management information system will highlight some of these deficiencies; the intent is to have more realistic assessments around the quantum and timing of renewal expenditure relating to this asset category in time for the next update to this strategy.

As noted in Part A of the Asset Management Plan, the Moutoa gates were constructed in 1962. More detailed condition assessment work has been completed on this structure suggesting that any significant renewal expenditure decisions lie outside the timeframe of this strategy. Further work will be completed over the next three years to inform the next update of this strategy. The Makino gates are a relatively recent construction (2009) and accordingly renewals over the life of this strategy are relatively modest.

Appendix A: Requirement for Infrastructure Strategy under Local Government Act 2002

101B Infrastructure strategy

(1) A local authority must, as part of its long-term plan, prepare and adopt an infrastructure strategy for a period of at least 30 consecutive financial years.

(2) The purpose of the infrastructure strategy is to—

- (a) identify significant infrastructure issues for the local authority over the period covered by the strategy; and
- (b) identify the principal options for managing those issues and the implications of those options.

(3) The infrastructure strategy must outline how the local authority intends to manage its infrastructure assets, taking into account the need to—

- (a) renew or replace existing assets; and
- (b) respond to growth or decline in the demand for services reliant on those assets; and
- (c) allow for planned increases or decreases in levels of service provided through those assets; and
- (d) maintain or improve public health and environmental outcomes or mitigate adverse effects on them; and
- (e) provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provision for those risks.

(4) The infrastructure strategy must outline the most likely scenario for the management of the local authority's infrastructure assets over the period of the strategy and, in that context, must—

- (a) show indicative estimates of the projected capital and operating expenditure associated with the management of those assets—
  - (i) in each of the first 10 years covered by the strategy; and
  - (ii) in each subsequent period of 5 years covered by the strategy; and
- (b) identify—
  - (i) the significant decisions about capital expenditure the local authority expects it will be required to make; and
  - (ii) when the local authority expects those decisions will be required; and
  - (iii) for each decision, the principal options the local authority expects to have to consider; and
  - (iv) the approximate scale or extent of the costs associated with each decision; and
- (c) include the following assumptions on which the scenario is based:
  - (i) the assumptions of the local authority about the life cycle of significant infrastructure assets:
  - (ii) the assumptions of the local authority about growth or decline in the demand for relevant services:
  - (iii) the assumptions of the local authority about increases or decreases in relevant levels of service; and
- (d) if assumptions referred to in paragraph (b) involve a high level of uncertainty,—
  - (i) identify the nature of that uncertainty; and
  - (ii) include an outline of the potential effects of that uncertainty.

(5) A local authority may meet the requirements of section 101A and this section by adopting a single financial and infrastructure strategy document as part of its long-term plan.

(6) In this section, infrastructure assets includes—

(a) existing or proposed assets to be used to provide services by or on behalf of the local authority in relation to the following groups of activities:

(i) water supply:

(ii) sewerage and the treatment and disposal of sewage:

(iii) stormwater drainage:

(iv) flood protection and control works:

(v) the provision of roads and footpaths; and

(b) any other assets that the local authority, in its discretion, wishes to include in the strategy."