

Lake Taupō asset management plan



Prepared by Integrated Catchment Management Directorate,
Brough Resource Management and GHD Limited

For Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

March 2015

Doc#3156045

Contents

| | |
|---|-----------|
| Executive summary | v |
| 1 Introduction | 1 |
| 1.1 About this plan | 1 |
| 1.2 Scope of this plan | 1 |
| 1.3 The need for flood protection and river management | 2 |
| 1.4 Scope of assets and services | 3 |
| 1.5 How the service is provided | 3 |
| 1.5.1 Flood protection schemes | 5 |
| 1.5.2 River management services | 5 |
| 1.6 Legislative framework | 5 |
| 1.7 Planning for tomorrow | 5 |
| 2 The service we provide | 7 |
| 2.1 Our partners, stakeholders and the community | 7 |
| 2.1.1 Ngāti Tūwharetoa | 7 |
| 2.1.2 Taupō District Council | 7 |
| 2.1.3 Lake Taupō catchment community | 7 |
| 2.1.4 Hydro power generators | 8 |
| 2.1.5 Department of Conservation | 9 |
| 2.1.6 Other stakeholders | 10 |
| 2.2 Key service drivers | 10 |
| 2.2.1 Community outcomes | 10 |
| 2.2.2 Outcome descriptors and measures | 10 |
| 2.2.3 Levels of service | 10 |
| 3 Assets we own | 14 |
| 3.1 Asset summary | 14 |
| 3.2 Asset description and key issues | 15 |
| 3.2.1 Stopbanks | 15 |
| 3.2.2 Structures | 16 |
| 3.2.3 River management works (including retaining structures) | 17 |
| 3.2.4 Channels | 18 |
| 3.3 Data confidence and reliability | 18 |
| 3.4 Asset age | 20 |
| 3.5 Asset condition | 21 |
| 3.6 Condition results | 22 |
| 3.7 Asset capacity and reliability | 22 |
| 3.7.1 Capacity | 22 |
| 3.7.2 Reliability (performance) | 22 |
| 3.7.3 Performance of stopbanks | 23 |
| 4 Managing growth and demand | 24 |
| 4.1 Introduction | 24 |
| 4.2 Predicted urban growth in southern Taupō district | 24 |
| 4.2.1 Growth in the Tongariro flood protection catchment | 24 |
| 4.2.2 Growth in the Tauranga Taupō flood protection catchment | 25 |
| 4.3 Taupō district economic growth trends | 25 |
| 4.4 Demand management plan | 27 |

| | | |
|----------|--|-----------|
| 5 | Protecting our environment | 29 |
| 5.1 | Lake Taupō catchment | 29 |
| 5.2 | Tongariro river catchment and flood protection scheme | 30 |
| 5.3 | Tauranga Taupō river catchment and flood protection scheme | 31 |
| 5.4 | Environmental operating regime | 31 |
| 6 | Managing our assets | 32 |
| 6.1 | Overview of activities | 32 |
| 6.2 | Catchment oversight | 32 |
| 6.3 | Information and advice | 32 |
| 6.4 | River management | 32 |
| 6.5 | Flood protection | 33 |
| 6.5.1 | Tongariro flood control scheme | 33 |
| 6.5.2 | Tauranga Taupō flood control scheme | 36 |
| 7 | Risk management | 39 |
| 7.1 | Overview | 39 |
| 7.1.1 | Corporate policy | 39 |
| 7.2 | Risk management process | 39 |
| 7.2.1 | Putting the risks into perspective | 40 |
| 7.2.2 | Risk types and levels | 41 |
| 7.2.3 | Assessment of risk | 41 |
| 7.3 | Residual risk | 42 |
| 7.4 | Risk register | 42 |
| 7.5 | Risk action plan | 42 |
| 8 | Financial management | 44 |
| 8.1 | Overview | 44 |
| 8.1.1 | Introduction | 44 |
| 8.2 | Expenditure | 44 |
| 8.2.1 | Definitions | 44 |
| 8.2.2 | Management assumptions | 45 |
| 8.3 | Summary financial forecast | 45 |
| 8.4 | Operations and maintenance planning | 47 |
| 8.4.1 | Introduction | 47 |
| 8.4.2 | Routine (general) maintenance | 47 |
| 8.4.3 | Operations and maintenance programme | 48 |
| 8.5 | Capital and renewal planning | 49 |
| 8.5.1 | Renewal works | 49 |
| 8.5.2 | Renewal strategy | 49 |
| 8.5.3 | Life cycle | 49 |
| 8.5.4 | Replacement (renewal) works summary | 50 |
| 8.5.5 | New works | 50 |
| 8.5.6 | Development planning categories | 51 |
| 8.5.7 | Selection criteria | 51 |
| 8.6 | Disposals | 52 |
| 8.7 | Asset valuation | 52 |
| 8.7.1 | Introduction | 52 |
| 8.7.2 | Valuation methodology | 52 |
| 8.7.3 | Valuation overview | 53 |
| 8.8 | Funding strategy | 53 |

| | | |
|----------|--|-----------|
| 8.8.1 | Financial statements and projections | 53 |
| 8.8.2 | Depreciation | 53 |
| 8.9 | Policies | 53 |
| 8.9.1 | Finance policies | 53 |
| 8.9.2 | Infrastructure assets – accounting policies/guidelines | 54 |
| 8.10 | Risk to significant forecasting assumptions | 54 |
| 9 | Continuous improvement | 56 |
| 9.1 | Improvement process overview | 56 |
| 9.2 | Improvement plan | 56 |
| | References | 59 |
| | Glossary of terms | 61 |
| | Acronyms | 63 |

Figures

| | | |
|-----------|--|----|
| Figure 1 | Relationship between operational planning documents | 2 |
| Figure 2 | Lake Taupō Zone | 4 |
| Figure 3 | Tongariro hydro electricity scheme | 9 |
| Figure 4 | ORC Lake Taupō catchment zone assets | 15 |
| Figure 5 | Lengths of embankment assets | 16 |
| Figure 6 | Tongariro floodgate | 16 |
| Figure 7 | Rip rap protection at Bridge Lodge stopbank | 17 |
| Figure 8 | Length of rip rap by catchment | 18 |
| Figure 9 | Asset average age versus average remaining life | 21 |
| Figure 10 | Vacant land in Turangi with infrastructural capacity for serviced lots | 25 |
| Figure 11 | Population of the Taupō district 1991-2013 | 26 |
| Figure 12 | Turangi township population 1991-2013 | 26 |
| Figure 13 | Change in land cover in Lake Taupō catchment | 30 |
| Figure 14 | Tongariro flood control scheme | 35 |
| Figure 15 | Tauranga Taupō flood control scheme | 37 |
| Figure 16 | Risk management process | 40 |
| Figure 17 | Risk hierarchy levels | 41 |
| Figure 18 | Financial forecast – Lake Taupō river management and flood protection activities | 47 |
| Figure 19 | Balancing proactive and reactive maintenance | 48 |

Tables

| | | |
|----------|--|----|
| Table 1 | Level of service - Tongariro flood protection scheme | 11 |
| Table 2 | Level of service – Tauranga Taupō flood protection scheme | 12 |
| Table 3 | Level of service – River management services | 13 |
| Table 4 | Asset inventory and valuation by financial class (June 2014) | 14 |
| Table 5 | Asset data - confidence grades | 19 |
| Table 6 | Summary of asset data accuracy for critical and non-critical assets (Feb 2015) | 19 |
| Table 7 | Asset data – completeness grades | 19 |
| Table 8 | Overall data completeness (Aug 2015) | 20 |
| Table 9 | Target level of asset data accuracy and completeness | 20 |
| Table 10 | Typical condition rating model | 21 |
| Table 11 | Asset capacity | 22 |
| Table 12 | Stopbanks crest levels | 23 |

| | | |
|----------|---|----|
| Table 13 | Demand management instruments | 27 |
| Table 14 | Tongariro flood scheme resource consents | 34 |
| Table 15 | Tauranga Taupō flood scheme resource consents | 36 |
| Table 16 | Risk assessment matrix | 42 |
| Table 17 | Risk action plan – Lake Taupō asset management plan | 43 |
| Table 18 | Maintenance types | 44 |
| Table 19 | Summary of revenue and expenditure for river management and flood protection activities for the Lake Taupō zone 2015-2025 | 46 |
| Table 20 | Projected asset lives | 50 |
| Table 21 | Development planning categories | 51 |
| Table 22 | Capital new works and renewals | 51 |
| Table 23 | Funding policy | 53 |
| Table 24 | Disaster recovery funding | 54 |
| Table 25 | Improvement plan | 57 |

Executive summary

Asset management plans provide information on the design, management and operation of assets to show that they are achieving their intended purpose at a scale that is appropriate for the services they perform to the community. The focus of this plan is on flood protection and river management infrastructural assets owned, managed and operated by the Waikato Regional Council (WRC) within the Lake Taupō catchment. Collectively, the assets have a total replacement value of \$7,204,990, a current book value of \$5,513,520 and an annual depreciation of \$104,384 as at 30 June 2014. The information in this plan builds upon, and is linked directly to, the community aspirations, regional levels of service and levels of funding articulated in the Long Term Plan 2015-2025.

The Tongariro and Tauranga Taupō flood protection schemes comprise the majority of assets within the catchment. Smaller scale river management assets are also located within the Hinemaiaia river and the Hanganito canal.

In line with the strategic management approach council has adopted to improving its assets, section 9 of this plan includes actions to be undertaken over the next three years. Specific improvements planned of note include the following.

- Due to the dynamic nature of the Tongariro and Tauranga Taupō rivers and the relative newness of both the flood control schemes, more frequent reviews of the asset performance is considered necessary for improving council's understanding of how these rivers behave and the future management requirements. A review of the Tauranga Taupō scheme is scheduled for 2015/16 and cross section surveys for the Tongariro scheme are planned for 2016/17 with the intention of updating the hydraulic model for the scheme in 2017/18.
- In general, the asset register for the catchment is considered to be complete with good knowledge of asset age due to the recent construction of the two flood protection schemes. However, there is an ongoing need to collect attribute data, particularly for embankments and river management works, and this is identified as an action in the improvement plan.
- The Awamate stopbank which is part of the Tongariro flood protection scheme is incomplete but requires satisfactory agreements with property owners in order to progress.

This plan will be updated regularly with reviews undertaken at least every three years so that information relating to the management of assets remains relevant and any changes in levels of service can be aligned with council's LTP cycle.

1 Introduction

1.1 About this plan

Waikato Regional Council owns, manages and operates infrastructural assets that collectively provide for flood protection and river management within the Lake Taupō catchment.

The Tongariro and Tauranga Taupō flood protection schemes comprise the majority of assets within the catchment. Smaller scale river management assets are also located within the Hinemaiaia river and the Hangarito canal.

This asset management plan (AMP) provides detailed information to show that the flood protection and river management assets in the Lake Taupō catchment are designed, managed and operated to meet their intended purpose, and at a scale that is appropriate for the services they perform to the community. The information in this plan builds upon, and is linked directly to, the community aspirations, regional levels of service and levels of funding articulated in the Long Term Plan 2015-2025 (LTP).

The council has adopted a strategic management approach to improvement planning, continually developing AMPs, and implementing improvement processes and practices. This plan will be updated regularly with reviews undertaken at least every three years so that information relating to the management of assets remains relevant and any changes in levels of service can be aligned with council's LTP cycle.

1.2 Scope of this plan

The focus of council's Integrated Catchment Management (ICM) Directorate is on delivering practical services and specialised advice to communities and land owners to improve catchment health.

This plan focuses on flood protection and river management infrastructural assets. It does not cover other aspects of council's work within the catchment. These wider matters will be addressed in council's Lake Taupō zone plan (currently in development). The zone plan is an overarching document containing strategies relating to the way council will undertake catchment management. Figure 1 shows the relationship between the zone plan and other operational plans council may develop for a particular zone.



Figure 1 Relationship between operational planning documents

1.3 The need for flood protection and river management

WRC provides communities with an agreed level of protection from flooding events. The objective of undertaking flood protection and river management works is to safeguard the economic and social wellbeing of the region and to enhance the environment.

Under the Resource Management Act (RMA) 1991, WRC is primarily responsible for controlling the use of land to avoid or mitigate natural hazards, specifically in relation to flooding and river management. Taupō District Council (TDC) also has a responsibility under the RMA to control the actual or potential effects of the use, development, or protection of land for the purpose of natural hazards.

The Tongariro and Tauranga Taupō rivers have a recent history of flooding events resulting in inundation of land within the lower reaches of both rivers. Specifically, the township of Turangi and the communities of Oruatua and Te Rangiita are identified as being at risk of inundation from certain flooding events.

To provide the township of Turangi and the communities of Oruatua and Te Rangiita with an agreed level of protection from certain flooding events, WRC operates and manages two flood protection schemes:

- Tongariro flood protection scheme
- Tauranga Taupō flood protection scheme

WRC also undertakes works on rivers within the Lake Taupō catchment directed at controlling bank erosion, channel instability, riparian vegetation and the aggregation of riverbed sediments.

1.4 Scope of assets and services

River and flood protection assets in the Lake Taupō catchment include:

- Stopbanks
- Retaining structures
- Channels
- Structures
- Weirs
- River training works
- Floodgates
- Fencing
- Culverts

Stopbanks and retaining structures comprise approximately 79% of assets by value (Optimised Replacement Cost), while channels are the largest assets by physical area.

At the time of preparing this plan the replacement value of the flood protection and river management assets owned, managed and operated by WRC in the Lake Taupō catchment was \$7,204,990.

To effectively maintain and manage Lake Taupō flood protection and river management assets, the annual operating expenditure is on average \$635,959. The funding for operational and capital expenditure is derived from rating income, apportioned across general regional rates and targeted rates from properties directly benefiting from the two flood protection schemes.

1.5 How the service is provided

WRC has divided the Waikato region into eight zones for management purposes that run along catchment boundaries. Some zones may include more than one catchment. In the case of the Taupō zone, the boundary follows the physical catchment for Lake Taupō¹ (see Figure 2).

WRC provides both flood protection schemes and river management services in the Lake Taupō catchment.

¹ The terms 'zone' and 'catchment' are used interchangeably within this plan.

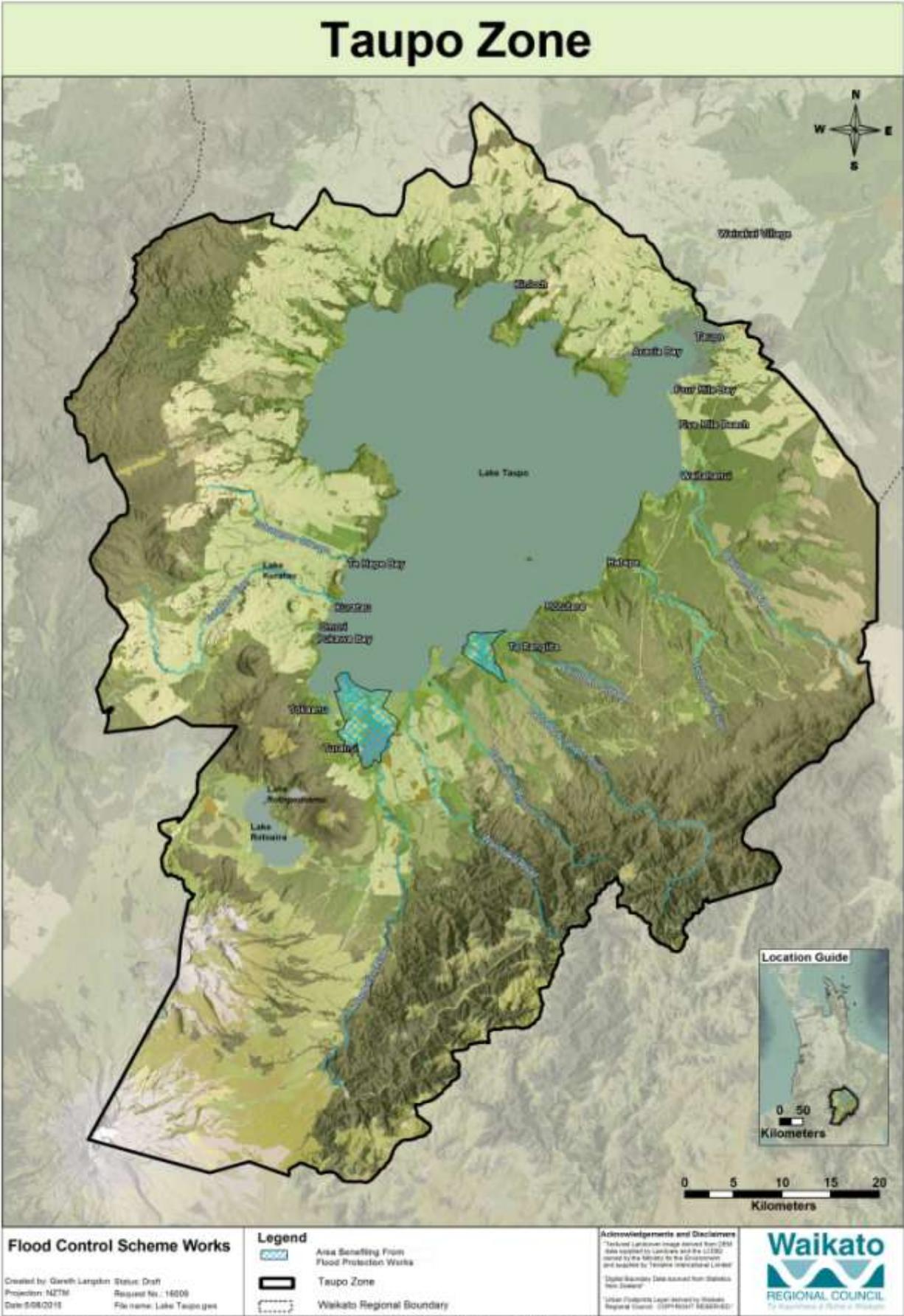


Figure 2 Lake Taupō Zone

1.5.1 Flood protection schemes

WRC operates and manages the Tongariro flood protection scheme. The scheme is designed to protect the community of Turangi and property adjacent to the Tongariro river from flooding and inundation up to a 1% Annual Exceedance Probability (AEP)² or 100-year rainfall event, generating an estimated design flood flow of 1,500 m³/sec. The stopbank heights are set above the flood flow profile height by varying freeboard.

WRC also operates and manages the Tauranga Taupō flood protection scheme. The scheme is designed to protect the communities of Oruatua and Te Rangiita, and property adjacent to the Tauranga Taupō river and within the river floodplain, from flooding and inundation up to a 2% AEP³ or 50-year rainfall event, generating an estimated design flood flow of (318 m³/s). The stopbanks heights are set above the flood flow profile height by varying freeboard.

The Tongariro and Tauranga Taupō flood protection schemes are comprised of a range of individual assets (e.g. stopbanks, retaining structures, floodgates etc.) that collectively form the control scheme. All assets need to be maintained to specified design standards in order to remain effective.

More detailed information regarding the two flood protection schemes can be found in Section 6.5 of this Plan.

1.5.2 River management services

River management addresses issues such as instability of river and stream banks and beds, congestion of waterways and management of land adjacent to the river or stream. The purpose of intervention is to stabilise river and stream beds and banks and reduce the adverse effects created by peak flood flows within rivers and streams.

WRC operates and manages smaller scale river management assets located within the Hangarito channel and Hinemaiaia Rivers. The river management assets assist with 'training' of watercourses, stabilising of banks, beds and channels and control of sediment deposition.

More detailed information on river management services can be found in Section 6.4 of this plan.

1.6 Legislative framework

This plan has been prepared taking into account the Local Government Act (LGA) 2002, RMA, Soil Conservation and River Controls Act 1941 and other legislation as appropriate.

1.7 Planning for tomorrow

The LGA and subsequent amendments requires the WRC to prepare a 30 year infrastructure management strategy. WRC's 2015-2045 Infrastructure Strategy sets out how the council 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

² 1% AEP means that there is a 1% probability that a flood event of this magnitude will occur in any given year.

³ 2% AEP means that there is a 2% probability that a flood event of this magnitude will occur in any given year.

- maintain or improve public health and environmental outcomes or mitigate adverse effects
- provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provision for managing those risks.

This plan is prepared in accordance with the 30 year infrastructure management strategy and sets out how council manages flood protection in the Taupō zone. This includes both an operational perspective (e.g. operational costs associated with maintaining agreed levels of service) and a capital expenditure perspective (e.g. the costs of providing new, renewing and/or replacing existing assets).

2 The service we provide

2.1 Our partners, stakeholders and the community

2.1.1 Ngāti Tūwharetoa

Taupō-nui-a-tia is taonga of paramount importance to Ngāti Tūwharetoa and, Ngāti Tūwharetoa hold manawhenua and kaitiaki for all of the lands within their rohe.

The special relationship between Ngāti Tūwharetoa and Taupō Moana extends to all freshwater flowing within, and into, Lake Taupō and downstream into the Waikato River. In 2010 the Tūwharetoa Māori Trust Board - on behalf of Ngāti Tūwharetoa - entered into co-governance and co-management arrangements with the Crown in respect of the Waikato River.

Ngāti Tūwharetoa is also the largest private landowner within Taupō district. The Tūwharetoa Māori Trust Board holds the title to the bed of Lake Taupō, as well as the title to certain rivers and streams flowing into the lake, and the bed of the Waikato River from the lake to the Rock of Tia⁴.

The effectiveness of flood protection and river management, specifically the Tongariro and Tauranga Taupō control schemes, is predicated on a good working relationship between WRC and the Tūwharetoa Māori Trust Board, and meaningful engagement with Ngā Hapū o Ngāti Tūwharetoa.

2.1.2 Taupō District Council

The Lake Taupō catchment is located entirely within the TDC boundary.

The WRC has a legislative and a strategic relationship with the TDC in respect of achieving the sustainable management of natural and physical resources within the Taupō zone⁵, and the delivery of services - including the management of natural hazards - to shared ratepayers within the Lake Taupō catchment.

The successful long-term management of the Tongariro and Tauranga Taupō control schemes is supported by the best available information from the TDC on the location and sequencing of future urban growth, and the effective management of land use particularly in relation to identified natural hazards.

2.1.3 Lake Taupō catchment community

The population of the Taupō district at the time of the 2013 census was 35,850 people from an estimated 18,201 households⁶. The five year trend shows population growth in the district is increasing at a much slower rate than for the remainder of the Waikato region.

The largest urban centre in the Lake Taupō catchment is the township of Taupō - located on the northern shores of Lake Taupō - with a population of approximately 22,300 in 2013. Taupō is the main urban centre and a recognised tourist destination.

⁴ The landownership tenure is relatively unique, with Ngāti Tūwharetoa retaining its historic land title within the meaning of Section 129 (1) (a, b or c) of Te Ture Whenua Māori Land Act 1993.

⁵ The physical area of the Lake Taupō zone is outlined in Figure 2.

⁶ It should be noted that Taupō district boundaries extend well beyond the physical catchment of Lake Taupō. However most of the usually resident population resides within the physical catchment.

The second largest urban centre is the township of Turangi with a population of 3,183. Turangi is located on the banks of the Tongariro river to the south of Lake Taupō and is the largest urban centre in the southern part of the Lake Taupō catchment. Turangi is notable for its planned growth in 1964 to support the construction of the Tongariro Power Development Scheme.

There are also a number of other lakeshore settlements in the southern part of the Lake Taupō catchment. Each of the southern settlements has individual characteristics that have evolved over time.

The 2013 Southern Settlements Structure Plan⁷, developed by TDC, indicates population growth in each of the settlements is variable. Settlements such as Kuratau and Motuoapa have in the recent past experienced relatively high growth, whereas settlements such as Te Rangiita and Oruatua are relatively stagnant or in gradual decline. Notably the town of Turangi has experienced a long-term decline in population. While the number of allotments and dwellings may have increased slightly, the resident population is continuing to decrease.

The Lake Taupō catchment community are dual customers of both TDC and WRC. The levels of service in respect to flood protection and river management services are agreed with the relevant communities and are articulated through this plan.

2.1.4 Hydro power generators

WRC has long-standing relationships with primary hydro generators Mighty River Power and Genesis Energy. An important driver behind this relationship is the need to work closely on implementing a high flow management plan during times of flooding⁸.

The installation of the Taupō control gates in 1941 was combined with a widening of the channel which allows for increased outflows in a flood event. Despite this, high storm inflows will exceed maximum outflows and the lake will rise. In addition to the benefits that the control gates provide in terms of electricity generation, the control gates allow for management of flood events across the catchment and an overall reduction of high lake levels for Lake Taupō.

The Taupō control gates are owned and operated by Mighty River Power. However, under resource consents WRC has the power to instruct Mighty River Power to operate the gates for civil defence or flood management purposes. In practice, flood management of the hydro system is achieved through consultation and agreement between Mighty River Power and WRC as provided for within the high flow management plan.

Genesis Energy owns and operates the Tongariro power scheme. The scheme and its structures extend from the southern flanks of Mount Ruapehu in the south, to the southern point of Lake Taupō in the north, and along either side of the mountain range formed by Ruapehu, Ngauruhoe and Tongariro. The scheme taps a catchment area of more than 2600 sq km (see Figure 3).

The scheme contributes on average an additional 28 m³/s inflow into the Lake Taupō catchment from its diversion of water from the Whanganui, Moawhango and Whangaehu catchments - also known as the 'foreign water diversions'. Resource consents for the ongoing operation of the scheme were made operative on 1 December 2004.

⁷ TDC, 2013. Southern Settlements Structure Plan, 2013.

⁸ WRC 2013. High Flow Management Plan EW Docs #3088099v1

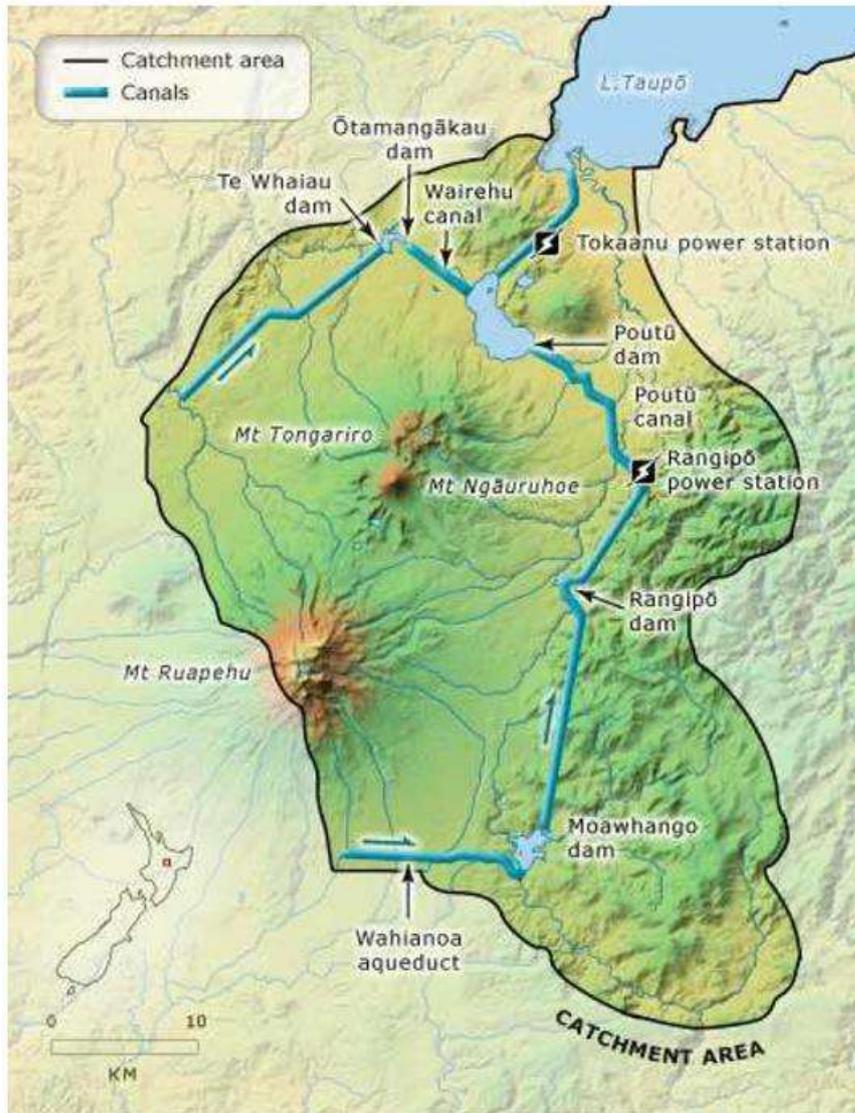


Figure 3 Tongariro hydro electricity scheme

Genesis Energy works closely with WRC and Mighty River Power to assist with flood management within the Taupō catchment. Resource consent conditions require Genesis to cease diverting water from outside the catchment into Lake Taupō when the level of Lake Taupō exceeds, or is clearly likely to exceed, its maximum control level.

Other hydro operations on rivers in the catchment include:

- Kuratau hydro power plant (6MW) operated by King Country Energy Ltd. The Kuratau hydro lake was dammed in 1962. The Kuratau catchment is over 190km² to the south-west part of the Lake Taupō catchment and is dammed approximately 5 km from Lake Taupō for the purposes of hydro power generation.
- Hinemaiaia hydro scheme (6MW) operated by TrustPower Two hydro lakes (33ha and 12ha) on the Hinemaiaia river form part of the scheme.

2.1.5 Department of Conservation

The Department of Conservation (DOC) manages public conservation land within the headwaters of both the Tongariro and Tauranga Taupō rivers under the Conservation Act 1987. DOC is responsible for the preservation of indigenous freshwater fisheries and the protection of recreational freshwater fisheries (including the Lake Taupō sport fishery) and freshwater fish habitats.

2.1.6 Other stakeholders

The New Zealand Transport Agency (NZTA) manages the state highway network, including State Highway 1, which runs adjacent to Lake Taupō and crosses both the Tongariro and Tauranga Taupō rivers. The control of flooding events is critical to the effective functioning of State Highway 1, and the design and location of state highway infrastructure in, on, under or adjacent to the beds of the Tongariro and Tauranga Taupō rivers has implications on the effectiveness of the two flood protection schemes. It can be noted that in the case of the Tauranga Taupō flood scheme, the State Highway (east of the bridge) is designed to act as a floodway under certain conditions.

Other stakeholders with an interest in river and flood control activities include:

- Forest owners/managers
- Recreation users (e.g. Tongariro and Lake Taupō Anglers Club Inc)
- Community groups (e.g. Advocates for the Tongariro River).

2.2 Key service drivers

2.2.1 Community outcomes

Community outcomes are described in the LTP as outcomes that WRC aims to achieve in meeting the current and future needs of regional communities for good quality local infrastructure, local public services, and performance of regulatory functions.

To align with WRC's strategic direction, community outcomes have been distilled into three themes - healthy environment, strong economy and vibrant communities - each with a range of outcome descriptors.

The provision of flood protection and river management services in the Lake Taupō catchment focuses on the vibrant communities and healthy environment community outcomes and contribute to the strong economy outcome.

2.2.2 Outcome descriptors and measures

The LTP articulates descriptors and measures for community outcomes. Flood protection services fit into what the LTP describes as the 'safety' environ with an outcome descriptor of 'productive land, people, and property are safeguarded' and an outcome measure of 'Maintain a 24/7 group civil defence emergency response and incident response function'. River management services in the Lake Taupō catchment are inherently linked with flood protection services and also contribute to the same outcome descriptors and outcome measures.

In respect of stand alone river management services undertaken in the Lake Taupō catchment, these services fit more broadly into what the LTP describes as the 'water' environ and assists with achieving a range of outcome descriptors and outcome measures.

2.2.3 Levels of service

For the purposes of simplicity, the levels of service for flood protection in the Lake Taupō catchment are combined into the two flood protection schemes, and the wider river management services provided in the Lake Taupō catchment.

The levels of service are shown in Tables 1, 2 and 3 below.

Table 1 Level of service - Tongariro flood protection scheme

| Tongariro Flood Protection Scheme | | | | | |
|--|---|---------------------------------|---------------------------------|---------------------------------|------------------------------------|
| Links to Community outcomes | Healthy Environment | Strong Economy | Vibrant Communities | | |
| LTP Level of service | The regional community expectation is this asset/service will provide: <ul style="list-style-type: none"> To provide the standard of flood protection agreed with communities (as set out in zone plans and other documents). | | | | |
| AMP Level of service | The Turangi community expectation is this asset/service will provide: <ul style="list-style-type: none"> Protection from flooding events up to 1% AEP (1/100 year) for the design discharge of 1,500m³/sec with varying freeboard. | | | | |
| LTP Performance measure | Major flood protection and control works are maintained, repaired and renewed to the key standards defined in the local authority's relevant planning documents. | | | | |
| AMP Performance measure | Zero failures of flood protection scheme below specified 1% AEP design levels. 100% compliance with the conditions of resource consents 121305, 121306, 104532, 104807, 110223, 110224 and 030640. Annual report submitted to Lake Taupō Catchment Committee and Integrated Catchment Management Committee on the achievement of performance measures. | | | | |
| Performance targets | Current performance | Year 1 target 2015/16 | Year 2 target 2016/17 | Year 3 target 2017/18 | Year 4-10 target 2018/25 |
| Major flood protection and control works are maintained, repaired and renewed to key standards defined in relevant planning documents⁹ | New measure | Achieved | Achieved | Achieved | Achieved |
| Compliance with conditions of resource consents | Achieved | Achieved | Achieved | Achieved | Achieved |
| Annual report to catchment committee | Achieved | Achieved | Achieved | Achieved | Achieved |
| LTP mechanisms to achieve targets | Maintain stopbanks to stopbank design heights, achieving performance grade 4 or better. Maintain operational readiness of all floodgated stormwater outlets. Annual stopbank inspection programme undertaken. | | | | |
| AMP mechanisms to achieve targets | The following procedures will measure whether performance targets are achieved: <ul style="list-style-type: none"> Preparation of annual report to catchment committee on performance measures 5-10 yearly crest level survey Annual performance and condition inspections Monthly operational inspections and failure reports 10 yearly capacity audits Design level flood review Annual health & safety audits | | | | |

⁹ Refer to Doc # 3352292 Flood Protection and Control Works Metadata.

Table 2 Level of service – Tauranga Taupō flood protection scheme

| Tauranga Taupō Flood Protection Scheme | | | | | |
|---|---|-----------------------|----------------------------|-----------------------|--------------------------|
| Links to Community outcomes | Healthy Environment | Strong Economy | Vibrant Communities | | |
| LTP Level of service | To provide the standard of flood protection agreed with communities (as set out in zone plans and other documents). | | | | |
| AMP Level of service | The community expectation is this asset/service will provide: <ul style="list-style-type: none"> Protection from flooding events up to 2% AEP (1/50 year) for the design discharge of 318m³/s. | | | | |
| LTP Performance measure | Major flood protection and control works are maintained, repaired and renewed to the key standards defined in the local authority's relevant planning documents. | | | | |
| AMP Performance measure | Zero failures of flood protection scheme below specified 2% AEP design levels. 100% compliance with the conditions of resource consents 108324, 108325, 108326, 108697, 109978, 111087, 111088 and 117974. Annual report submitted to Lake Taupō Catchment Committee and Integrated Catchment Management Committee on the achievement of performance measures. | | | | |
| Performance targets | Current performance | Year 1 target 2015/16 | Year 2 target 2016/17 | Year 3 target 2017/18 | Year 4-10 target 2018/25 |
| Major flood protection and control works are maintained, repaired and renewed to key standards defined in relevant planning documents¹⁰ | New measure | Achieved | Achieved | Achieved | Achieved |
| Compliance with conditions of resource consents | Achieved | Achieved | Achieved | Achieved | Achieved |
| Annual report to catchment committee | Achieved | Achieved | Achieved | Achieved | Achieved |
| LTP mechanisms to achieve targets | Maintain stopbanks to stopbank design heights, achieving performance grade 4 or better. Maintain operational readiness of all floodgated stormwater outlets. Annual stopbank inspection programme undertaken. | | | | |
| AMP mechanisms to achieve targets | The following procedures will measure whether performance targets are achieved: <ul style="list-style-type: none"> Preparation of annual report to catchment committee on performance measures 5-10 yearly crest level survey Annual performance and condition inspections Monthly operational inspections and failure reports 10 yearly capacity audits Design level flood review Annual health and safety audits | | | | |

¹⁰ Refer to Doc # 3352292 Flood Protection and Control Works Metadata.

Table 3 Level of service – River management services

| River Management Services | | | | | |
|---|--|----------------------------------|----------------------------------|----------------------------------|-------------------------------------|
| Links to Community outcomes | Healthy Environment | Strong Economy | Vibrant Communities | | |
| LTP Level of service | To achieve a balance between maintaining channel capacity, channel stability and environmental values in the management of priority rivers and streams in each management zone. | | | | |
| AMP Level of service | The community expectation is this asset/service will provide: Maintenance of channel capacity and channel stability in the Tongariro, Tauranga Taupō and Hinemaiaia rivers and the Hangarito canal. | | | | |
| LTP Performance measure | Percentage of river instability enquiries responded to within three days, and appropriate actions taken on a prioritisation basis. | | | | |
| AMP Performance measure | River management works are completed in accordance with applicable design standards and as-built plans 100% compliance with the conditions of resource consents 107283, 107284 and 107285. Prepare an annual report submitted to Lake Taupō Catchment Committee and Integrated Catchment Management Committee on the achievement of performance measures. | | | | |
| Performance targets | Current performance | Year 1 target 2015/16 | Year 2 target 2016/17 | Year 3 target 2017/18 | Year 4-10 target 2018/25 |
| Percentage of river instability enquiries responded to within three days | n/a | 95% | 95% | 95% | 95% |
| River management works completed in accordance with designs | Achieved | Achieved | Achieved | Achieved | Achieved |
| Compliance with conditions of resource consents | Achieved | Achieved | Achieved | Achieved | Achieved |
| Annual report to catchment committee | Achieved | Achieved | Achieved | Achieved | Achieved |
| LTP mechanisms to achieve targets | River management and drainage works undertaken in accordance with the Waikato Regional Council Regional Plan. Maintain channels free of obstructions ¹¹ or significant blockages, and address river and stream bank erosion on a prioritised basis where practicable. Manage pest plants where they may impact upon capacity and flow, and on a prioritised basis. Maintain riparian margins (of council owned land) by planting, stock exclusion and/or erosion protection. Introduce regional channel capacity guidelines (improvement plan). Continually seek opportunities for environmental enhancement of river and stream environments. | | | | |
| How we will measure if target is achieved | The following procedures will measure whether performance targets are achieved: <ul style="list-style-type: none"> • Annual report to catchment committee on performance measures • Annual performance and condition inspections • Routine operational inspections and failure reports • Annual health and safety audits | | | | |

¹¹ As appropriate as debris in channels will, in some instances, be important for the ecology of the river or stream.

3 Assets we own

3.1 Asset summary

Flood protection and river management assets in the Taupō zone have a total replacement value of \$7,204,990, a current book value of \$5,513,520 and an annual depreciation of \$104,384 as of 30 June 2014.

The assets that are owned by council are listed in Table 4 below.

Table 4 Asset inventory and valuation by financial class (June 2014)

| Service type | Financial class | No. | Units | Optimised replacement cost (\$) @ 30/06/2014 | Optimised depreciated replacement cost (\$) @ 30/06/2014 | Annual depreciation (\$) 2013/14 |
|---------------------------------------|----------------------|---------|----------|--|--|----------------------------------|
| Flood protection and river management | Channels | 216,530 | m | \$220,903 | \$199,750 | \$1,788 |
| | Culverts | 3 | ea | \$423,235 | \$375,461 | \$4,841 |
| | Fencing | 2,500 | m | \$44,625 | \$34,963 | \$1,635 |
| | Floodgates | 24 | ea | \$ 67,097 | \$55,978 | \$1,072 |
| | Retaining structures | 3,565 | m | \$3,155,992 | \$1,914,169 | \$63,297 |
| | River training works | | m | \$15,000 | \$13,576 | \$131 |
| | Stop banks | 7,948 | m | \$2,495,929 | \$2,297,806 | \$6,280 |
| | Structures -weirs | 20 1 | Ea Ea | \$758,688 \$23,520 | \$599,825 \$21,992 | \$25,133 \$207 |
| Total | | | | \$7,204,990 | \$5,513,520 | \$104,384 |

Figure 4 shows the ORC of the Lake Taupō assets. The pie chart illustrates that the retaining structures followed by the embankment assets hold the largest values in this zone.

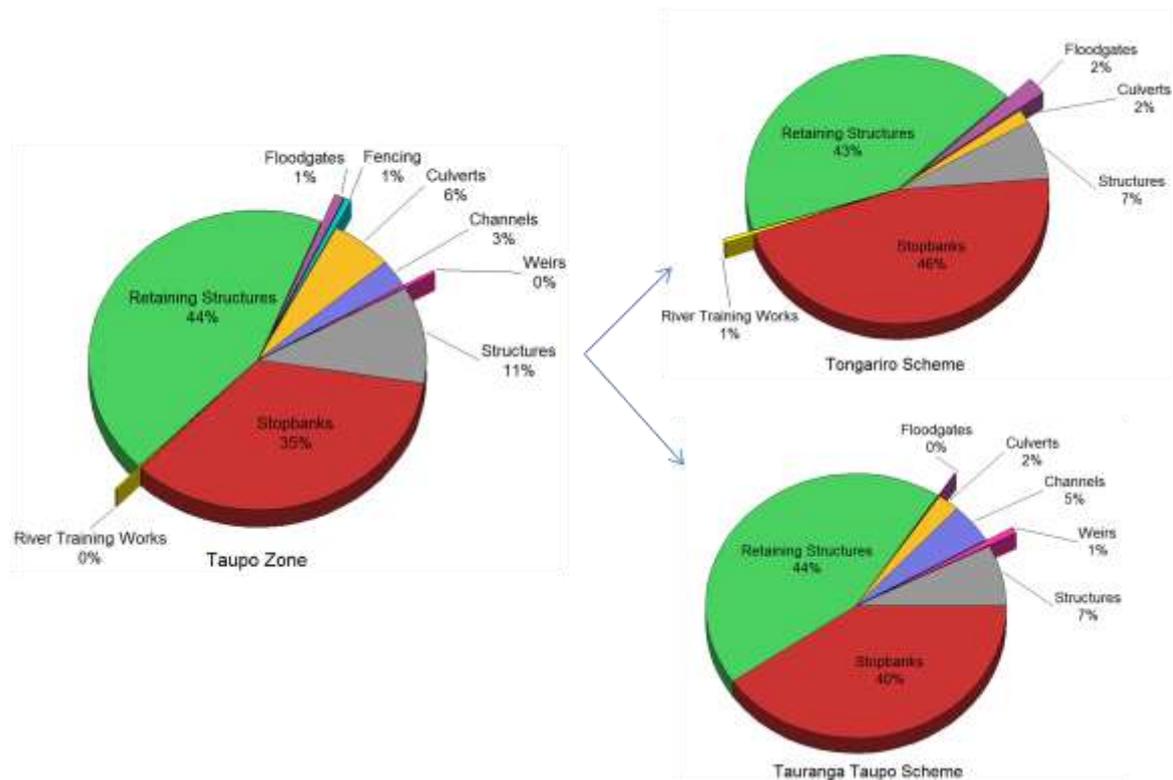


Figure 4 ORC Lake Taupō catchment zone assets

3.2 Asset description and key issues

3.2.1 Stopbanks

Stopbanks are compacted earth embankments built alongside rivers to provide protection to the bordering land from flooding.

In the context of flood protection schemes spillways are structures used to provide for the controlled release of flows exceeding design events.

Key issues

- Stock damage
- Alignment being too close to the river channel increasing the risk of undermining
- Width in some rural locations
- Settlement
- Keeping up with changes in stopbank height (i.e. channel capacity) to maintain existing levels of service and taking into account silting and/or aggradation of river beds, climate change and increased rainfall intensity:
 - toe erosion and old, large trees compromising structural integrity
 - foundation stability due to geotechnical conditions
 - earthquake damage
 - land ownership and access issues.

The total ORC of stopbanks for the Lake Taupō zone is \$2,495,929 (as at 30 June 2014); this represents 35% of the total Lake Taupō zone network value. Asset condition is monitored by visual inspections, physical surveys and scheme reviews.

Figure 5 shows the lengths in the Lake Taupō zone of the various types of stopbanks. All the stopbanks in this zone are sand foundation stopbanks.

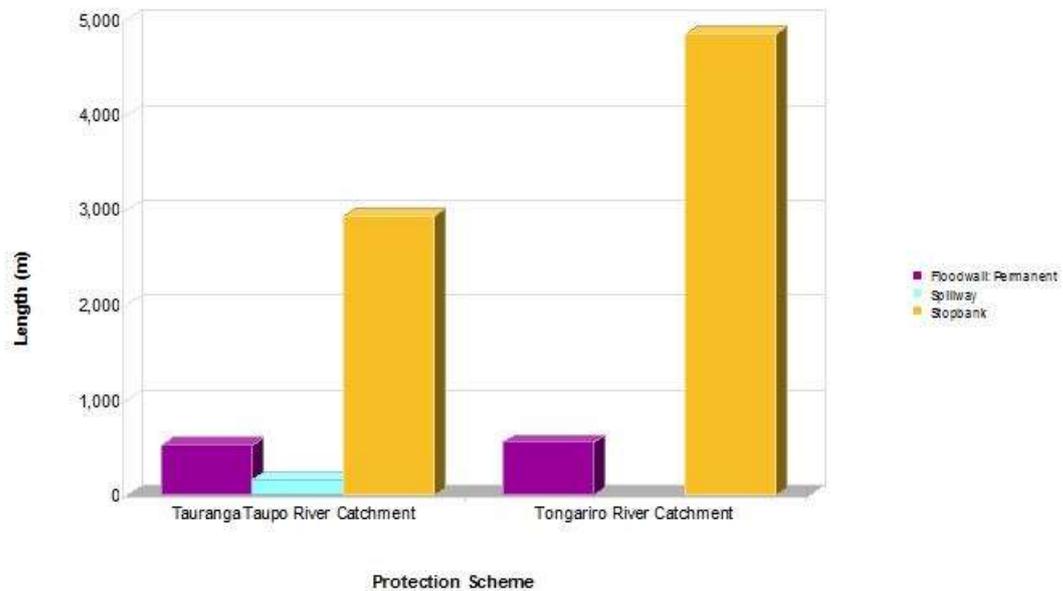


Figure 5 Lengths of embankment assets

3.2.2 Structures

WRC has a number of structures within the Lake Taupō zone including floodgates, floodwalls, culverts and fences. These assets undergo a programme of regular maintenance with asset condition monitored by regular inspection.



Figure 6 Tongariro floodgate

Key issues

- Damage from significant storm events
- Blockages due to debris in flood gates etc and consequential backflow
- Vandalism

- Fish passage when new assets are built and other environmental requirements
- Scouring
- Earthquake damage to structures
- Geothermal activity causing corrosion and undermining foundations
- Insufficient capacity due to increasing required performance standards e.g. community expectations, climate change
- Land ownership and access issues

Structures make up 11% of the total ORC of all the Lake Taupō zone infrastructural assets, with a total value of \$758,688.

3.2.3 River management works (including retaining structures)

The Lake Taupō zone has a number of structures that exist within the river channel; these are classified as 'in river management works' and include weirs, river training groynes and rock erosion protection (rip rap).

Key issues

- Damage from high river flows
- Pest infestation

Rock erosion protection (rip rap) is the most significant type of river management work undertaken with a replacement cost of \$3,155,992 as at 30 June 2014 (as demonstrated in Figure 7). The breakdown of length of rip rap by protection scheme can be seen in Figure 8.



Figure 7 Rip rap protection at Bridge Lodge stopbank

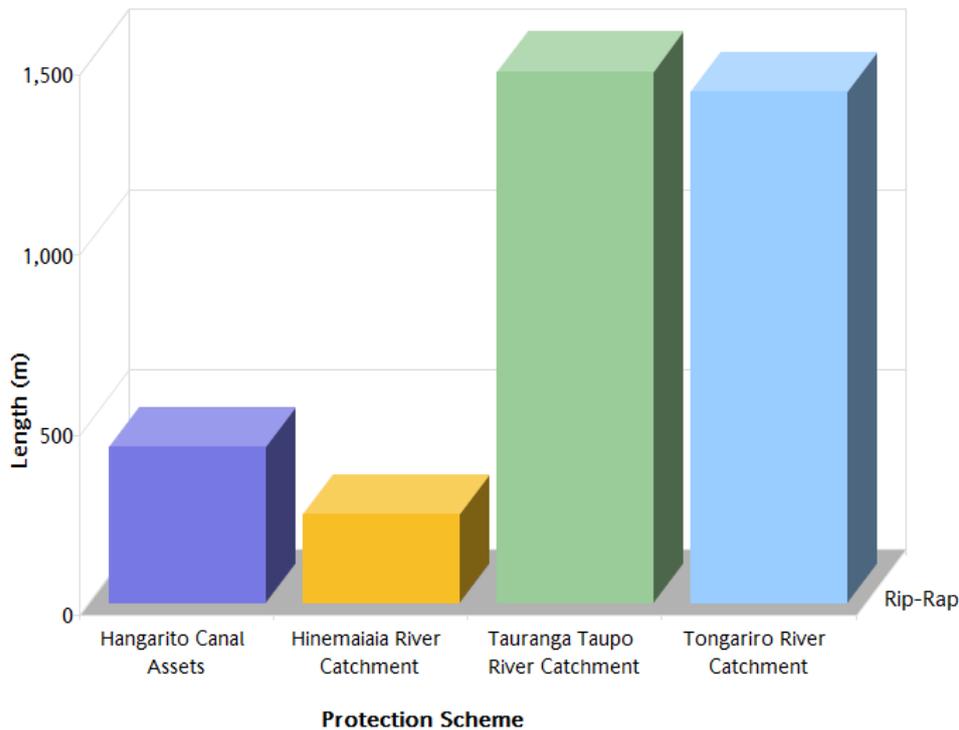


Figure 8 Length of rip rap by catchment

3.2.4 Channels

Channels include rivers and streams and canals. The condition of the waterways is generally monitored by visual inspections and physical surveys.

Key issues

- Excessive plant pest growth
- Blockages impeding flows
- Environmental issues e.g. timing of maintenance
- Pest and weed control e.g. invasive exotic species
- Regular maintenance is required to ensure design capacity is maintained

Channels make up 3% of the total ORC of all the Lake Taupō Catchment assets, with a total value of \$220,903 (attributed to the canals). The length of rivers and streams and canals in the Taupō zone are approx 216.5km.

3.3 Data confidence and reliability

The asset register is considered to be complete with good knowledge of asset age due to the recent construction of the schemes (on the whole). There is still a need to collect key attribute data particularly for embankments and river management works.

A programme to improve on the historical asset data has been implemented since 2012. It will improve on the asset data completeness and asset condition and performance information. The following reviews are underway or have been completed:

- A stopbank crest-level design data review

- Cross sectional surveys of the floodway for levels of services and management purposes.

A condition inspection guidance manual is in place and an audit of the stopbank condition assessment was completed in 2012.

Table 5 provides the confidence framework from the International Infrastructure Management Manual (IIMM) used to determine the confidence in the asset data used in this asset management plan.

Table 5 Asset data - confidence grades

| Confidence grade | General meaning |
|-------------------------|--|
| Highly reliable | Data based on sound records, procedure, investigations and analysis, documented properly and recognised as the best method of assessment. |
| Reliable | Data based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example the data is old, some documentation is missing, and reliance is placed on unconfirmed reports or some extrapolation. |
| Uncertain | Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade highly reliable or reliable data is available. |
| Very uncertain | Data based on unconfirmed verbal reports and/or cursory inspection and analysis. |

Table 6 reflects the confidence in the asset data for the assets within the Lake Taupō Catchment zone. The 'material data' refers to the construction material of the asset. 'Other attribute data' includes length, height, volume, width, foundation type, design parameters etc.

Table 6 Summary of asset data accuracy for critical and non-critical assets (Feb 2015)

| Asset type | Material data (where applicable) | Age | Other attribute data | Overall |
|------------------------|---|----------------|-----------------------------|----------------|
| Embankments | Reliable | Reliable | Reliable | Reliable |
| Structures | Reliable | Reliable | Reliable | Reliable |
| River management works | Reliable | Uncertain | Reliable | Reliable |
| Channels | Not applicable | Not applicable | Reliable | Reliable |

Note: This table relates only to the information in the asset register and does not reflect the completeness of the data.

Table 7 outlines the grading system used to summarise the completeness of the data held in the asset register.

Table 7 Asset data – completeness grades

| Data completeness | General meaning |
|--------------------------|---|
| 0 – 20% | The asset register contains minimal information about the assets with the |

| | |
|-----------|--|
| | majority of assets not listed at all. |
| 20 – 40% | About a third of the assets are listed, and/or about a third of the attribute information is listed. |
| 40 – 60% | About half of the assets are included in the asset register and/or of the assets included; only half the asset attribute data is included. |
| 60 – 80% | Most assets are included on the asset register with most of the relevant asset attributes. |
| 80 – 100% | The asset register contains a complete set of data for every known asset. |

Table 8 provides an indication of the overall data completeness for the Lake Taupō catchment zone. The low overall scores for embankments and river management works are a reflection of incomplete attribute data rather than missing assets.

Table 8 Overall data completeness (Aug 2015)

| Asset type | Material data (where applicable) | Age | Other attribute data | Overall |
|------------------------|----------------------------------|-----------|----------------------|---------|
| Embankments | Not Applicable | 80 – 100% | 40 – 60% | 50% |
| Structures | 60 – 80% | 80 – 100% | 40 - 60% | 60% |
| River management works | 80 – 100% | 80 – 100% | 20 – 40% | 50% |
| Channels | Not applicable | 80 – 100% | 60 – 80% | 70% |

The following table (Table 9) gives a summary of an initial assessment of the level of completeness and data accuracy WRC wants to achieve for each asset type.

Table 9 Target level of asset data accuracy and completeness

| Asset type | Accuracy | Completeness |
|------------------------|-----------------|--------------|
| Embankments | Highly reliable | 100% |
| Structures | Highly reliable | 100% |
| River management works | Reliable | 80% |
| Channels | Reliable | 60-70% |

Whilst the data currently held for WRC assets is generally considered reliable there are some significant gaps in overall completeness of attribute data. The first focus for improvement will be embankments where confirmation of design data will go a long way toward improving data completeness. The data collection for structures and river management works is prioritised around the collection of key attribute data to support asset valuation. This requires a combination of field verification and reference to design plans

3.4 Asset age

The following figure shows a comparison between the average age of the asset groups and the estimated average remaining useful life.

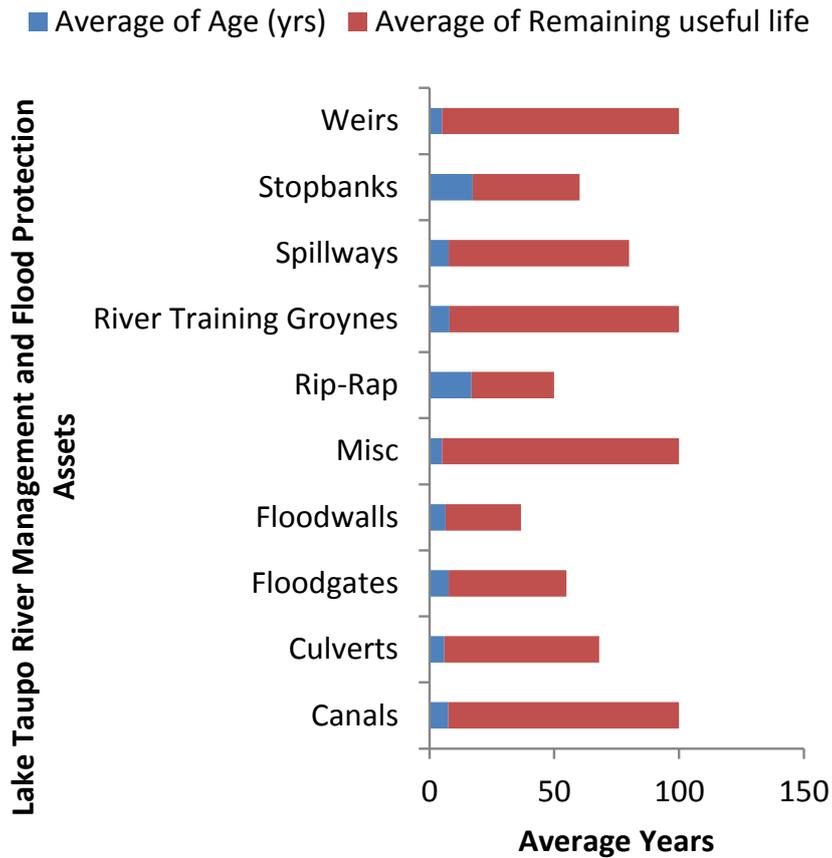


Figure 9 Asset average age versus average remaining life

3.5 Asset condition

Council has an asset register for all assets that contains:

- A definition of all assets including description and location.
- Physical dimensions and capacity.
- Age and replacement costs.
- An assessment of asset condition.

The condition assessment model in Table 10 is the basis of assessing the condition of Council’s assets in the Lake Taupō catchment zone.

Table 10 Typical condition rating model

| Grade | Condition | Description of condition | Approximate remaining life (% of base life) |
|-------|--------------|---|---|
| 0 | Non-existent | Asset is absent or no longer exists | N/A |
| 1 | Very good | New condition or cosmetic defects that will have no effect on performance. No work required. | 80% to 100% |
| 2 | Good | Normal weathering that will not reduce the overall performance of the asset. Routine maintenance to continue. | 60% to 80% |

| | | | |
|---|-----------|---|----------------|
| 3 | Fair | Minor defects and normal weathering that will have minimal effect on the overall performance of the asset. Backlog or non-routine maintenance is required. | 20% to 60% |
| 4 | Poor | Defects that cause a reduction in the performance of the asset or could do so in the near future. Further investigation or substantial short-term remediation is required. | 2 years to 20% |
| 5 | Very poor | Defects that significantly reduce the performance of the asset (asset may be described as barely serviceable) or severe defects resulting in complete performance failure. Structural failure is imminent or a significant safety risk exists. Urgent remedial work or replacement is required immediately. | < 2 years |

3.6 Condition results

Following the annual condition inspection of flood protection and river management assets a Condition and Performance Report is prepared to summarise the results and to highlight any issues¹².

3.7 Asset capacity and reliability

3.7.1 Capacity

Table 11 outlines the different design capacities (where applicable) of the WRC Lake Taupō assets.

Table 11 Asset capacity

| Asset group | Lake Taupō zone |
|---------------------|---|
| Embankments | Maintained to the design crest level (flood protect + loss of freeboard) With renewal of the stopbanks initiated when settlement of 50% of the freeboard occurs. |
| Structures | Maintained to capacity as designed. |
| In river structures | Maintained to ensure they are functioning as designed . |
| Channels | Maintained in order to achieve objectives. |

3.7.2 Reliability (performance)

A small asset failure (namely in the stopbanks or erosion protection asset groups) can lead to inundation of a large area of the flood plain resulting in disproportionate damage to the initial failure.

The erosion protection assets can also be subject to substantial damage themselves from flows less than design level.

Reactive maintenance is expended on repairing flood damage resulting from moderate sized floods.

¹² For the full 2013/14 report for Taupō refer to [EWDOCS_n3088099_v1_2013_14_Condition_Assessment_Report_Taupō_Zone.docm](#)

Preventative maintenance, regular inspection, monitoring and hydraulic modelling all contribute to ensuring service reliability standards are met.

3.7.3 Performance of stopbanks

The performance of an earthen structure (stopbank and detention dam) is technically assessed on the basis of its actual surveyed crest level compared to the design crest level and the probability of failure of the structure. Probability of failure is based on the likelihood primarily through flooding and erosion. This figure combines the structural details (geometry, type of soil or construction material, location and condition) and modes of failure.

Crest levels of the stopbanks are surveyed between five to ten years.

The table below shows the length of stopbanks below design flood level. The target percentage is as per section 2 - the services we provide¹³. The data is based on surveys carried out on the Tauranga Taupō river in 2011 and the Tongariro river in 2012.

Table 12 Stopbanks crest levels

| Zone/district | Total stopbank length (km) | Length below design flood level (km) | Above design flood level (%) |
|---------------------------------|----------------------------|--------------------------------------|------------------------------|
| Tauranga Taupō | 4.30km | N/A | N/A |
| Tongariro | 3.22km | 0.14km ¹⁴ | 96% |
| Total Lake Taupō catchment zone | 7.52km ¹⁵ | N/A | N/A |

¹³ Refer to Levels of Service Table 2 and Table 3 in section 2.

¹⁴ Note: Length below design flood level figures produced by Conquest (WRC's asset management database) have been reviewed and adjusted to take account of performance calculation methodology limitations. The 0.14km identified as below design levels relates to a portion of stopbank that has been raised but requires a survey to confirm that it is now meeting design levels.

¹⁵ Note: Information relating to the length of stopbanks in council's asset management database has been updated since 2011 and 2012 when crest level surveys were carried out. As a consequence there is a discrepancy between the information in Table 12 and Table 4.

4 Managing growth and demand

4.1 Introduction

The LGA (Schedule 10) requires that future growth and anticipated demand is considered as part of long-term asset management planning. This enables the future requirements for constructing new, and upgrading existing, assets to be identified and planned in advance.

In 2013 TDC adopted the Southern Lake Structure Plan (the structure plan) which sets out the relative sequencing and location for urban, commercial and rural residential growth in the immediate catchments of the Tongariro and Tauranga-Taupō flood protection schemes. Economic trend data also provides an indicator of future growth within the wider Taupō District.

This AMP draws on the information in the TDC Structure Plan and describes the: (i) predicted urban growth in the southern part of the Taupō District and; (ii) relevant economic trends in the Taupō District; and (iii) strategies WRC will initiate to manage growth and demand related to flood protection and river management assets.

4.2 Predicted urban growth in southern Taupō district

The structure plan was developed as part of the wider Taupō District 2050 Growth Management Strategy.

The purpose of the structure plan is to manage future residential growth in the southern settlements of the Taupō District. With a planning horizon to 2035, the structure plan provides information as to the location and likely sequencing of residential growth in the catchment areas of the Tongariro and Tauranga Taupō flood protection schemes.

4.2.1 Growth in the Tongariro flood protection catchment

The main urban centre in the Tongariro flood protection catchment is the town of Turangi, with the settlement of Tokaanu being located further to the west of the Tokaanu tailrace.

By 2035 the structure plan anticipates that approximately 58 new lots will be created in Turangi along with the construction of the associated residential dwellings. Vacant land with sufficient infrastructural capacity in excess of the anticipated new lots is identified in the structure plan - refer Figure 10 (the vacant land is highlighted in blue). Development of these lots would have no impact on the flood protection scheme. The benefit derived by these lots from the scheme is considered to be indirect and primarily related to the protection of the surrounding infrastructure. The structure plan also indicates there are currently 467 vacant lots in Turangi; consequently the additional and new development areas are unlikely to be required in the foreseeable future.



Figure 10 Vacant land in Turangi with infrastructural capacity for serviced lots

The Taupahi Road area and other areas identified in the structure plan fall outside of the existing Taupō District flood hazard overlay. No new development is identified in the Tongariro delta area, Little Waihi, Grace Road, Mangamawhitiwhiti area and in Tokaanu.

4.2.2 Growth in the Tauranga Taupō flood protection catchment

The main urban areas in the Tauranga Taupō flood protection catchment are Te Rangīta and Oruatua, with the larger urban area of Motuoapa being located to the south west of the Tauranga Taupō River.

The structure plan indicates that no new development is identified to occur in Te Rangīta and Oruatua. Instead the structure plan anticipates approximately 204 new lots and associated residential dwellings would be constructed in Motuoapa by 2035. At this time the newly subdivided urban area located to the south of Kiko Road - accessed from Rangimoana Avenue - has capacity for approximately 173 serviced residential lots, leaving a shortfall of 40 lots. The new urban area has capacity for servicing newly constructed dwellings.

The new development area of Motuoapa identified in the structure plan falls outside of the Taupō district flood hazard overlay and is not part of the Tauranga Taupō flood protection scheme. The benefit derived from the schemes by the new lots is likely to be indirect and related to roading access along State Highway One.

4.3 Taupō district economic growth trends

As noted in 2.1.3, the population of the Taupō district in the 2013 census was 35,850 from an estimated 18,201 households (including unoccupied dwellings)¹⁶. Figure 11

¹⁶ <http://www.stats.govt.nz/Census/2013CensusHomePage/QuickStats/AboutAPlace/SnapShot.aspx?tab=PopulationDwellings>

shows over the period 1991 to 2013 population growth in the Taupō district has steadily increased at a rate of approximately 11% - substantially less than the Waikato region average of 20% and 21% nationally.

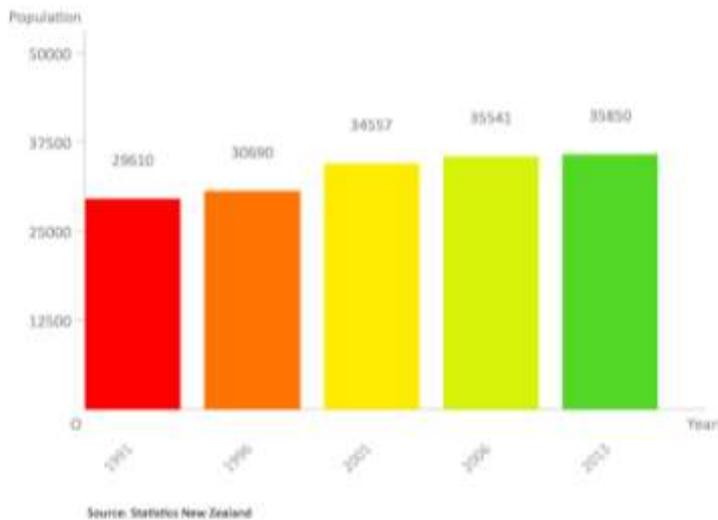


Figure 11 Population of the Taupō district 1991-2013

While no precise population data is available for the southern part of the Taupō district, the following figure shows the population of Turangi has been steadily declining. However despite a declining population the number of rateable sections within Turangi has remained static.

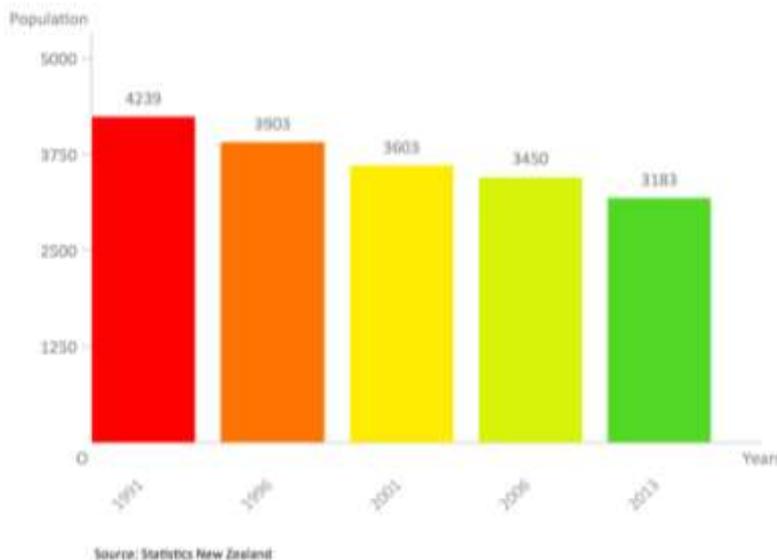


Figure 12 Turangi township population 1991-2013

The Economic Monitor for the Taupō district recorded real economic activity/GDP growth of 3.4% for the 2013-2014 year, up 3.2% from the previous year¹⁷. The increase in growth is supported by an increase in the number of visitor nights spent in Taupō and an increasing number of building consents issued by the TDC.

¹⁷ <http://www.greatlaketaupo.biz/images/Reports/Taupō-District-Economic-Monitor-Sep-14.pdf>

The 10 year nominal Gross Domestic Product (GDP) data shows the pastoral (particularly dairy), manufacturing and geothermal energy industries have grown dramatically. Tourism, forestry and logging and commercial services industries have also grown but at a slower rate.

The combination of steady population growth in the Taupō district and increasing economic activity indicates the residential growth projections contained in the 2013 Southern Lake Structure Plan are likely to be accurate. The spatial location of new development within both the Tauranga Taupō and Tongarariro flood control scheme catchments suggests current capacity of the assets is sufficient to cater for the impacts of predicted growth.

4.4 Demand management plan

The objective of demand management planning is to modify customer demand for services so as to maximise the use of existing assets and to avoid or defer the need for new assets or services. Community demand for catchment services is largely driven by economics, environmental considerations and changes in internal and external factors.

- As intensity of land use and the economic returns from protected land increases, the tolerance for flooding reduces, and there is therefore a demand for increased services. Increased returns from the land also provide a means for funding increased services.
- Environmental considerations and the RMA place constraints on the ability to develop new services (i.e. develop unprotected land) and to increase the level of service for existing protected land.
- Internal factors - there may be internal change (e.g. subsidence) which results in demand for increased levels of service.
- External factors that may drive demand include changes in weather patterns (e.g. climate change), and changes in land use throughout the catchment, which may result in increased runoff and flooding.

Non-asset solutions can include insurance and change of land use. It is considered that the most effective way of managing future demand for both new services and increased levels of service is via a multi-faceted approach as set out in the following table.

Table 13 Demand management instruments

| Component | Tool | Description |
|----------------------------|---|--|
| Legislation and regulation | Operative Waikato Regional Plan 2011 | Control of the use of land for the purpose of soil conservation and avoidance and mitigation of hazards. |
| | Operative Taupō District Plan 2007 | Land use planning in respect of the sustainable management of natural and physical resources in the Taupō district including controlling the nature and extent of development within identified flood and erosion prone areas. |
| | Southern Settlement Structure Plan 2013 | Manage and allow for future residential growth in the southern settlements of the Taupō district. |
| Financial and economic | Funding policy | Costs of the works and services are borne by the beneficiaries of the services provided and the contributors to the need for the services in proportion to the degree of |

| | | |
|-----------|--|---|
| | | <p>benefit received and/or contribution to the need.</p> <p>The Waikato Catchment Project Watershed Funding Policy describes how the existing works are funded, and provides a framework for funding new capital works. The new works have to meet specific criteria before these can be considered for funding. The criteria include:</p> <ul style="list-style-type: none"> • There is community demand for the works • The work must be technically feasible and economically viable • The works must not compromise the standards of an existing service • The work must meet the requirements of the RMA • The beneficiaries agree to fund the works in accordance with the funding policy • The land receiving the service must be classified for the benefit received and rated accordingly. <p>Council will consider applications for new works on a case-by-case basis, and on their specific merits and meeting the above criteria might not result council approval.</p> |
| Education | <p>Catchment committee</p> <p>Customer service</p> | <p>Educate community in order to manage expectations for new or upgraded works.</p> <p>Encourage less intense land uses in some areas.</p> |

5 Protecting our environment

5.1 Lake Taupō catchment

The Lake Taupō catchment covers an approximate area of 349,655ha. Lake Taupō is the largest lake by surface area in New Zealand at some 61,491ha, and comprises 17.5% of the Lake Taupō catchment area.

Around 40 rivers, streams and tributaries feed into Lake Taupō with a combined length of approximately 597km (refer Figure 2). However the combined length of all watercourses that drain the Lake Taupō catchment encompasses some 1,468km of streams and rivers. The Tongariro and Tauranga Taupō are the largest rivers that feed into the eastern side of Lake Taupō by length and also by volume.

With the exception of Lake Taupō, there are 11 other smaller lakes in the Lake Taupō catchment of which Lake Rotoaira is the largest.

Land use in the catchment has changed dramatically since 1840. The four major changes have been:

- loss of tussock or shrubland and indigenous forest cover
- development of urban areas and hard infrastructure (roading etc)
- an increase in exotic production forestry
- an increase in areas used for primary production (exotic pasture).

The following figure shows the extent of change in land use cover from 1840 to 1996.

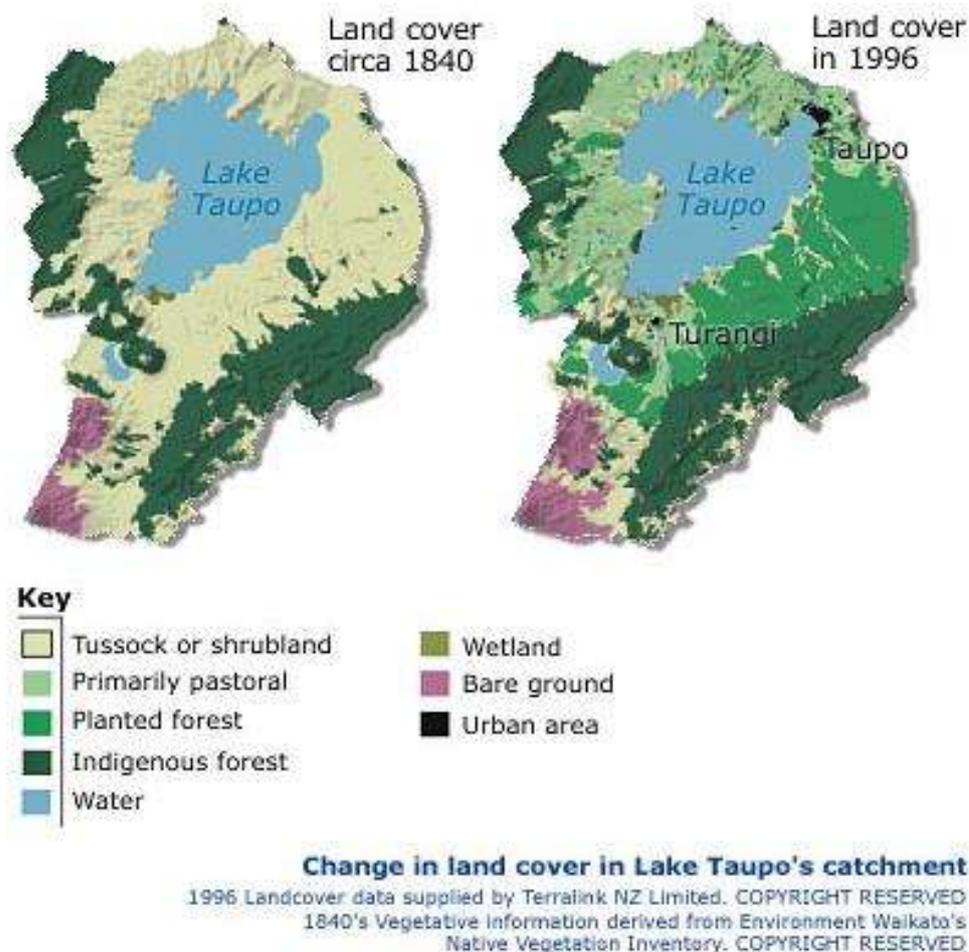


Figure 13 Change in land cover in Lake Taupō catchment

5.2 Tongariro river catchment and flood protection scheme

The Tongariro river has several river and stream tributaries that flow from the Tongariro National Park, Kaimanawa Ranges and the Umukarikari Ranges. The river has a catchment of 791km² and is 92km in length. The Tongariro Power Development (TPD) has significantly modified the natural hydrology of the river system.

The Tongariro river is described as a constantly changing river system with a steadily developing alluvial fan and river delta. The deposition of alluvial sediment at the head of the delta is part of the natural fan building process. At the same time, riverbed sediments are mobile and actively building up (aggrading) in many parts of the channel and degrading in others. Changes in sediments have a major influence on the ability of the river to convey flood flows.

The river delta has significant ecological values and supports wetland areas. The delta is of particular importance and value to Ngati Turangitukua and contains a number of sites of significance.

The river supports resident and lake migrant populations of both rainbow and brown trout and is an internationally recognised trout fishery. Early flood protection measures were

put in place around the Turangi township in the 1960s following a severe flood in 1958. Following the 1998 flood, further construction work was undertaken by the TDC. During the development of project watershed funding policy, the community need for comprehensive flood protection system was identified and the initial design started in 2002 following adoption of the funding policy. WRC was granted resource consent in 2004 to construct additional flood protection assets based on work undertaken to model the 1% AEP flood event. A flood event in 2004 resulted in a redesign of the scheme which was completed in stages between 2005 and 2008.

5.3 Tauranga Taupō river catchment and flood protection scheme

The Tauranga Taupō river runs from the Kaimanawa ranges into the south eastern shore of Lake Taupō. With a catchment covering approximately 230km² the Tauranga Taupō river is described as highly dynamic with substantial gravel transport during flood events¹⁸. It is 45km in length and is the second largest of the rivers flowing into the eastern side of Lake Taupō.

The vegetative cover within the Tauranga Taupō river catchment is predominantly a mix of indigenous native forest (67.5%) and areas of exotic production forestry (30.3%), particularly in the upper catchment. The lower catchment contains the communities of Oruatua and Te Rangiita, and a mix of exotic production forestry and pasture.

Historically the Tauranga Taupō river has caused significant flooding in and around the settlements of Oruatua and Te Rangiita. The Waikato Valley Authority put the first flood protection scheme in place in 1981 following major flooding events in 1958 and 1964.

A significant flood in 2001 resulted in the Tauranga Taupō river breaking out of its channel and forming a new course. The new channel, and dewatering of the former channel, changed the balance of flood risk in the lower catchment and adversely affected the trout fishery in the lower reaches of the Tauranga Taupō river.

In response to the 2001 breakout, WRC was granted a suite of resource consents in 2003 and a further consent in 2004 to construct and operate the flood protection scheme including undertaking various river management works in the Tauranga -Taupō River and associated riparian margins.

5.4 Environmental operating regime

Collectively the conditions of the resource consents for the Tongariro and Tauranga Taupō flood protection schemes set out the environmental operating regime. In this regard WRC places significant emphasis on ensuring compliance with the applicable resource consent conditions in the operation and maintenance of the flood protection schemes.

Environmental performance is measured by WRC achieving compliance with all conditions of the relevant resource consents, and is reported annually to the Lake Taupō catchment committee.

A list of the relevant resource consents is contained in section 6.5 of this plan.

¹⁸ Tauranga Taupo – Catchment Management Plan: Technical Report 2005/06

6 Managing our assets

6.1 Overview of activities

The aims of WRC's river and flood protection activities are to:

- Manage issues in a 'whole of catchment' context
- Manage hazards and effects associated with soil erosion and flooding
- Reduce sediment entering waterways
- Improve water quality
- Improve river and lake bank stability
- Improve river and lake environments by creating better habitats for a wider variety of plants and animals
- Maintain and manage existing river, lake and catchment assets.

This section describes the services provided to achieve these aims.

6.2 Catchment oversight

The council's role in the Lake Taupō catchment extends beyond simply river management and flood protection. It includes the overall management and coordination of zone activities to improve catchment health. Strategies to achieve zone goals are articulated through a zone plan. This AMP is a key input into the zone plan.

Oversight of all annual and forward programmes for the zone are considered by community and sector representatives through a catchment committee and reported to the wider community and the council.

Catchment oversight also includes the maintenance of partnerships and relationships with key stakeholders across the zone. The objectives are to ensure the delivery of the zone programmes and activities as set out in the LTP.

6.3 Information and advice

The activity of managing assets within the Lake Taupō catchment involves responding to enquiries and provision of advice and information on river management, flood protection and other catchment matters. It also includes monitoring programmes to assess the environmental changes resulting from the activities undertaken. The findings of the monitoring are reported to the community via the catchment committee and council.

6.4 River management

River management addresses issues such as instability of river and stream banks and beds, congestion of waterways and management of land adjacent to the river or stream. The purpose is to stabilise river and stream beds and banks and address the adverse effects created by peak flood flows within rivers and streams.

Typical river management works include:

- Controlling bank erosion (by planting and fencing off river banks, construction of rock or other bank revetment works or construction of groynes)
- River training works (ensuring the flow paths of rivers are stable and optimum channel widths are maintained)
- Removing blockages and obstructions
- Gravel and sand management.

River management achieves:

- Sustainable, stable and healthy rivers
- Integrated catchment management
- Management of flood waters
- Enhancement of the environmental values of river systems
- Liaison and integration with other WRC activities and programmes.

From time to time management plans are prepared for specific rivers. At the time of writing this plan, documents have been developed for:

- Hangarito Stream (Doc # 2931847)
- Proposed Management of the Waimarino Stream (Draft), 2013 (Doc # 2328974)
- Lower Kuratau River Care Plan, 2003. (Doc # 821396v1)

6.5 Flood protection

A greater level of management and protection works is required on some rivers prone to flooding, in particular the Tongariro and Tauranga Taupō rivers. Typical flood protection management issues include:

- Resource and land use consent (related to the construction and maintenance of flood protection structures)
- Maintenance and management of works
- Channel management including gravel and sediment management, bank protection works, channel maintenance and riparian management
- Restoration of disturbed sites including rehabilitation of construction sites and the maintenance of rehabilitated areas
- Catchment/land management including indigenous vegetation, production forestry, urban and pasture and quarries
- Emergency response to flooding and other hazards.

Major additional flood protection works have been undertaken along these rivers to protect the local communities including:

- Management of flood risks and hazards associated with rivers
- Specific protection works as agreed with communities.

Due to the dynamic nature of the rivers and the relative newness of both the flood control schemes, more frequent reviews of the asset performance is considered necessary for improving council's understanding of how these rivers behave and the future management requirements.

6.5.1 Tongariro flood control scheme

The Tongariro river is a constantly changing river system with the town of Turangi located at the entrance to the river delta. River bed sediments are actively building up and moving through the river channel and have a major influence on the river.

WRC, through Project Watershed, manages a flood protection scheme along the Tongariro river within Turangi township which was constructed to protect people and property from flooding up to a 1% AEP standard as agreed with the community.

Flood protection is provided by a combination of stopbanks, river channels, river banks, berms and flood plains. Erosion control works ensure stability of the river banks and gravel extraction ensure the capacity of the floodway.

WRC has the following operational consents in place to maintain the scheme:

Table 14 Tongariro flood scheme resource consents

| Consent type | Consent No | Expiry (year) |
|--|-------------------|----------------------|
| Erosion control/flood protection works. | 121305 | 2031 |
| Divert water and temporarily dam and divert water within the Tongariro river as required to exercise resource consent 121305. | 121306 | 2031 |
| Undertake erosion protection works on the bed and banks of a 250 metre reach of the left bank of the Tongariro river and undertake ongoing maintenance of structure as required. | 104532 | 2036 |
| To divert floodwaters of the Tongariro river by a stopbank on the true left bank of the Tongariro river. | 104807 | 2036 |
| Undertake works including gravel abstraction, debris/vegetation removal, soil disturbance, other bed disturbance and temporary diversion of river associated with construction of stopbanks. | 110223 | 2039 |
| Divert water via the operation of stopbanks and floodwalls in the bed and on the floodplain of the Tongariro river. | 110224 | 2039 |
| River restoration and enhancement works on the Tongariro river, undertake willow clearance and erosion protection works. | RM030640 | 2019 |

This scheme is supported by the following documents which are updated as required:

- Tongariro River Flood Control Scheme Management Plan for Floodway Maintenance, May 2012 (Doc # 1972444)
- Tongariro River and Catchment Management Plan, December 2006 (Doc # 927658/v2)

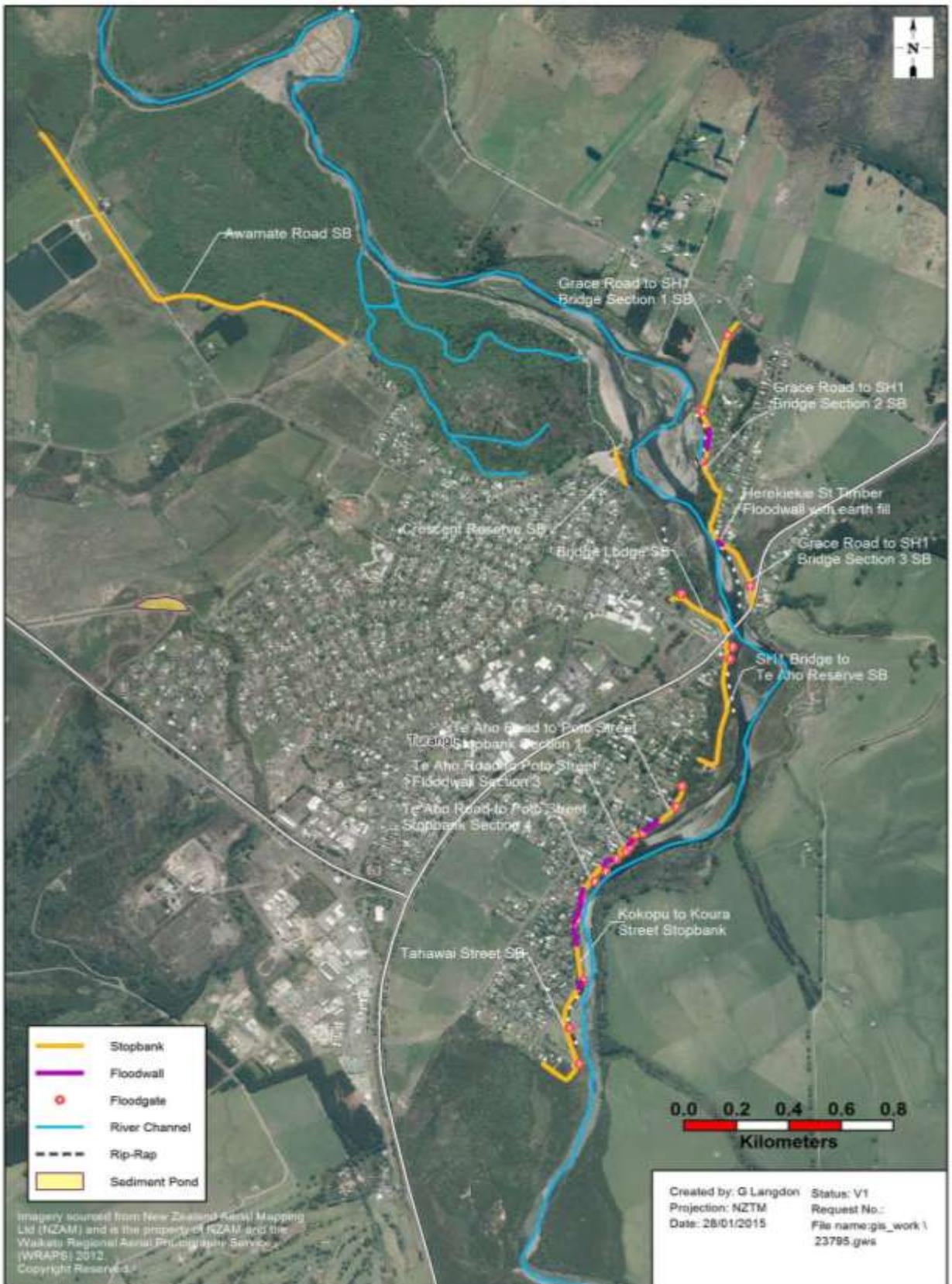


Figure 14 Tongariro flood control scheme

6.5.2 Tauranga Taupō flood control scheme

Historically the Tauranga Taupō river has caused significant flooding in and around the settlements of Oruatua and Te Rangiita and on adjacent farmland. The river has a substantial hill country catchment and is highly dynamic with substantial gravel transport in floods. Changes in the river course have altered the balance of flood overflow and caused erosion and scouring in some areas and gravel deposits in others.

The first flood protection scheme along the Tauranga Taupō river was adopted in 1981 following major flood events in 1958 and 1964.

WRC manages the flood protection scheme to protect people and property from flooding up to a 50 year event standard as agreed with the community.

Flood protection is provided by a combination of stopbanks, gradient control structures, overflow spillways, river channels, river banks, berms and floodplains.

Table 15 Tauranga Taupō flood scheme resource consents

| Consent type | Consent No | Expiry (year) |
|--|------------|---------------|
| Construct erosion control structure weirs, spillways and river sill works and undertake ongoing maintenance of those structures as required in the bed of the Tauranga Taupō River for flood hazard control works. | 108324 | 2038 |
| Extract gravel and shingle, and to disturb the bed of the Tauranga Taupō river generally in association with flood hazard control works. | 108325 | 2038 |
| Divert floodwater by way of stopbanks and divert the flow of the Tauranga Taupō river by way of constructed diversion channel and river sill works. Also undertake ongoing maintenance associated with flood hazard control works. | 108326 | 2038 |
| Construct and use culverts and undertake works in association with Kiko culverts associated with flood hazard control works. | 108697 | 2038 |
| Construct and maintain 2 x 100m rock rip rap erosion protection walls on the banks of Tauranga Taupō river | 109978 | 2039 |
| Placement of additional erosion control structures in and on the bank of the Tauranga Taupō river for flood protection purposes. | 111087 | 2039 |
| Divert water by way of a flood control wall and stopbank for flood protection purposes. | 111088 | 2039 |
| Construct, maintain and use a stopbank (approx 225m long) on the floodplain of the Tauranga Taupō river and associated damming and diversion of flood water for flood protection purposes. | 117974 | 2043 |

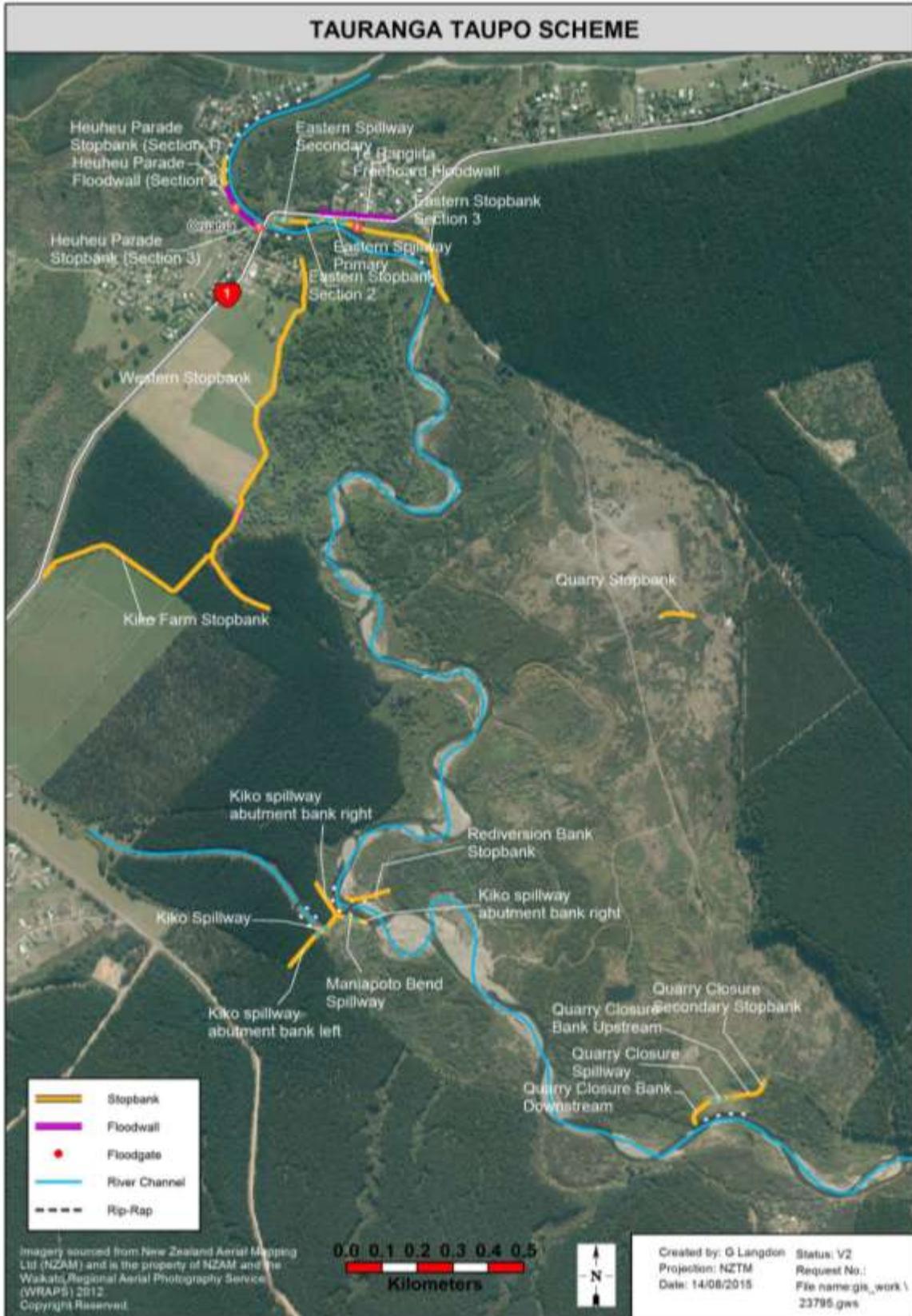


Figure 15 Tauranga Taupō flood control scheme

This scheme is supported by the following documents which are updated as required:

- River Management and Gravel Extraction Plan, Tauranga Taupō River, Dec 2012 (Doc # 2788048)
- Tauranga Taupō River – Catchment Management Plan, November 2005 (Doc #1003804)

7 Risk management

7.1 Overview

This section covers the risk management processes implemented by council and how these apply to current and future integrated catchment services activities. In addition, it provides a register of asset risks for the zone and highlights the most significant risks and the approach to their management.

The objective of risk management is to identify the specific business risks together with any possible risks associated with the ownership and management of ICM assets and provision of services. This can be used to determine the direct and indirect costs associated with these risks, and form a priority-based action plan to address them.

7.1.1 Corporate policy

The council policy covering a framework for risk management was adopted in September 2014. The policy covers the risk management objectives and process, assessment of consequence, likelihood and risk, risk treatment and responsibility. An overview of the risk management process and a summary of the key elements are contained in this section of the AMP. A full description of all the risk management elements is available in the corporate policy (Waikato Regional Council Risk Management Framework Corporate Policy, September 2014 – Doc # 3174654).

7.2 Risk management process

The risk assessment process follows the corporate policy which has been based upon the Australian New Zealand Risk Management Standard AS/NZS ISO 31000:2009. This has been used to establish a risk assessment matrix as shown in Table 16. This matrix provides a tool to quantify a risk by identifying the likelihood of the risk occurring and the outcomes or consequences should the risk occur. The first step in the process is to identify all possible risks; once identified, these risks are entered into the risk register.

The following flowchart and text details the key elements of the risk management process and is taken from council's Corporate Risk Management Policy (Doc # 3174654).

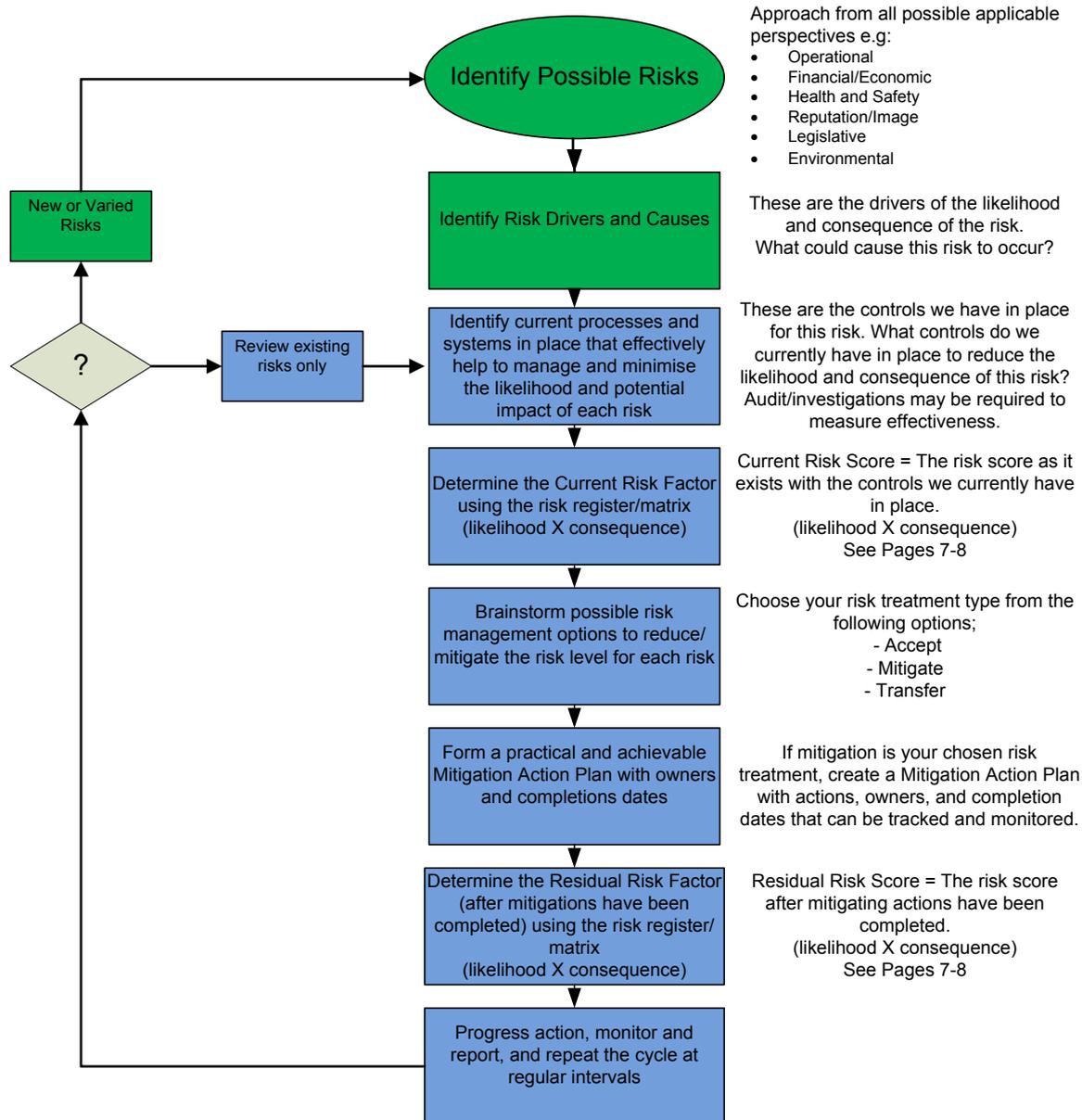


Figure 16 Risk management process

7.2.1 Putting the risks into perspective

The council policy and operation cannot influence all the factors contributing to the risk of an event. However, WRC has a responsibility to assess the risks in order to best manage the activity with the resources available to avoid and mitigate the effects of any event.

The council has grouped risk into four activity areas these being:

- General risks
- River management
- Flood management
- Catchment management

Risks under each of these activity areas has been assessed in the Asset Risk Register via the risk management framework described within this section. Risks, which after

having been assessed remain with a high or extreme rating, are captured in the overall action plan contained in this section of the AMP.

7.2.2 Risk types and levels

A key objective of the risk plan is to identify the risks associated with the management of infrastructure assets within the Lake Taupō zone. This requires approaching the risks from a number of perspectives for example:

- operational
- health and safety
- legislative
- financial/economic
- reputation / image
- environmental

These risks are pertinent to both a higher, corporate level, and to a more detailed asset-specific level, but do not substitute for more specific risk analysis at those levels (see Figure 17).

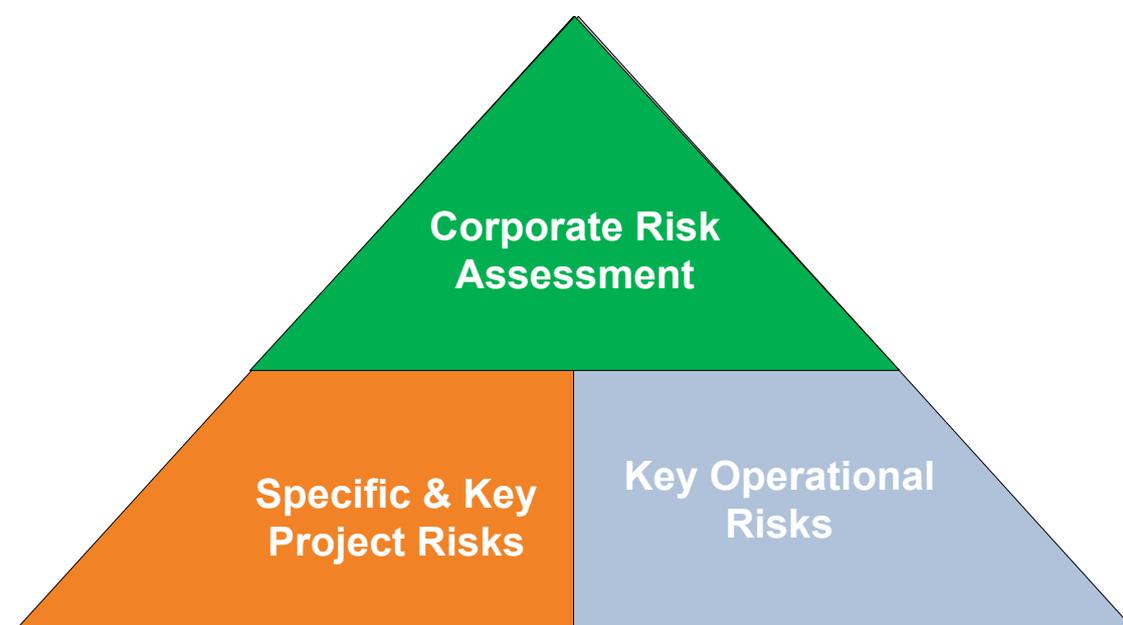


Figure 17 Risk hierarchy levels

The next step beyond this risk analysis is to develop more detailed risk plans where the criticality of specific assets is assessed and an action plan developed as appropriate.

7.2.3 Assessment of risk

The likelihood of occurrence and severity of consequences have been used to determine a risk rating. The risk rating enables definition between those risks that are significant and those that are of a lesser nature.

Table 16 Risk assessment matrix

| Likelihood | Consequence | | | | |
|--------------------|-------------------|-----------|--------------|-----------|------------------|
| | Insignificant (1) | Minor (2) | Moderate (3) | Major (4) | Catastrophic (5) |
| Rare (1) | 1 | 2 | 3 | 4 | 5 |
| Unlikely (2) | 2 | 4 | 6 | 8 | 10 |
| Moderate (3) | 3 | 6 | 9 | 12 | 15 |
| Likely (4) | 4 | 8 | 12 | 16 | 20 |
| Almost certain (5) | 5 | 10 | 15 | 20 | 25 |

Once the impact has been ranked according to the relative risk level it poses, it is then possible to target the treatment of the risk exposure, by beginning with the highest risks and identifying the potential mitigation measures.

7.3 Residual risk

The residual risk is the actual risk that remains after mitigation measures are implemented. The measures implemented reduce either, or both, the consequence and the likelihood of a risk occurrence. The revised factors are inputted into the same risk matrix to obtain the Residual Risk Factor.

7.4 Risk register

The risk register provided in the following table for the current and future ICM activities have been developed in consultation with key staff. For further information refer to Waikato Regional Council, Integrated Catchment Management Risk Register (Doc # 3436289).

7.5 Risk action plan

Table 17 is compiled from consideration of both the ICM Risk Register and specific zone risks. It highlights the most significant risks experienced within the Taupō zone.

Actions that are required to achieve the desired improvements are indicated along with how progress on these actions will be monitored and reported. Where applicable, action tasks will detail time frames for achievement, and responsibility for these actions.

Table 17 Risk action plan – Lake Taupō asset management plan

| REF | RISK DESCRIPTION | CAUSE | CONTROLS | RATING |
|---------------|---|--|---|----------------------------|
| Enter risk ID | Briefly describe the risk. | What could cause this risk to occur? | Are there any controls in place today which could prevent this risk occurring? | Risk rating pre mitigation |
| 11 | Awamate stopbank is incomplete resulting in lower levels of service and increased vulnerability of properties in the vicinity. | LINZ ¹⁹ settlement and satisfactory agreements with property owners to facilitate completion of the stopbank. Large flood event. | Relationship management landowner and LINZ. | High Risk (10) |
| 8 | Tauranga Taupō flow recorder site at risk of being damaged during flood event, resulting in loss of early warning to community and scheme managers, as well as loss of data for flood analysis. | Damage to flow site from flooding Failure of equipment. | Review of site underway (Taupō operations team and RUD ²⁰) and proposal for monitoring site flood hardening underway. | High Risk (12) |
| 9 | Key personnel/contractors leaving, resulting in loss of intellectual knowledge. | Various. | Inspections, works planning and assessments undertaken through a collaborative process. Use of conquest for timing of activities. | High Risk (12) |
| 10 | Incomplete information for stopbanks resulting in unknown vulnerability and performance. | Kiko stopbank (Tauranga Taupō river) information is not complete. | Ongoing inspection processes and annual work plan. | High Risk (15) |
| 14 | Lack of vegetation management resulting in loss of floodway capacity. | Lack of management and/or inspections. Absence of landowner agreement. | Ongoing inspection processes and proactive management where feasible, AMP and annual work plan. | High Risk (16) |

¹⁹ Land Information New Zealand

²⁰ Resource Use Directorate

8 Financial management

8.1 Overview

8.1.1 Introduction

This section of the AMP covers the financial strategies, policies, assumptions and financial forecast for river management and flood protection within the Taupō zone.

A financial forecast is an essential part of a sustainable approach to the management of infrastructure assets. The forecast provides a long-term view of how assets will be managed, the associated costs and when additional funding may be required to meet expected service levels.

The confidence in the underlying data upon which the financial forecast is based is discussed in section 3.

8.2 Expenditure

All costs incurred through the ownership of infrastructural assets, and that directly relate to the running of those assets, fall into two categories - capital/renewal expenditure or maintenance expenditure. Under the generally accepted accounting practice (GAAP) the following definitions need to be applied to the treatment of costs against infrastructure assets.

8.2.1 Definitions

8.2.1.1 Operations and maintenance expenditure

“Costs which are repairs and maintenance should be expensed.”

Maintenance costs are generally subdivided into three groups; these are described in Table 18.

Table 18 Maintenance types

| Maintenance type | General meaning |
|---------------------|--|
| Routine | Day-to-day maintenance which is required on an ongoing basis and is budgeted for. |
| Planned (proactive) | Non day-to-day maintenance which is identified in advance and is incorporated into a maintenance budget for a certain time period. |
| Reactive | Maintenance that is unexpected and necessary to attend to immediately to continue operation of the service. |

All maintenance costs are written off in the year of expenditure.

8.2.1.2 Replacement/renewal expenditure

“Costs which restore and sustain the intended service potential of the network is renewal expenditure and should be capitalised.” An example of this work is the de-siltation of artificial channels to return them to the design standard.

Renewal expenditure is treated in the same way as capital expenditure. For accounting purposes, any work performed on an asset that has previously been classified as

renewal costs will be subject to these guidelines and now be classified as capital expenditure.

8.2.1.3 Capital (new works) expenditure

“Costs which add to the service potential of the network as a whole”. These expenses should be capitalised and depreciated.

8.2.2 Management assumptions

This AMP has been prepared subject to the following limitations and assumptions.

- The plan is based on currently available information and data.
- Effects of climate change are considered based on the Ministry for the Environment guidelines.
- Financial forecasts are limited to 10 years.
- Land use within the catchment will remain the same.
- Existing levels of service will be maintained.
- Consultation with the community is ongoing. Targeted consultation in the development of this plan has been focused on input from community representatives associated with the catchment committee and stakeholders associated with the flood control schemes and various river works.
- There will be minimal change in applicable standards and technologies over the life of the plan.
- This plan has not considered future budget constraints.
- This plan has not considered changes to the RMA and the influence this will have in this activity area.
- The plan has not made any specific provision for management and governance changes that may result from co-management.

8.3 Summary financial forecast

The financial summary presented in this plan is based on the 2015/25 LTP adopted by council in June 2015. The LTP contains key financial management principles applying to the Lake Taupō zone, including:

- Definition of a zone reserving policy
- Capital funding mechanisms
- Insurance framework for zone assets.

The Lake Taupō asset management services are provided on an annualised maintenance cost basis. While there are activities on specific types of assets that are not carried out each year, the work is spread as evenly as possible across each year.

The following table and Figure 18 below provide a summary of the revenue and expenditure for the river management and flood protection activities for the Lake Taupō catchment. The table includes 2014/15 actuals and a 10 year financial forecast (2015-25). The figures for 2015-25 are based on the current value for 2014/15, therefore do not include inflation.

The operating reserve balance for the Lake Taupō catchment remains positive over the next 10 years. The zone establishment loan was repaid during 2014/15 and the capital rate loans will be repaid during 2021/22.

Lake Taupo

| | Budget figures | | | | | | | | | | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 |
| FLOOD PROTECTION GOA | | | | | | | | | | | |
| MAINTENANCE | Actual | LTP |
| River management | 286,952 | 308,490 | 307,043 | 308,236 | 314,558 | 323,159 | 348,432 | 337,844 | 346,544 | 355,468 | 367,946 |
| Tongariro | 159,597 | 170,797 | 164,372 | 163,196 | 166,246 | 170,826 | 193,500 | 178,592 | 183,240 | 187,912 | 195,736 |
| Tauranga Taupo | 81,023 | 73,995 | 76,911 | 77,835 | 79,603 | 81,757 | 83,149 | 85,469 | 87,651 | 89,924 | 92,439 |
| Hangarito | 20,120 | 14,348 | 15,640 | 14,758 | 15,082 | 15,488 | 15,738 | 16,168 | 16,586 | 16,995 | 17,448 |
| Other Rivers | 26,212 | 49,350 | 50,120 | 52,448 | 53,626 | 55,088 | 56,044 | 57,615 | 59,067 | 60,637 | 62,323 |
| Flood protection | 202,303 | 230,148 | 218,596 | 234,025 | 244,847 | 246,565 | 255,646 | 258,000 | 267,173 | 272,695 | 286,423 |
| Tongariro | 126,374 | 134,313 | 133,339 | 141,327 | 146,537 | 148,444 | 151,443 | 155,047 | 159,307 | 163,101 | 167,479 |
| Tauranga Taupo | 54,162 | 68,606 | 57,569 | 64,669 | 69,659 | 68,678 | 74,281 | 72,202 | 76,295 | 77,258 | 85,721 |
| Other Rivers | 21,767 | 27,230 | 27,689 | 28,029 | 28,652 | 29,443 | 29,922 | 30,751 | 31,570 | 32,336 | 33,223 |
| | 489,255 | 538,639 | 525,639 | 542,262 | 559,404 | 569,724 | 604,078 | 595,844 | 613,716 | 628,163 | 654,370 |
| Depreciation ¹ | 102,167 | 102,200 | 107,706 | 110,494 | 113,262 | 125,853 | 129,207 | 133,220 | 149,704 | 155,412 | 160,932 |
| TOTAL FLOOD PROTECTION GOA | 591,422 | 640,839 | 633,345 | 652,756 | 672,666 | 695,577 | 733,285 | 729,064 | 763,420 | 783,575 | 815,301 |
| FUNDED BY | | | | | | | | | | | |
| General rate | 64,410 | 71,431 | 70,380 | 72,965 | 75,432 | 78,222 | 81,984 | 81,854 | 86,439 | 88,217 | 92,031 |
| Targeted rate | 494,782 | 546,677 | 540,234 | 557,060 | 574,504 | 594,625 | 628,570 | 624,479 | 654,250 | 672,627 | 700,539 |
| Interest on Reserves | 8,632 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 | 9,711 |
| TOTAL REVENUE | 567,824 | 627,819 | 620,325 | 639,736 | 659,646 | 682,557 | 720,265 | 716,044 | 750,400 | 770,555 | 802,281 |
| TRANSFER TO / (FROM) OPERATING RESERVE | (125,765) | (115,220) | (120,726) | (123,514) | (126,282) | (138,873) | (142,227) | (146,240) | (162,724) | (168,432) | (173,952) |
| CAPITAL | | | | | | | | | | | |
| New Works | - | - | - | - | - | - | - | - | - | - | - |
| Renewals | - | - | 97,000 | - | - | - | - | - | - | - | - |
| TOTAL CAPITAL | - | - | 97,000 | - |
| FUNDED BY | | | | | | | | | | | |
| Depreciation | 102,167 | 102,200 | 107,706 | 110,494 | 113,262 | 125,853 | 129,207 | 133,220 | 149,704 | 155,412 | 160,932 |
| Targeted capital rates charged | 132,186 | 132,186 | 132,186 | 132,186 | 132,186 | 132,186 | 132,186 | 132,186 | - | - | - |
| TOTAL REVENUE | 234,353 | 234,386 | 239,892 | 242,681 | 245,448 | 258,040 | 261,393 | 265,407 | 149,704 | 155,412 | 160,932 |
| TRANSFER TO / (FROM) CAPITAL RESERVE | 234,353 | 234,386 | 142,892 | 242,681 | 245,448 | 258,040 | 261,393 | 265,407 | 149,704 | 155,412 | 160,932 |

Notes

1. Depreciation budget reflects revaluation result in 2014/15 and estimates of revaluation impacts during the life of the LTP.

The impact on depreciation of new works has not been included as they are considered to be minor.

Table 19 Summary of revenue and expenditure for river management and flood protection activities for the Lake Taupō zone 2015-2025

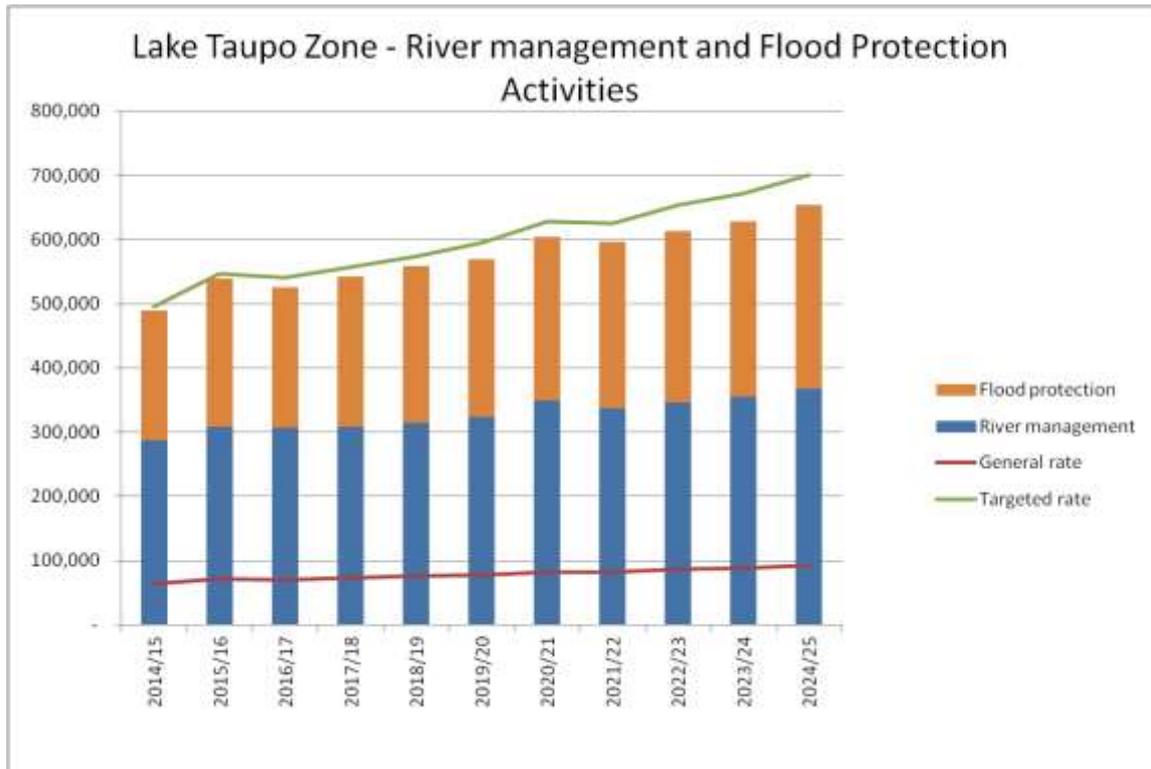


Figure 18 Financial forecast – Lake Taupō river management and flood protection activities

8.4 Operations and maintenance planning

8.4.1 Introduction

WRC’s maintenance strategies describe how the river management and flood protection activities will be undertaken on a day-to-day basis to consistently achieve the optimum use of the asset.

8.4.2 Routine (general) maintenance

Routine maintenance is the regular day-to-day work necessary to keep assets operating including instances where portions of the asset fail and need immediate repair. This work falls into two broad categories as follows:

- **Planned (proactive)** - Proactive inspection and maintenance works planned to prevent asset failure.
- **Reactive** - Reactive action to correct asset malfunctions and failures on an as required basis.

A key element of asset management planning is determining the most cost-effective blend of planned and unplanned maintenance as illustrated in Figure 19.

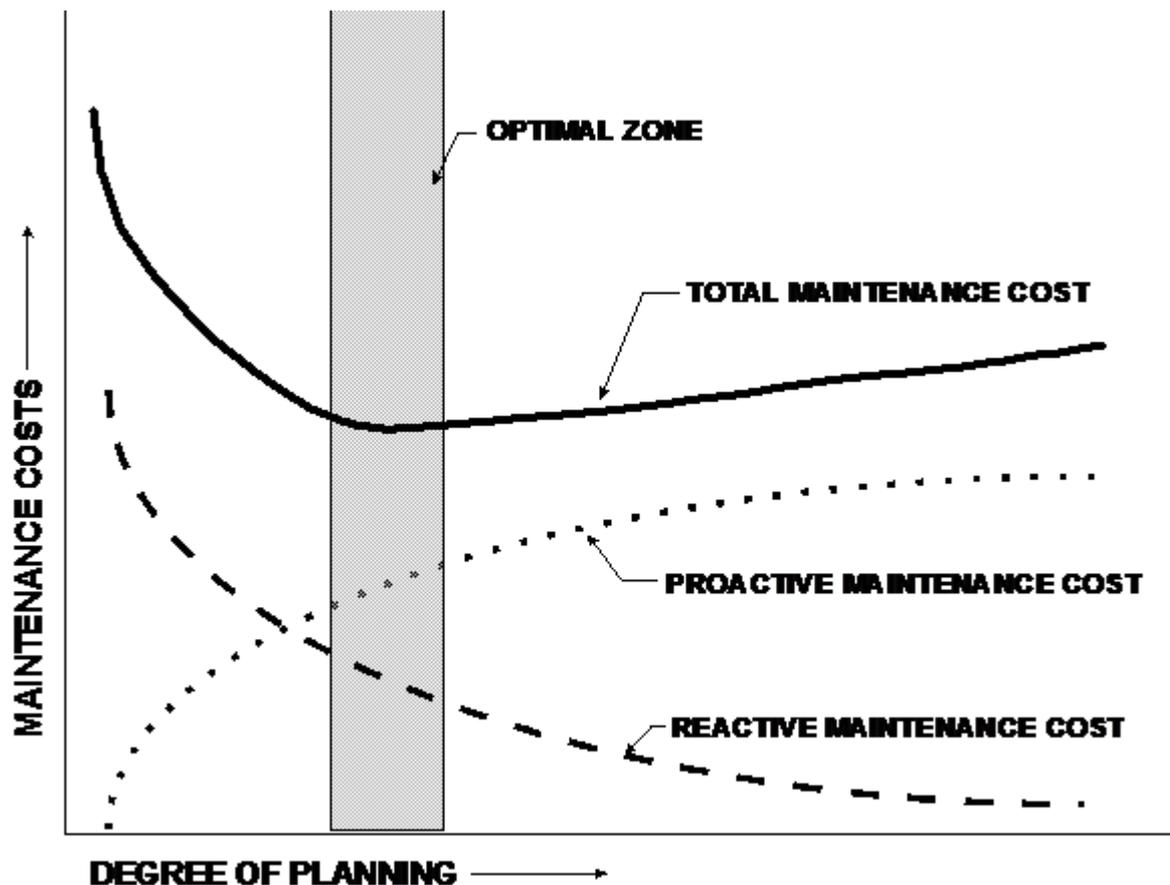


Figure 19 Balancing proactive and reactive maintenance

The short-term maintenance strategy is intended to maintain the current levels of service standards. The long-term maintenance strategy will be modified to reflect the following factors:

- **Risk of failure** - The risk associated with failure of critical assets
- **Levels of service** - Changes in the current or agreed level of service
- **Economic efficiency** - Asset condition assessment
- **Extend the life of the asset component** - Asset improvements and development programme
- **Legislative compliance** – e.g. requirements of LGA.

8.4.3 Operations and maintenance programme

The annual maintenance programme includes provision for:

- Standard monitoring maintenance works necessary to ensure that the assets are operational at all times. Such works include monitoring inspections, audits and surveys, removal of blockages from outlet channels and floodgate flaps, weed spray and lubrication of mechanical components.
- Planned maintenance works which are undertaken on a cyclic basis, or through the annual condition survey, crest level surveys, cross section surveys and structures audit reports. Prioritisation is based on the risks of failure.
- Unplanned maintenance which is urgent maintenance work identified during routine inspections, or through customer feedback. These are investigated and assessed, and if the risks of failure warrant it, works are added to the current annual maintenance programme.

8.5 Capital and renewal planning

8.5.1 Renewal works

Renewal expenditure is work that restores an existing asset to its original level of service (i.e. capacity or the required condition). These broadly fit into the following work categories:

- **Rehabilitation** - Involves the repair of an existing asset or asset component. Rehabilitation does not provide for a planned increase in the operating capacity or design loading. It is intended to enable the asset to continue to be operated to meet the current levels of service.
- **Replacement** – Does not provide for a planned increase to the operating capacity or design loading. Some minor increase in capacity may result from the process of replacement, but a substantial improvement is needed before asset development is considered to have occurred.

8.5.2 Renewal strategy

Renewal strategies provide for the progressive replacement or rehabilitation of individual assets that have reached the end of their useful life. This is managed at a rate that maintains the standard and value of the assets as a whole. This programme must be maintained at adequate levels to sustain current levels of service and the overall quality of infrastructure assets.

The general renewal strategy is to rehabilitate or replace assets when justified by asset performance, economics and risk.

8.5.2.1 Asset performance

An asset is renewed when it fails to meet the required level of service. The monitoring of asset reliability, capacity and efficiency during planned maintenance inspections and operational activity identifies non-performing assets. Indicators of non-performing assets include:

- Structural failure
- Repeated asset failure (breaks, faults)
- Ineffective and/or uneconomic operation
- Unsafe conditions for the public.

8.5.2.2 Economics

Assets are renewed when it is no longer economic to continue with repairs (i.e. the annual cost of repairs exceeds the annualised cost of its renewal). An economic consideration is the co-ordination of renewal works with other planned works such as road reconstruction. Council actively researches the effectiveness of new technology which may reduce the direct and social costs of repair works.

8.5.2.3 Risk

When the risk of failure and associated environmental, public health, financial or social impact justifies action (e.g. probable extent of flooding damage, health and safety risk), proactive inspection is undertaken to determine asset condition at a frequency appropriate to the risk and rate of asset decay.

8.5.3 Life cycle

The current life cycle expectations for the river and catchment assets are shown in Table 20 below.

Table 20 Projected asset lives

| | Item | (Years) |
|---------------------|------------------------|---------|
| Embankments | Stopbanks | |
| | - sand foundation | 60 |
| | Spillways | 80 |
| Structures | Floodgates | |
| | - barrels | 80 |
| | - headwalls | 80 |
| | - flap valves | 50 |
| | Floodwalls | |
| | - timber | 25 |
| | - concrete | 100 |
| | Culverts | |
| | - barrels | 80 |
| | - headwalls | 50-80 |
| In river structures | Sediment pond | 100 |
| | Rip rap | 50 |
| | River training groynes | 100 |
| | Weirs (rock/timber) | 100 |
| Channels | Canals | 100 |
| Soil conservation | Fencing | 30 |
| | Planting/retirement | N/A |
| | Structures | |
| | - detention bunds | 50 |
| | - culvert | 80 |
| | - drop | 80 |

8.5.4 Replacement (renewal) works summary

While many of the smaller replacement (renewal) items are undertaken during maintenance, all major works are programmed as replacement items and are managed in a similar way to new capital works.

The replacement (renewal) programme and expenditure forecast for the next 10 years needs to be improved as asset condition and data confidence improves.

WRC will consider the financial and customer risks of having sufficient funds to deal with renewal demands, consideration of detailed assessments, implementing proactive renewals and recognising the increasing maintenance and operational requirements.

8.5.5 New works

New works are the creation of new assets or works, which upgrade or improve an existing asset beyond its existing capacity or performance in response to changes in

usage or customer expectations. WRC recognises that asset development and asset renewal can occur simultaneously.

- Asset renewal is maintaining the condition of the assets and current service levels.
- Asset development is providing service improvements measured by asset performance.

8.5.6 Development planning categories

New works fall into four separate categories as shown in Table 21 below.

Table 21 Development planning categories

| Category | Detail |
|------------------|--|
| Growth | Any asset development (council funded or externally funded) that is required as a result of growth. |
| Level of service | Any asset development that is required as a result of an increase in levels of service. |
| Legislative | Any asset developed to meet legislative requirements. |
| Vested | Any assets vested (gifted) with council. As required by schedule 10 of the LGA 2002, with respect to council funded development work, this plan also identifies and differentiates requirements of additional asset capacity in terms of increased demand (e.g. growth) or increase in service provision levels and standards. |

8.5.7 Selection criteria

The council carries out a prioritisation process of all necessary renewal or development works. The priority list is used to assign funds when preparing the financial plans. It is important that the process be regularly reviewed and that the cost estimates reviewed at the detailed design stage and/or purchase.

The capital works plan shown in Table 22 following sets out the programme for renewing or replacing existing assets as they wear out or become uneconomic to maintain. The programme is set and prioritised based on current condition estimated remaining life, and the risks associated with failure. It also includes the planned new capital works.

Table 22 Capital new works and renewals

| Capital/ renewal works | Capital/ renewal | Expenditure forecast | | | | Comments |
|------------------------------|---------------------|----------------------|---------|---------|---------|--|
| | | 2015/16 | 2016/17 | 2017/18 | 2018/19 | |
| Awamate stop bank | Capital | \$95,000 | | | | Planning for completion of this stop bank on the Tongariro river depends on successful negotiation between the Crown, WRC and the landowners. Satisfactory resolution for all parties is being actively pursued. No other new capital works are currently planned |

8.6 Disposals

As part of the life cycle management of assets it is vital to consider the costs of asset disposal in the long-term financial forecasts for an asset. The cost of asset disposal is expected to be incorporated within the capital cost of new works, or asset renewals.

Disposal is the retirement or sale of assets whether surplus or superseded by new or improved systems. Assets may become surplus to requirements for any of the following reasons:

- Under utilisation
- Obsolescence
- Provision exceeds required level of service
- Assets replaced before its predicted economic life
- Uneconomic to upgrade or operate
- Policy changes
- Service provided by other means (e.g. private sector involvement)
- Potential risk of ownership (financial, environmental, legal and social).

The formal process for disposal of zone assets is as follows:

- Assets are identified as obsolete due to changes in technology, site conditions and community demand, or failure of the asset to provide the service.
- Disposal options are considered and a cost/benefit analysis carried out. The most cost-effective option to dispose of the asset will be undertaken:
 - input sought from catchment committees as appropriate
 - the council's approval sought according to its delegations manual
 - disposal is undertaken including obtaining any consents for disposal works.

Gains and losses on disposals are determined by comparing the proceeds with the carrying amount of the asset and are included in the statement of financial performance. When revalued assets are sold, the amounts included in asset revaluation reserves in respect of those assets are transferred to retained earnings.

Currently, there are no plans to dispose of any surplus scheme assets; however planned replacement of some components will be undertaken as per the replacement/renewal plan. Salvage values of replaced assets are unlikely to be significant and are therefore (conservatively) not included in financial forecasts.

8.7 Asset valuation

8.7.1 Introduction

Asset valuations are used for calculating long-term asset renewal projections, identifying loss of service potential (depreciation) and for financial reporting purposes.

Revaluations are undertaken every three years and key outputs from this work are ORC, optimised depreciated replacement cost (ODRC) and assessment of remaining economic life.

Assets are fully maintained and depreciated and therefore no significant changes in valuation are anticipated.

8.7.2 Valuation methodology

Council's latest revaluation of infrastructure assets was undertaken in 2013 (Doc # 3051943 'Infrastructure Valuation – Valuation of Waikato Regional Council Infrastructure

Assets as at 31 December 2013). The valuation process was undertaken by AECOM New Zealand Limited in accordance with the standards and guidelines set out in:

- New Zealand International Accounting Standards No. 16 (NZIAS 16)
- New Zealand Infrastructure Valuation and Depreciation Guidelines (Edition 2), issued by National Asset Management Steering Group (NAMS) of IPWEA.

8.7.3 Valuation overview

The valued assets of the zone have a total replacement value of \$7,204,990, a current book value of \$5,513,520 and an annual depreciation of \$104,384 as at June 2015. The breakdown of assets is shown in Table 4 (see page 14).

8.8 Funding strategy

The funding for river management and flood protection works in the Lake Taupō zone is set out in the LTP Section 3 'The Finances'.

A Waikato catchment wide funding system (Doc # 752002 'Project Watershed – Level of Service and Funding Policy, June 2002) provides the mechanism for funding all river management and flood control schemes within the zone (see Table 23).

Table 23 Funding policy

| Activity | Funded by | | | TOTAL |
|------------------------|---------------|----------------|-----------|-------|
| | General rates | Catchment rate | Zone rate | |
| Catchment oversight | 26% | 46% | 28% | 100% |
| Information and advice | 26% | 46% | 28% | 100% |
| River management | 5% - 13% | 23% - 28% | 40% - 67% | 100% |
| Flood protection | 13% - 15% | 61% - 64% | 20% - 26% | 100% |

WRC's infrastructural capital expenditure programme over the 10 years is funded by way of depreciation and capital rates. Internal borrowing is utilised to provide the initial capital financing. Capital rate revenue is then applied to the payment of interest and principal. These funding tools have been selected to ensure that the costs of these long-term capital projects are spread over time to take account of intergenerational equity considerations.

8.8.1 Financial statements and projections

Financial projections for the zone are made over a ten year horizon commencing from the 2015/2016 financial year. The projections made here are consistent with those in council's 2015 - 2025 LTP.

8.8.2 Depreciation

Depreciation - a non-cash transaction - is transferred to a reserve which is used to fund fixed asset replacements.

8.9 Policies

8.9.1 Finance policies

Pursuant to LGA Section 102 WRC must, in order to provide predictability and certainty about sources and levels of funding, adopt the following funding and financial policies:

- (a) a revenue and financing policy; and
- (b) a liability management policy; and

- (c) an investment policy; and
- (d) a policy on development contributions or financial contributions;
- (e) a policy on the remission and postponement of rates on Māori freehold land.

In addition, WRC may adopt either or both of the following policies:

- (a) a rates remission policy
- (b) a rates postponement policy.

8.9.2 Infrastructure assets – accounting policies/guidelines

The treatment of infrastructure assets is outlined in the WRC Infrastructure Assets: Accounting policies/guidelines (Doc # 985755).

- The document is reviewed every year as part of the year end financial report preparation.
- The scheme will be valued in accordance with the procedures and methods set out in the New Zealand Infrastructure Asset Management Manual. The scheme will be revalued every three years and this will be based on the ODRC method.
- The optimised replacement cost model considers technology changes, over-design, redundancy and system configuration to identify a benchmark alternative asset that efficiently replicates the current asset, while providing the same level of service. ODRC equals this replacement cost, after deducting an allowance for wear/consumption to reflect the remaining economic cost.

Currently the financial/accounting system is run within the finance department of WRC.

8.10 Risk to significant forecasting assumptions

There are risks and uncertainties associated with future cost forecasts because it is not always possible to accurately predict the level of reactive maintenance required. Reactive maintenance is subject to a range of influences including the weather and river flows etc. Major disaster (floods and earthquake) risks are however provided for through the mechanisms listed in Table 24.

Table 24 Disaster recovery funding

| Treatment option | Item | Description |
|------------------|--------------------------------------|---|
| Internal funding | Zone based disaster recovery funding | To meet routine damages up to a 5 year event (20% AEP) for both insured and non-insured assets. |
| | Operational budgets | |
| | Zone disaster recovery reserve | |
| | Regional disaster recovery reserves | Contributions made by each zone to the regional reserve at 2% of zone rating. To meet damages from between the 20 year event (5% AEP) and events that qualify for insurance cover and/or government funding. Available to cover the insurance 'excess' in events which qualify under council insurance policy. |

| | | |
|-------------------|--|---|
| Risk transference | Council insurance | For 100% of the risk cost for insured assets and damage between the insurance excess and \$10 million. For 40% of the risk cost for insured assets between the \$10 million primary layer and the maximum probable loss. |
| | Government funded (National Recovery Plan) | For 60% of the risk cost for insured assets between National Recovery Plan excess and the probable maximum loss. |

9 Continuous improvement

9.1 Improvement process overview

The council has adopted a strategic management approach to improvement planning, continually developing AMPs, and implementing improvement processes and practices. This improvement plan is integral to that approach, quantifying current business practice and measuring progress toward an identified future position.

The purpose of the improvement plan is to:

- Provide for AMP monitoring, review, revision and audit to improve the effectiveness of AMP outputs and compliance with audit criteria, legislative requirements and appropriate best practice
- Provide for the review of service standards to reflect community outcomes
- Identify and prioritise ways to cost-effectively improve the quality of the AMP, and therefore decision-making and service delivery.
- Identify indicative time scales, priorities, human and financial resources required to achieve AMP objectives.

The development of this AMP is based on existing levels of service, the best available current information and the knowledge of council staff. It is intended that the development of this plan is part of an ongoing process and that the document will be reviewed and updated regularly. This review process involves using improved knowledge of customer expectations (community and stakeholder consultation) and information from asset management systems and databases. This will enable council to optimise decision-making, review outputs, develop strategies, improve risk management and extend the planning horizon. This section describes:

- The specific improvements proposed over the next three years.
- The procedures proposed to be implemented within the organisation for monitoring and review.

9.2 Improvement plan

Table 25 below contains the improvement projects/tasks to be undertaken over the next three years including resources and priorities.

Table 25 Improvement plan

| Project | Tasks | Staff Time/Cost | Priority | Responsibility | 2015/16 | | | | 2016/17 | | | | 2017/18 | | | |
|--|---|---------------------------------|----------|---------------------------------|---------|----|----|----|---------|----|----|----|---------|----|----|----|
| | | | | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Community engagement | | | | | | | | | | | | | | | | |
| Awareness and information | Periodic media releases | As required | LOW | Zone Mgr | | | | | | | | | | | | |
| | Catchment committee engagement. | 6 days | HIGH | Zone Mgr | | | | | | | | | | | | |
| | Flood management schemes stakeholder meetings: <ul style="list-style-type: none"> Tongariro Tauranga Taupō. | 6 days | HIGH | Zone Mgr/ River Mgt Officer | | | | | | | | | | | | |
| Collaboration | Capitalise on opportunities to work with other agencies and community groups. | As required | MED | Zone Mgr/ River Mgt Officer | | | | | | | | | | | | |
| Asset management | | | | | | | | | | | | | | | | |
| Data management | Ongoing collection and updating of maintenance data. | Ongoing | HIGH | AM Team Leader | | | | | | | | | | | | |
| Information systems | | | | | | | | | | | | | | | | |
| Customer enquiries | Respond to customer enquires appropriately and in accordance with corporate time frames. | As required | LOW | Zone Mgr/ River Mgt Officer | | | | | | | | | | | | |
| Improvements to data collection capability | Introduce mobile device capability: This is an ICM wide project to provide asset managers with mobile capability to improve the recording of asset defects and enable improvements in data quality. | 45 days \$50,000 - \$100,000 | HIGH | AM Team Leader/ Ops Mgr | | | | | | | | | | | | |
| Operations and maintenance | | | | | | | | | | | | | | | | |
| River management | Manage rivers in accordance with WRC River Management Guidelines and resource consents. | Ongoing | HIGH | Zone Mgr/ Rivers Mgt Officer | | | | | | | | | | | | |
| Maintenance plans | Update works programme based on River and Gravel Tongariro River Management Plan. | Ongoing | MED | Rivers Mgt Officer | | | | | | | | | | | | |
| | Update Tauranga Taupō River Management and Gravel Extraction Plan. | Ongoing | MED | Rivers Mgt Officer | | | | | | | | | | | | |

| Project | Tasks | Staff Time/Cost | Priority | Responsibility | 2015/16 | | | | 2016/17 | | | | 2017/18 | | | |
|--|--|------------------|----------|----------------------------------|---------|----|----|----|---------|----|----|----|---------|----|----|----|
| | | | | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Risk management | Undertake actions as outlined in risk register. | Ongoing | MED | Zone Mgr/ Rivers Mgt Officer | | | | | | | | | | | | |
| Strategic planning | | | | | | | | | | | | | | | | |
| Tongariro River Scheme Review – Part 2 | Survey of channel cross sections | To be determined | HIGH | Team Leader – Technical Services | | | | | | | | | | | | |
| | Update hydraulic model (inc. climate change considerations) | To be determined | HIGH | Team Leader – Technical Services | | | | | | | | | | | | |
| Tauranga Taupō River Scheme Review | Due for review in 2015/16 | To be determined | HIGH | Team Leader – Technical Services | | | | | | | | | | | | |
| Levels of Service | Consultation on any changes in levels of service as a consequence of scheme reviews (undertaken as part of LTP process). | Every 3 years | MED | Director/Zone Mgr | | | | | | | | | | | | |
| Scheme improvement | | | | | | | | | | | | | | | | |
| Tongariro River Scheme | Awamate stopbank construction | \$95,000 | HIGH | AM Team Leader/Zone Mgr | | | | | | | | | | | | |
| Improvement planning | Annual review of this improvement plan - record progress and change time frames as necessary. | 1 day per year | MED | Zone Mgr/ River Mgt Officer | | | | | | | | | | | | |

References

- AS/NZS ISO 31000:2009 Risk management – Principles and Guidelines, 2009.
- Environment Waikato, 1995. Stopbank Management Guidelines. Technical Report 1995/8.
- Environment Waikato, 1997a. Floodgate Management Guidelines. Prepared by Opus International Consultants for Environment Waikato, Technical Report 1997/13. Environment Waikato, 1997.
- Waikato Regional Council (Environment Waikato) 2000. Waikato Regional Policy Statement. Environment Waikato Policy Series 2000/30. Hamilton, Waikato Regional Council (Environment Waikato).
- Environment Waikato, 2002. Project Watershed – Waikato River Catchment Services – Level of Service and Funding Policy. Environment Waikato, 2002.
- Environment Waikato, 2003. Environmental Guidelines. Internal Policy Series 03/06, EWDOCS #848198. Environment Waikato, 2003.
- Environment Waikato, 2004: Disaster Damage and Risk Management Policy for Infrastructural Assets. Report to Operations Committee June 2004. EWDOCS # 919767. Environment Waikato, 2004.
- Environment Waikato, 2007a. Best Practice Guidelines for Vegetation Management and in Stream Works. Technical Report 2007/41. Environment Waikato, 2007.
- Environment Waikato, 2007b. Waikato Regional Plan. Environment Waikato, 2007.
- Environment Waikato, 2008a: Infrastructural Assets Accounting Policies/Guidelines. Prepared for Environment Waikato by Trish Nooroa. Created May 2000, Updated August 2008. Environment Waikato, 2008.
- Environment Waikato, 2009a. River and Catchment Services – Description of Services Incorporating Schedule 10/Service Level Requirements under the Local Government Act 2002. EWDOCS #1439351. Environment Waikato, 2009.
- Environment Waikato, 2009e. Condition and Performance Report 2008/09 All Zones. EWDOCS #1462203, Environment Waikato, 2009.
- Environment Waikato: River & Catchment Services Group. 2010. Land Use & Water Resources consent application and assessment of environmental effects for the Tongariro River Gravel Management, Prepared by Taupō Planning Consultant and Design Services, 2010.
- Environment Waikato Technical Report 2005/26, Tauranga Taupō River - Catchment Management Plan (Doc # 1003804), November 2005.
- Local Government Act 2002.

- MFE, 2008. Climate Change Effects and Impacts Assessment. A Guidance Manual for Local Government in New Zealand. 2nd Edition. Ministry for the Environment 2008.
- NAMS, 2006a. International Infrastructure Management Manual – Version 3. National Asset Management Steering Group, Ingenium, 2006.
- NAMS, 2006b. New Zealand Infrastructure Asset Valuation and Depreciation Guidelines. National Asset Management Steering Group, Ingenium, 2006.
- NAMS, 2007. Developing Levels of Service and Performance Measures – Creating Customer Value from Community Assets, Version 2. National Asset Management Steering Group, Ingenium, 2007.
- Resource Management Act, 1991.
- Taupō District Council, 2013. Southern Settlements Structure Plan, 2013.
- Waikato Regional Council Policy Series 2011/03. Overview of River and Catchment Services (Doc #1717271 v1.1). Prepared by: River and Catchment Services Group and GHD Limited 2010. May 2011.
- Waikato Regional Council, 2012, Tongariro River Flood Control Scheme - Management Plan for Floodway Maintenance – Draft (Doc # 1972444). River and Catchment Services, 2012.
- Waikato Regional Council 2012, River Management and Gravel Extraction Plan Tauranga Taupō River (Doc # 2090239), River and Catchment Services, 2012.
- Waikato Regional Council 2013. High Flow Management Plan EW Docs #3088099v1
- Waikato Regional Council, 2015 - 2022 Long Term Plan, Waikato Regional Council Policy Series 2012/05, ISSN 2230-2399 (Print) ISSN 2230-4347 (Online), Waikato Regional Council, 2012.
- Waikato Regional Council, Asset Management Processes for flood protection and drainage assets.
- Waikato Regional Council Technical Report 2011/05, Significant Natural Areas of the Waikato Region – Lake Ecosystems, Wildland Consultants, 2011.
- Waikato Regional Plan (and Variation 5), Reprinted April 2012.

Glossary of terms

| | |
|--------------------------------------|---|
| Annual Exceedance Probability | Annual Exceedance Probability means that there is a x% probability that a flood event of this magnitude will occur in any given year. |
| Annual Plan | The Annual Plan provides a statement of the direction of council and ensures consistency and coordination in both making policies and decisions concerning the use of council resources. It is a reference document for monitoring and measuring performance for the community as well as the council itself. |
| Aggradation | The accumulation of sediment in rivers and waterways due to sediment supply exceeding the waterway's ability to transport sediment. |
| Asset Management (AM) | The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner. |
| Asset Management System | A system (usually computerised) for collecting, analysing and reporting data on the utilisation, performance, life cycle management and funding of existing assets. |
| Asset register | A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, construction, technical and financial information about each. |
| Asset renewal | Major work, which restores an existing asset to its original capacity or the required condition (stopbank top-up etc.). |
| Capital expenditure (CAPEX) | Expenditure used to create new assets or to increase the capacity of existing assets beyond their original design capacity or service potential. CAPEX increases the value of an asset. |
| Climate change | A long term significant change in the average weather. |
| Community outcomes | Outcomes developed with the community that outline the community's vision. |
| Components | Specific parts of an asset having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality. |
| Condition monitoring | Continuous or periodic inspection, assessment, measurement and interpretation of resulting data, to indicate the condition of a specific component so as to determine the need for some preventative or remedial action. |
| Critical assets | Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets. |
| Depreciated replacement cost | The replacement cost of an asset spread over the expected lifetime of the asset. |
| Depreciation | The wearing out, consumption or other loss of value of an asset, whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted for by the historical cost (or re-valued amount) of the asset less its residual value over its useful life. |
| Disposal | Activities necessary to dispose of decommissioned assets. |
| Life cycle management | A process of managing an asset from initial construction through to disposal. |
| Long Term Plan (LTP) | Council's 10 year programme setting out the community outcomes sought, key activities, levels of service, performance measures and funding. |

| | |
|------------------------------------|--|
| Reach | A defined section of a river, used for management purposes. |
| Remaining useful life (RUL) | Remaining useful life of an asset or asset component (generally useful or effective life less age). |
| River training groynes | Structures built into the riverbanks, which protrude out into the river channel, to push water away from the bank edge. Can be made of rock, concrete, or fallen trees with the butt end anchored into the bank, and can be solid or permeable. Groynes help prevent erosion and trap silt, which helps build up eroded areas. |
| Stakeholder | A person or organisation who has a legitimate interest in an activity e.g. community, iwi, etc. |
| Stopbank | An embankment adjacent to a river or watercourse, which retains floodwaters from flowing onto a floodplain. |
| Sustainability | The process of meeting the needs of the present community without compromising the ability of future generations to meet their own needs. |

Acronyms

| | |
|--------|--|
| AEP | Annual Exceedance Probability |
| AM | Asset Management |
| AMP | Asset Management Plan |
| AS/NZS | Australia and New Zealand Standards |
| DOC | Department of Conservation |
| GAAP | Generally Accepted Accounting Practice |
| GDP | Gross Domestic Product |
| ha | Hectares |
| ICM | Integrated Catchment Management |
| IIMM | International Infrastructure Management Manual |
| km | Kilometres |
| LGA | Local Government Act 2002 |
| LINZ | Land Information New Zealand |
| LoS | Levels of Service |
| LTP | Long Term Plan |
| NAMS | National Asset Management Steering (Group) |
| NZTA | New Zealand Transport Agency |
| ODRC | Optimised Depreciated Replacement Cost |
| ORC | Optimised replacement cost |
| RMA | Resource Management Act 1991 |
| TDC | Taupō District Council |
| TPD | Tongariro Power Development |
| WRC | Waikato Regional Council |