greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

TE KĀURU UPPER RUAMĀHANGA FLOODPLAIN MANAGEMENT PLAN

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GWRC PUBLICATION NUMBER: GW/FP-G-20/64

ISBN: 978-0-473-54530-7 (PAPERBACK)
ISBN: 978-0-473-54531-4 (HARDCOVER)
ISBN: 978-0-473-54532-1 (PDF)

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This Te Kāuru Upper Ruamāhanga Floodplain Management Plan is endorsed by:

Bob Francis
Chair, Te Kāuru Upper Ruamāhanga
Floodplain Management Plan Subcommittee

Councillor Adrienne Staples
Greater Wellington Regional Council Councillor, Wairarapa Constituency representative on behalf of the council

This plan has been prepared by the Te Kāuru Upper Ruamāhanga Floodplain Management Plan Subcommittee. During its development the subcommittee comprised:

Bob Francis (Chair)
Councillor Barbara Donaldson (Greater Wellington Regional Council)
Councillor Adrienne Staples (Greater Wellington Regional Council)
Former Councillor Gary McPhee (Greater Wellington Regional Council)
Councillor Graham McClymont (Masterton District Council)
Councillor Brian Deller (Carterton District Council)
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Janine Ogg
Michael Williams

Foreword

The Te Kāuru Upper Ruamāhanga Floodplain Management Plan represents many years of investigating the most appropriate, comprehensive and long-term approach for managing the flood and erosion risks to both rural and urban land within the Te Kāuru Upper Ruamāhanga catchment.

Preparing this plan has involved the assessment of various options that were based on a vision and a set of aims developed early in the process. Importantly, the practicality, cost, environmental impact, cultural values/needs of the community and legislative and policy requirements have all influenced the document.

Following several stages of consultation and engagement with the community on three draft volumes of the plan, many updates and amendments were made. The three draft volumes were combined into a single “proposed” floodplain management plan. A further consultation process was undertaken along with seeking submissions on the document. A hearings process took place in April 2019 which resulted in further changes before the plan was finalised.

But while the community identified and set the objectives for the plan, its focus was broader than flood protection, reflecting today’s emphasis on careful environment management and the natural expression of our rivers.

This and other public feedback has been encapsulated in the resulting floodplain management plan, put together by Greater Wellington Regional Council in collaboration with Carterton District Council, Masterton District Council, Ngāti Kahangunu ki Wairarapa, Rangitāne o Wairarapa and the wider community. The Te Kāuru Upper Ruamāhanga Floodplain Management Subcommittee has facilitated the development of the plan.

It will be a long-term plan and living document that will guide the approach to flood and erosion management within the Te Kāuru Upper Ruamāhanga catchment. As such ongoing monitoring will enable the outcomes to be regularly reviewed. Additionally, a comprehensive review of the plan will occur after 20 years or earlier if the flood hazard is significantly altered by flooding, earthquakes or new information.

I wish to recognise my subcommittee members who worked tirelessly over the past five years and Greater Wellington Regional Council staff including the leadership from Manager of Flood Protection Graeme Campbell, initial Project Manager Alistair Allan and then for the last three years Project Manager Francie Morrow. I also recognise Greater Wellington staff in the Masterton office who provided excellent support.

Reaching this point was never going to be easy, given differing views on flood protection and environment management, but we got there in the end and have produced a document that will meet the needs of the region for decades to come.

Bob Francis, QSO, MBE, JP

Chair.

PART 1: BACKGROUND AND OVERVIEW

PART 2: LOCATION-SPECIFIC VALUES, ISSUES AND RESPONSES

PART 1:
BACKGROUND AND OVERVIEW

Executive Summary

The rivers in the Te Kāuru Upper Ruamāhanga catchment have a long history of flooding, causing danger and disruption for people and sometimes devastating damage to property and community assets.

This Te Kāuru Upper Ruamāhanga Floodplain Management Plan (FMP) addresses the risks of flooding by providing a blueprint for ongoing and future flood and erosion works, on both rural and urban land. Its aim is to protect, enhance and restore the rivers natural and cultural values while supporting sustainable economic development and resilient communities. It changes the ways in which river works are managed, with a goal of maximising natural river processes and enhancing the environment, while providing an agreed level of flood and erosion protection for people and property.

This approach seeks to enable the rivers which make up the Te Kāuru Upper Ruamāhanga catchment to behave more naturally, with less frequent interventions. It seeks to strike a balance between improving the river environment and recognising the economic value of the adjacent land (and aspirations of landowners). A key change is to accommodate erosion within the western rivers' buffers from time to time and increase provisions for establishing planting within buffers. This is a change from frequent, small, reactive responses to less frequent but more often larger works. Much of the work is likely to be staged over several decades.

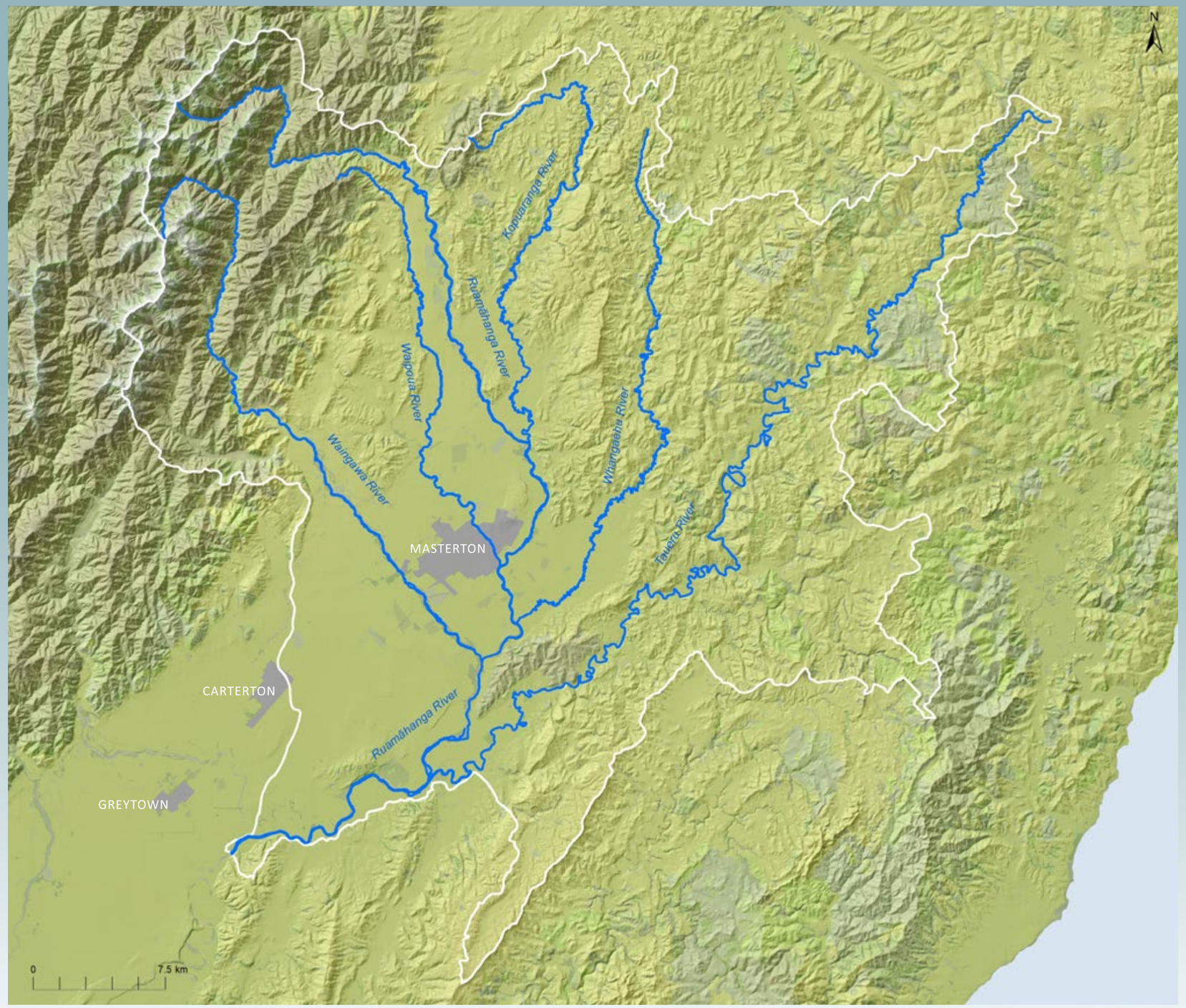
This FMP aims to benefit the wider community and the environment through flood hazard and erosion protection and enhancement of the rivers' environmental and cultural values. It also aims to provide a wide range of community benefits, including cultural, environmental, recreational, economic and social benefits. It uses a combination of flood- and erosion-management responses, tailored to the catchment's two distinct river types: the large, gravel-bed Waingawa, Waipoua and Ruamāhanga Rivers to the west; and the smaller, silt-bed Kopuaranga, Whangaehu and Taueru Rivers which come from the eastern hills.

River management responses include a package of 'common methods' (methods used selectively throughout the catchment, such as river management envelopes which enable riparian planting of buffers) and 'reach-specific responses', which apply when specific responses are required to address more complex or location-specific issues. This FMP also advocates a move away from an exotic willow monoculture to a mixed native/exotic riparian approach for the entire buffer in the Te Kāuru Upper Ruamāhanga catchment.

The FMP proposes a fair and equitable approach to funding that recognises landowners' agreement – under existing river schemes – to provide flood and erosion protection measures on their land. This requires giving more room to the river which may result in land being eroded back to, or close to, the edge of the river management envelope before any physical intervention takes place. Implementation of river management responses relating to buffers will be largely driven by flood events and river behaviour. Much of the work is likely to be staged over several decades, with the costs of delivery resting with the whole community.

The extent of river management will be directed by an agreed 'level of service' (or design standard) that gives an indication of the maximum protection that the structural and non-structural river management responses can provide. Desired levels of service for various issues, structures or reaches have been noted throughout this plan. GWRC will employ an adaptive management strategy which combines several monitoring regimes to help assess the effects of planting buffers on the western rivers and stabilising the banks on the eastern rivers.

The FMP also includes an allowance for GWRC to purchase land from landowners who prefer not to own buffers under the new floodplain management regime. It does not propose compulsory land acquisition or the use of any other powers to compel landowners to establish vegetation on their land. It is expected that all river management will take place under the hierarchy of this FMP, Operational Management Plans and annual work programmes, and in accordance with GWRC's Code of Practice for River Management Activities.



Te Kāuru Upper Ruamāhanga catchment

1. What is this floodplain management plan?

This Te Kāuru Upper Ruamāhanga Floodplain Management Plan (FMP) provides a long-term framework for floodplain management in the Te Kāuru Upper Ruamāhanga catchment. The catchment covers the area from the upper reaches of the Ruamāhanga River to its confluence (junction) with the Waiōhine River, and includes the Waipoua, Waingawa, Kopuaranga, Whangaehu and Taueru (or Tauweru) Rivers from their headwaters in the Tararua Range and eastern hills to their confluences with the Ruamāhanga River. The catchment has a total area of approximately 1,560km^2.

Floodplain management planning is a commonly used and effective process for addressing flooding and erosion issues associated with rivers. The plan that results takes a long-term approach to managing risks and improving the security and quality of life for the present and future generations of people living on the floodplain. It also helps to prepare communities for coping with a flood when it occurs and aims to ensure that any future development considers flood and erosion risks.

The FMP is non-statutory, so its policies and flood-mitigation methods have no legal standing as regulations. However, it has considerable weight in decision-making, especially given the community's involvement in its development public process undertaken to prepare the plans and Greater Wellington Regional Council's (GWRC's) responsibility for flood protection in the region.

The FMP:

- Provides information on the Te Kāuru Upper Ruamāhanga catchment's rivers and associated tributaries, the risks of flooding and erosion, and what has been done to manage the risks so far
- Describes the catchment's environmental, cultural and recreational values, and how floodplain management can help to maintain or improve these values
- Describes the results the community would like to see achieved in the floodplain, including the measures required to minimise risk in the event of flooding. This information was gathered from a range of local, regional, and national people and organisations affected by the consequences of flooding, including the regional and district councils, iwi, government agencies, infrastructure providers, community groups and private land and business owners

The development process and parties involved are described in more detail in *Appendix 1*.

The role of mana whenua

Mana whenua have a key role in articulating the need to care for the region's mauri, or life-giving properties, especially the mauri of fresh and coastal waters on which wellbeing depends. They provided valuable information on their collective and separate values and sites of significance as part of helping to develop this FMP, and have been involved in other council processes such as the proposed Natural Resources Plan (pNRP) and the Ruamāhanga Whaitua.

This FMP supports many of the pNRP's objectives for the Wellington Region, as well as the recommendations of the Whaitua Implementation Programme (WIP). All river management operations will comply with the relevant pNRP rules and non-regulatory methods, and any adopted WIP recommendations.

A living document for widespread use

This FMP is the primary floodplain management guidance and reference document for landowners, government agencies, the community and decision-makers who are making plans for and/or administering the Te Kāuru Upper Ruamāhanga catchment. It is a living document and as such will be reviewed and updated as required. At the time of any update, all interested stakeholders will be consulted about the catchment's long-term management.

This FMP has two parts:

- **Part 1** describes why we need the FMP (including its vision and aims), the suite of common methods and other responses that will be used throughout the catchment, and how the FMP will be implemented.
- **Part 2** sets out the floodplain management outcomes to be delivered in the Te Kāuru Upper Ruamāhanga catchment. It divides the six rivers that make up the catchment into 20 reaches (17 western gravel-bedded reaches and three eastern silt-bedded rivers) for the purpose of identifying each reach's existing values and flood and erosion issues and the most suitable management response.

A glossary of technical and other terms can be found on page 208.

2. Why do we need this plan?

This Te Kāuru Upper Ruamāhanga Floodplain Management Plan provides a framework for managing flood and erosion risks in the Te Kāuru Upper Ruamāhanga catchment. It aims to help keep people and property safe, and its vision is that the catchment becomes:

"A CONNECTED, RESILIENT, PROSPEROUS AND SUSTAINABLE COMMUNITY, PROUD OF ITS RIVERS, THAT IS INVOLVED IN MANAGING FLOOD RISKS IN A MANNER THAT RECOGNISES LOCAL IDENTITY AND PROTECTS, ENHANCES OR RESTORES NATURAL AND CULTURAL VALUES"

The rivers in the Te Kāuru Upper Ruamāhanga catchment have a long history of flooding, causing danger and disruption for people and sometimes devastating damage to property and community assets.

This plan addresses the risks associated with floods and erosion in the catchment by providing a blueprint for ongoing and future flood and erosion works, on both rural and urban land.

It is the result of many years of investigation to find the most appropriate, comprehensive and long-term approach. A wide range of options was considered – each based on the vision and a set of aims developed early in the process, and assessed according to practicality, cost, environmental impacts, cultural values, the community's views and needs, and legislative and policy requirements. The chosen approach is a package of 'common methods' (methods used selectively throughout the catchment, such as river management envelopes) and 'reach-specific responses' (responses tailored to specific river reaches).

The plan has been put together by Greater Wellington Regional Council in collaboration with Carterton District Council (CDC), Masterton District Council (MDC), Ngāti Kahungunu ki Wairarapa, Rangitāne o Wairarapa and the wider community. Its development was facilitated by the Te Kāuru Upper Ruamāhanga Floodplain Management Plan Subcommittee.

As the plan takes a long-term approach to flood and erosion management in the catchment, progress will be monitored and the results regularly reviewed. It will undergo a comprehensive review in 20 years' time, or earlier if the flood hazards change significantly owing to flooding, earthquakes or new information.

2.1 The purpose of the plan

This FMP aims to keep people and property in the Te Kāuru Upper Ruamāhanga catchment safe. Its implementation involves proactively managing the river channels and using land use and protection measures to support the continued and appropriate use of rural and urban land and resources in potential flood- and erosion-prone areas.

The plan has some common underlying themes, including a desire to:

- Avoid risk
- Reduce flood risk to people and property
- Support a resilient local economy and a river scheme that is affordable and fairly funded
- Work with district councils to coordinate long-term planning outcomes
- Recognise the role of tangata whenua and their cultural values
- Recognise environmental matters
- Provide recreational opportunities

2.2 The principles of river management for flood protection

Sustainable and effective river management is based on six interrelating principles. These have guided the FMP's development and will be incorporated into GWRC's Operational Management Plans, which detail on how this FMP will be implemented operationally in five- to ten-year horizons.

1. Rivers are dynamic. They are constantly changing and at any time are an expression of physical, climatic and human processes (both past and present) at the catchment and reach levels.
2. Work with rivers, not against them. Healthy rivers are diverse rivers. Diverse rivers have natural character that provides for an expression of mauri and their inherent aquatic and riparian habitats, which in turn supports species diversity.
3. Rivers need room to move. Rivers naturally meander, and the meander pattern tends to migrate downstream over time. Central to this process are erosion, the deposition of river bed and bank material and the relocation of riparian margins (the strips of land along the edges of rivers).
4. River management requires knowledge. Catchment-specific river histories and how much bedload sediment can be transported by the river need to be understood when predicting reach-specific future states and what is realistically achievable.
5. Rivers are managed for a range of flood flows. Both maximum flood and channel-carrying capacities are managed to meet the community's expectations for protection and the avoidance and/or mitigation of flood hazards.
6. River management requires adaptability. The unpredictability of dynamic rivers, combined with fixed channel capacity constraints, means flexible management is important to achieving agreed outcomes.

2.3 The catchment's values

As with all rivers, those that make up the Te Kāuru Upper Ruamāhanga catchment are attributed with a diverse range of values. These include intrinsic values encountered throughout the catchment that influence the way humans relate to and interact with the floodplain, such as swimming and fishing areas and sites of significance to mana whenua. Their emphasis shifts in response to the community's culture and may change as generations come and go.

The Resource Management Act 1991 (RMA) provides a broad framework to ensure that all New Zealand's rivers are sustainably managed to provide for New Zealanders' social, economic and cultural wellbeing and to preserve their natural character. Values of the rivers that make up the Wellington region are managed through the pNRP and Whaitua processes. Within the Te Kāuru Upper Ruamāhanga catchment these were identified with input from the local community and tangata whenua. The values associated with its natural character include:

- Providing food and resources
- Contributing to identity
- Providing for livelihood
- Sustaining health and wellbeing
- Providing recreation opportunities

Many of these values extend back to pre-European settlement, and are commonly referred to as 'cultural values' in FMPs.

Te Kāuru (the headwaters of the Ruamāhanga River) extends from the rugged Tararua Range to the eastern hills. The gravel-bedded western rivers emerge from the Tararua Range – well known for its pristine native forests – onto the fertile Wairarapa Plains, and as a result their upper reaches are commonly valued for their beauty, mauri, recreational opportunities and spiritual significance. In contrast the eastern rivers have silty beds, and are characterised by lower undulating hills dominated by agricultural use. Strong cultural and ecological values remain alongside several recreational areas.

This FMP also identifies specific values within the Te Kāuru Upper Ruamāhanga floodplain. These are shown on a series of maps in Part 2 and include the following:

Landscape values

The rivers in the catchment have been divided into reaches that recognise their unique attributes, landscape contexts and riparian margins. Each reach was rated for its landscape modification and scenic value. This included consideration of the region's landscape character and landscape value which was assessed as part of developing the pNRP.

Recreational values

All the rivers in the catchment have some level of recreation value, as they are used by groups and individuals for pastimes, hobbies and recreation activities such as swimming, kayaking, fishing, duck hunting, jet boating and walking. These sites include recreation areas established along river margins.

Heritage values

The Ruamāhanga River and its tributaries have had an important role in shaping the pattern of settlement in the Wairarapa valley. Early settlement in the area focused on the river margins, and sites of heritage value remain on parts of the floodplain.

Cultural values

Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa have close relationships with the rivers, wetlands and floodplains throughout the Te Kāuru Upper Ruamāhanga catchment. These include sites of specific importance and broader, more holistic cultural values. GWRC, MDC, CDC and iwi are working in partnership to ensure a mutual understanding of places in the catchment and wider cultural values.

Land use values

Land use values apply to current and future land uses in urban and rural contexts, such as future development sites, key infrastructure and sites of potential contamination included in GWRC's Selected Land Use Register (SLUR).

Ecological values

The catchment is valued for its broad ecological diversity. It features native and introduced fish and a range of bird species, including several ground-nesting species such as the nationally threatened Buller's gull. Apart from a cover of native vegetation in the upper reaches of the western rivers, vegetation along the river margins is dominated by willows, with pockets of important habitat, indigenous forest, stonefields and boulderfields, natural wetlands and ponds.

2.4 The plan's vision

The vision for the Te Kāuru Upper Ruamāhanga catchment's FMP is to establish:

A CONNECTED, RESILIENT, PROSPEROUS AND SUSTAINABLE COMMUNITY, PROUD OF ITS RIVERS, THAT IS INVOLVED IN MANAGING FLOOD RISKS IN A MANNER THAT RECOGNISES LOCAL IDENTITY AND PROTECTS, ENHANCES OR RESTORES NATURAL AND CULTURAL VALUE

It aligns with the expected outcomes stated in the regional and district councils' Long Term Plans, as shown in the diagram below.

The FMP's vision has been shaped and guided by the values of the Te Kāuru Upper Ruamāhanga catchment. These values include:

- Promoting sustainable economic development
- Protecting and enhancing natural spaces and systems
- Recognising and improving tangata whenua values
- Providing for wider community needs, including building resilient communities

Achieving the vision will depend on people and communities working together.

THE VISION FOR THE TE KĀURU UPPER RUAMĀHANGA FMP

A connected, resilient, prosperous and sustainable community, proud of its rivers, that is involved in managing flood risks in a manner that recognises local identity and protects, enhances or restores natural and cultural value

Masterton District Council Long Term Plan:

- A thriving and resilient economy
- A sustainable and healthy environment
- An engaged and empowered community
- An efficient and effective infrastructure
- Pride in our identity and heritage

Carterton District Council Long Term Plan:

- A strong community
- A prosperous economy
- A healthy natural and built environment
- Quality, fit-for-purpose infrastructure
- A strong and effective Council

Greater Wellington Regional Council Long Term Plan:

- A strong economy
- A connected community
- A resilient community
- A healthy community
- An engaged community

2.5 The plan's aims

This FMP's aims were developed using a wide range of sources, including council policies, the mission and purpose statements of organisations involved with the FMP, and the issues and values of affected communities. More detailed management objectives were developed for each reach and for specific sites; these are described in Part 2.

The aims have been split into five groups, but it is important to note the complex relationships both across the groups and between individual aims. Also note that the aims listed below are not in any priority order.

1. To work together to develop a sustainable floodplain management plan

a. Provide affordable flood hazard management across a whole continuum of flood risk
b. Align with integrated catchment management principles
c. Follow the principles set out in the flood protection Code of Practice for River Management Activities
d. Endeavour to make future development and land use compatible with flood risk

2. To support sustainable economic development

a. Inform the Long Term Plans of local authorities
b. Reduce the likelihood of loss to private property, business and agriculture
c. Make property owners aware of their flood risks and damage potential
d. Manage or reduce the risk to essential public infrastructure and maintain lifelines during flood events

3. To protect and improve the cultural values of rivers

a. Improve the recognition of the impacts of flood and flood hazard management on cultural activities and values
b. Improve the mauri of waterways in the catchment
c. Improve access for mahinga kai and cultural practices
d. Recognise and consider the interconnectedness of natural systems

4. To recognise local community needs and build resilient communities

a. Make communities aware of their flood and erosion risk
b. Recognise opportunities to support the sustainable aspirations of the community and landowners
c. Identify and support opportunities for improved public access to and along rivers
d. Maintain and improve the level of safety for recreation users of the rivers

5. To protect and enhance our natural spaces

a. Improve awareness and understanding of the natural values and character of the river environment
b. Improve recognition of impacts of flood and flood hazard management on environmental and ecological values
c. Create more space for rivers and their natural processes
d. Improve the water quality and habitat diversity along the rivers
e. Make the use or extraction of natural resources, including gravel management, sustainable and compliant with relevant policies

2.6 Legislation, policies and principles

Decisions about flood risk management, such as in the Te Kāuru Upper Ruamāhanga catchment, are based on a mix of national and regional statutes, policies and principles that underlie, and set the context for, effective floodplain management planning.

At a legislative level, floodplain management is principally influenced by four key statutes: the RMA; the Local Government Act 2002 (LGA); the Soil Conservation and Rivers Control Act 1941; and the Local Government (Rating) Act 2002. Each has a distinct and important role in flood risk management, including the authority to introduce regulatory and non-regulatory measures that enable central and local government to manage those risks. For example, the RMA provides a regulatory planning context for regional and city/district councils to control land use to avoid or mitigate natural hazards such as flooding, while the LGA and the Soil Conservation and Rivers Control Act enable regional councils to initiate and fund non-regulatory measures, such as stopbank (embankments built to stop floodwater from rivers flooding nearby land) construction and river channel maintenance.

At a national level, the National Policy Statement for Freshwater Management (NPS-FM, 2014 (amended 2017)) provides direction for local authorities on managing freshwater through a framework that considers and recognises Te Mana o te Wai (the integrated and holistic wellbeing of the water) as an integral part of freshwater management. It also includes objectives and policies for ensuring that water is managed in an integrated and sustainable way, with a provision for economic growth in set water quality and quantity limits.

At a policy level, the Regional Policy Statement for the Wellington Region (RPS) has a prominent role in managing natural hazards such as river flooding. It does this establishing a policy framework for the region and requiring GWRC and district councils to use that framework in their respective regional and district plans. Of particular note is the RPS directive in Policy 29 that district and regional plans "avoid subdivision and inappropriate development in areas at high risk from natural hazards".

This FMP will take into account the Wairarapa Moana Statutory Board's natural resources document once it is developed. The document will identify the issues, values, vision, objectives and desired outcomes for the sustainable management of natural resources in the Ruamāhanga River catchment, to the extent that they relate to the health and wellbeing of Wairarapa Moana or the Ruamāhanga River catchment (Section 7.73 Deed of Settlement Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua).

GWRC has adopted four core principles that underpin its approach to floodplain management planning, and that reinforce and complement the statutory and policy considerations outlined above. They are:

- Avoid building in areas at high risk of flood hazard (such as undeveloped 'greenfield' areas)
- Only consider new flood protection infrastructure where existing development is at risk (such as dwellings, irrigation infrastructure and dairy sheds)
- Establish standards of flood protection relative to the degree of risk (such as a minimum 1% Annual Exceedance Probability [AEP] flood standard for stopbanks constructed to protect existing urban areas and associated land use)
- Plan for climate change in assessing the degree of flood hazard risk and determining an appropriate response (such as a 0.8m allowance for sea-level rise)

These principles were influential in developing the responses included in this FMP.

Appendix 4 has more detail on these core principles.

2.7 The Te Kāuru FMP and its relationship to the Ruamāhanga Whaitua

The Ruamāhanga Whaitua Committee was established in 2013 to recommend ways to maintain and improve the quality of the catchment's freshwater. GWRC asked the committee for recommendations on implementing the NPS-FM in the Ruamāhanga Whaitua catchment. In August 2018 the WIP was finalised and it has since been approved by GWRC. The WIP will be integrated with the pNRP over the next few years.

This FMP recognises that the WIP will influence flood protection methods now and into the future, and how this FMP can assist in achieving the objectives of the WIP.

The WIP outlines objectives for the NPS-FM that include:

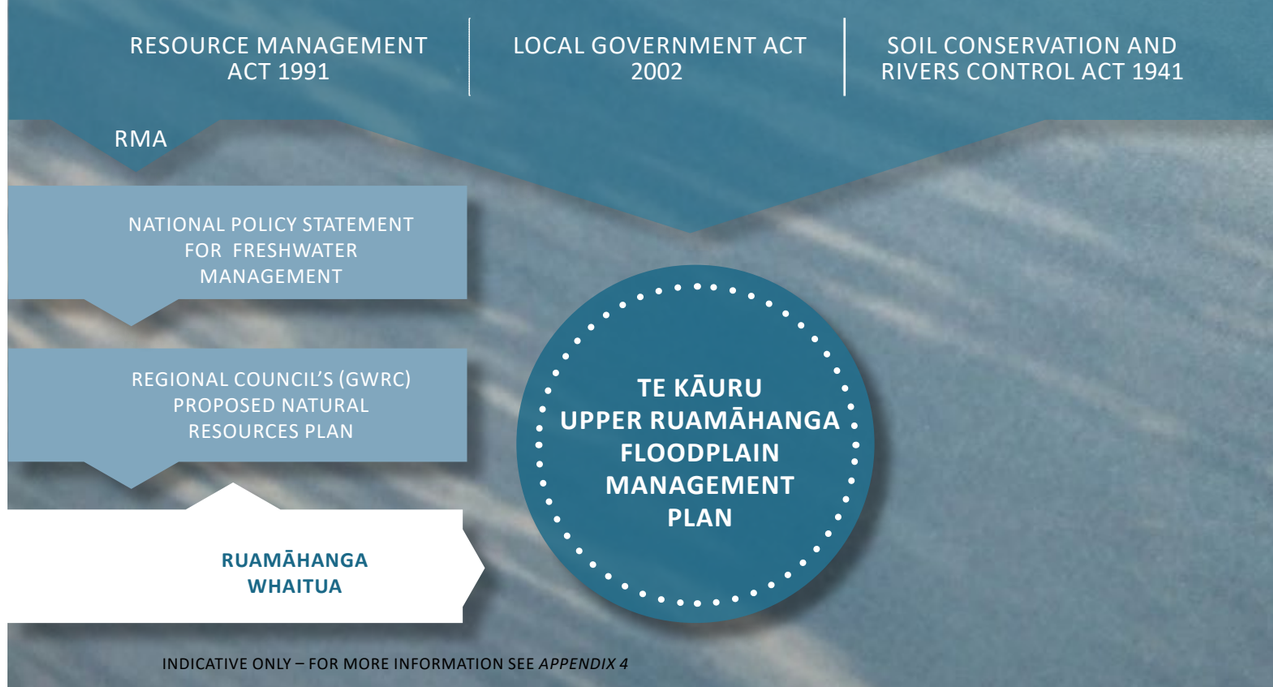
- Mauri, natural form and character and habitat objectives
- Fish and mahinga kai objectives
- Sediment objective
- Water quality, algae and invertebrate freshwater objectives for rivers and lakes

The Te Kāuru river management groups align with the freshwater management units within the Whaitua as outlined in the table below.

TE KĀURU RIVER MANAGEMENT GROUPS	FRESHWATER MANAGEMENT UNITS AS PER WHAITUA
Waingawa River	Western hill rivers
Waipoua River	Western hill rivers
Upper Ruamāhanga River – Mount Bruce	Valley floor streams group, western hill rivers
Upper Ruamāhanga River – Te Ore Ore	Valley floor streams group, northern rivers
Upper Ruamāhanga River – Gladstone	Valley floor streams group, eastern hill rivers
Kopuaranga River	Northern rivers
Whangaehu River	Northern rivers
Taueru River	Eastern rivers

Staff will continue to work across the organisation and with the community to ensure all objectives are optimised.

HOW THE TE KĀURU FMP AND WHAITUA FIT TOGETHER



INDICATIVE ONLY – FOR MORE INFORMATION SEE *APPENDIX 4*

2.8 The history of flooding

The Te Kāuru Upper Ruamāhanga catchment has a long history of river management associated with human settlement and people's desire to protect themselves and their assets from the threat of flooding. Floods that breached the river banks and flowed across the Te Kāuru Upper Ruamāhanga floodplain occurred relatively frequently, especially in the eastern areas of the catchment.

Early Māori, and later the first European settlers, established sites according to the seasons. The timing was driven by factors including flood risk, and the locations were chosen according to their closeness to important and lucrative resources, which were often close to rivers. The sites provided easy transport links and good access to water, food and fertile land, and eventually led to permanent settlements. Some are now large, permanent towns that still include hazardous areas, which has sometimes led to conflicts in community aspirations. Left unresolved, these conflicts can result in risks to life and property.

The Ruamāhanga River's risk of flood events is well known in the Wairarapa community. During the early 20th century settlers suffered damage and loss when the river overflowed its banks, washing shingle onto valuable pastures. The river bed had become badly choked with willows, flood flows were restricted and the channel was inadequate and ill-aligned for the floodwater volumes.

The major flood risk to Masterton came from the Waipoua River, and was compounded by the backing-up effects of flooding in the Ruamāhanga River. Because of this the Waipoua River was substantially modified and straightened in the 1930s and 1940s, and stopbanks were constructed along the margins.

1947 brought one of the most destructive flood events in the Wairarapa valley, with the flow in the Ruamāhanga River measuring 2,580m³/s near Martinborough. The flood was estimated to be a 1% AEP flood event, meaning there was a 1% chance of this event occurring in any year. The most significant impacts were felt in the lower reaches of the Ruamāhanga catchment, but floodwaters entered Masterton and other Wairarapa towns and most of the river's stopbanks were overtopped (the water overflowed the stopbanks). Thousands of hectares of farmland were flooded, thousands of farm animals drowned and the damage to individual properties was significant.

In response to the ongoing risk of flooding, various river schemes were proposed and implemented to stabilise the river alignments, provide bank edge protections and improve stopbanks.

The flood risks by river

The rivers of the upper Wairarapa valley are connected, so when one rises the others can follow. This can increase the risk of flooding and lead to significant property damage. For example, a flood in 1998, which ran largely through rural areas, damaged a large number of private properties and flood protection infrastructure.

The Waingawa River is steep and powerful, but fortunately for much of the surrounding community it is entrenched in a naturally confined floodplain. This means that, even in a large flood event, most flooding is contained by river terraces from where it enters the Wairarapa Plains until it joins the Ruamāhanga River. Recent river activity can be clearly seen on the ground in these confining terraces, where overflow paths have left their mark from deposition and scour. However, while the river's flood risk is limited, the erosion risk (both modelled and observed) is significant; this high-energy river regularly reshapes its main channel during flooding.

Flooding of Bruce Street 1934

The Whangaehu River has long been the cause of extensive flooding across the Wairarapa Plains. During the 1960s and 1970s attempts were made to manage the flooding hazard through straightening the river and undertaking intensive willow tree planting, but owing to significant erosion issues with the willows the river channel became choked with vegetation and migrated to adjoining areas. Sedimentation then constricted the channel further.

The Taueru River has experienced a number of significant flood events. Similarly to the Whangaehu River, willow trees planted along its length resulted in channel constrictions. In 1994 a river scheme was established to address flooding issues in the river's lower reaches.

In 2004 and 2005 extensive flooding in the Kopuaranga River led to the formation of a river scheme. As with the Taueru and Whangaehu Rivers, the river scheme focused mainly on managing the impacts of flooding related to willows choking flows in the river channel.

2.9 Future flooding and climate change

While climate modelling and historical data can provide some insight into how natural cycles and climate change will interact, the underlying science continues to evolve. Scientific understanding and/or national guidance may mean future changes for climate change policies.

2.9.1 Climate change

International and local agencies predict that climate change will affect river hydrology. Weather patterns are expected to become more erratic, with more droughts followed by high-intensity storms. As these predictions vary in magnitude, GWRC has adopted the Ministry for the Environment's guidance, which indicates a 1% AEP rainfall in the Te Kāuru Upper Ruamāhanga catchment to be 20% greater by 2100. It has used this allowance to model flood maps and plan for flood-risk management.

According to NIWA, the potential climate change implications for the Te Kāuru Upper Ruamāhanga catchment could include:

- A greater number of droughts followed by storms of greater rainfall intensity
- Rainfall reductions of up to 15% in spring, and increases in winter/autumn
- Decreases in the total volume of precipitation the catchment receives
- Changes in high flows and low flows towards more extreme values
- More frequent high flows
- Increases in short-duration storm intensity, with little change in long-duration storm intensity

2.9.2 Climate cycles

Short- and long-term climate cycles, influenced by natural fluctuations such as the El Niño-Southern Oscillation (ENSO) and the Interdecadal Pacific Oscillation (IPO), also affect climate and river hydrology.

- ENSO cycles, commonly known as El Niño and La Niña, are short-term, irregular phase changes in the Pacific Ocean that affect rainfall patterns and trade winds. The geographically diverse regions of New Zealand (including the Wellington Region) are affected differently by these cycles. Wairarapa tends to have a drier-than-normal climate in El Niño phases and a wetter-than-normal climate in La Niña phases.
- The IPO is a large-scale, long-period cycle operating at a multi-decade return that causes fluctuations in atmospheric pressure and sea surface temperatures. It appears to influence the impacts of inter-annual ENSO climate variability in New Zealand. Typically, high sea surface temperatures have been observed during negative IPO phases, leading to higher-than-normal rainfall conditions in the greater Wairarapa region, and low temperatures during positive IPO phases have led to drier-than-normal conditions. In 2018 the IPO appeared to be approaching the middle of a negative phase, indicating a likely wetter period overall for the Te Kāuru Upper Ruamāhanga catchment.
- There is currently no scientific consensus on how climate change will affect the ENSO and IPO cycles. However, climate change is likely to increase the frequency and intensity of extreme weather events, regardless of whether they are associated with the ENSO or the IPO.
- The ENSO and IPO cycles represent climate variability on large time scales and may not represent a particular yearly climate.

2.9.3 More information

More information on the different aspects of climate change can be found at the following websites:

- El Niño and La Niña – www.niwa.co.nz/climate/information-and-resources/elnino
- IPO – www.niwa.co.nz/node/111124
- Ministry for the Environment Climate Change – www.climatechange.govt.nz
- GWRC Climate Change – www.gw.govt.nz/climate-change

2.10 Why change? Drivers and benefits

The development of this FMP has been driven by the need to:

- Continue providing flood hazard management and erosion protection for land beyond buffers, using sustainable management approaches
- Distribute river scheme resources more equitably
- Enhance the rivers' environmental and cultural values by allowing the rivers to behave more naturally where possible, and minimise the frequency of in-stream works

It aims to deliver benefits through:

- Equity and social gains – The benefits of floodplain management and river schemes will be more equitably distributed. Currently some landowners receive more river scheme expenditure than others, often because they do not provide space for buffers. To address this, reactive works will no longer be automatically directed to properties where buffers to control erosion have not been provided.
- Increased environmental value – Ecosystems and biodiversity will improve through methods such as providing more space for river channels, which will lead to a more diverse aquatic and riparian habitat and better connections between terrestrial and aquatic ecosystems. A more naturally meandering river enables a greater variety of flow velocities, depths and temperatures and supports greater habitat diversity than is generally available in more restricted or highly managed river channels. It also provides opportunities for more diverse riparian plants, which in turn increase food and shelter for terrestrial ecosystems. These outcomes will help to improve natural character and conditions that provide for diversity in aquatic life.
- Increased cultural value – This embodies kaitiakitanga (guardianship of, and caring for, the river) and will be achieved through considering the catchment-scale processes and allowing the rivers to express more of their natural character, behaviour and form. This will also enhance the rivers' mana.
- Economic opportunities – Changes in land use along river corridors may create economic opportunities. For example, vegetated buffers may provide food for bees and support the honey industry.
- Improved recreational and amenity value – Improvements in the rivers' natural character are expected to support more bird and fish life, and improved water quality will enhance recreational opportunities in and along their margins.

The most significant changes to river management in the Te Kāuru Upper Ruamāhanga catchment involve planting buffers and giving the river more room to move. This is in line with the RMA, GWRC's pNRP, the Ruamāhanga Whaitua's WIP and other national and regional policies.

As outlined in Section 2.9, climate change is another driver for change. A background report, *Buffer Management – Benefits and Risks*, by Professor Russell Death (2018) is available on request.

Changes are happening internationally as well. For example, the Netherlands is establishing programmes to increase rivers' capacity for higher water levels and reduce the risk of flood damage. Other countries such as Russia, Switzerland, Finland, Sweden, Norway, Estonia and Denmark are undertaking river restoration works for flood protection and habitat enhancement. For more information, visit https://restorerivers.eu.

GWRC has a number of programmes that support rivers' natural character and riparian vegetation. Initiatives being undertaken by other parties include:

- DairyNZ's waterway management programmes
- The Department of Conservation' (DoC) and Fonterra's Living Water initiative
- The Ministry for the Environment's Our Fresh Water 2017 programme
- The Waikato region's Healthy Rivers programme
- Taranaki Regional Council's work on planting riparian zones
- The Government's One Billion Trees Programme

2.11 Risks and constraints

This FMP acknowledges a number of risks associated with the changes outlined in this FMP.

- Monitoring and intervening where required may cost more and be more intense for the river environment than more frequent, smaller interventions. The size and nature of this risk depends on future natural processes in the catchment, which are difficult to predict
- Some landowners may not support the potential loss of productive land in the existing buffer
- Environmental risks include a potential increase in pest animals and plants (such as old man's beard) in large planted buffers

Several key constraints were considered when assessing the management options. They included:

- The locations of existing assets (such as bridges, roads and houses)
- The need to balance the environmental and cultural values of enabling rivers to behave more naturally with the economic costs of the potential loss of productive land

2.12 The outcome of this FMP

This FMP aims to change the ways in which river management envelopes are implemented and river works are managed, with a goal of maximising natural river processes and enhancing the environment while providing an agreed level of flood and erosion protection. This aligns with the FMP's vision and aims to protect, enhance and restore natural and cultural values while supporting sustainable economic development and resilient communities.

3. Response approaches

As this FMP covers a large area with a variety of land uses and river types, a combination of flood- and erosion-management river schemes has been developed to suit the catchment's two distinct river types:

- River schemes covering the western side of the valley deal with the large, gravel-bedded Waingawa, Waipoua and Ruamāhanga Rivers. These rivers are managed in existing 'river management envelopes' (see Section 3.2.2).
- River schemes covering the eastern side deal with the smaller, silt-bedded Kopuaranga, Whangaehu and Taueru Rivers, which come from the eastern hills and do not have river management envelopes.

Previous management practices are discussed in *Appendix 2*, while *Appendix 3* covers the story of river schemes in the Te Kāuru Upper Ruamāhanga catchment, from the past to the present.

Two approaches to river management

This FMP outlines a river management approach that seeks to enable the rivers to behave more naturally, with less frequent interventions, in the current envelopes. It is an explicit attempt to strike a balance between improving the river environments and recognising the economic value of the adjacent land (and landowners' views).

The FMP uses two approaches to river management:

- 'Common methods' are used selectively throughout the catchment. Some apply to the whole catchment area, while others are specific to river management regimes in some reaches.
- 'Reach-specific methods' apply when specific responses are required to address more complex or location-specific issues (these are detailed in Part 2). It provides information on a reach-by-reach basis, including details on how and where responses apply. In some cases the responses are exceptions to the common methods, and may include project-specific measures to address a particular flood or erosion issue. 'Major Project Responses' apply to locations where the issues cannot be managed through common methods alone.

Section 3's focus: common methods

This section outlines the common methods. They have been categorised into five groups:

- Structural
- River management
- Planning and policy
- Emergency management
- Environmental enhancement

3.1 Structural responses

Structural responses involve the development of structures and other physical works to keep floodwaters away from existing developments. They include, for example, stopbanks and floodwalls, which are typically designed to specific flood standards such as 1% AEP.

Structural responses typically require ongoing bank edge works and channel management to ensure that flood defence structures and physical works remain effective. In the Te Kāuru Upper Ruamāhanga catchment, rock lines, riparian planted buffers and groynes are all used to protect flood defences such as stopbanks and maintain the channel positions.

New structural responses, such as stopbanks, are not included in common methods as they are site-specific responses.

3.2 River management responses

River management responses are GWRC's ongoing physical interventions in the river environment, so are the 'sharp end' of the FMP for many people and groups with interests in the river environment. Comprising works in river beds and on river berms, they must comply with GWRC's 'Code of Practice for River Management Activities'.

GWRC will apply these responses through Operational Management Plans. These plans complement the FMP by looking five to ten years ahead and setting out, reach by reach, the detailed works and priorities for annual work programmes and plans. In turn, these programmes and plans cover the details of what and where activities will be carried out on an annual basis. Note Operational Management Plans may need to be revised to take into account damage after flood events.

River management common methods (see Sections 3.2.1 to 3.2.11) reflect the community's desire to allow space and freedom for rivers so that they can behave naturally, while providing a degree of certainty and protection to neighbouring landowners. They achieve this by, for example:

- Using envelopes in the western rivers rather than holding them to fixed lines (in either their alignment or their bed levels) (Sections 3.2.2 and 3.2.3). This allows for the natural processes of bed scour/deposition and bank erosion/accretion associated with meander migration
- Using riparian planting of buffers in the western rivers and vegetated edge protection in the eastern rivers as the preferred edge protection method, and using flexible buffers to enable the natural river processes (Sections 3.2.5, 3.2.6 and 3.2.11) and/or
- Minimising the frequency of interventions in the channel, and where intervention is necessary using good management practices to maintain a clear fairway and buffer

The expected outcome is that the rivers will be able to behave in a more natural way with a greater variety of form and habitat. However, this FMP acknowledges that:

- Interventions with machinery will still be needed in the river environment – and in some cases they will be significant (for example, to re-establish vegetated buffers after major damage)
- In other locations, regular work with machinery may still be the best way to achieve the FMP's overall outcomes where other methods are not effective
- While GWRC will be required to intervene with mechanical means less frequently in the western river channels, the overall scale of works will not necessarily be less

Alternatives will be considered through the FMP and Operational Management Plans, and mechanical interventions will be avoided if there are better alternatives (including taking all the values described in Section 2.3 into account).

The FMP and the Operational Management Plans seek to strike a balance between:

- The values in each reach and the benefits of allowing the river to behave more naturally, and
- The benefits of controlling the river's behaviour to manage flooding and erosion problems (which include protecting people, properties and productive land)

Decisions on the river management common methods to use and how and where to apply them will be made openly through the directions in this FMP and those provided through the Operational Management Plans and the Code of Practice for River Management Activities (see Section 3.2.1).

The first consideration when assessing any response should be "can we avoid doing work here?" With this in mind, interventions to move any of the western rivers out of the buffer will generally take place only when:

- The historical channel lines indicate an unusually high risk to adjacent land if the river were to erode further, or
- Erosion is continuing further landward with no signs of the erosion migrating downstream (that is, a considerable 'hook' is developing that threatens to result in a major realignment of the river), or
- Erosion has occurred and worsened through a series of minor events, leading to concern that the land behind the buffer would be threatened by ongoing erosion in further minor events, or
- There is a threat to public infrastructure

While exceptional circumstances may arise, the Operational Management Plans are expected to follow these principles.

An intervention hierarchy has been developed to help with decision-making. The general concept is that where there is a risk to land of erosion in the buffer, the scale and type of works used must result in a low risk of adverse impacts. If the risk presented by a particular situation increases, along with its associated potential impacts, the activities available for intervention must also increase to include those assessed as having medium and high risks of adverse impacts (explained in the table opposite).

HIERARCHY OF INTERVENTION FOR THE WESTERN RIVERS

	SITUATION	INTERVENTION TYPE	ACTIVITIES	TIMEFRAME FOR COMPLETION
LOW RISK	Land in buffer is at risk of erosion	Limited intervention/monitoring of risk by staff	Only activities that will result in a low risk of adverse impacts (these will have the effect of limiting work in the wetted channel and in high-value riparian areas)	Scheduled regular maintenance (annual work programmes)
MEDIUM RISK	The outer management line is at risk of erosion	Moderate-priority intervention	Only activities that will result in low and/or medium risk of adverse impacts, or a limited amount of high-impact activities	Incorporated in annual work programmes
HIGH RISK	Risk to life Risk of damage to key infrastructure Erosion has occured beyond the outer management line	Immediate intervention	All activities available – with low, medium and high adverse impacts	Urgent – to be completed ahead of programmed work that can be practically deferred to allow for the completion of priority, reactive work

This hierarchy is an effective way to align the risks of a situation with the potential adverse impacts of an intervention. In effect, it means that:

- Low-risk situations, such as minor erosion of land in a buffer where there is no critical infrastructure, can only be managed with activities that are not undertaken in the wetted channel
- High-risk situations, such as a breach of the outer management line or an immediate risk to critical infrastructure, can use all the available activities, including those undertaken in the wetted channel

Further developments of this guidance will recognise the need to maintain a degree of flexibility in dealing with different situations, while still providing enough direction to ensure a high degree of consistency and the achievement of agreed outcomes.

3.2.1 The Code of Practice for River Management Activities

The Code of Practice guides all river management activities that GWRC undertakes for the purposes of flood and erosion protection in the Wellington Region – irrespective of funding, location or whether the activities require resource consent. This means it applies to permitted activities as well as those for which resource consent is required by the pNRP.

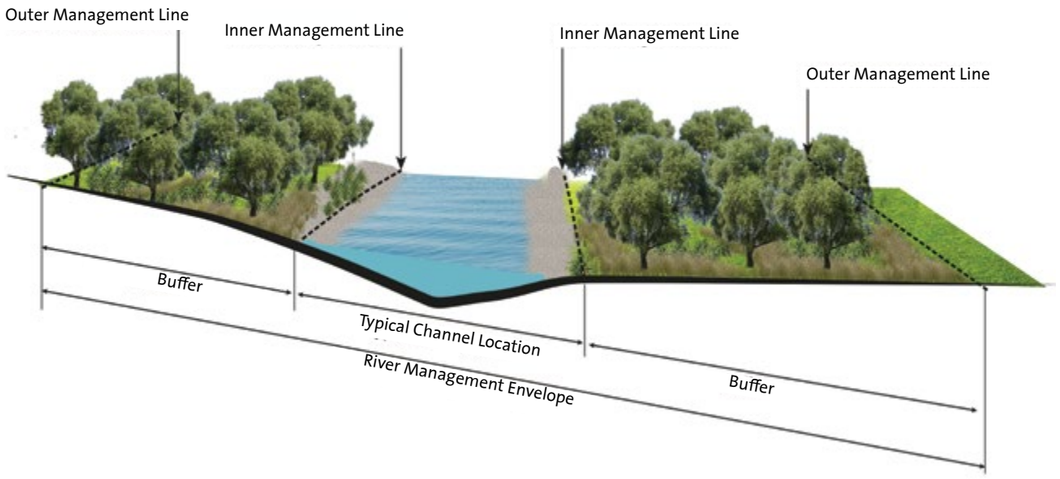
The Code of Practice aims to achieve:

- Greater awareness of the effects of river management decisions and activities on a river's natural character and other significant river values, at both broad (whole of river) and detailed (reach or site specific) scales
- Greater consistency of river management practice in the rivers that GWRC administers and manages
- Good management of the environmental and cultural impacts of river management activities
- Adaptive river management practices to improve environmental outcomes

While individual catchments were considered in the Code of Practice's development, it is not intended to be used in determining the best method or activity for a catchment, river or reach. Instead, it provides direction for river management activities on the ground.

This FMP gives directions on where and how the common methods are to be applied to each river and/or reach, and indicates the values to be considered and the restrictions that should apply in choosing river management activities. Operational Management Plans must be consistent with the FMP's directions, and GWRC staff should note the directions or restrictions when planning activities to use (and how, when and where to use them), and ensure that those activities are carried out in accordance with the Code of Practice.

Note that the information in this FMP is not exhaustive and other restrictions will apply in different places and times.



3.2.2 River management envelopes

River management envelopes define the lateral extent in which a river is managed. They are only used in the western rivers.

An 'outer management line' (see the graphic above) defines the extent that may be eroded in small to moderate floods and/or will be used for riparian planting. The space between the banks of the river and the outer management line is known as a 'buffer'. GWRC seeks to manage the envelope so that the land outside it is protected from erosion to around a 5% AEP level of service (a flood that has a 5% chance of happening every year). The level of service is the minimum expected level of performance of a flood protection asset or service.

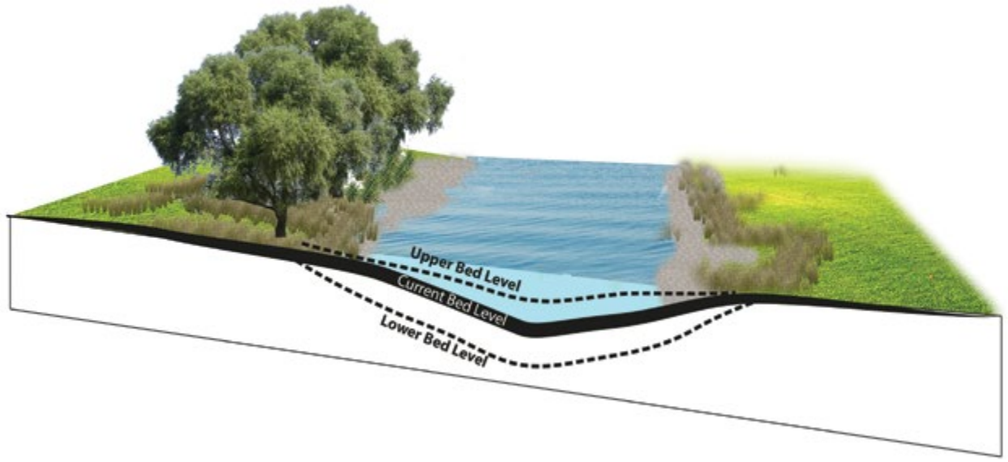
The river management envelopes (also known as design lines) have been in place since the early 1990s. They were established to support good river management practice and to give adjacent landowners a level of confidence and clarity about the maximum lateral extent to which the active river channels would be managed.

The inner management lines indicate the active river channel's location most of the time, and the outer management lines indicate the outermost extent to which the river will be managed – giving the river room to move in the buffer.

Landowners make an important contribution to flood and erosion security and ecological benefits by making land available for the protection of their own and their communities' assets and enabling natural river behaviour. Section 3.3.8 covers the approach to securing their contribution through strategic land purchases.

River management envelopes have a number of benefits:

- Providing a river with room enables it to take a more natural form, and results in less risk of high flows breaching the wider river corridor into people's homes and farms
- Wider channels put less pressure on banks, so the buffers are likely to be retained. That said, there is a tendency for lateral shift, which needs to be closely monitored
- Giving a river room enables the establishment of natural erosion-resisting elements, such as bed armour, vegetation and bar forms. With these in place, erosion rates should decrease
- Reducing the channelised floodways in some reaches of Te Kāuru Upper Ruamāhanga catchment will prevent the rapid flow of nutrients and other contaminants, reducing their discharge into coastal marine ecosystems



3.2.3 River-bed-level monitoring

A river bed can rise (aggrade) and fall (degrade) with time, and in a long period of time can fluctuate between these two states. These movements happen due to natural events, but they can also be significantly affected by human activities. They are particularly evident in gravel-bedded rivers (here, the western rivers), where bed levels can rise and fall in relatively short timeframes.

GWRC's extensive network of cross-sections on all the region's main rivers has been surveyed since the 1990s. Given time and more information, it will be possible to record the longer-term rise and fall trends, enabling a better understanding of the sediment movement processes. The information will be useful for people interested in the effects of river bed levels and their close connection to the groundwater table.

With enough data, it will be possible to establish river bed envelopes that include limits for the upper and lower envelopes. These limits will be used to identify early signs of problems and trigger GWRC alerts to assess the areas and determine responses, which could be gravel extraction, reviews of the river management envelopes or the prioritisation of other management methods.

Through using river bed envelopes and monitoring long-term rise and fall trends, GWRC will be able to make early assessments of the need to change current river management approaches and how those changes should happen.

3.2.4 Gravel extraction and analysis

Gravel extraction is one tool that GWRC uses to manage the gravel in the western rivers (see Sections 3.2.3 and 3.2.8 for information on the monitoring activities).

GWRC uses gravel extraction to maintain a river's capacity to hold water in its banks and to manage problem beaches and channel alignment. However, extraction can have negative effects, including:

- Reduced water quality
- Negative impacts on fish and wildlife habitat
- Increased lateral bank erosion
- Undermining of assets such as bridges, rock structures, stopbanks and riparian planted buffers

For this reason, GWRC tries to extract gravel sustainably (that is, at a rate that matches the gravel supply). This helps to maintain channel capacity while avoiding the negative impacts of over-extraction.

Rivers in the Wellington Region commonly experience aggradation in the flat lower reaches and degradation in the steep higher reaches. While GWRC usually aims to encourage extraction in the downstream reaches, the quality of their gravel is not as desirable to contractors as that further upstream, so there is a continual issue of managing supply and demand. GWRC also needs to keep contractors interested in extracting the resource, as many have the option of abandoning river extraction in favour of dry extraction.

Contractors require licences to extract gravel under the existing GWRC river management/operations consents. This practice will continue with the proposed new global consent for GWRC's Wairarapa operations.

The licences enable GWRC to monitor, record and regulate extraction locations and quantities. This is vital in ensuring appropriate gravel analyses, which are used to establish the locations and required quantities of gravel extraction.

Each gravel analysis results in a series of recommendations, which may require GWRC to increase, decrease, cease or maintain the current extraction rate or focus extraction on different areas of the river.

Gravel analysis requires river surveys, which GWRC has set up for all the major rivers and streams in the Wellington Region. GWRC processes the survey data and compared it to data collected from previous surveys.

Individuals can extract 15m³ per 12-month period for personal use, and riverside landowners can extract 50m³ per 12-month period under Rule 120 of the pNRP and Rule 38 of the Regional Freshwater Plan.

3.2.5 Riparian planting of buffers

A buffer is an envelope of land beyond the river channel on all the Te Kāuru Upper Ruamāhanga western rivers that is allocated for erosion control and protection – often, but not exclusively, in the form of trees. Establishing these envelopes is also useful for other common river management methods, including river management envelopes, river-bed-level monitoring and mixed riparian planting in buffers.

In Wairarapa, willow trees have been planted as buffers for river and erosion management for more than 30 years. These buffers have helped to:

- Reduce lateral erosion and sedimentation
- Improve meander alignment (the shape of the river) and reduce channel distortions
- Provide cover and habitat for wildlife
- Reduce the nutrients and pathogens from runoff entering the waterways

Vegetation can increase a river's resistance to erosion along a bank edge – in effect slowing the erosion process so that less land will be eroded than would with bare, unplanted land. However, while willow trees are often used to bind river-bank material, this FMP advocates a more diverse mix of planting for the western and eastern rivers (see Section 3.2.6).

The land included in buffers may suffer from erosion damage (for example, during a flood event) before erosion control measures such as planting are established. In some instances the buffers will naturally refill with gravel and be re-planted as river meanders migrate downstream, and at other times the buffers will be artificially reconstructed by machine work and re-planted.

Allowing the rivers more room may mean a loss of vegetation in buffers that have already been planted. This will depend on the land area, soil types, bank slope, land use and vegetation type and density.

High banks and erodible cliffs can be included in buffers. In these cases vegetation cannot be planted in the buffers because their root zones will be too high above the rivers to be effective in slowing erosion (or for tree survival). The common approach is to allow a buffer to partly or fully erode so that riparian planting can be established at river level to protect the land behind the buffer.

There has been mixed success historically in riparian planting of buffers or edges throughout the catchment, as nearly all the land is privately owned. It has only recently been recognised for its economic value in managing river erosion.

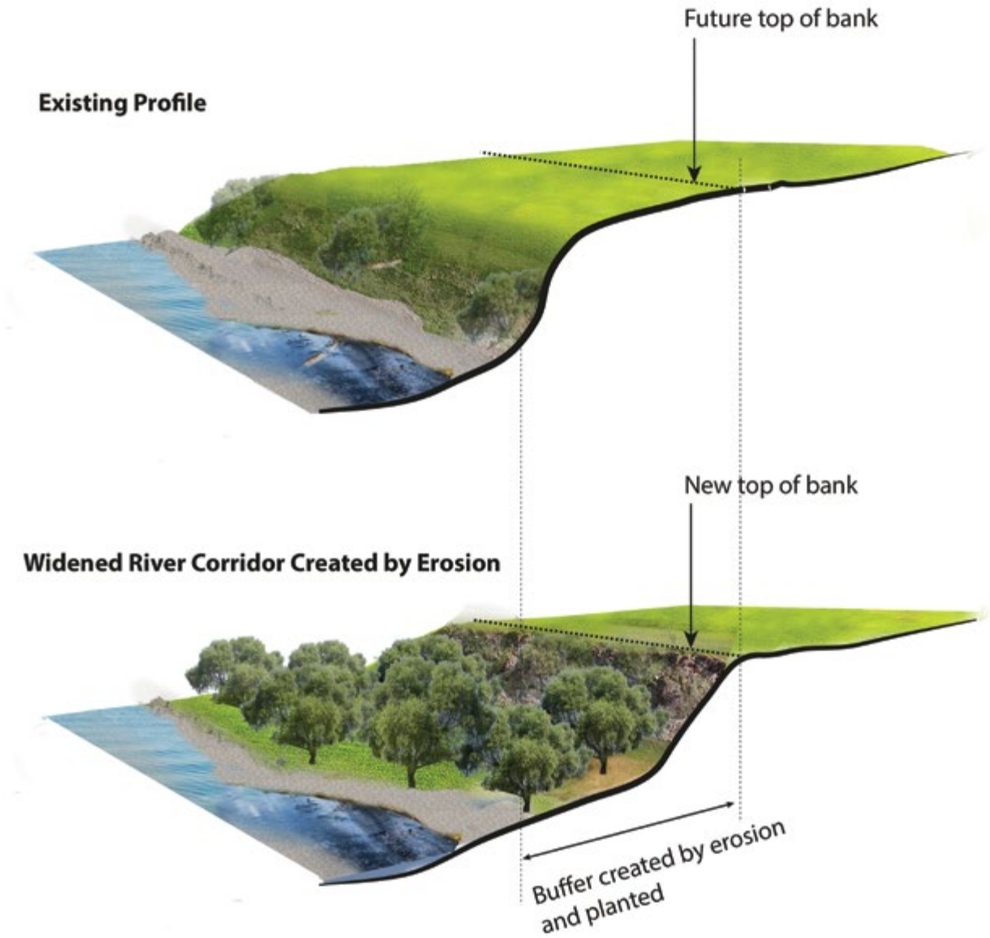
There is a considerable opportunity to combine riparian planted buffers with environmental enhancements (see Section 3.5), such as wetland areas where appropriate. The Environmental Strategy (see Section 3.5.1) will identify areas that have environmental enhancement opportunities, and could also identify sites where landowners are keen to participate in environmental enhancement efforts, areas where wider buffers could be established and/or areas where additional land could be purchased.

The many benefits of planting buffers along the western rivers and along the eastern rivers' bank edges include:

- Bank stabilisation, which helps to reduce the amount of fine, suspended sediment
- Improvements in the absorption of surface runoff into the soil, reducing contaminants from land use activities entering the rivers
- Improvements in water quality through reductions in sediment and contaminants from land use activities
- Improvements in biodiversity and visual amenity
- Regulation of in-stream temperatures
- Improvements in the rivers' natural character
- Improvements in cultural values with native planting
- Support for invertebrate communities due to reductions in water temperature

It is recognised that the benefits of a given buffer will depend on the land use, soil type, bank slope and riparian vegetation type and density. The buffer's width may also have an effect, with some studies indicating that a width of 30m will protect river health, while others have recommended 50m. The buffer's length is also important for bank stability.

The economic benefits of riparian planting relate to the economic value of ecosystem services, which benefit humans by improving water quality, increasing aquatic life and decreasing sediment and contaminant loading.



The FMP recognises that there are also downsides associated with planting the western river buffers and the eastern river banks. They include:

- The potential for increased roughness, sediment migration and channel realignment, which may cause unexpected changes in active channels with the potential for overtopping and avulsion (the rapid abandonment of a river channel and the formation of a new river channel)
- The risk of buffers eroding laterally and therefore eroding the vegetation
- The costs of weed control
- The need to achieve a balance between giving the rivers more room for their natural hydromorphology and the constraints of current infrastructure and channel forms
- The need to ensure that riparian vegetation planted near electric lines is selected or managed to comply with the Electricity (Hazards from Trees) Regulations 2003

The rivers will need to be monitored via surveys using LiDAR (a surveying method that maps surface information using a laser) and/or drones to identify any of these potential issues before they become a reality.

In terms of weed control, this FMP recognises that it may take up to five years post-planting to control weed growth (see Sections 3.2.7, 3.5.3 and 4.4.2).

3.2.6 Mixed riparian planting in buffers

As mentioned in Section 3.2.5, river management in Wairarapa has relied heavily on willow planting to maintain stable bank edges. This is because willows:

- Are fast-growing, robust trees with branch growth that can reduce flood speeds on berms
- Have dense root masses that can bind bank-edge soils
- Can be transplanted mechanically
- Have been recorded as being more resilient to stress and more likely to survive than many other species

This FMP advocates a move from an exotic willow monoculture to a mixed native/exotic riparian approach for the entire buffer in the Te Kāuru Upper Ruamāhanga catchment. This approach is already used both regionally and nationally. Depending on the location, this could mean:

- Using willows for frontline defences and natives further away from the active bed, or
- Under-planting natives into willow stands, and when the natives are mature enough removing what remains of the willow stands (where practicable)

The programme of removing crack willow (*Salix fragilis*) in the eastern rivers will continue, with hybrid willows and/or natives being planted along the bank edges.

The use of suitable native plant species offers the benefits of:

- Improved biodiversity
- Enhanced visual amenity
- Improved water quality
- More stable stream and river beds
- A reduction in the long-term risks of pests and diseases associated with using only willows for river-bank plantings

The FMP encourages research into the best methodology for mixed riparian plantings in the local environment. This could include identifying examples of mixed riparian planting along the river and the implications and potential for success. There is also an opportunity to explore (with tangata whenua) the planting of rongoā, or traditional healing plant species, in areas that the public can access.

Initiatives to plant and maintain mixed riparian planting in buffers should ideally be led by the community. GWRC can provide plants and some resources to help with the planting, but ongoing maintenance will rely on community support. GWRC has already established good working relationships with landowners who are part of river schemes, and could explore opportunities to broaden the involvement of these groups as well as landowners outside the river scheme areas. Through the Riparian Management Officer (an appointment recommended in Section 3.5.3), advice and support will be available to landowners wishing to explore mixed riparian planting in buffers.

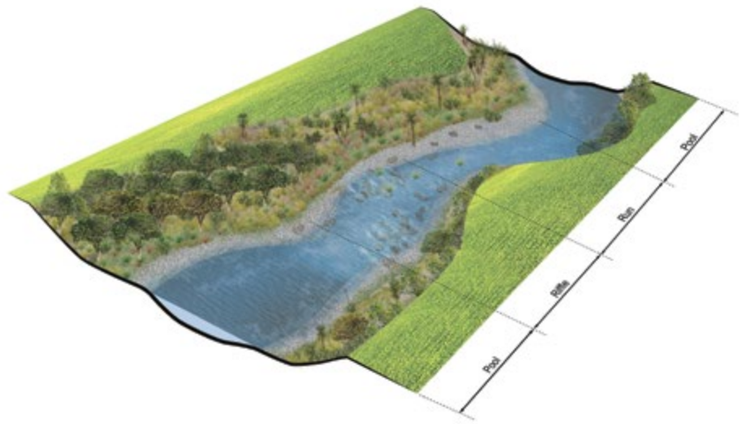
3.2.7 Pest management in riparian planted buffers

Introduced pest plants and animals can threaten human health, the economy, Māori heritage, recreation and native plants, animals and habitats. Depending on the species that need to be controlled and the area to be covered, the method and therefore the cost of pest management will vary.

In the Te Kāuru Upper Ruamāhanga catchment, approximately 880ha of riparian planting (once all planting is complete) will need to be controlled for various pest plants (such as old man's beard and blackberry) and pest animals (such as possums and rabbits). Due to the wide range of species that may affect the buffers, spraying will likely be the most effective control method for pest plants, and trapping and poisoned bait for pest animal control.

Pest control will be supported by the Riparian Management Officer (Section 3.5.3), and its implementation is discussed in Section 4.4.2.

Blackberry along the Ruamāhanga River



3.2.8 Pool-riffle-run envelope

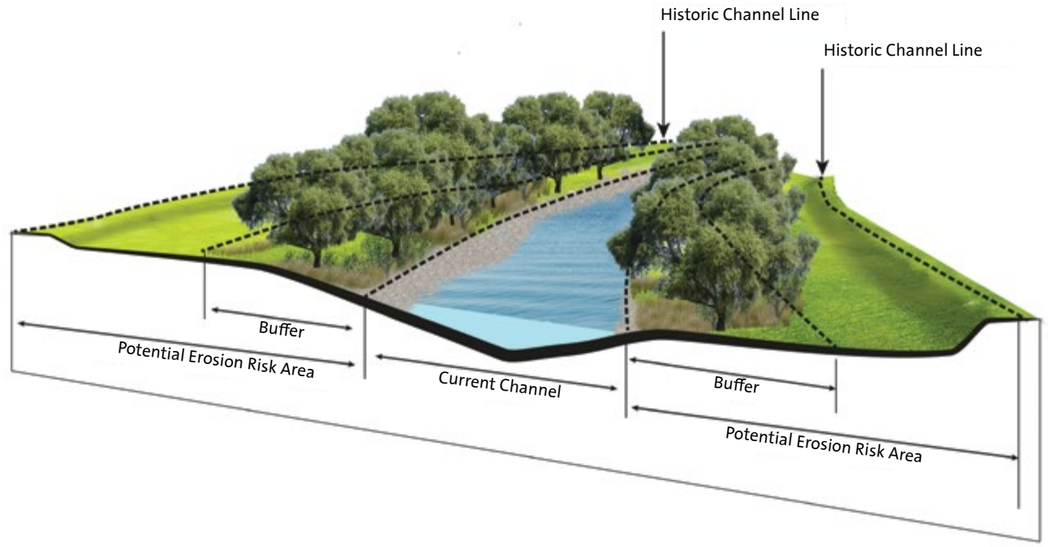
In many rivers, the channels and water levels are naturally regulated by a sequence of pools, riffles (rocky or shallow parts) and runs (smooth, unbroken flow). A diverse mix of flows and depths is important in creating a variety of habitats for fish and invertebrate life, and can support a range of recreation activities. In a meandering river bed, this diversity is largely provided by the number and occurrence of pool-riffle-run sequences.

A pool, riffle and run count is a method used to ensure that habitat and river form diversity is maintained in a managed river system. In a highly managed or stable river it is practical to set an exact number of pools, riffles and runs.

Through implementation of this FMP the reaches of the gravel-fed western rivers will be assigned with pool, riffle and run counts, with defined upper and lower acceptable limits per river management reach forming an ‘envelope’.

Under this method, no intervention in the river system will be required to modify natural changes to pool, riffle and run counts that may occur during flood events. The counts will only be used for planning river maintenance works.

The pool-riffle-run envelope will be included in monitoring and performance measures. By counting the number of pools, riffles and runs, the river forms and changes between surveys can be assessed and compared. In the long term, this will help in identifying trends in the rivers in connection with river maintenance works.



3.2.9 Historical channel lines

The upper Ruamāhanga River has in the past meandered widely across the Wairarapa Plains. Some of these historical channels can be seen in old river terraces that are visible in the land, such as the hillside behind Oxford Street in Masterton. In other cases these channels have been infilled to change the land uses. During large flood events rivers can reoccupy these infilled or old channels and present hazards or be subject to greater erosion.

The photographed and observed historical channels are included in plans in this FMP and in the Operational Management Plans, with the aim of:

- Raising awareness of these landforms
- Helping property and asset owners to make informed decisions on siting infrastructure
- Providing an information-only source for identifying assets on farms and businesses that would not otherwise be controlled under district plan rules for hazard avoidance. These include irrigators, cattle shelters, some farm outbuildings and other utility-type structures
- Providing an information-only source for siting roads and other infrastructure

3.2.10 Isolated works support

GWRC may provide, on application, financial contributions towards river works that fit with its Isolated Works Policy. These 'isolated works' are privately owned flood or erosion protection works currently undertaken outside river scheme areas. GWRC's contribution is designed to provide a level of service to areas that do not qualify for works under river schemes.

Minor alterations to the Isolated Works Policy are planned to enable people in existing river schemes to access this support. For example, support should be available for erosion control in a river scheme area if that control is not provided for directly in the river scheme's level of service.

3.2.11 Alternative land uses in riparian planted buffers

Most riparian planted buffers have a single purpose: to make land available for erosion control and protection. Some alternative land uses have been trialled to recognise potential revenue streams from these parcels of land that are not available in the adjacent rural land (which is usually used for cropping, dairy or sheep and beef). These additional revenue streams could include beekeeping and growing willows as an alternate fodder crop for drought periods.

The Community Support Officer recommended by this FMP (see Section 3.5.2) will advise and support landowners wishing to explore these additional revenue opportunities.

There may also be opportunities to lease land for the purposes of public recreation, access and flood protection and erosion control.

3.3 Planning and policy responses

Planning and policy responses can include: flood mapping; land zoning; rules restricting the type of development allowed in flood-prone areas; standards for activities in flood-prone areas; and plan provisions (rules or consent conditions) to ensure the operation, maintenance and protection of flood protection works.

River management envelopes affected by active erosion could be recognised in district plans or through hazard mapping, zoning and designations, or any combination of these mechanisms.

Objectives, policies and rules may also need to consider matters such as the location, building, maintenance, operation and protection of structures such as stopbanks, weirs, groynes, flood gates and diversions, and other flood protection measures.

3.3.1 Land use controls

As flood and erosion information is updated, district plan amendments are required to update the recommended land use controls. Amendments include overlays and zones that capture:

1. River corridors
2. Overflow paths
3. Ponding (inundation areas)
4. Residual overflows
5. Residual ponding
6. Erosion hazards

This FMP advocates this six-tier approach, or a similar one, as it clearly defines the nature and extent of the flood hazards from direct flood risks and 'residual' risks. To enable this approach, changes will be required to the Wairarapa Combined District Plan (WCDP) through either a regular district plan review or a separate 'plan change '. The main recommended changes are:

- Introducing and mapping hazard categories (preferably through a flood hazard overlay)
- Restricting buildings/structures/earthworks in the river corridors and overflow paths
- Ensuring that all new habitable buildings in ponding and residual overflow areas have elevated floor levels
- Not allowing any new subdivision in ponding areas, or critical infrastructure that does not take the hazard into account
- Requiring setbacks from stopbank structures

Until these changes are made, this FMP can provide CDC and MDC with information and outcomes to consider in any future planning applications. In addition, and as an interim measure, the district plan maps could be updated with the revised flood hazard information without any need to change the underlying policies and rules. The timing of any review or change to the district plan will be determined by CDC, MDC and South Wairarapa District Council.

3.3.2 Designations

One of the methods GWRC is seeking to use is the Notice of Requirement process (under the RMA) to designate the major projects and river management envelopes (buffers) on the western rivers.

Designations do not confer automatic access to the designated land. Most of the land designated for buffers, stopbanks, floodways and drains remains in private ownership. This is described in more detail in Sections 3.3.7 and 3.3.8.

A designation will enable GWRC to prevent:

- Unauthorised activities (such as structures, planting and pipes) on or under buffers or stopbanks that could affect their structural integrity
- Unauthorised vehicles accessing buffers or stopbanks
- The location of obstructions (shelterbelts, tree planting and structures) in floodways that would adversely affect the conveyance of floodwater if a flood occurred in the designated areas

3.3.3 Flood hazard maps

Flood hazard maps were produced before this FMP was prepared to help with understanding and communicating the flood issues. They were generated using both computer modelling to predict flood behaviour and historical data to match the model as closely as possible to past events. A 1% AEP event was used in line with regional policy and guidance documents, as well as a range of other events including historical floods and events both smaller and larger than the 1% AEP event.

Climate change impacts are included in most of the scenarios because this FMP considers long timeframes in which climate change is predicted to be significant. In addition, national guidelines and GWRC policy require climate change to be considered. Uncertainties in the data and other factors that cannot be included directly in the model are also considered via a freeboard (sensitivity allowance in modelled flood levels).

Mapping is undertaken at a catchment scale rather than for particular sites, as this is appropriate for planning solutions to flooding, informing emergency management and providing advice on flood hazards for existing and new developments. GWRC uses the information to meet its statutory requirements to understand and manage flood risks, while district councils use it in carrying out their obligations in district planning and providing Land Information Memoranda, and their functions under the Building Act 2004. Flood hazard maps also make important contributions to many of the other common methods.

The flood hazard maps are peer reviewed and represent the best information available at a particular time. As technology and information change (for example, more powerful computers are developed, and rainfall and river flow records get longer) the maps are updated to ensure that the information continues to be fit for purpose.

Flood hazard maps will be used to support future changes to the WCDP. Depending on the timing of changes and the information required at the time, further development work may be required for both the maps and erosion hazard areas.

3.3.4 Rural stopbanks policy

Stopbanks are embankments built to stop floodwater from rivers flooding nearby land. They may look like grassy banks, but they have been built according to specific engineering designs and standards.

The established stopbanks in the Te Kāuru Upper Ruamāhanga catchment have a variety of levels of service (or capacity) each defined by an AEP. In assessing each one's level of service for this FMP, some existing 'legacy' stopbanks in the river schemes were identified as less effective than others regarding who they benefited and the services they provided. This led to issues of equity between different areas and landowners.

To ensure a more equitable outcome, Part 2 of this FMP provides for each stopbank a definition, an identified level of service and management guidance, including options such as maintaining, retreating or retiring/transferring the stopbank. This becomes particularly important when existing stopbanks are located in the buffer. Removing or retreating stopbanks in rural buffers will not be considered a high priority for implementation until their integrity is threatened.

This FMP does not propose any new stopbanks to protect rural areas, with the exception of a possible stopbank alignment at Rathkeale College.

It is possible that in the future private landowners will propose building stopbanks to protect their land. GWRC will consider these proposals on a case-by-case basis according to matters such as:

- The benefits a stopbank provides
- Its impacts on the flood hazard to other properties
- The vulnerability of the land behind the stopbank, including in the case of stopbank failure
- The stopbank's level of service (including when it is too high, thereby facilitating inappropriate residential development)
- Its impacts on river management, particularly its distance from the river

3.3.5 River scheme funding decision-making policy

The 2019 river scheme funding model addresses the impacts of flood events up to a 20% AEP magnitude through annual rates, and 20%-5% AEP events through reserves. Floods bigger than a 5% AEP event have access to funding from GWRC's Major Flood Damage Reserves.

Central government funding may be available after a major flood that exceeds a 2.5% AEP event. If additional funding cannot be obtained, any damage may need to be tolerated in events greater than 5% AEP magnitude, or repair works may need to be completed using debt funding. The decision-making process for works requiring high funding levels will be clarified through the development of a policy that determines:

- What works can be carried out under annual works
- What works can be carried out using reserves
- How decisions are made on works that exceed reserve funds

3.3.6 Asset abandonment/retirement

A number of assets no longer provide the services or perform the functions for which they were designed. Part 2 identifies these assets in each reach, including the method of retirement/abandonment and an indicative timeframe where this is practical.

As a general rule, flood protection assets in a river management envelope will be retreated to less erosion-prone locations or abandoned/retired. However, this will not be a priority until the stopbanks' integrity is threatened.

3.3.7 River management access

GWRC requires access to land to carry out works for river channel management and asset construction and maintenance. Often this access needs to be ongoing and have a reasonable degree of certainty. This is achieved through mechanisms such as:

- Informal access agreements
- Formal access agreements
- Esplanade strips (created during subdivision)
- Easements
- Designations
- Land purchases
- The existing river schemes rely largely on informal goodwill and landowners' willingness to allow river works and buffer establishment on their properties – although GWRC's existing stopbanks have been designated in the WCDP.

As mentioned in Section 3.3.2, GWRC is seeking to designate river management envelopes in the WCDP. This will clearly identify that these particular areas of land are needed for river management purposes and will enable GWRC to control activities and/or structures located on that land. Any Notice of Requirement would require consultation with the affected community.

3.3.8 Strategic land purchases

GWRC's preference is to own its stopbank footprints, with the option of leasing them back to the adjacent landowners for grazing. However, some landowners are concerned about public ownership of river corridors and margins, particularly in relation to the security of their property and changes to the way the land would be managed. In most circumstances in the Wairarapa context, GWRC has designations over its structural assets.

Implementing the major projects described in this FMP will require significant works on private land, and therefore land purchases in the future. Some of these works will be many years away, but as a high priority in implementing this FMP GWRC will seek designations on all sites where future Major Project Responses require assets to be built or relocated.

Implementing the FMP's river management/buffer approach in the western rivers will require changes in land use, such as open areas of river margin being planted with riparian plants. Where a landowner would prefer to sell that land to GWRC rather than retain ownership, this FMP seeks funding for GWRC to be able to buy that land. This will also apply to landowners who have already set land aside to establish riparian planted buffers, because it is important that all landowners are treated equally.

This FMP does not seek to bring all river corridor or buffer land into public ownership. However, a strategic land purchase list will be developed and costed, and a plan established to acquire the land over time (through mutual agreement) via a 'strategic land purchase fund'. This will need to align with reach-specific buffer recommendations, planned Major Project Responses and high-priority sites identified in the Environmental Strategy. An indicative cost for this, based on buying half the land that sits in the river management envelopes, is $5 million over the life of this plan. GWRC will also support the creation of esplanade strips by district councils when riverside properties are subdivided.

The strategic land purchase fund will also be available for funding infrastructure retreats from the river management envelope. GWRC's contribution will be in line with funding policies at the time, with the remainder funded by the asset owners. GWRC's contribution will be capped based on an estimate of the cost avoided by retreating the asset. For example, GWRC may contribute to a road retreatment where doing so avoids the need to build rock groynes. GWRC would contribute the difference between the cost of building the rock groynes and the cost of implementing and maintaining a standard vegetated buffer. A more comprehensive policy will be developed as part of implementing this FMP.

3.3.9 Protection against deforestation in upper catchment

The upper catchments of the western rivers fall in the Tararua Range, including Tararua Forest Park. Much of this area is protected as DoC estate. Areas outside this that are currently forested have differing levels of protection.

Rules are required to prevent deforestation in the upper catchments, to ensure that the runoff characteristics of this area remain intact. They can be delivered through regional plan and district plan rules, as well as advice and support from GWRC.

3.4 Emergency management responses

Emergency management has an important role in floodplain management planning. When a flood emergency occurs, a community's ability to cope depends entirely on the preparedness of its emergency services, public agencies, utility services, businesses and residents.

3.4.1 Community resilience

A resilient community is well prepared for emergencies and has the knowledge, skills, resources and relationships to respond to and recover from a flood event. When a flood emergency happens, the community's ability to cope depends on its resilience.

The Wellington Regional Emergency Management Office (WREMO) will work with the community to increase its resilience through education programmes designed for three target groups:

- The business community, through offering tools for business continuity planning to increase their resilience
- School teachers, through education on emergency management
- Aged residential care facilities, as these are one of the most vulnerable areas

In addition, educational brochures developed by WREMO and supported by the materials from this FMP will be available for the public to help in their personal emergency planning.

As an outcome of this FMP, GWRC will provide WREMO with detailed mapping tailored to emergency management uses. The maps will display vulnerable access routes or lifelines, and the scale of events that will cause these lifelines to be cut. Additionally, GWRC will provide an address list of properties located in areas likely to be affected by a 1% AEP flood event, with the intention that it be used to deliver the community preparedness message to these properties' owners and occupants. Properties that are vulnerable to frequent floods will be highlighted.

3.4.2 Flood forecasting and warning system

GWRC and WREMO together provide a flood warning service for the Wellington Region. GWRC also makes environmental data, such as data on river flows and rainfall amounts, available to the public via a range of methods including its website.

Flood warning is recognised as a major tool for equipping people to take their own actions to avoid flood risk. In a large flood or in areas that have very low levels of flood protection, flood warning is crucial for people who are exposed to these hazards and for emergency managers trying to minimise risk to life and property.

The development of this FMP has led to a number of suggestions for improvements to the system, as did a 2016 review of GWRC's and WREMO's flood warning system. Areas identified as potentially needing investigation and/or improvement are:

- Initiatives to support people in planning their responses to flooding, so that a warning will result in their taking effective action
- Using automated technology to supplement telephone trees
- Providing ways for flood-warning recipients to manage their own subscriptions to alerts (so that details are kept up to date)
- Providing additional or relocating gauges to provide earlier warning times (especially on rivers' upper reaches)
- Purchasing advanced weather forecasting and/or supporting improved forecasting through financial contributions (such as contributing to a new weather radar site)
- Improving the reliability of communications for critical warning sites
- Providing resources for more river gauging to improve the accuracy of flow estimates
- Expanding or developing the flood forecasting system to give advance warning of flooding
- Developing ways to monitor river flow gauges for landslide dam formation, especially during heavy rainfall events

3.5 Environmental enhancement responses

Environmental enhancement responses seek to raise awareness and understanding of the natural values and character of the river environment, and encourage and support environmental restoration and maintenance efforts. Its primary goal is to recognise and improve environmental values alongside flood and flood risk management.

3.5.1 Environmental Strategy

The Environmental Strategy will detail the projects required to deliver the environmental, amenity and cultural outcomes sought by this FMP that are beyond those achieved solely through flood and erosion risk management. It will also provide guidance on coordinating the actions of groups involved in managing the rivers, and a strategy to enable these groups and organisations to work supportively.

The Environmental Strategy will be developed either in partnership or in close collaboration with other affected and/or interested parties, including, but not limited to, the district councils, DoC, iwi, Fish & Game New Zealand, Forest & Bird and other identified stakeholders.

The table opposite sets out the identified environmental issues for the Te Kāuru Upper Ruamāhanga catchment and outlines the general actions that can be taken to enhance the river environment.

ENVIRONMENTAL ISSUES AND ACTIONS

ENVIRONMENTAL ISSUES	IMPROVEMENTS
Public access and private ownership The majority of the land adjacent to the rivers is in private ownership. Public access to the rivers is generally limited to the areas in the DoC estate, including upstream areas of the Ruamāhanga and Waingawa Rivers, and urban areas of the Waipoua River	Work with district councils and support recreation opportunity improvements, including connecting access along the Waipoua, Ruamāhanga and Waingawa Rivers Support landowners wishing to retire farm-land and advocate for improved recreational access Integrate riparian planting and wetland creation opportunities with buffer establishment. For example, where buffer land is being purchased or retired in partnership with willing landowners, look at opportunities to create a wider buffer to allow for wetland creation/restoration and native planting behind
Weed management The buffers are infested with weeds, including blackberry, tree lucerne and old man's beard	Weed clearance programmes Yearly checks to ensure areas of weed infestation are identified. This will influence the measures required to ensure weeds are kept under control (see also Sections 3.2.7, 3.5.3 and 4.4.2)
Crack willow and grey willow Historically, crack willow (*Salix fragilis*) was used extensively throughout the Te Kāuru Upper Ruamāhanga catchment	Reduce the presence of crack willow and restore ecological value to the eastern rivers Use hybrid willows (such as *Salix matsudana* and *tangoio*) for new plantings and, when suitably mature, other protection methods to minimise self-propagation potential Advocate for private planting of natives in association with willows and outside riparian planted buffers
Loss of diversity	Improved buffer planting and widened strips will help improve diversity Support landowners wishing to retire farm-land and carry out native planting. Provide information on how to access contestable funding to support these efforts
Loss of mahinga kai	To be developed in association with Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa
River management River management methods, particularly bulldozer operations in the channel, affect the environment. These impacts can include loss of aquatic habitat, reduction in water quality and associated reductions in amenity values	Minimise impacts by undertaking works in accordance with the Code of Practice for River Management Activities Where possible, utilise other measures that require less regular and/or extensive in-stream river works
Straightening of river channels	Seek to allow the river more room to move and maintain natural processes

3.5.2 Community Support Officer

GWRC works with communities to manage the flood risk from the region's rivers and streams. This includes:

- Developing floodplain management plans
- Providing an advice and consultation service on flood and erosion risks
- Maintaining and building new flood protection works
- Maintaining or improving the environment and recreational opportunities
- Providing advice to WREMO during large floods

There are opportunities for GWRC to build on its existing relationships with landowners, iwi and the wider community who wish to be involved in the health of river environments.

There is also potential to establish a part-time or full-time role of Community Support Officer, to support and advise the community on local projects and initiatives relating to the river environment. The key tasks of this role will include:

- Providing a point of connection with the community
- Building relationships with local river recreational groups
- Reinforcing partnerships with iwi
- Calling for volunteers through the GWRC website, social media and volunteer websites
- Facilitating practical education days with community groups including schools, marae and business organisations
- Encouraging greater participation by showcasing the areas of concern in the region and the positive results of volunteer efforts at local events

This role could be facilitated by allocating a portion of the current officer's working time to community support and drawing on local expertise and knowledge to work with the broader community, current river scheme committees and landowners. For the eastern hills area, this role could connect with Land Management Advisors, who already work with rural landowners and have established relationships in the area.

GWRC will seek partnerships with other organisations and agencies to fund this role.

Photos courtesy of
Don Rutherford, riverside landowner undertaking enhancement native tree planting on his section of Waipoua River.

3.5.3 Riparian Management Officer

This FMP recommends a new Riparian Management Officer role, which will focus on establishing and maintaining riparian plantings in the buffers and ensuring a coordinated approach to pest management in the buffers. The responsibilities could include:

- Managing the budget for and distribution of traps and sprays for landowners to undertake their own pest management
- Assisting in the development of riparian management plans for buffers
- Coordinating community groups, volunteers and others wishing to help with plantings and maintenance
- Undertaking weed management on planted sites for up to five years post-planting, which will be reviewed after two years

3.5.4 Care groups and clubs

Healthy streams and rivers are an asset for any community. They are peaceful and fun places to be near, have cultural significance and can be full of wildlife.

River care groups can participate in their local rivers by being involved with:

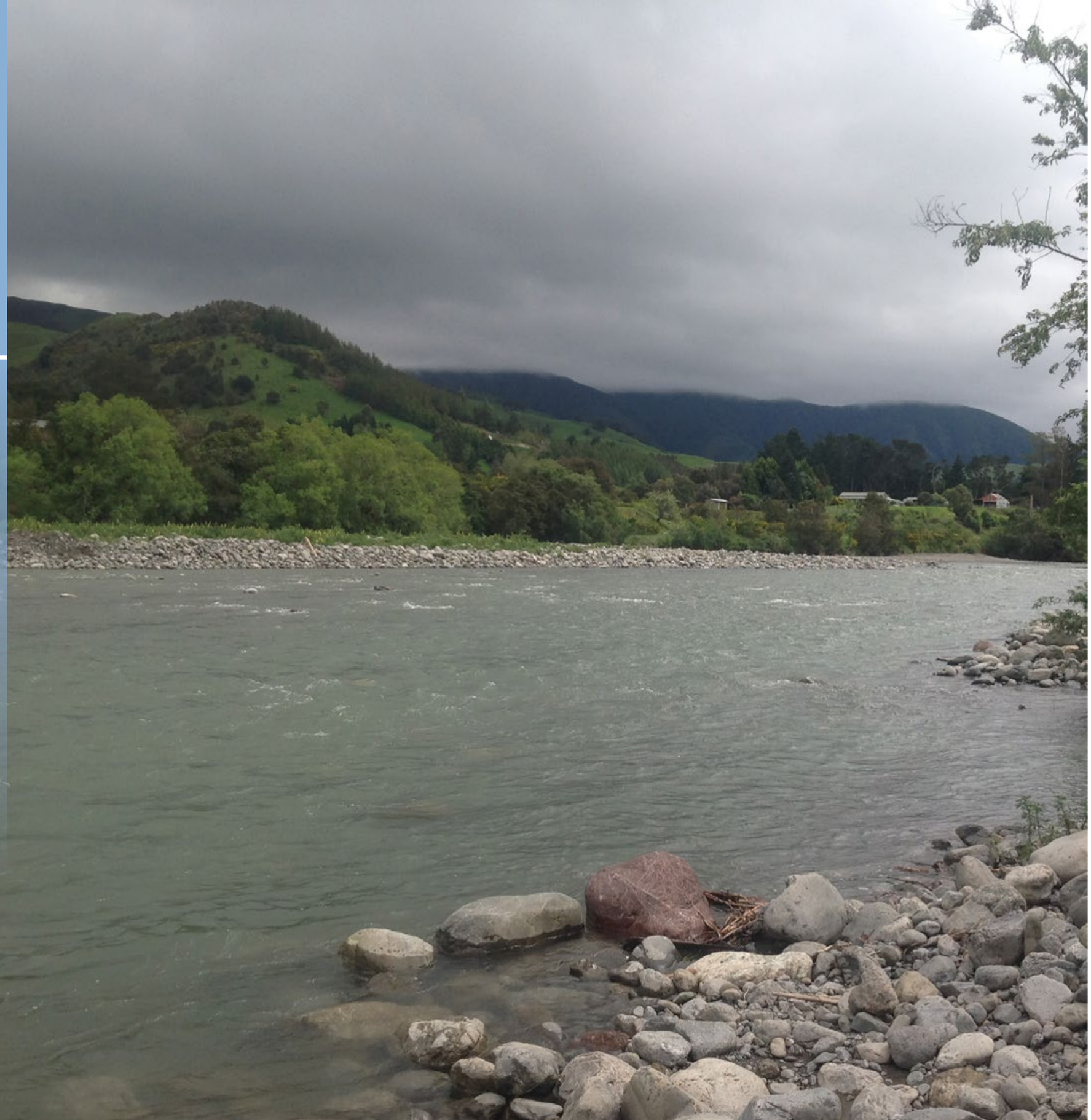
- Delivering native planting programmes and/or other Environmental Strategy outcomes
- Maintaining vegetation to prevent waterway obstruction
- Encouraging the community to take a greater interest in and get more involved with river environments
- Advocating and working with landowners to improve access
- Managing animal and plant pests
- Monitoring and reporting on river management and FMP implementation on behalf of the community

Wairarapa's western rivers are perhaps more suited to the care group concept than those in the eastern side of the valley, as they have better public access and higher rates of recreational use.

GWRC works with a number of care groups in Wairarapa. Their tasks can include:

- Strategic planning – Developing stream restoration plans and timelines for the work
- Communications – Keeping all interested people informed
- Baseline assessments – Walking the rivers/streams and recording their conditions at the start, providing a baseline measure
- Research – Working to find the most successful and efficient techniques for improving stream and river health
- Operations – Removing rubbish, planting, weeding and doing other jobs to restore and maintain healthy streams and rivers

As mentioned in Section 3.5.2, establishing a Community Support Officer at GWRC will help to build community relations and encourage the establishment of new river care groups in the catchments western side.



4. How will this plan be implemented?

This section sets out how the flood protection and management measures in this FMP will be implemented and by whom, and how they will be funded. In short, the implementation measures outlined in this section will be carried out by a number of authorities and individuals.

4.1 Governance

For more than 50 years, river schemes have been maintained to protect people, property, infrastructure and productive rural land in the Wellington Region. The river schemes have been designed to reduce, mitigate and manage the risks of flooding and erosion in the region, and have been drafted and implemented at various times based mainly on the wishes and support of the local communities.

The Te Kāuru Upper Ruamāhanga catchment has eight existing river schemes that make up a large proportion of the floodable land area.

Each river scheme has an annual maintenance programme that is established before the start of each new financial year. The programme identifies and prioritises work for that financial year.

Each river scheme also has a committee made up of directly affected landowners whose land is next to the respective river or river reach, and GWRC and territorial authority representatives. River scheme committees in the Te Kāuru Upper Ruamāhanga catchment have reported to the GWRC Environment Committee.

4.1.1 Governance structure

For this FMP, the governance structure comprises a formal advisory committee, the Upper Ruamāhanga River Management Advisory Committee. The committee's responsibilities are outlined in Section 4.2.1.

The Advisory Committee will make recommendations to GWRC on the FMP's implementation, and be a point of contact for members of the public, landowners and other stakeholders on any issues relating to the plan, including its implementation methods and action plan.

The Advisory Committee will comprise seven representatives from river management groups (formerly called river scheme committees) in the Te Kāuru Upper Ruamāhanga catchment, and one representative of the three eastern river scheme areas. It will also include representatives from CDC (two), MDC (three), GWRC (two) and iwi (two).

As the implementation of previous river schemes has shown, community input is invaluable to implementation. Members of the community contribute a wealth of local knowledge and experience, and the inclusion of representatives from DoC, Fish & Game and iwi has improved committees' diversity and knowledge – ultimately leading to a better understanding of the broader values and benefits of the river management work. In time, this representation may evolve as the communities through which the rivers flow change.

The river management groups will continue to comprise representatives of landowners and other community groups and organisations. Their reporting structure will also be retained, and the groups will continue to have annual meetings supported by staff from the GWRC Masterton office to consider the annual maintenance work programmes and associated expenditure. The groups' representatives will then be able to take these views to the Advisory Committee, which in turn will report to GWRC.

The Advisory Committee will meet more often than the existing river scheme committees (perhaps quarterly) in the initial stages of the FMP implementation, and will report to GWRC through appropriate committees. For example, the Environment Committee has a special responsibility, among other things, to monitor and oversee the development and implementation of floodplain management plans, including this FMP. The Advisory Committee may consider and make recommendations to GWRC on flood protection issues relevant to Wairarapa.

This new governance structure will align with the funding structure changes, which aim to spread the targeted rate portion of rates across the Te Kāuru Upper Ruamāhanga catchment. The governance structure will therefore allow for the involvement of the catchment community.

4.2 Responsibilities

The following parties have direct or indirect roles in implementing this FMP.

4.2.1 Upper Ruamāhanga River Management Advisory Committee

As discussed in Section 4.1.1, an Advisory Committee will be established by GWRC and operate under agreed terms of reference. It will be responsible for monitoring this FMP's implementation, including ensuring that the action plan is further developed and implemented and includes a process for monitoring progress against actions.

The Advisory Committee will also be a point of contact for members of the public, landowners and other stakeholders who have issues with the plan, its implementation methods and its action plan. It will make recommendations on this FMP to GWRC and other organisations with responsibilities in this area.

4.2.2 Greater Wellington Regional Council

GWRC will be responsible for the overall coordination and monitoring of this FMP, as well as relevant physical flood protection structures and works such as river management and stopbanks. It will also provide flood hazard mapping and advise territorial authorities on flood hazard areas for use in developing appropriate land use planning controls in the WCDP.

4.2.3 District Councils – Masterton and Carterton

Many of the land use planning control measures will be implemented by MDC and CDC through the WCDP. These councils are also responsible for maintaining and protecting public assets such as the bridges along local roads. District councils will also implement some environmental enhancements (such as walkways on riverside reserves).

4.2.4 Landowners

Landowners in the floodplain have an important role in implementing identified actions, as they are the beneficiaries of the FMP's successful implementation. In addition to having representation on the Advisory Committee, they may be required to work with GWRC staff on particular projects or works that directly affect their land, such as the final composition of riparian planted buffers. Landowners also have an ongoing role in maintaining projects or works, such as protecting stopbanks or vegetated buffers from damage by machinery or stock.

4.2.5 Community groups and other parties

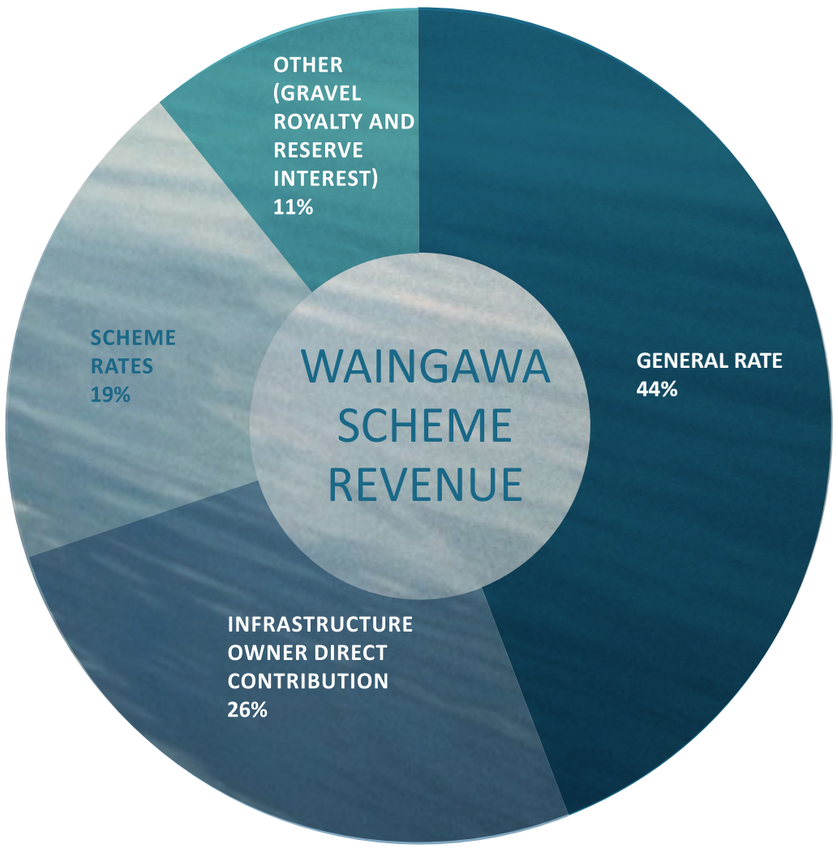
Interest and community groups often have significant local knowledge and can make valuable contributions to managing rivers for flood and erosion protection purposes. These can include contributing to other parties' work such as riparian planting of buffers. The governance structure will encourage community groups to join river management groups and/or the Advisory Committee.

4.2.6 NZ Transport Agency and KiwiRail

The NZ Transport Agency and KiwiRail are responsible for maintaining and protecting their assets in Wairarapa, including bridges that cross the Waingawa, Waipoua, Ruamāhanga and Kopuaranga Rivers.

4.2.7 Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa

Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa are partners with GWRC in Wairarapa. This relationship includes maintaining meaningful engagement as required through statutory acknowledgements and as promoted under the pNRP.



4.3 Funding structure

There are significant costs associated with the flood management responses in this FMP. A new funding structure is proposed, and measures will be implemented according to the funding policy in place at the time.

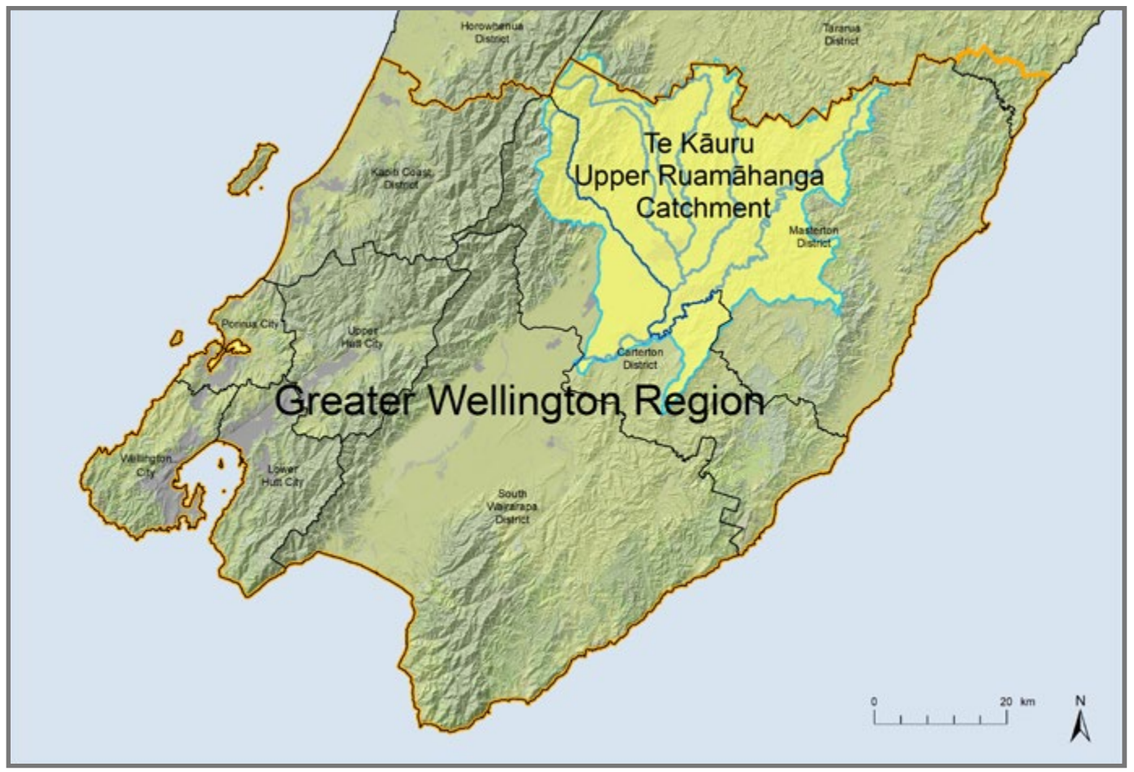
4.3.1 Summary

Until now, landowners have funded a portion of the total river scheme costs, also known as targeted rates. However, to recognise and reflect the wider benefits of this FMP, it is proposed that these targeted rates be funded by all ratepayers in the Te Kāuru Upper Ruamāhanga catchment.

This funding approach recognises that:

- The FMP seeks to provide greater security, a wider range of benefits, a needs-based approach to river works and some solutions to long-standing problems, particularly relating to water quality. This will, in the long term, cost more to implement and maintain than do the current river schemes
- The FMP will deliver wider benefits, which should be funded from the wider catchment community
- The FMP seeks to address current inconsistencies and complexities in and between the river schemes
- In this FMP, the concept of using buffer areas for river management purposes will require a change to the use of affected land. This contribution has to be recognised or compensated

The decisions on the funding approach were influenced by the outcomes and feedback received in the development of the FMP.



4.3.2 Previous funding structure

In the previous funding approach the river schemes were divided into categories (or classifications) according to the flood and erosion protection benefits landowners received. Landowners were rated according to the pieces of land that fell into these classifications, and the classifications would become outdated as the landowners' situations or needs changed.

The ratings were also:

- Difficult to keep up to date as properties changed hands or were subdivided and developed
- Overly complex – for example, the Kopuaranga river scheme had 12 classifications for a simple river scheme of willow tree removal and management, and only $13,000 per year of rates was collected

A proportion of the river schemes' operational costs (up to 50%) was funded from the general rates paid by ratepayers in the Wellington Region.

Through the Long Term Plan process in 2018, GWRC agreed to retain the current funding policy for flood protection. This is subject to review every three years, and under it:

- The general rates fund 100% of the work for the 'understanding flood risk' activity. This relates to the investigations and modelling required to identify flood risks in the region, as well as the development of mitigation strategies for Floodplain Management Plans
- The general rates fund up to 50% of the other two flood protection activities – 'implementation' and 'operations and maintenance'

The balance of the funding is termed the 'local share' and must be contributed by the local community in some form. It is made up of:

- Local councils' contributions to infrastructure protection
- Gravel royalties
- Interest on river scheme reserves
- River scheme landowners' contributions via a classification model

River scheme landowners have previously contributed an average 28% of the total funding, but the amount has ranged from 16% to 51% of the total funding for the river schemes in the Te Kāuru Upper Ruamāhanga catchment, depending on the river schemes.

The diagram on page 32 shows the contributions to the Waingawa River scheme in the 2017/18 financial year. The river schemes did not, as a rule, carry out major works using loan funding (capital expenditure); these were funded through annual budgets and the use of flood damage reserves after major floods.

4.3.3 Drivers for change in funding models

This FMP proposes to spend money on major projects and general works that are not necessarily 'river scheme' based, and are a departure from the current river scheme approach of annual work programmes. This work, likely staged over many years, must be funded and it is doubtful that the current river scheme funding approaches are appropriate. The projects are expected to be funded by loans or capital expenditure, and the existing funding model does not accommodate this easily.

The FMP's projects and new approaches to managing the rivers are intended to provide a wide range of community benefits, including cultural, environmental, recreational, economic and social benefits. The costs of their delivery should rest with the whole community.

The previous funding arrangements had some unintended outcomes. For example, the river scheme budgets were determined by how much landowners were prepared to contribute, and in turn determined how much and what kind of work was carried out. Seeking wider funding will help to achieve a more coordinated, consistent, fair and needs-based approach.

Using buffer areas for river management purposes requires a change of land use in some affected areas. A common response among river scheme landowners is, "If the community wants to use this land for community outcomes, the community should be paying for the river scheme". This FMP proposes a fair and equitable approach to funding, which recognises that some landowners under the existing river schemes have already agreed to flood protection measures on their land (such as by allowing vegetated buffers to be planted).

4.3.4 Costs and proposed funding

At the time of writing, the funding required to cover the eight river schemes in the Te Kāuru Upper Ruamāhanga catchment is approximately $930,000 per year. Of that, riverside landowners, through a targeted rate, fund approximately $290,000. If a catchment-wide funding model were adopted and this $290,000 were spread across all ratepayers in the catchment, the rate would be about $4.80 per $100,000 of capital value (which for a $350,000 property would be $17 per year).

The table below shows the eight river schemes' total revenue in percentage and dollars in 2017/18. Of this, the targeted rates (collected from river scheme members) is the portion proposed to be covered by a catchment-wide rating.

2017/18 RIVER SCHEME REVENUE BREAKDOWN

	TOTAL REVENUE FOR EIGHT RIVER SCHEMES	PERCENTAGE OF REVENUE
General rate	~$407,000	44%
Infrastructure owner direct contribution	~$174,000	19%
RIVER SCHEME RATES	**~$290,000**	**28%**
Other	~$80,000	9%
Total	~$930,000	$100%

4.3.5 Cost to ratepayers

This FMP aims to benefit the wider community and the environment through flood hazard and erosion protection and enhancements of the rivers' environmental and cultural values. The costs of this will be met through:

- A spread of the targeted rate
- Increased operational expenditure through general responses
- New capital expenditure through Major Projects Responses

The estimated increases in rates are for the local share as well as the increase in the general rate. They are based on the current model, in which the general rate is up to 50%. Therefore the local share, collected through the targeted rate, covers about half the associated costs, but its distribution varies across ratepayers.

Operational expenditure covers the annual expenses of flood and erosion protection, including ongoing river management work and many of the general responses listed on page 41. While these ongoing river management costs are not expected to increase, additional operational activities are proposed, so a rate increase for all operational activities has been estimated at $13 per $100,000 of capital value (CV). It is expected that this increase will be spread over a number of years.

Capital expenditure funding will be used to finance the Major Project Responses outlined in Part 2. The Waipoua urban flood risk will be investigated and options considered during Stage 1 of implementation, and subsequent work will be determined once Stage 1 is complete (and are not yet detailed). The Major Project Responses (including Stage 1 of the Waipoua urban reach only) are estimated to cost $4 million, of which $2 million will be rated across the entire region. The remaining $2 million, the local share, will be funded through a targeted rate across the Te Kāuru Upper Ruamāhanga catchment. This would equate to a rates increase of approximately $3 per $100,000 of CV. For each of the Major Project Responses, guidance will be sought from MDC, CDC and the asset owners on whether the projects will be funded more directly.

The timing of rates increases is estimated to be:

- One to two years – approximately $2-$3 per $100,000 CV
- Three to five years – approximately $5-$10 per $100,000 CV
- Six to ten years – to be confirmed

4.3.6 Affordability and willingness to pay

It is important to ensure that the proposed works and funding arrangements are affordable and the costs are spread fairly – so works will be staged to ensure they are funded appropriately. This FMP will be implemented over decades, and when individual work programmes have been confirmed, their prioritisation and staging will be agreed.

Councils fund their infrastructure works through Long Term Plans. In developing the plans, councillors weigh up all the work programmes and proposals for new expenditure and decide on what work will be undertaken and when. This FMP will make a significant contribution to future Long Term Plans, but the pace of implementation will be controlled by council decisions on expenditure and the budgets/spend outlined in those plans.

4.3.7 River scheme reserves

Until now, the river schemes have put money aside in reserve funds to cover years when there is a lot of flood damage. The value of these reserves has varied across the river schemes, from about 100% to 400% of their annual operational/ maintenance budgets.

GWRC has not set reserve targets on a scheme-by-scheme basis. Instead, it applies a rule of thumb that reserves should be at least 200% of the normal annual operational spend. This would likely cover only the 'clean-up' costs and emergency repairs immediately after a flood event, not any subsequent remediation works.

As there have been no major flood events for many years, the reserve balances have built up. If there is any change to funding arrangements that affects how reserves are managed, the contributions made by river scheme members over time will need to be recognised and GWRC will ensure that the reserve balances and debts are treated fairly.

Given this FMP's 'level of service' approach and the move to having the wider community fund river operations, the response to flood damage in the future will be less dictated by reserve balances. Instead, community funds will be directed to the locations with the most urgent needs. Over time it is also likely that the existing river scheme reserves will be combined into a single reserve. If this happens, a transitional period will be required to 'earmark' previous river scheme reserves for expenditure in particular river scheme areas.

The Government has indicated that it is considering changing its policies on financial support for regions following large flood events. This may trigger a need to reconsider appropriate reserve levels in the future. However, this FMP does not assume a reliance solely on Government support for large events.

4.4 Outcomes

This section provides more detail on how major elements from each group of FMP responses can be implemented over time. It also includes a table of general responses (Section 4.4.6) that are more catchment-wide (not covered in Part 2) with an indication of their costs and priority.

4.4.1 Structural measures

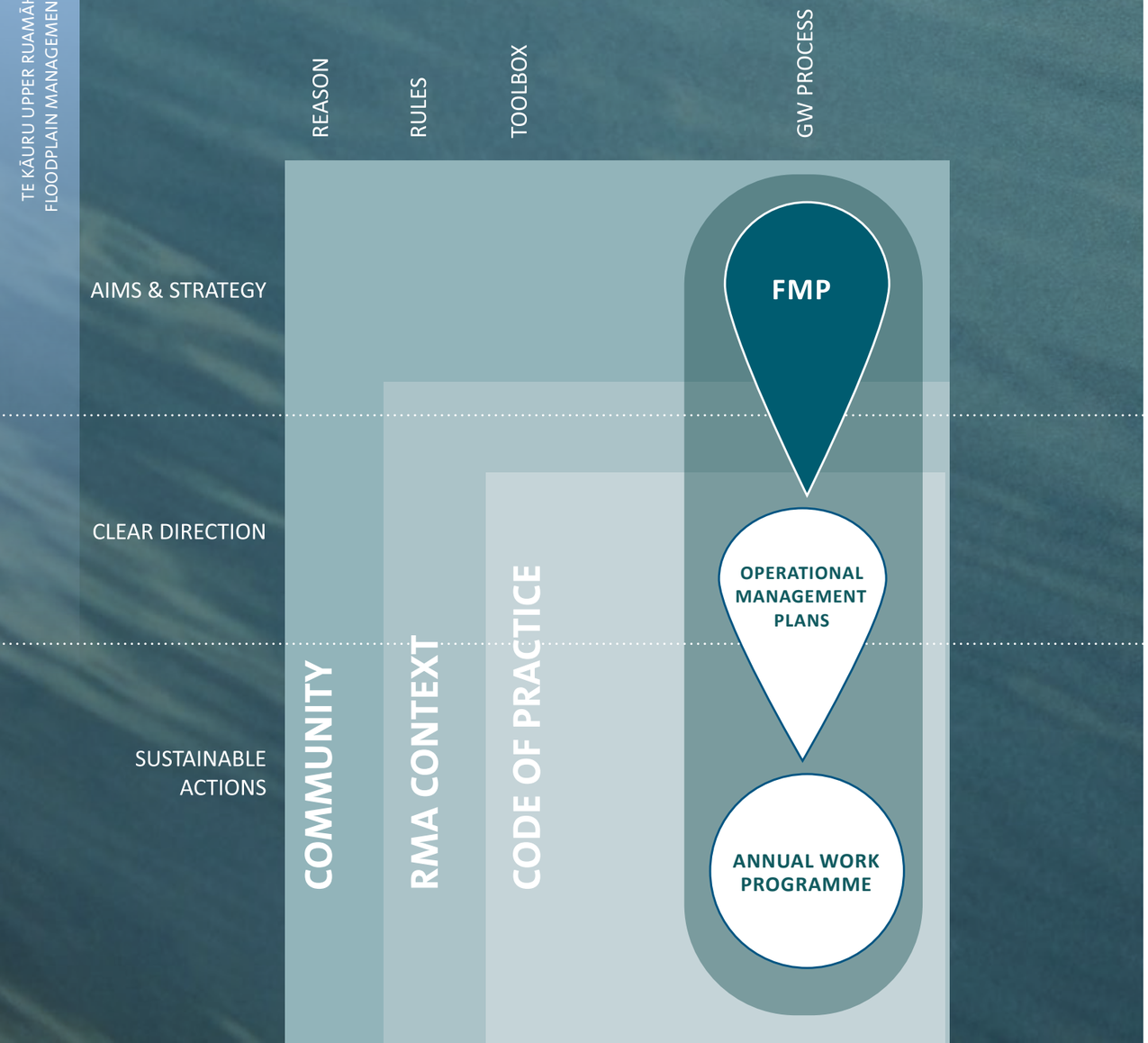
New structural measures, mainly stopbanks, will be delivered through site-specific Major Project Responses. These responses are described in detail in Part 2 and summarised in the table at right. Most have been developed in response to known problems and situations that have not been resolved through work programmes in existing river schemes.

Response priorities are indicated as high, medium or low based on community feedback, the nature of the known hazards, the nature of the associated risks, and the perceived urgency of rectifying the existing situation. Generally, the high-priority projects will be undertaken in the first 10 years of the FMP's implementation.

MAJOR PROJECT RESPONSES SUMMARY (REFER PART 2)

NAME	MANAGEMENT MEASURE	PRIMARY REASON FOR RESPONSE	PRIORITY	COST	FUNDING
WAIPOUA URBAN REACH	Assess and address flood issue to Masterton	To increase current and future flood protection to urban area of Masterton	High	Stage 1 $350,000	Capital funding TBC
RIVER ROAD PROPERTIES	Increase bank protection to river edge at River Road and widen river channel	To increase protection to River Road, Masterton	High	$575,000	Capital funding TBC
RIVER ROAD PROPERTIES	Easements and other legal costs as required	To allow construction/maintenance of groynes and widening of the river	High	$50,000	Capital funding TBC
MDC WATER SUPPLY	Targeted operational river management with revised emergency management plan	To manage risk of erosion posed to the water supply pipeline	High	Varying but of magnitude $5,000-$20,000 per annum generally, with allowance for targeted emergency works as required	Operational funding
HOMEBUSH WASTEWATER TREATMENT PLANT	Resilience works in headworks facility (plinth for generation, raising electrical works)	To increase resilience of Homebush Wastewater Treatment Plant headworks in case of stopbank overtopping	TBC	$50,000	Capital funding TBC
PAIERAU ROAD	Permanent warning signs and improved flood forecasting	To increase the safety of road users by providing permanent warning signs and increasing lead time for road closure to 2.5 hours	Medium	$20,000	Capital funding TBC
SOUTH MASTERTON STOPBANK AND URBAN GATEWAY	Contaminated site assessment, visual improvements in the buffer, establishment of public access to the river	Appealing gateway to Masterton, recreational access and contaminated site management	Medium	$100,000 for contaminated site assessment	Capital funding TBC
RATHKEALE COLLEGE STOPBANK	TBC	To increase flooding protection to Rathkeale College and reduce erosion risk to stopbank and Rathkeale College	Medium	$1,000,000 TBC	Capital funding TBC
MDC WATER SUPPLY	Increase bank protection to river edge at Black Creek	To increase protection to water supply pipeline	Low	Up to $300,000	Capital funding TBC
SOUTH MASTERTON STOPBANK	Retreat existing stopbank to less erosion-prone location outside the buffer	Stopbank is non-critical asset from flood hazard perspective but may be important for preventing contaminated material entering the river	Low	$485,000	Capital funding TBC
HOOD AERODROME	Rock line connecting terrace with existing rock groyne at the end of the runway	To increase protection to the runway and avoid any contaminated material being eroded into the river	Low	$755,000	Capital funding TBC

LINKS BETWEEN FMP, OPERATIONAL MANAGEMENT PLANS AND ANNUAL WORK PROGRAMME



4.4.2 River management

River management will take place under the hierarchy of this FMP, Operational Management Plans and annual work programmes.

- FMP – Provides the overall direction at river- and reach-wide scales and principles/policies that apply to the rivers. States the goal for each reach and may give direction on particular management methods to be used or avoided. It also directs Major Project Responses and any exceptions to the common methods.
- Operational Management Plans – Contain five to ten years of work programmes, including their detailed priorities and management approaches. The Operational Management Plans must be consistent with the FMP, but through their preparation may propose changes to the FMP.
- Annual work programmes – Annual programmes of work, based on the Operational Management Plans but also dealing with reactive work and prioritising various minor repair and buffer implementation projects. Annual work programmes will be worked through with local river committees.

All works in the rivers will be carried out in accordance with GWRC's Code of Practice for River Management Activities – a consented document that applies regionally, is evidence based and is regularly updated to provide standards of 'good management practice'. Good management practice involves planning, communicating, recording and reviewing all river works and continually developing and improving methods to enhance cultural and environmental values.

The code does not direct which activities should be undertaken and where (this should come through the above hierarchy and GWRC staff decisions), but it does cover the range of river management activities available and outlines good management practice in how they should be applied. These include GWRC's in-stream works for flood protection, which have the potential to affect aquatic and riparian habitats, aquatic species and morphological features.

River management envelopes

The river management envelopes (design lines) in the western rivers have been reviewed following consultation on the draft FMP. Areas where the inner and outer management lines obviously do not match the rivers' current positions have been identified and updated in consultation with specific landowners.

As part of this FMP's implementation, the inner and outer management lines will be reviewed to ensure consistency along the various western river reaches. Where applicable, and if deemed necessary and of value to address specific issues, modern geomorphology theory (the study of landforms and landscapes, primarily in terms of erosion and deposition of rock and sediments by water) will be applied to envelope locations. This work may include reviewing locations where the river management envelopes (see Section 3.2.2) have not been performing in ways that are consistent with the use of riparian planted buffers as the primary management tool. To ensure ongoing relevance and consistency, it is proposed that the river management envelopes be reviewed every 20 years as part of a major FMP review.

Other management envelopes (bed-level and pool-riffle-run) will be developed as an outcome of this FMP. River bed levels (see Section 3.2.3) and gravel volumes (see Section 3.2.4) will be regularly monitored and analysed, as specified in this FMP.

Buffers

In a significant change, this FMP allows rivers to erode the western river buffers from time to time, and removes the need to always intervene urgently with works in the wet to 'hold the line' to the inner management line. It is a change in approach from frequent, small, reactive responses to less frequent but more often larger works.

The use of non-intrusive works, such as dry river bed maintenance works and vegetation maintenance, will continue unchanged. To achieve this, most buffers should be established with dense vegetation to slow erosion, as this will likely deliver wider benefits to the river system and, in turn, the community.

To be effective, a buffer must be at, or only slightly above, the river bed level so that the tree roots will hold the soil. Once they are mature, willow trees can be 'layered' against the bank edge to provide greater protection against erosion. The best sites (and high-priority sites for buffer establishment) are areas where rivers have already eroded the buffers, or in some cases where the buffers are on farmland slightly above the river bed.

This FMP acknowledges that allowing a river room to move may result in more sediment being supplied to the western rivers from bank erosion. However, rivers' unpredictable nature makes it difficult to say for certain that this will happen. If erosion does increase, the sediment sources are likely to be areas in the lower reaches that have previously been artificially constrained. If sediment is added to the system, it is likely to be deposited in the lower valley, after the confluence with the Waiōhine River but before the coast.

The riparian planting programme for the entire buffer will involve planting willow poles and supporting them with mixed native vegetation where possible. It will take place either on private land with the landowners' agreement or on publicly owned land.

The Operational Management Plans will identify the high-priority sites for riparian planted buffers. These will generally:

- Be areas of high erosion risk, where regular in-stream works have been required to protect the edge; and
- Have already been eroded by the river; or
- Be low farmland where riparian plants can be effectively established

While these sites will be priorities, there will still be a need to respond to flood behaviour and either reinstate or plant new buffer areas, and over time new areas of erosion will present further opportunities. Landowners will need to accept that their land may be required for river space, and that the land may be allowed to erode back to, or close to, the edge of the river management envelope before any physical intervention.

On the other hand, parts of the river management envelope will be at low risk of erosion. If these areas are high above the river there is no benefit in installing dense vegetation. Buffer implementation will be driven in large part by flood events and river behaviour.

Cliffs are a special case for buffer establishment. Unless there is an exception in this FMP or an existing erosion control structure (a river scheme asset), the preferred use of riparian buffer planting also applies to cliffs. In this case the river manager will wait until the buffer has been eroded (or mostly eroded) down to river level before establishing riparian planting in the buffer at the toe of the cliff.

Part 2 identifies the reach-specific areas where the buffer management method does not apply – for example, areas that rely on a high level of mechanical intervention or the use of rock edge protection.

The implementation of this changed river management approach will take place over decades. It is also reversible, although there could be a 're-investment' phase and a significant reliance on in-stream works to regain control of the current river alignment. Eroded topsoil would also take some time to re-establish.

An adaptive monitoring and management strategy will be developed to support this FMP's vision, and will include measuring channel morphology over time, using drones or aerial photography, and reporting changes using the Habitat Quality Index. Other monitoring techniques could cover river cross-sections, depth distributions, bank vegetation canopy and the calibre of floodplain trees. Some, such as river cross-sections, are currently being used.

GWRC already has a number of monitoring regimes that can be collated to help assess the effects of planting buffers on the western rivers and stabilising the banks on the eastern rivers.

The implementation of these methods, and particularly the planting of new buffer areas, requires landowner support and agreement. The FMP includes an allowance for GWRC to purchase land from landowners who prefer not to own buffers under the new management regime. It does not propose compulsory land acquisition or the use of any other powers to compel landowners to establish vegetation on their land. However, landowners will not receive the full level of service (protection) to land behind the buffer until a buffer is established to provide such protection.

Costs – riparian planting of buffers

The cost of planting the buffers on the western rivers and replacing crack willows with hybrids and/or natives on the eastern river banks has been estimated at $625,000 per annum over the life of the implementation plan. It includes ground preparation, plant acquisition, planting and fencing (weed control is covered separately on page 39).

This cost will be largely covered by the operational and maintenance costs of flood protection in the Te Kāuru Upper Ruamāhanga catchment. The responsibility for managing the riparian buffers will be shared by GWRC and individual landowners. Other funding options will be explored to supplement this, including planting initiatives such as One Billion Trees and Trees That Count.

GWRC will work with other planting-related organisations and local nurseries to ensure a sufficient supply. Already, existing and new suppliers are looking to scale up production to meet the anticipated demand in coming years.

All the western river buffers will be planted and then fenced at the buffer boundaries to protect the plantings, while the willow-removal and re-planting programme on the eastern rivers will take place along their banks. The responsibility for fencing costs along the eastern rivers will be explored with the landowners.

The western rivers have a total 876ha of buffer, of which 537ha (61%) are on pastoral land or in vegetation less than 1.5m high and the rest are vegetated. The three eastern rivers span a total 81km.

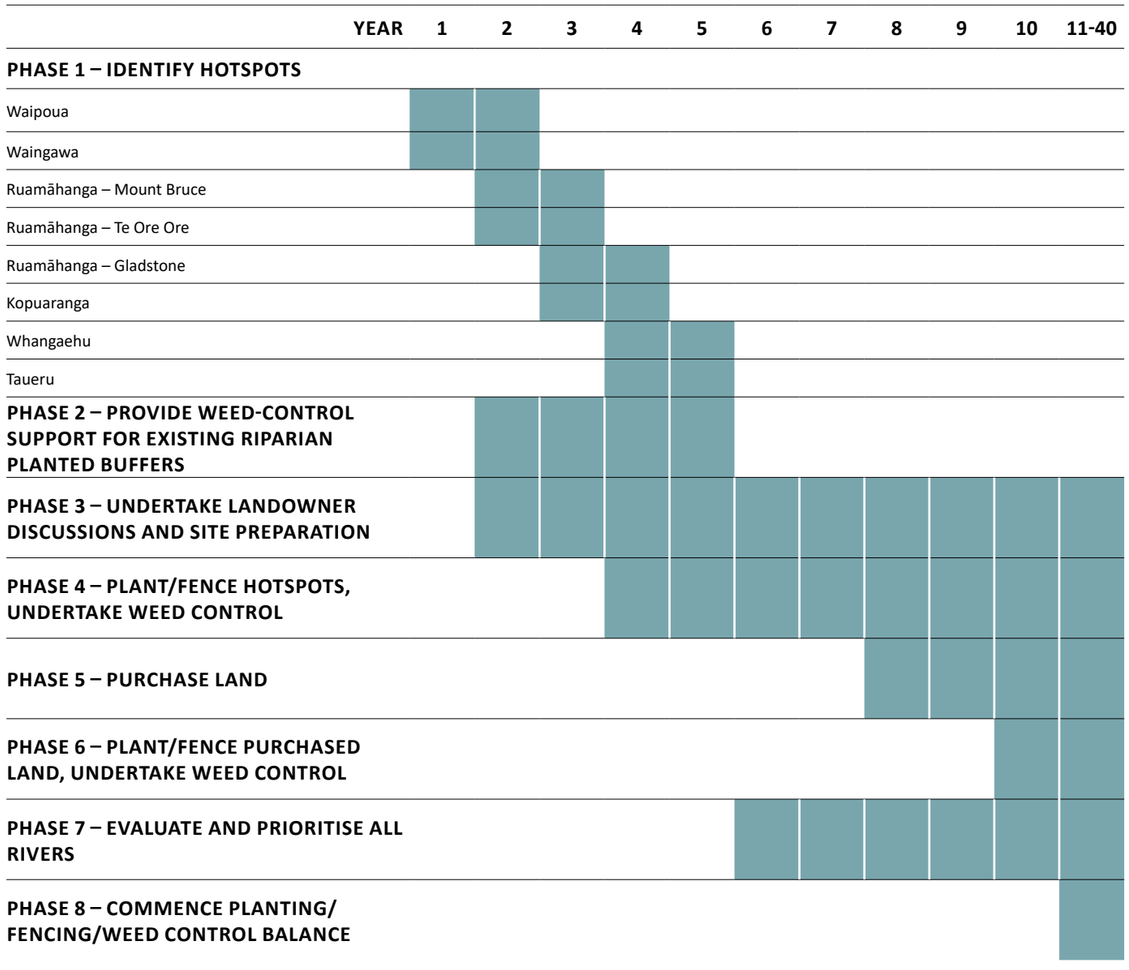
Implementation – riparian planting of the buffers

Assuming that 40% of the buffer area is currently planted, the targets for the riparian planting include:

- Year 10 – 60% of the total buffer area to be in riparian vegetation
- Year 20 – 80% of the total buffer area to be in riparian vegetation
- Year 40 – 100% of the total buffer area to be in riparian vegetation

Further on-site information will be gathered as part of developing the Operational Management Plans.

PLANTING IMPLEMENTATION PLAN



Pest plant and animal management

Below are the responsibilities for pest control management and funding in the Te Kāuru Upper Ruamāhanga catchment.

- Establish a Riparian Management Officer position.
  - The role will focus on establishing and maintaining riparian plantings in the buffers and ensuring a coordinated approach to pest management in the buffers
  - It will include:
    - Managing the budget for and distribution of traps and sprays for landowners to undertake their own pest management
    - Helping to develop riparian management plans for the buffers
    - Coordinating community groups, volunteers and others wishing to help with planting and maintenance
    - Undertaking weed management on planted sites for up to five years post-planting, which will be reviewed after two years
  - Approximately $120,000 per year will be required to establish this position; this includes a salary and overheads
- Help, where required or requested, to manage weeds for up to five years after the buffers are planted, including a review after two years
  - The responsibility for controlling weeds at planted buffers will be jointly managed by GWRC, landowners and community groups as appropriate, and coordinated by the Riparian Management Officer
  - After a period of up to five years, landowners will be expected take most of the responsibility for weed control, with the Riparian Management Officer coordinating advice, spray provision and community group support
  - Training and certification will be available for those requiring or requesting spray who are not already trained in its use
- Provide advice, traps, bait and bait stations for pest animal management
  - Landowners will be responsible for controlling pest animals in planted buffers. However, GWRC will advise on pest management, supply traps and bait stations for installation when buffers are planted, and supply landowners with bait for the stations for up to five years post-planting
- Budget for pest management in the buffers
  - The budget for pest management in the buffers will have two sections:
    - Funding for the set-up costs of weed and pest control on recently planted buffers – placing traps and bait stations and undertaking pre- and post-planting weed spraying for up to five years
    - Funding for ongoing maintenance – providing spray, weed-control training and bait for pest animal control for the duration of the implementation plan
  - The yearly budget would depend on the percentage of new area planted each year. An average annual budget of $82,000 has been allocated

4.4.3 Planning and policy

The land use controls under the WCDP are the most important planning and policy methods for the river management programme. They will be developed in partnership with the district councils either as plan changes or as part of the WCDP review.

It will also be important to have a Strategic Land Purchase and Asset Retreat policy and funding to enable the programme's implementation.

4.4.4 Emergency management

Section 3.4 describes the emergency management measures that will be implemented, mainly by GWRC in partnership with WREMO.

4.4.5 Environmental enhancement

To ensure an effective environmental enhancement response, it will be important to develop and implement the Environmental Strategy. This will bring different agencies together with a plan and priorities for improvements to the river environments.

The Community Support Officer and Riparian Management Officer will have key roles in its implementation, and GWRC will explore co-funding options with other agencies. A small increase in the cost of river maintenance and management activities will likely be required.

4.4.6 General responses

The table below summarises the general responses discussed in this FMP and indicates the relevant priorities and costs. As they are more catchment-wide, they are therefore not covered in Part 2.

The table includes the costs of ongoing river management works. It is likely (but not confirmed) that these costs will not increase as a result of the new operational approaches outlined in this FMP. However, there will be cost increases in the flood and erosion protection work associated with the additional outcomes listed in the General Responses Summary (page 41) and the Major Project Responses Summary (page 35).

Operational costs will be reviewed as part of the assessment of the FMP's success.

GENERAL RESPONSES SUMMARY

ACTION	DESCRIPTION	SECTION REFERENCE	PRIORITY	COST	FUNDING
Ongoing river management work	Based on 2018 operational budgets	n/a	High	Approximately $930,000 per annum	GWRC operational expenditure
Develop bed-level envelopes for Waipoua, Waingawa and Ruamāhanga Rivers	Bed envelopes with guidance on how to respond to areas of degradation (where beds are dropping) and aggradation (beds are filling in)	3.2.3	High	$200,000	GWRC operational expenditure
Develop pool-riffle-run envelopes	Upper and lower envelopes for pool-riffle-run sequences in different river reaches – to be used in planning programmed physical works	3.2.8	High	$50,000	GWRC operational expenditure
Riparian planting of buffers	Planting of the full buffer area of the Te Kāuru Upper Ruamāhanga catchment, including ground preparation, plants, planting and fencing	3.2.5	High	$625,000 per annum	GWRC operational expenditure
WCDP review	Developing flood mapping and contributing policy advice for input to the WCDP review. New designations for major projects	3.3	High	$200,000	GWRC loan-funded expenditure
Develop Environmental Strategy	A strategy and action plan for specific enhancements in the river environments – multi-agency	3.5.1	High	$200,000	GWRC loan-funded expenditure
New governance and funding structures	Establish the new governance structures and funding approaches required to implement this FMP. May require changes to council policies and/or be implemented via Long Term Plan	4.1 and 4.3	High	$50,000	GWRC operational expenditure
Design lines review	Review outer and inner design lines in line with operational experience and any new information	4.4.2	High	$200,000	GWRC operational expenditure
Pest plant and animal management	Budget set aside to help in the establishment and ongoing management of pest animal and plant control	4.4.2	High	$82,500 per annum	GWRC operational expenditure
Operational expenditure	An agreed and understood framework for how works will be prioritised after a major flood, and how this relates to normal river scheme governance arrangements	3.3.5	Medium	$30,000	GWRC operational expenditure
Strategic land purchases and asset retreats	Funding available for purchases of land for FMP implementation (buffer establishment, future major projects, Environmental Strategy implementation etc) and for GWRC's contribution to retreating public assets out of buffers when this is a suitable alternative to protecting them in place. Criteria to be developed	3.3.8	Medium	$5 million	GWRC loan-funded expenditure
Riparian Management Officer	Resource to assist in establishing and managing riparian planting on the entire buffer	3.5.3	Medium	$120,000 per annum ongoing	GWRC operational expenditure
Emergency management and flood warning improvements	Collaboration with WREMO on emergency management planning. Technical advice and support to WREMO, including new mapping. New flood warning infrastructure, such as additional rain gauge and flow-monitoring sites	3.4	Medium	$100,000	GWRC loan-funded expenditure for infrastructure upgrades
Community Support Officer	Part- or full-time resource to establish/support community groups and help to deliver environmental, recreational and cultural outcomes	3.5.2	Low	$60,000 per annum ongoing	GWRC operational expenditure, seeking partner support
Major review of FMP	Formal review of FMP performance	4.4.7	Low	$300,000	GWRC operational expenditure

4.4.7 Monitoring and review

Through monitoring this FMP's aims and objectives, outcomes can be regularly reviewed.

This FMP will be a living document, with regular reviews enabling updates and changes where needed to the floodplain management planning process, flood hazard maps and flood hazard mitigation measures.

The FMP will be largely implemented through river management activities, which will be authorised through resource consents. Both the resource consents and the associated Code of Practice for River Management Activities are legally mandated, and include management processes that allow for improvements to be made as new information and techniques become available.

Section 4.4.2 provides an outline of the plan to monitor the buffer implementation process.

GWRC will work with Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa to develop a cultural health monitoring framework for this FMP, and both iwi will participate in the monitoring and review processes.

A comprehensive review of the final FMP will be undertaken every 20 years, or earlier if the flood hazard is significantly altered by flooding, earthquakes or new information, or there are major regulatory or resource consent changes.

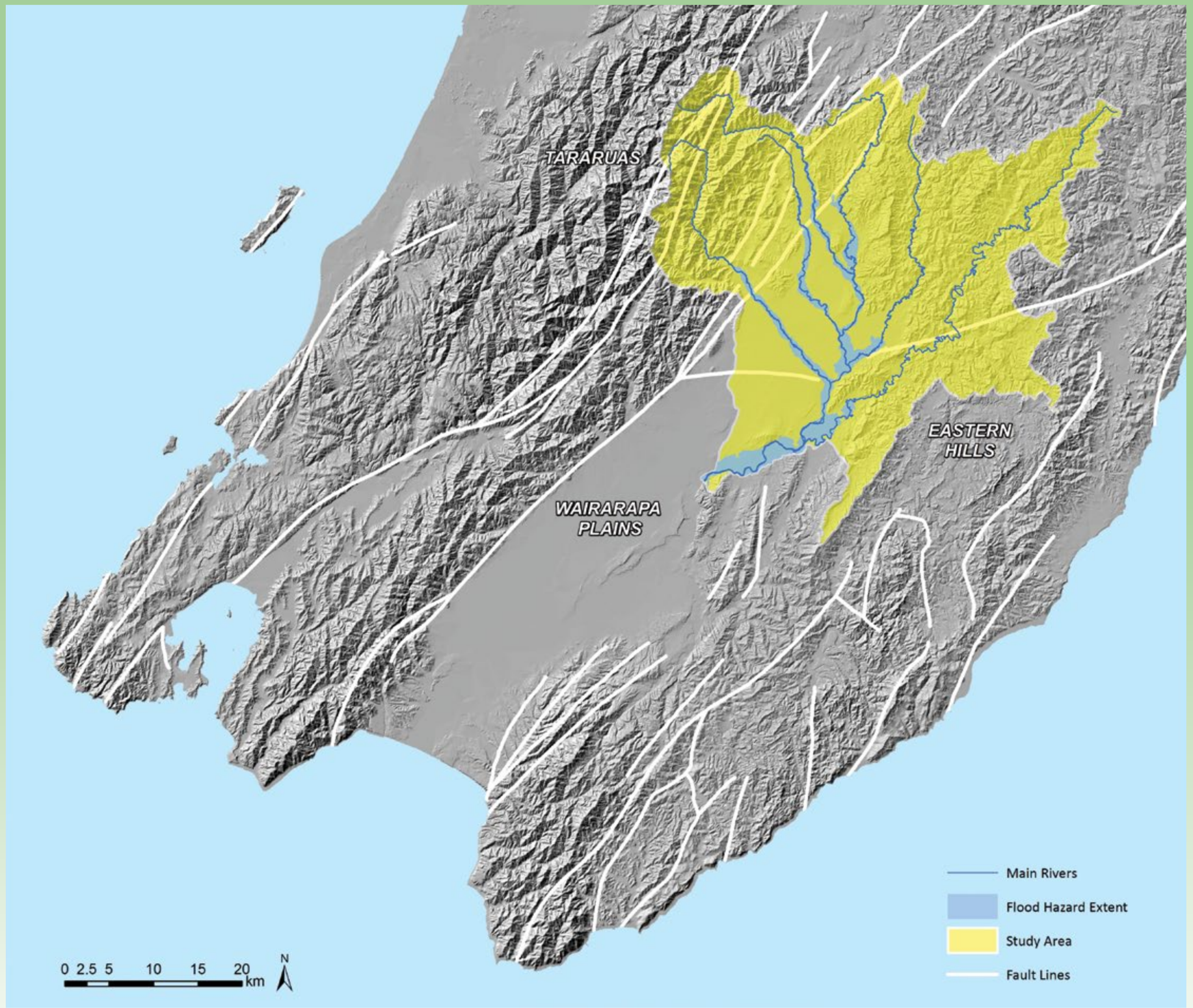
Operational Management Plans will be completed and reviewed more often, and minor reviews will be undertaken yearly through GWRC's annual plan process. The comprehensive review will re-model the flood hazard to ensure that the information is accurate.

The table at right summarises what will be reviewed and when.

REVIEW PROGRAMME

REVIEW TIMEFRAME	REVIEW SCOPE	REPORT ON WHAT?
ANNUAL	• Implementation programme • Operational programme summary	• What was proposed • What work was done • The reason for the difference • Proposals for the next year • The implementation status (in summary)
EVERY 3 YEARS (TO FEED INTO GWRC/CDC/MDC LONG TERM PLANS)	• Implementation progress • Priority and costs of major projects and operational expenditure • Alignment between agencies on projects and funding	• Investment priorities • Staging/speed of implementation • Risks and opportunities
INITIAL 10-YEAR REVIEW	• An assessment of progress for key aspects of implementation and a formal report to the Advisory Committee and Wairarapa Committee incorporating external feedback as appropriate • Incorporate changes or new information due to plans external to this FMP	• Review progress on delivering all high-priority major projects • Review how Operational Management Plan process has performed • Review how design envelope and buffer approach has performed, and the success of its implementation • Incorporate any changes required due to: » Resource consenting outcomes » Waiōhine and Lower Wairarapa Valley Floodplain Management Plans » Whaitua/Natural Resources Plan outcomes » Wairarapa Moana treaty settlement outcomes
EVERY 20 YEARS – MAJOR REVIEW	Scope to be agreed with iwi and stakeholders. Expected to include: • Effectiveness/Progress of all common methods and general responses • Progress in implementing Major Project Responses, and what has been achieved (such as flood damage saved) • Appropriateness of governance structure and funding approach • Review of catchment hydrology and flood extents • River bed envelopes and river management envelopes/design lines • Lessons learned from major flood events • Future proposed budgets – affordability, value and sufficiency • Reprioritising and costing all outstanding works	To GWRC, MDC, CDC and the Upper Ruamāhanga River Management Advisory Committee as a standalone report and updated FMP following consultation with stakeholders.

PART 2:
LOCATION-SPECIFIC VALUES, ISSUES AND RESPONSES



Regional context

5. Overview and regional context

This Part 2 of the FMP sets out the floodplain management outcomes for the Te Kāuru Upper Ruamāhanga catchment. It should be read in conjunction with Part 1, which provides background information on and an overview of the FMP, including its implementation and the allocation of responsibilities.

The six rivers that make up the Te Kāuru Upper Ruamāhanga catchment have been divided into 20 reaches (17 western gravel-bedded reaches, and three eastern silt-bedded rivers), each with its own floodplain management response. Each reach is set in the broader catchment and regional context (introduced at the beginning of this document), then described in terms of:

- Its character and values, including upstream and downstream influences
- The identified flood and erosion issues to be addressed. Note that any amendments to the flood hazard maps that are recommended as a result of the independent audit will be implemented. The updated flood hazard maps will be issued in the next year, to be incorporated into the updated WCDP
- The reach's specific flood and erosion responses, including Major Project Responses where relevant

The reaches of the eastern rivers have been amalgamated for the purpose of defining floodplain management responses, given that they have similar attributes and outcomes.

5.1 Wairarapa valley

The Wairarapa valley is situated in the Wellington Region, which is at the southern end of Te Ika a Māui, the North Island of New Zealand. It has a temperate climate with distinct seasonal variations. It is known for having relatively stable weather patterns, commonly experiencing long, hot, relatively dry summers and mild winters.

The Wairarapa valley is made up of:

- The western Tararua Range, formed from greywacke rock of varying ages
- The Wairarapa Plains, formed from deposited alluvial gravels and silts
- The eastern hills, formed from deposited marine sediments

The area's geology is dominated by the underlying active boundary between the Pacific and Australian tectonic plates, which have created extensive faulting throughout the valley, mainly on a north-east/south-west alignment. The largest recorded fault movement – the 1855 Wairarapa magnitude-8.3 earthquake – caused a 13m horizontal movement and significant changes to the plains and river systems.

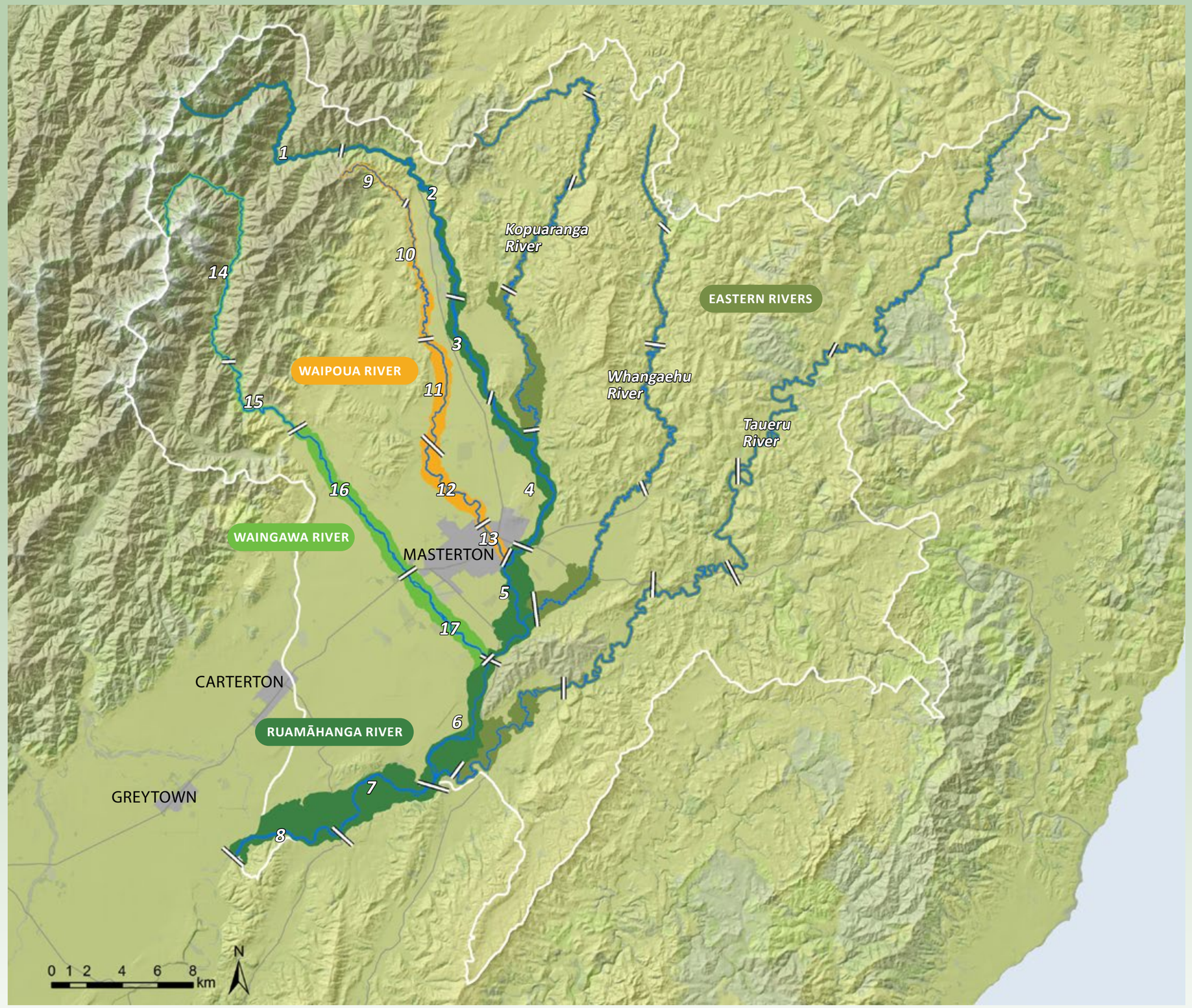
Wairarapa's geological and climatic characteristics are reflected in the rivers – as can be seen in the high-energy, gravel-bedded western rivers and the low-energy, generally soft, sediment-bedded eastern rivers.

Humans have influenced Wairarapa's floodplain and channel form since early settlement, and it has been suggested that the arrival of Western civilisation came at a time when the indigenous vegetation was already in a state of flux. Considerable areas of land were cleared through burning in the first few centuries of Māori settlement and the extent of land clearance increased after the arrival of Europeans.

Early observers estimated that around 80,000ha of Wairarapa were grassland, 30,000ha were forest, 10,000ha were fern and scrub and 8,000ha were swamp. Its large areas of natural grassland and close proximity to Wellington made Wairarapa an attractive area for farming, and New Zealand's first sheep station was established in 1844. At the time the land along the Ruamāhanga River was covered with dense bush, and detailed surveys of the Waingawa River from 1900 show native scrub coverage of the banks and islands.

Farming continued to develop, and the introduction of further exotic species – deer, pigs and possums – continued a trend of deforestation, exposing further areas of the ranges to natural erosive forces. This would, over time, contribute to rises in river bed levels across the plains. European settlers planted willows as an early bank flood and erosion protection tool, and further population increases saw more detailed and varied methods developed to protect both farmland and homes. These included the use of stopbanks, river diversions, improved willow works, reforestation and exotic-pest control.

Rainfall patterns in the catchment are dominated by the Tararua Range. They create a relatively dry plains area (800mm average annual rainfall), with a significant increase in rainfall in the mountains (6,000mm average annual rainfall).



Te Kāuru Upper Ruamāhanga catchment

5.2 Rivers and settlement in the Te Kāuru Upper Ruamāhanga catchment

The Ruamāhanga is the river into which almost all other rivers in the Wairarapa valley eventually flow. It connects the Tararua Range to Wairarapa Moana, eventually flowing from there into Raukawa Moana/Palliser Bay. The Te Kāuru Upper Ruamāhanga catchment extends from the Tararua Range to the confluence with the Waiōhine River, covering an area of 1,560km^2 through which the Waipoua, Waingawa, Whangaehu, Kopuaranga and Taueru Rivers and their tributaries flow.

The western rivers emerging from the rugged Tararua Range are well known for their pristine environments near the headwaters, and as a result they are much valued for their beauty, mauri, recreational opportunities and spiritual significance. The eastern tributary landform is characterised by undulating hills, which are today dominated by agricultural use. However, there remains a strong cultural significance in and around these eastern rivers for tangata whenua, and they are popular in some areas for recreational pursuits.

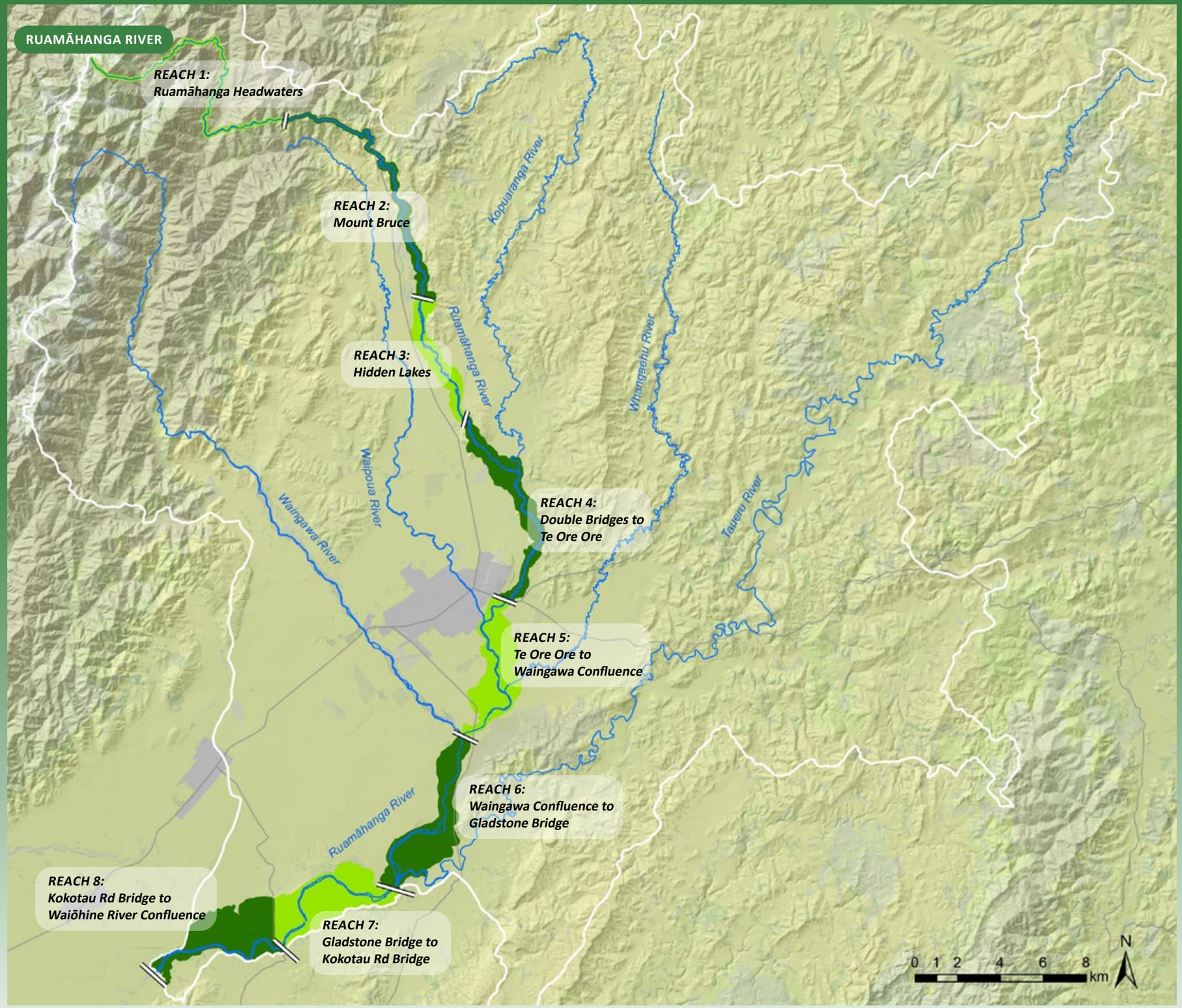
Both the western and eastern tributaries run out onto the fertile Wairarapa Plains, which have been formed over time through deposits of alluvial material, including greywacke alluvium from the Tararua Range and alluvial silts and sands eroded from a mixture of the mudstones, sandstones and limestones that form the eastern Wairarapa hills. The catchment's land use is dominated by native forest in the upper Tararua Range, which transitions to a range of primary production activities (plantation forestry, dry stock grazing, dairying and cropping), rural lifestyle developments and urban areas on the floodplain.

Tangata whenua have multi-generational connections with the Ruamāhanga River and its tributaries. Both Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa currently share the role of kaitiaki for these catchments.

While non-Māori have been present in Wairarapa for a shorter period, over several generations they also have developed strong ties to the land and landforms. Some of the families arrived on the first European settler ships and have made their mark on the modern social, political and physical landscape through generations of involvement in Wairarapa's development.

Today Wairarapa has a distinct identity. It has both a legacy of, and a current state rich with cultural significance to Māori. With strong roots in agriculture – the area's leading industry – it is also famous for the quality of its landscape and associated recreational opportunities, and its hosting of a number of regional events and concerts. Home to some 40,000 residents, Wairarapa has produced or become home to more than a representative share of well known ambassadors, ranging from noted scientists and engineers to popular musicians and film directors.

All the catchment's rivers have a diverse range of values attributed to them, and as generations have come and gone the emphasis on these values has shifted in response to the cultures of the people who value them.


RUAMĀHANGA RIVER
REACH 1:
Ruamāhanga Headwaters
REACH 2:
Mount Bruce
REACH 3:
Hidden Lakes
REACH 4:
Double Bridges to
Te Ore Ore
REACH 5:
Te Ore Ore to
Waingawa Confluence
REACH 6:
Waingawa Confluence to
Gladstone Bridge
REACH 7:
Gladstone Bridge to
Kokotau Rd Bridge
REACH 8:
Kokotau Rd Bridge to
Waiōhine River Confluence
Kopuaranga River
Ruamāhanga River
Whangaehu River
Tauweru River
Waipoua River
Waingawa River
Ruamāhanga River
0 1 2 4 6 8
km
N

6. The Ruamāhanga River

The Ruamāhanga River flows from its source in the Tararua Range down through steep, mountainous terrain and native forests, running through rock-lined gorges and 'boulder garden rapids' (where numerous rocks and boulders are strewn throughout the channel) before leaving the foothills close to Mount Bruce. From there it flows through a number of steep-sided gorges, where historical river terracing can be seen through the fringes of patchy native and exotic vegetation, before opening out into the pastoral Wairarapa Plains. Here it turns to a more southerly direction, flowing downstream through confluences with all the other rivers that flow through the Wairarapa valley.

The Ruamāhanga is the most significant ancestral river of Wairarapa mana whenua. Its name is attributed to a number of stories relating to the translation of 'rua', meaning two, and 'māhanga', meaning twins, forks or snare traps. One story is that the translation of two forks refers to the east/west alternating confluences along its length as it travels from north to south. Another is that its name was given by Haunui-a-Nanaia, who caught two birds in a snare trap on the banks of the river.

The main river channel from the State Highway 2 bridge near Mount Bruce downstream to the Waiōhine confluence extends some 58km. It has a semi-braided form in its upper reaches and changes to a managed single thread following a gravel corridor in the lower reaches (approximately at Te Ore Ore).

Different soil types have developed at various locations on the floodplain, depending on the rate of flood deposition, the source of material, the time since deposition, and natural drainage. The natural fertility and erodibility of these soils is quite variable. Inappropriate land use and a lack of shelter may cause wind erosion.

Land use in the catchment includes native forest in the upper catchment in the Tararua Range, which transitions to a range of primary production activities (dairying, dry stock grazing, cropping and plantation forestry), rural lifestyle developments and urban areas (Masterton) on the floodplain.

There are many significant wāhi tapu and archaeological sites associated with the Ruamāhanga River's waters and banks, including urupā, pā, kainga and middens. Several of the archaeological sites are recorded with the New Zealand Archaeological Association, and some urupā also have registered titles.

Key recreational activities include hill walking, wilderness fishing in the Tararua Range, jet boating below the confluence with the Waingawa River, and kayaking. The Ruamāhanga River is well known for its good-quality swimming holes and gravel beaches suitable for summer picnics.

The river is also an important ecological corridor, providing nesting sites for birds, habitat and migratory native and exotic fish species. It is also becoming nationally important for threatened bird life. In recent years it has been recorded as bucking the national trend of decline in black-billed gull species, and it supports populations of black- fronted dotterel, pied stilts, black shags and New Zealand pipit. The current river managers have for the past decade been improving their management techniques to lessen harm to these species' habitats, with positive results for the bird populations.

26 fish species have been identified that have either lived in or passed through the Ruamāhanga River. More than half of the 20 species of native fish found in the Te Kāuru Upper Ruamāhanga catchment are considered to be 'at risk', meaning their populations nationwide are considered to be declining. The associated restoration of the Wairarapa eel (tuna) fishery is particularly significant for Māori.

General issues

The Ruamāhanga River is well known to the Wairarapa community for its flood flows. Its relatively entrenched upper reaches hold much of the floodwater (confining it between old river terraces) and its passage is controlled in several locations by prominent rocky outcrops. As it turns to the south at its confluence with the Kopuaranga River it opens into a broader floodplain, and the flood extent covers a greater area of adjacent land. This trend of a broadening floodplain continues to its confluence with the Waiōhine River.

The flooding of the Ruamāhanga River also strongly influences the flooding in each of its tributaries. If a flood event occurs in the river at the same time as one in any of the tributary rivers, much higher flood levels are experienced in the tributary.

There are several sites of particular concern for their erosion risk. These include the banks of the river adjacent to Hidden Lakes and the areas around Henley Lake Parks and eastern Masterton, both of which feature substantial erosion protection works. Flood protection has recently been upgraded to protect the Homebush Wastewater Treatment Plant, and areas potentially at risk of erosion include a former Masterton landfill site and several stock bridges and structures related to farming activities along the length of the river.

General issues relating to the upper Ruamāhanga River include:

- Lateral erosion of the river banks due to natural processes in the river, such as the meandering of the channel and the degradation and aggradation of the river bed. River-bank stability can be compromised by degradation or be affected by additional erosion pressure as the river tries to wind its way around islands in the middle of the channel
- Reduced channel capacity to carry floodwaters due to aggradation, generally in the lower reaches
- Invasive introduced vegetation species, including yellow lupin, tree lucerne, broom and crack willow, that dominate in channel areas and obstruct flood flows
- Threats to existing planted vegetation (mainly willow buffers) from old man's beard and other plant, animal and insect pests that attack the species
- Numerous private water intakes from the river channel that require protection to ensure water supply
- The river being restricted in the river management envelope, increasing erosion pressure and reducing flood capacity
- The value of the rivers for recreation and habitat at times conflicting with river management works

Ruamāhanga Headwaters – Reach 1

Character

The upper reaches of the Ruamāhanga River flow through Tararua Forest Park. The river follows a narrow, gravel-choked valley surrounded by steep, bush-clad, mountainous terrain. Much of the headwaters of the upper Ruamāhanga River are in a natural state, with pools and rapids enclosed by diverse areas of native vegetation.

Key characteristics

- Narrow gravel valleys with boulder gardens and pools
- Predominant cover of native vegetation along margins
- Wilderness recreation opportunities

Values

The headwaters of the upper Ruamāhanga River are protected as part of the DoC estate, which provides the setting for wilderness experiences. Overall the landscape has very low levels of landscape modification, with corresponding very high scenic value. The entire reach is zoned Rural (Conservation) in the WCDP.

Due to the strong underlying wilderness and scenic values, this reach features popular walking and tramping tracks with huts, leading into the Tararua Range. Wilderness fishing is popular, as is some grade 2+ kayaking through boulder gardens and sharp ends. All recreation access is limited to foot access only.

The reach has substantial ecological values associated with its underlying conservation value. These relate to the terrestrial habitats associated with fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland and stonefields and boulderfields.

Wāhi tapu have been identified in this area, with the headwaters providing an important cultural connection to the Tararua Range.

Key floodplain management points

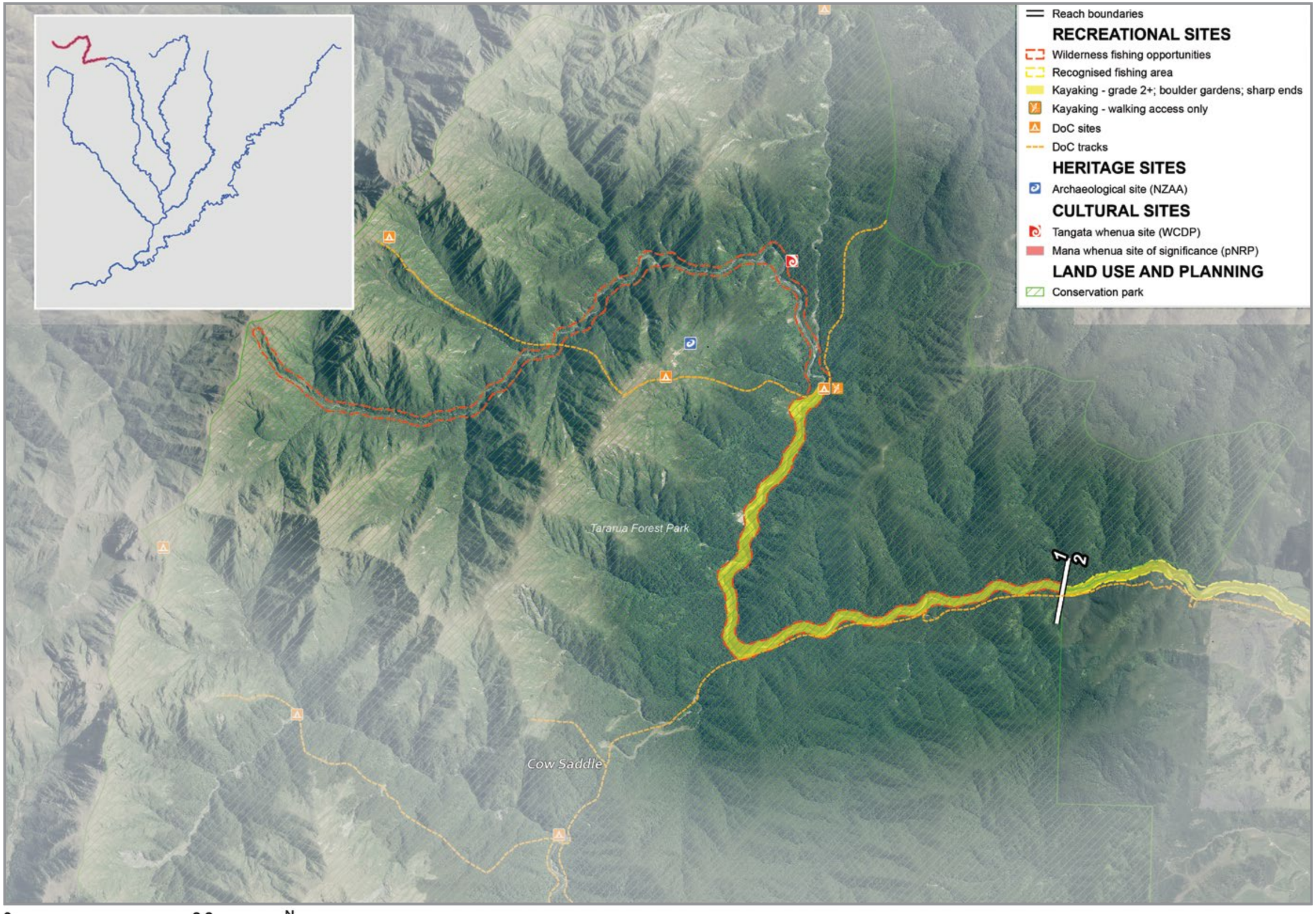
- Encourage continued recognition of this reach's values and character.
- Support initiatives that aim to preserve or improve its natural values.

Under this FMP there is no intention to undertake maintenance activities in the reach. No specific flood and erosion issues have been identified.

REACH-SPECIFIC RESPONSES

	SITE	TYPE OF RESPONSE	MEASURES
COMMON METHODS	Entire reach	River management	Isolated works support, Code of Practice
	Entire reach	Planning and policy	Protection against deforestation in upper catchment
	Entire reach	Emergency management	Emergency management planning, flood forecasting and warning system
	Entire reach	Environmental enhancement	Community Support Officer

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Very low	Very high	Walking tracks and huts (DoC), angler access, kayak access (foot only), kayaking, wilderness fishing	-	Sacred place, wāhi tapu; stopover camp, puni; wāhi whakawātea	Rural (Conservation), Road, River	Fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields


Reach boundaries
RECREATIONAL SITES
Wilderness fishing opportunities
Recognised fishing area
Kayaking - grade 2+; boulder gardens; sharp ends
Kayaking - walking access only
DoC sites
DoC tracks
HERITAGE SITES
Archaeological site (NZAA)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Tararua Forest Park
Cow Saddle
1
2
0
2.2
km
N

Mount Bruce – Reach 2

Character

This reach flows from the base of Tararua Forest Park south of Mount Bruce into the upper Wairarapa Plains. In this area the river is partially contained in the semi-enclosed, flat valley floor that follows the base of the Tararua Range. The river's formative influence is clearly apparent along adjacent terraces aligned in a north-south direction beyond its main channel.

In the reach's upper section the river passes through a series of gorges in the vicinity of Mount Bruce Bridge. Below this, much of the river settles into a series of pools, riffles and runs with narrow braids. The river margins are mainly enclosed by mixed native and exotic vegetation that separates the river from adjoining farmland. A more significant area of podocarp forest is apparent at Dunvegan Forest on the western banks.

Key characteristics

- Steep, rock-lined gorges containing boulders, pools and rapids
- Distinct river terraces stepping down to the river corridor
- Mixed exotic and remnant native vegetation

Values

This reach of the Ruamāhanga River is slightly more modified than its headwaters, with much of the surrounding landscape used for primary production. Parts of the reach continue through gorges surrounded by indigenous vegetation, while exotic scrub and State Highway 2 also influence its character and values. Overall it has a low modification level and corresponding high scenic value.

The reach's upper parts feature popular walking, fishing and kayaking areas accessed from Mount Bruce Bridge and connecting with Tararua Forest Park. South of the bridge its flat water with riffles and braids is valued for kayaking, but it is infrequently fished.

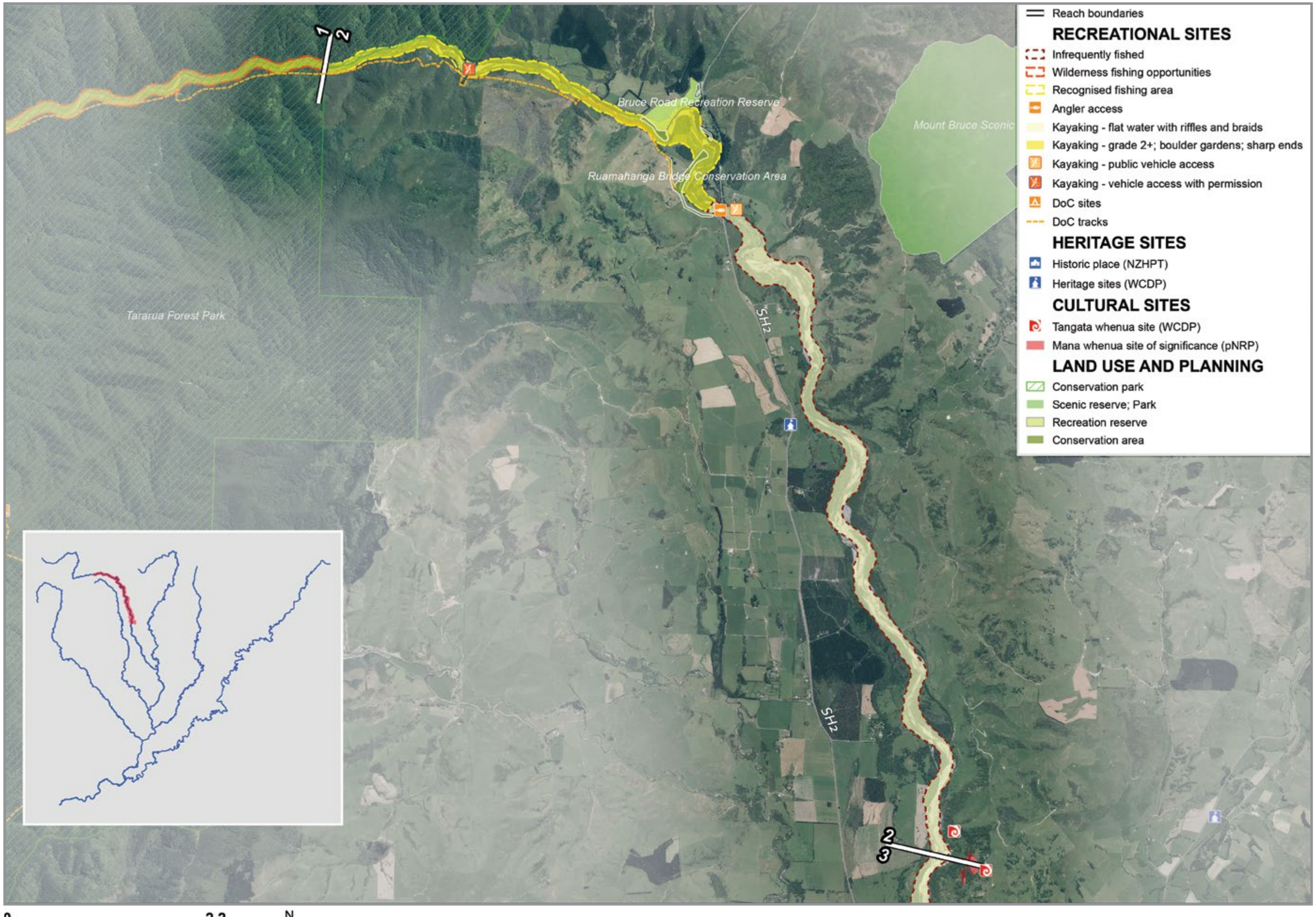
The important ecological values along this reach relate to a Recommended Area for Protection (RAP) that includes remnant indigenous vegetation at Dunvegan Forest and terrestrial habitats associated with fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

The numerous sites of cultural importance include wāhi tapu, an historic village, pā and waka landing sites.

Key floodplain management points

- Protect the Dunvegan Forest RAP site from negative impacts of flooding and erosion.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	High	Walking tracks (DoC), angler access, kayak access, fishing, kayaking	Old Settler's Cottage (WCDP)	Tangata whenua site (WCDP), wāhi tapu, historic village site, historic pā site, historic waka landing site	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, State Highway	Dunvegan Forest remnants (RAP), fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

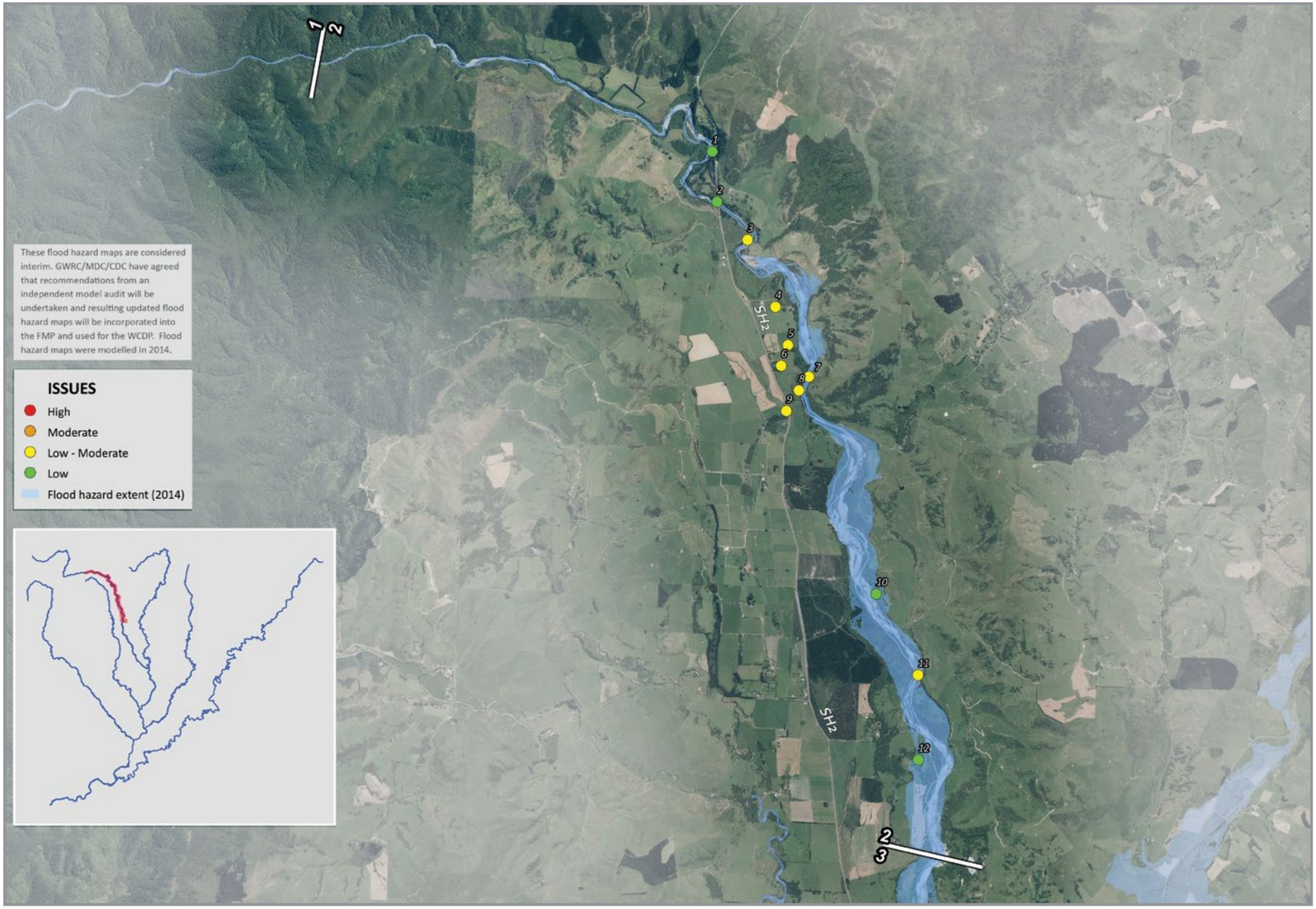

Reach boundaries
RECREATIONAL SITES
Infrequently fished
Wilderness fishing opportunities
Recognised fishing area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - grade 2+; boulder gardens; sharp ends
Kayaking - public vehicle access
Kayaking - vehicle access with permission
DoC sites
DoC tracks
HERITAGE SITES
Historic place (NZHPT)
Heritage sites (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Scenic reserve; Park
Recreation reserve
Conservation area
Bruce Road Recreation Reserve
Ruamahanga Bridge Conservation Area
Mount Bruce Scenic
Tararua Forest Park
SH2
SH2
1
2
2
3
0
2.2
km
N

Mount Bruce – Reach 2

Flood and erosion issues

A total of 12 flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**State Highway 2 [1]** State Highway 2 runs close to a gorge section of the Ruamāhanga River and sits in the erosion study area. The risk of erosion is considered low due to the natural rock formation that controls the erosion risk	**No defined design channel [10]** No design channel has been developed as a management tool upstream of this location. While this provides less certainty for adjacent landowners, it may have limited benefits due to the surrounding geology acting as a natural control on the river
	State Highway 2 bridge [2] The abutments of the State Highway 2 bridge sit in the erosion study area. The river at this location is well entrenched and the risk to the structure from erosion is considered to be low	**Dunvegan Forest RAP site [12]** Dunvegan Forest, a RAP site, sits in the erosion study area and is affected by the 1% AEP flood event
LOW TO MODERATE	**River scheme boundary [3]** The upstream boundary of the upper Ruamāhanga River schemes sits below the gorge area. It is recommended that this be reviewed in conjunction with landowners in the upstream area, and with reference to Issue IDs 1 and 2	**State Highway 2 in erosion study area [9]** State Highway 2 sits in the erosion study area but is considered to be at low risk due to its distance from the river's active channel and the underlying geology
	Private houses in erosion study area [4, 5, 6, 8] A number of house sites sit in the erosion study area. They are not affected by the 1% AEP flood event	**Private bridge [11]** A private access bridge crosses the river and its abutments are in the erosion study area. It may be susceptible to debris flows, erosion and bed-level changes
	Stock bridge [7] A privately owned stock bridge sits in the erosion study area and is potentially at risk of damage linked to flood debris, bed-level changes and large flood events	
MODERATE		
HIGH		



ISSUES – Reach 2: Mount Bruce

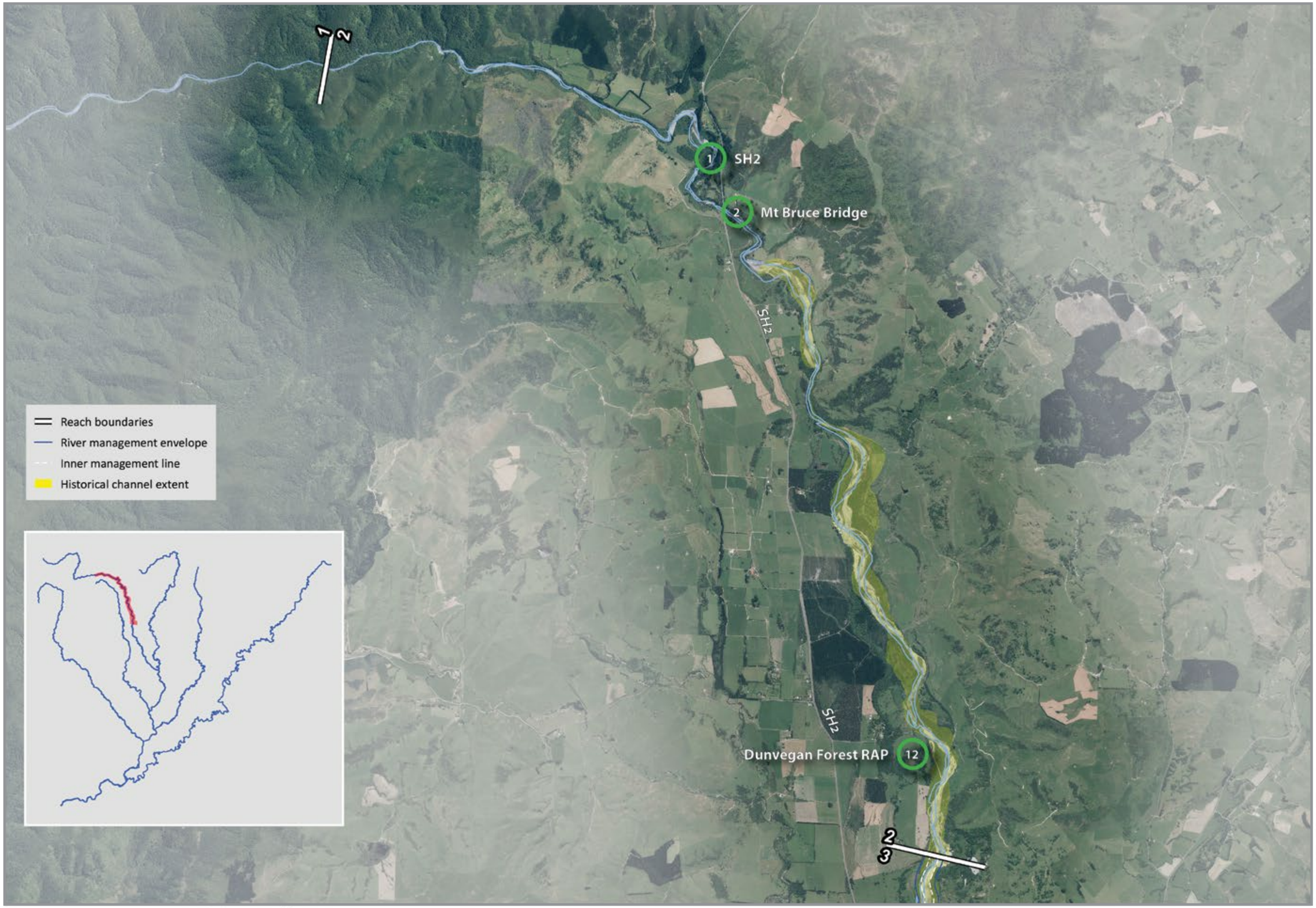
Mount Bruce – Reach 2

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	12	Dunvegan Forest RAP site	River management	Dunvegan Forest is an area of remnant native forest. While there is no requirement to protect the area against natural erosion or flood effects, there is an opportunity to reduce the impacts of flooding and erosion through river management approaches sensitive to impacts on the forest. GWRC will advise the RAP site managers on how to avoid erosion losses and damage to the site. Only soft edge protection is required. This area is ideal as a trial site for native tree edge-protection methods			Landowners	GWRC	Low
	1 2	SH2 and Mount Bruce Bridge	River management	GWRC Operations will provide information to the NZ Transport Agency if any erosion risk is identified to State Highway 2. The NZ Transport Agency will continue to monitor risks to State Highway 2 and Mount Bruce Bridge. A couple of locations have been identified as being in potential erosion extents, but the risk is considered low and there are no known historical issues that have required management			NZ Transport Agency	GWRC	High
		Mount Bruce Bridge	Environmental enhancement	The Mount Bruce Bridge access area is a popular access location. Opportunities will be developed as part of the Environmental Strategy to formalise this access point and provide clear, safe access to the river and associated facilities. It is essential to have community ownership of access points like these; GWRC will initiate and support the formation of a care group to work with clubs and individuals that value this location			GWRC	Community	Low
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Protection against deforestation in upper catchment, land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					
		Entire reach	River management	Remove this reach from the current river scheme. Apply standard Isolated Works policy for funding landowner-initiated works upstream of Hidden Lakes					


1
2
SH2
Mt Bruce Bridge
SH2
Reach boundaries
River management envelope
Inner management line
Historical channel extent
SH2
Dunvegan Forest RAP
12
2
3
0
2.2
km
N

Hidden Lakes – Reach 3

Character

This reach transitions from a semi-enclosed channel in the upper valley to the broader open character of the upper Wairarapa Plains. As it continues south the channel gets wider and begins to form a more distinctive, semi-braided channel. In association with braids, bank modification becomes increasingly prevalent, with shelves covered by willow planting and tree lucerne common along this reach.

Key characteristics

- Emerging semi-braided form containing riffles and pools
- Willow-lined margins
- Open pastoral character culminating along modified river margins

Values

This reach continues through rural land used for primary production activities and mainly established in pasture grassland. Beach re-contouring (moving gravel in the river bed) and willow planting become more common, together with several areas of indigenous vegetation. Overall it has a medium level of landscape modification, with medium/high scenic value.

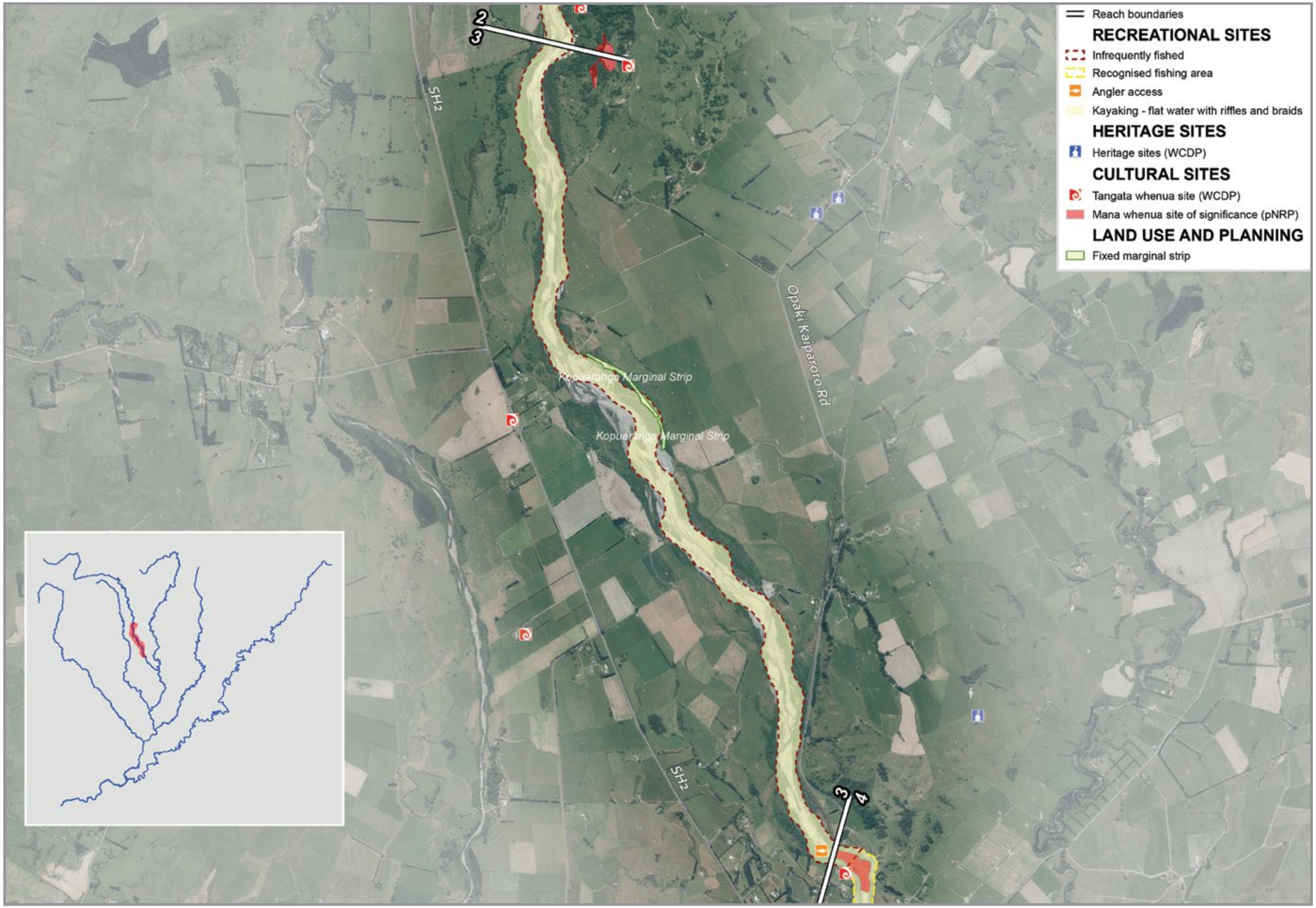
Some kayaking takes place along this reach, benefiting from flat water with riffles and braids that continue downstream from Mount Bruce Bridge. While fishing is infrequent, the fish passage to the upper reaches is important. The rail bridge and Opaki Kaiparoro Road bridge (which together make up Double Bridges) provides a popular swimming site from which kayaking and fishing continue downstream.

Terrestrial habitats with identified ecological value along this reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, and natural wetlands and ponds. There are also numerous sites of cultural importance, including an historic pā site adjoining Hidden Lakes alongside other house sites, a taniwha lair and established associations with mahinga kai.

Key floodplain management points

- River enhancement expenditure has previously been 0%-3% of total annual expenditure; this FMP increases the allowance. A Community Support Officer will support enhancement works.
- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- Recognise the significance of cultural values associated with this reach.
- Manage the gravel quantities in this reach sustainably to protect Double Bridges from scour and the effects of reduced flood capacity.
- Work with Double Bridges' owners to ensure their protection against flooding and the impacts of erosion, and maintain their ongoing operation.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium/High	Kayaking, infrequent fishing	-	Tangata whenua sites (WCDP) – historic pā site, historic house site, taniwha lair, mahinga kai	Rural (Primary Production), Rural (Special), Road, River, Railway, Flood Protection and Mitigation	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds


Reach boundaries
RECREATIONAL SITES
Infrequently fished
Recognised fishing area
Angler access
Kayaking - flat water with riffles and braids
HERITAGE SITES
Heritage sites (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
2
3
SH2
Opaki Kaiparoro Rd
Kopuaranga Marginal Strip
Kopuaranga Marginal Strip
SH2
3
4
0
1.4
km
N

Hidden Lakes – Reach 3

Flood and erosion issues

A total of 11 flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Gravel extraction [18]** This location is a good gravel-extraction point with good current access. It has degradated significantly, which may limit opportunities for gravel extraction in the future. The gravel is used and licensed by GWRC Flood Protection	
LOW TO MODERATE	**Farm ancillary buildings [14]** A small group of buildings believed to be farm ancillary structures is located in the erosion study area and are in the 1% AEP flood extent **House in erosion study area [15]** A house is located in the erosion study area and outside the 1% AEP flood extent **Houses in flood hazard areas [16, 17]** A couple of houses sit in but near the edge of the erosion study area and are affected by the 1% AEP flood event	**Houses in erosion study area [19]** Two houses sit in the erosion study area. However, they are protected by the railway line and State Highway 2. The erosion risk at this location is believed to be low **Opaki Kaiparoro Road in erosion study area [20]** Opaki Kaiparoro Road sits in the erosion study area. However, it is considered low risk due to the adjacent geology **Houses in erosion area [23]** A small group of houses near the southern abutments of Double Bridges sits in the erosion study area. The houses are set far back from the channel edge and are considered low risk due to the underlying geology
MODERATE	**Hidden Lakes [13]** The Hidden Lakes area is a site of regional significance. It sits in the erosion study area, and the bank edge adjacent to the site is subject to active erosion. There is no requirement to protect this site from natural erosive forces **Railway line in erosion study area [21]** The main north-south railway line sits in the erosion study area. The area is considered low risk due to the surrounding geology and the line's infrequent use	**Double Bridges [22]** Double Bridges sits in the erosion study area. The current bed-level management allows enough freeboard for flooding through the structures up to the bridge soffits. However, there are concerns about scour around the bridge piers
HIGH		

ISSUES – Reach 3: Hidden Lakes

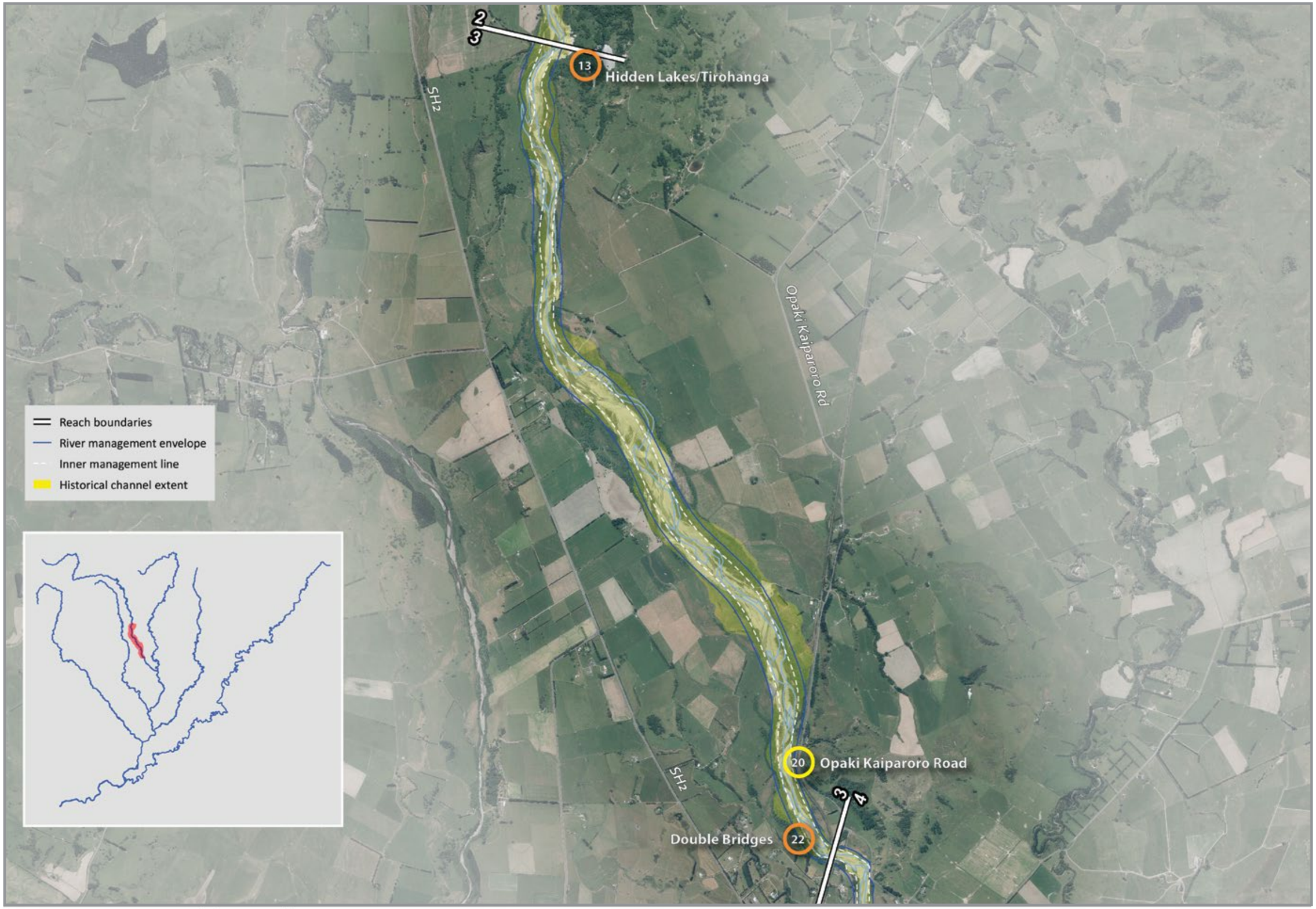
Hidden Lakes – Reach 3

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	13	Hidden Lakes, Tirohanga	Planning and policy	The site is protected in the pNRP. There is no requirement or expectation to protect it against natural erosion processes. GWRC will avoid upstream and downstream works worsening erosion at this site			Mana whenua	GWRC	Low
	20	Opaki Kaiparoro Road	River management	The asset owner is to continue monitoring risks to Opaki Kaiparoro Road. The road has been identified as being in potential erosion extents in several locations, but the risk is considered low and there are no known historical issues that have required management			Asset owner	GWRC	Low
	22	Double Bridges	River management	GWRC Operations will provide information to asset owners if any erosion risk is identified to Double Bridges.			GWRC	Asset owners	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed vegetation planting, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


2
3
13
Hidden Lakes/Tirohanga
SH2
Opaki Kaipararo Rd
Reach boundaries
River management envelope
Inner management line
Historical channel extent
20
Opaki Kaipararo Road
SH2
3
4
Double Bridges
22
0
1.4
km
N

Double Bridges to Te Ore Ore – Reach 4

Character

This reach continues a semi-braided character, which becomes progressively more channelised through the Wairarapa Plains along the western toe of Te Ore Ore. The confluence with the Kopuaranga River occurs midway along the reach, below which the river widens and continues in a semi-braided form across gravel with pools and riffles. Belts of willow enclose most of the river corridor and include cabled willows in some areas. Much of the surrounding landscape remains in productive rural use and includes several pivot irrigators, with playing fields and mixed indigenous and exotic vegetation adjoining the river near Rathkeale College.

Key characteristics

- Broad semi-braided form
- Continuous belts of willow planting enclosing margins
- Cabled willow trees established in some areas
- Rounded paddocks associated with pivot irrigators
- Proximity to playing fields at Rathkeale College

Values

This reach flows through rural land to the north of Masterton, which is mainly established in pasture grassland and increasing rural lifestyle settlement. The margins of the river become increasingly modified with stopbanks and willow and pole planting, particularly adjacent to Rathkeale College. Overall the level of landscape modification is medium with a corresponding medium level of scenic value.

The area is commonly used for fishing and kayaking as it features flat water that is easily accessible for beginners. These activities are typically accessed from bridge crossings at Double Bridges and Te Ore Ore Road, with an additional access point along Black Rock Road. Swimming is also popular at these access points, and a swimming hole has been identified at Rangitumau Bluff.

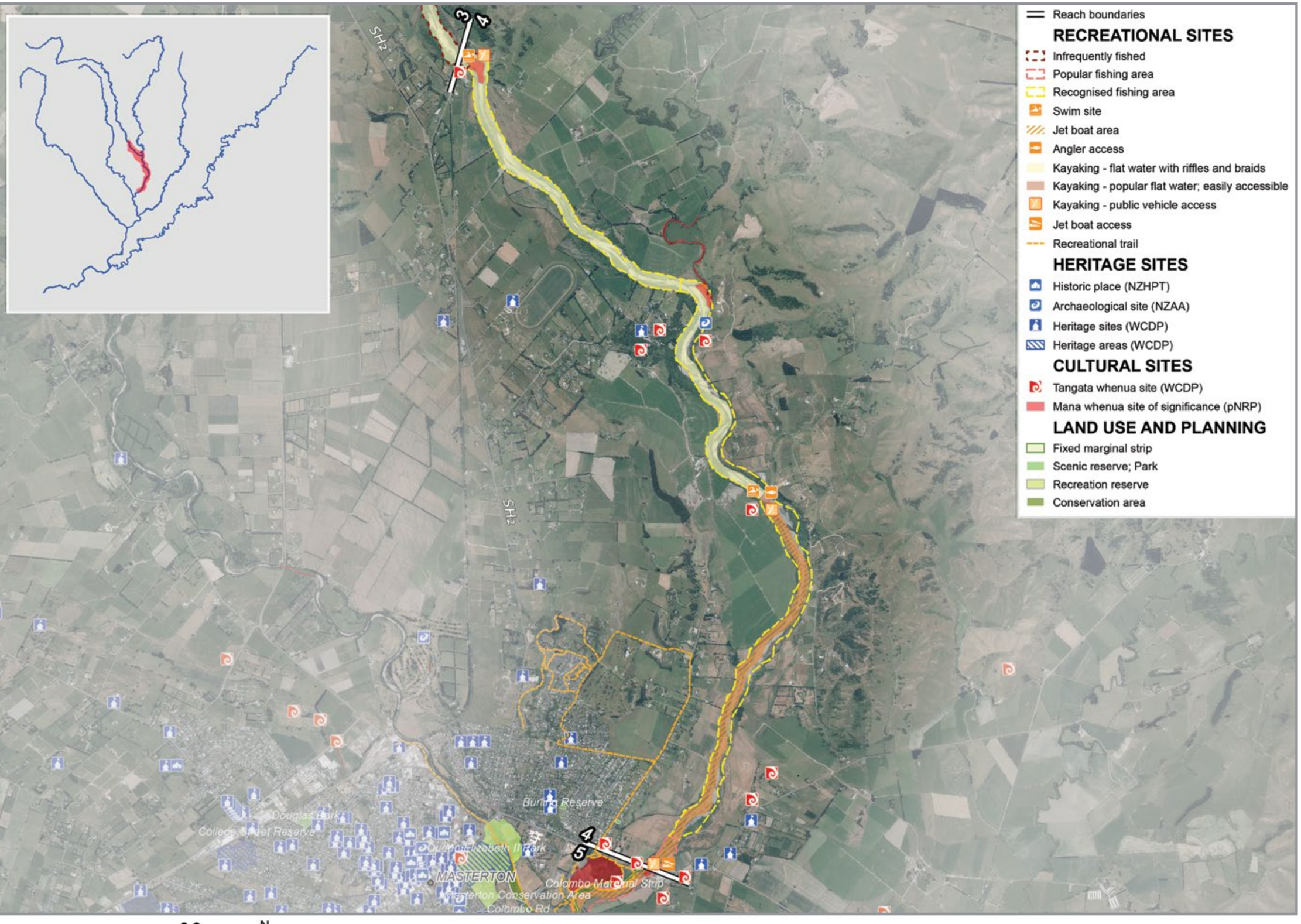
Terrestrial habitats with identified ecological values along this reach include fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds. The area also accommodates a breeding population of nationally endangered black-billed gulls along the stonefield and boulderfield areas, and is one of the few locations where their numbers have grown in recent years.

Along the river's western banks, the main house of Rathkeale College is an important heritage site identified in the WCDP. Cultural sites in this area include marae, historic pā sites, urupā, wāhi tapu and mahinga kai associations.

Key floodplain management points

- River enhancement expenditure has previously been 0%-3% of total annual expenditure; this FMP increases this allowance. A Community Support Officer will support enhancement works.
- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- Protect the swimming hole at Rangitumau Bluff and enhance recreational opportunities.
- Reduce the risk of failure to the stopbank network that protects Rathkeale College and grounds.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, kayak access, fishing, kayaking, swimming	Rathkeale College (WCDP), pā site and urupā (New Zealand Archaeological Association)	Tangata whenua sites (WCDP), mana whenua sites of significance (pNRP) – marae, historic pā sites, historic sites, urupā, wāhi tapu trees, historic baptism sites, mahinga kai, eel weir, pā tuna (kohekutu); mahinga kai; canoe landing place, tauranga waka; water spirit and guardian, taniwha (tuere), swimming place, wāhi kauhoe	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, State Highway.	Fenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds, breeding population of nationally endangered black billed gulls.

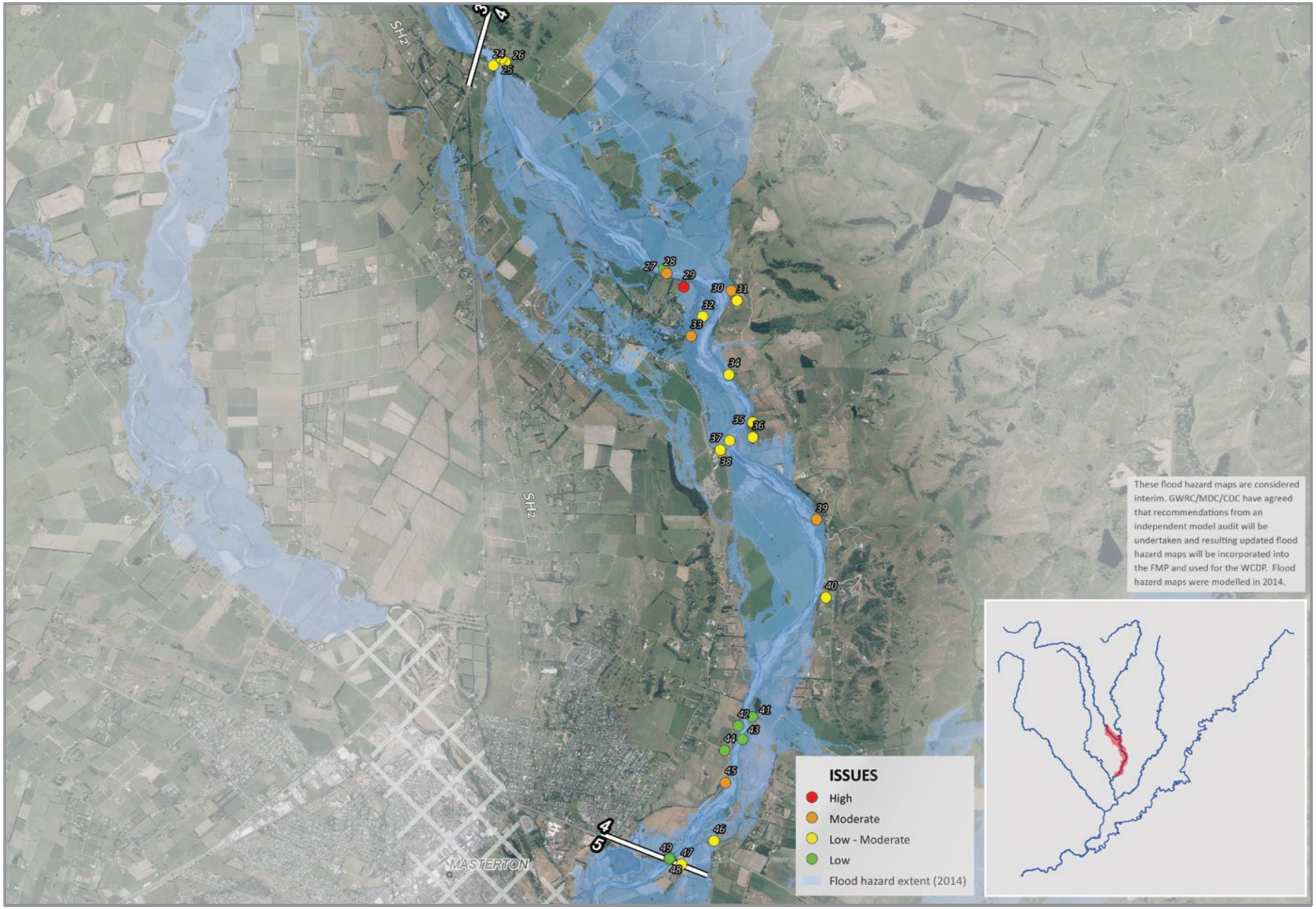

Reach boundaries
RECREATIONAL SITES
Infrequently fished
Popular fishing area
Recognised fishing area
Swim site
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - popular flat water; easily accessible
Kayaking - public vehicle access
Jet boat access
Recreational trail
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
Heritage areas (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
Scenic reserve; Park
Recreation reserve
Conservation area
SH2
3
4
5
MASTERTON
Burling Reserve
Douglas Park
College Street Reserve
Queen Elizabeth II Park
Masterton Conservation Area
Colombo Rd
Colombo Memorial Strip
0
2.2
km
N

Double Bridges to Te Ore Ore – Reach 4

Flood and erosion issues

A total of 26 flood and erosion issues have been identified along this reach owing to its closeness to Masterton. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Stopbank in erosion study area [27]** A stopbank sits in the erosion study area and inside the existing management buffer extent **Water intake [41]** A private subsurface intake would be adversely affected by any changes in bed level **Water intake [42]** A water intake sits in the erosion study area for use as part of a frost protection system **Channel alignment [43]** The channel alignment is being artificially maintained by hard edge protection. The river naturally tends to a wider channel through this reach	**House [44]** A private house sits in the erosion study area. However, it is considered of low risk due to the underlying geology and its distance from the river. This issue is not currently managed **Te Ore Ore Bridge sub-transmission lines [48]** Sub-transmission lines cross the river north of Te Ore Ore Bridge. The pylons are located in the erosion study area but are set back from the river bed and outside the active channel. This issue is not currently managed **Te Ore Ore Bridge [49]** Te Ore Ore Bridge is relatively new and therefore less susceptible to scour issues than others. Weirs located downstream were used to control bed levels for earlier bridges. These have been modified, and further changes to them could affect this bridge. The bridge abutments sit in the erosion study area
LOW TO MODERATE	**Opaki water race intake [24]** The Opaki water race intake sits in the erosion study area and is affected by bed-level changes in the active channel. The intake bed levels are relatively stable due to the intake's proximity to the Double Bridges. Occasional maintenance by MDC is required to ensure continued operation **Rangitumau Road [26]** The road sits in the erosion study area; however, it is well protected by a rock bluff and therefore considered to be of low risk. This issue is not currently managed **Swimming hole [25]** There is a popular but occasionally hazardous swimming hole at the base of the bluff near Rangitumau Road **House [31]** A single dwelling sits in the erosion study area, but it is outside and above the 1% AEP flood extent. This issue is not currently managed **Rathkeale College outbuildings [32]** A number of small facilities for Rathkeale College are contained in the erosion study area and the 1% AEP flood extent **River bed armouring [34]** The bed in locations downstream of Rathkeale College has a tendency to become 'armoured' and needs ongoing maintenance. This is believed to be caused by the erosion of finer sediments from the adjacent cliffs	**House [36, 35]** Houses are located in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Private water intake [37]** A private water intake is situated with the erosion study area; however, there are no known issues with its ongoing operation. This issue is not currently managed **Outbuildings [38]** A farm storage building, or possibly utility structure, is located in the erosion study area but outside the 1% AEP flood extent. This issue is not currently managed **Houses [40]** Two houses on Black Rock Road sit in the erosion study area. While these properties sit outside the 1% AEP flood extent, they would be affected by any overflow through the water race **Industrial yards [47]** Sheds, machinery and the possibility of contaminants are in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Te Ore Ore stopbank [46]** This low standard stopbank protects several properties. The 1% AEP event overtops this stopbank and affects a number of properties behind it and Te Ore Ore/Castlepoint Road
MODERATE	**Erosion control works [28]** Ongoing erosion control is required to protect the Rathkeale stopbank which is currently at risk of being undermined **Henley Lake water intake [45]** The water intake for Henley Lake occasionally has issues associated with channel alignment and bed-level changes	**Urupā site [30]** A historic urupā site sits on the edge of a cliff above the Ruamāhanga River and in the erosion study area **Rathkeale College sewage pond [33]** Currently unused sewage settlement ponds for Rathkeale College sit in both the erosion study area and the 1% AEP flood extent **Black Rock Road [39]** Black Rock Road is located in the erosion study area. It has required erosion protection in the past 10 years
HIGH	**Rathkeale stopbank [29]** The Rathkeale stopbank sits well in the buffer and erosion study area and is currently protected to a low erosion security standard by ongoing erosion management works	



ISSUES – Reach 4: Double Bridges to Te Ore Ore

Double Bridges to Te Ore Ore – Reach 4

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	29	Rathkeale stopbank	Emergency management	Breach scenarios for the stopbank at Rathkeale College will be defined to identify likely overflow routes and the consequences of failure affecting the college and accesses to the college. While a breach or failure of a relocated and upgraded stopbank is unlikely, it is possible that any overdesign event will affect access into the college area during such an event, leaving the college, its pupils and staff more vulnerable	5%	1%	GWRC	Rathkeale College, landowners	High
	32	Rathkeale College	Emergency management	WREMO to develop an emergency management plan with Rathkeale College for large flood events. In a 1% AEP event without further improvement to the flood protection infrastructure, the college's access to external services will be cut off for a short time due to an overland flow path that runs south of the college. The local topography makes it likely that heavy rainfall events in the vicinity of the college could also cut off road access		1%	Community	WREMO	High
	45	Henley Lake water intake	River management	GWRC to work with MDC to maintain security of intake for Henley Lake. The river management activities will be planned so as to not compromise intake functionality			GWRC	MDC	Medium
	46	Te Ore Ore stopbank	River management	Define the level of service required to achieve current standard and maintain to this standard			GWRC	Landowners	Medium
	26, 38, 39, 48, 49	Infrastructure	Emergency management	Inform asset owners of the risks to infrastructure assets in this reach and encourage them to prepare contingency plans to address flood and erosion risks. GWRC and WREMO to provide advice and support if requested		1%	Asset owners	WREMO	Medium
	37	Private water intakes		River management envelopes will contribute to the security of private water intakes. These intakes will have a low risk of damage up to a 20% AEP flood event (damage to structures is more likely in up to a 5% AEP event)		20%	Landowners	GWRC	Low
		Percy Reserve	Planning and policy	Policy development to address freedom camping in the reserve			MDC	Community	Medium
		Double Bridges	Environmental enhancement	Establish a care group and work with local groups to formalise this area as a recreation location. Improve the awareness of safety around water in the area's vicinity. Raise awareness of the river's cultural significance in the vicinity of Double Bridges			Community	GWRC	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
29	Rathkeale A	Protects school and surrounding area from flooding up to around a 5% AEP event	450	0	2	High	School/Private multiple	5%		Continue existing asset management	Low
29	Rathkeale B	Protects school and surrounding area from flooding up to around a 5% AEP event	900	900	4	High	School/Private multiple	5%	Directly adjacent to river, trees in stopbank	Major Project Response	High
46	Te Ore Ore	Provides some protection to Te Ore Ore Road and local land up to around a 10% AEP event	450	0	3	Low	Multiple private/public road	10%	Low-quality, rutted and uneven crest	Continue existing asset management	Low


SH2
3
4
26 Infrastructure
Double Bridges
Rathkeale stopbank 29
Rathkeale College stopbank Major Project Response (see page 70)
Rathkeale College 32
Private water intakes 37
Infrastructure 38
SH2
39 Infrastructure
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
45 Henley Lake water intake
Percy Reserve
4
5
49
46 Te Ore Ore stopbank
48 Infrastructure
Infrastructure
MASTERTON
0
2.2
km
N

Major Project Response: Rathkeale College stopbank

The issue

Rathkeale College is a boys' secondary school located approximately 5km north of Masterton, on an inside bend of the Ruamāhanga River. The reach is extremely narrow, which has caused significant erosion of the banks on both sides of the river.

There is infrastructure in the erosion hazard zone and the associated vegetative buffers on both banks: a pivot irrigator has been installed on the farmland on the north bank; and the boundary of the Rathkeale school grounds is protected by a stopbank. However, the stopbank is of poor quality, with mature trees growing too close to the bank on the river side, and the buffer between the stopbank and the river is very narrow and has been under consistent erosion pressure. Stopgap erosion protection measures have included debris fences, and rock groynes have been used to protect the stopbank.

The erosion pressure through this reach is expected to remain, so it is important to have a long-term solution that removes the existing infrastructure from the buffer.

The current vegetative buffer through this reach is significantly narrower than that upstream and downstream. This is not ideal, as post-erosion bank reinstatement requires significant work and expenditure. The preferred approach is to plant the full width of the existing buffer and potentially widen the buffer through the reach.

Relationship with common methods

The options for this reach (outlined below) are consistent with the use of two common methods: 'river edge envelopes' and 'riparian planting of buffers'.

Description

General

GWRC staff and Te Kāuru Upper Ruamāhanga Floodplain Management Plan Subcommittee (FMP Subcommittee) members have discussed options for this reach with the adjacent landowners. They include:

- Fully planting the existing (narrow) vegetative buffer
- Fully planting a widened vegetative buffer
- Retreating the Rathkeale stopbank further back from the river edge
- Increasing the river channel width
- Realigning the river channel
- Removing trees in the current inner management line

Implications

All these options involve adjacent landowners losing some productive land. Construction work on widening or realigning the river will affect its ecology.

Priority

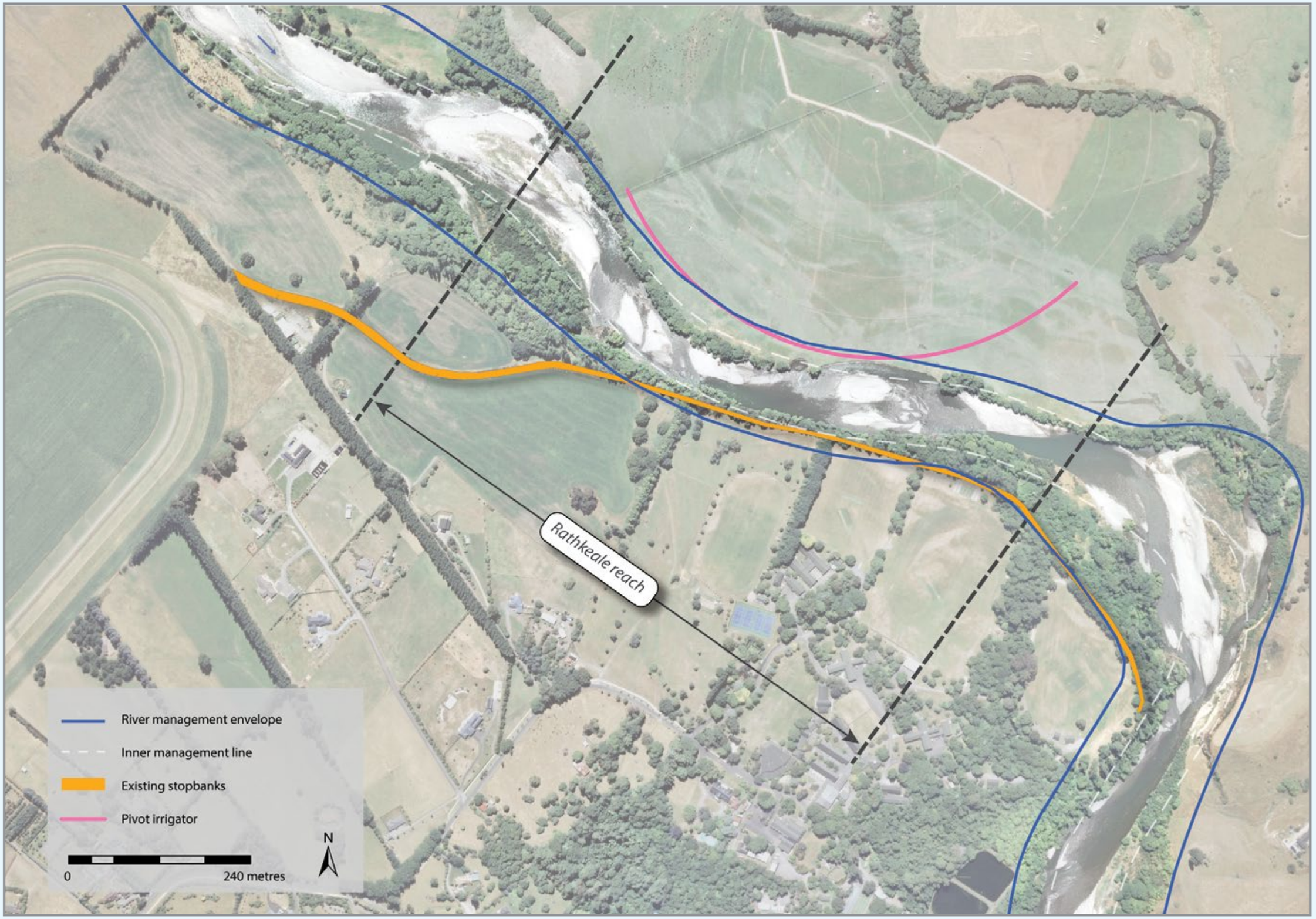
Medium. There has been recent erosion on both banks through this reach, including damage to the Rathkeale stopbank (see photo), although this has since been reinstated.

Level of Service

A 1% AEP (with climate change) level of service, to be confirmed with Rathkeale College and local landowners.

Ruamāhanga River at Rathkeale College

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
28 and 29	TBC	Low	Erosion by the river, overtopping of stopbank	1% AEP, including climate change	To increase flooding protection to Rathkeale College and reduce erosion risk to stopbank and Rathkeale College	GWRC/Rathkeale	Medium	$TBC	Capital funding TBC



Rathkeale College stopbank

Te Ore Ore to Waingawa – Reach 5

Character

This reach extends from Te Ore Ore Bridge to the south of Masterton through the Wairarapa Plains. Its western banks include features of urbanisation, including public access adjoining Henley Lake, the Masterton cleanfill station and the earthworks and ponds associated with the Homebush Wastewater Treatment Plant. Below the confluence with the Waipoua River the river channel tends to be managed as a single thread enclosed by willow and poplar belts along its margins. There is limited public access here.

Key characteristics

- Channelised bed through a gravel corridor
- Increasing urbanising influences along the western margins
- Poplar and willow bank planting

Values

Modified banks, including stopbanks, are common along this reach, and willow and poplar tree belts feature often. These landscape modifications mean it has low/medium scenic values.

Being close to Masterton, the reach offers a variety of recreational opportunities, including:

- A well used recreation area at Henley Lake Park that includes recognised fishing areas for rainbow trout and perch. Fishing increases in popularity to the north of this reach, which is closer to Masterton's outskirts
- Kayaking, with the flat water easily accessible for beginners
- Swimming sites throughout, particularly at the northern end of the reach close to Masterton. Swimming sites upstream of the Homebush Wastewater Treatment Plant also have cultural and recreational values

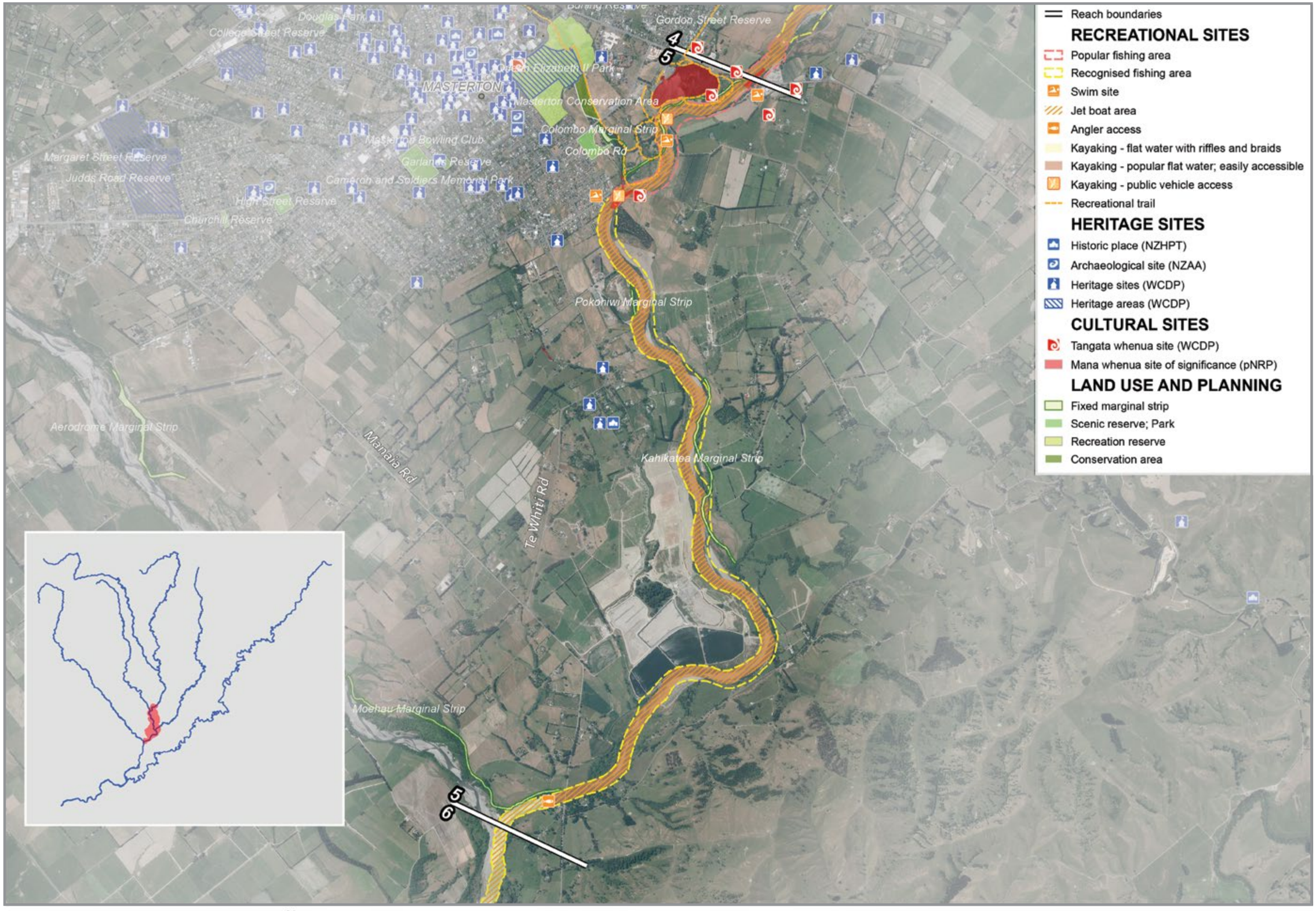
The terrestrial habitats of ecological value include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

There are numerous cultural sites throughout the reach, including marae, historic pā and house sites, urupā, baptism sites, mixing of mauri, a taniwha lair and associations with mahinga kai.

Key floodplain management points

- River maintenance activities will involve more works to maintain stopbank conditions, and river enhancement opportunities will be explored and supported. There is an opportunity for the community to decide to raise the reach's level of service and install more erosion protection structures in currently unprotected areas. This option would increase the annual maintenance costs.
- More buffers will be installed where possible, but this FMP acknowledges the importance of maintaining existing rock protection works and continuing to use new rock to protect key community infrastructure and assets.
- Recognise the importance of the confluence of the Waipoua and Ruamāhanga Rivers.
- Work with MDC to protect the Homebush Wastewater Treatment Plant from the impacts of flooding and erosion.
- Work with MDC to protect Henley Lake Park and recreation area from the negative effects of flooding and erosion.
- Work with MDC to protect and ensure the continued operation of Wardells Bridge.
- Work with MDC to protect the Masterton landfill and the environment from any damage that may be a risk as a result of flooding and erosion.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
High	Low/Medium	Angler access, kayak access, jet boat access, fishing, kayaking, jet boating, swimming	-	Tangata whenua sites (WCDP), mana whenua sites of significance (pNRP) – historic pā sites, historic house sites, historic baptisms sites, marae sites, urupā, taniwha lair, mahinga kai, mixing of mauri, water spirit and guardian, swimming place, wāhi kauhoe, puna rongoā; source of weaving material, puna raranga; outrigger canoe, waka ama	Rural (Primary Production), Rural (Special), Road, River, Residential, Flood Protection and Mitigation, Sewage Treatment and Disposal, Waste Management, Cemetery	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

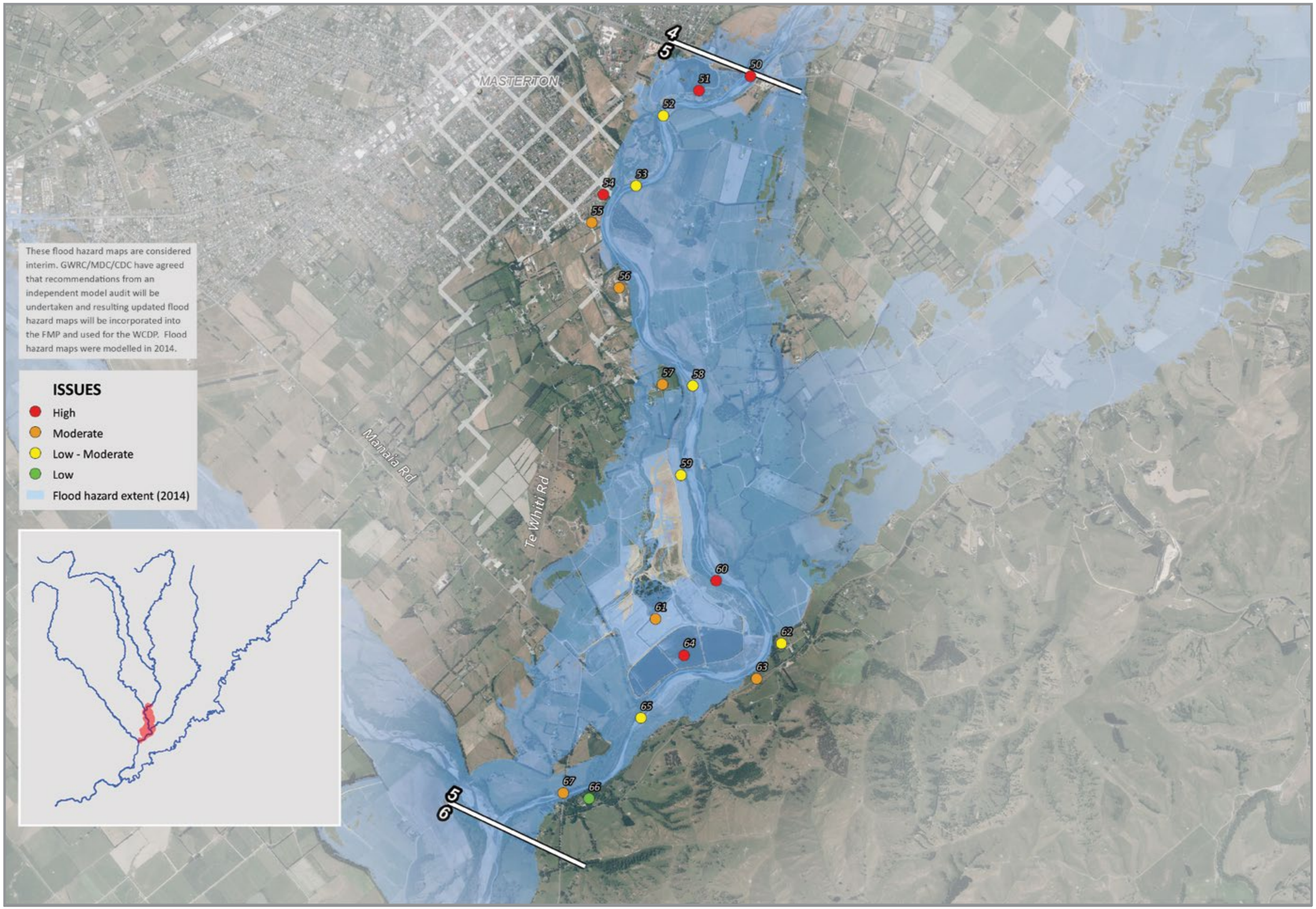

Reach boundaries
RECREATIONAL SITES
Popular fishing area
Recognised fishing area
Swim site
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - popular flat water; easily accessible
Kayaking - public vehicle access
Recreational trail
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
Heritage areas (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
Scenic reserve; Park
Recreation reserve
Conservation area
Douglas Park
College Street Reserve
Gordon Street Reserve
Queen Elizabeth II Park
MASTERTON
Masterton Conservation Area
Colombo Marginal Strip
Masterton Bowling Club
Colombo Rd
Margaret Street Reserve
Judds Road Reserve
Garlands Reserve
Cameron and Soldiers Memorial Park
High Street Reserve
Churchill Reserve
Pokoniwi Marginal Strip
Aerodrome Marginal Strip
Manaia Rd
Te Whiti Rd
Kahikatea Marginal Strip
Moehau Marginal Strip
4
5
5
6
0
1.6
km
N

Te Ore Ore to Waingawa – Reach 5

Flood and erosion issues

A total of 18 flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Houses [66]** Three houses sit in the erosion study area; however, the area has no history of erosion and the high bank with cemented deposits acts to reduce risk to the location. There are currently no managed issues	
LOW TO MODERATE	**Distribution lines [52]** Distribution lines cross the river from Henley Lake Park, where pylons on both banks sit in the erosion study area. However, these are set back from the bank edges so are considered at lower risk. This issue is not currently managed **Narrow channel at confluence [53]** The river becomes very narrow immediately upstream of the confluence with the Waipoua River. Frequent flooding across the true left bank affects a number of paddocks, but also has a beneficial effect of reducing erosion pressures at River Road **Stopbank [59]** The section of the stopbank downstream of the landfill has an unknown level of service. This stopbank is part of the protection for the Homebush Wastewater Treatment Plant	**House [62]** A single dwelling on Lees Pakaraka Road sits in the erosion study area but is outside the 1% AEP flood extent. It is currently protected by rock erosion protection **Channel alignment [65]** The channel alignment continues to push outside its design alignment. Ongoing rock groyne protection has been required to maintain the designed alignment **Channel alignment [58]** Historically the channel has been wider at this location. The design channel alignment through this reach is very narrow. This could have upstream and downstream effects
MODERATE	**Riverside Cemetery [55]** The cemetery sits in the erosion study area. It has historically suffered erosion, and light rock protection is in place to manage some of the effects **Closed landfill site [56]** The closed landfill site has suffered from ongoing erosion. It is currently protected by a combination of rock groynes and willow buffers. Of concern is the possible erosion of contaminated material **Stopbank [57]** The standard of this stopbank varies, with protection levels of 5%-10% AEP. It is of very poor quality and infested with trees. A number of downstream properties benefit from the protection it provides, including the Homebush Wastewater Treatment Plant	**Homebush Wastewater Treatment Plant [61]** The Homebush Wastewater Treatment Plant is in the erosion study area and the 1% AEP flood extent. While the plant has some stopbanks with a 1% AEP protection level, these are not continuous upstream, and flooding is modelled to outflank these structures **Lees Pakaraka Road [63]** Lees Pakaraka Road sits in the erosion study area and on the edge of the 1% AEP flood extent. It is currently protected by rock erosion protection **Wardells Bridge [67]** The bridge abutments sit in the erosion study area. The bed in the vicinity of the bridge has long been stable, with a low risk of erosion and scour. This issue is not currently managed
HIGH	**Te Ore Ore Bridge weirs [50]** The Te Ore Ore weirs were installed to protect the bridges crossing the river upstream. They have suffered damage in past floods and for a time were deemed hazardous to river users. Work on the weirs has helped to make them less hazardous and less visually obtrusive, but sections remain in place, acting like groynes **Henley Lake [51]** The banks next to Henley Lake Park are continually under erosion pressure. Work is underway to establish vegetative buffers and retreat the existing bank edge to reduce the erosive impacts. A significant area of the park is in the design channel. The narrow river width creates additional erosion pressure	**River Road properties [54]** There are 14 River Road properties in the erosion study area. In the 1998 floods, a dangerous erosion hazard was observed and some parts of these properties eroded into the river. The erosion is currently managed by a series of heavy rock groynes, which require ongoing maintenance and management **Homebush Wastewater Treatment Plant irrigation beds [60]** The irrigation beds for the Homebush Wastewater Treatment Plant are in the erosion study area and the river's erosion management buffer areas. They are vulnerable to an AEP flood event greater than 50% **Homebush Wastewater Treatment Plant discharge point [64]** The Homebush Wastewater Treatment Plant discharge point sits in the erosion study area



ISSUES – Reach 5: Te Ore Ore to Waingawa

Te Ore Ore to Waingawa – Reach 5

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	51	Henley Lake	River management	Narrow design lines will be reconsidered during the design line update process. Until then the narrow channel will be maintained as usual	20%	5%	GWRC	MDC	Medium
	50	Te Ore Ore Bridge weirs	River management	Remove remains of rail-iron and concrete-block weirs			GWRC	MDC	Medium
	55, 56	River Road Cemetery and Masterton landfill	River management	Before the River Road Major Project Response implementation (page 78), continue to maintain the rock groynes established to provide erosion protection			GWRC	MDC	High
	61	Homebush Wastewater Treatment Plant	Planning and policy	Refer to the Homebush Wastewater Treatment Plant Major Project Response (page 80)			MDC	GWRC	Medium
	63	Lees Pakaraka Rd	River management	Continue to maintain protection in conjunction with MDC	5%	5%	MDC	GWRC	Medium
	67	Wardells Bridge	River management	Continue to monitor bed levels and erosion risk to abutments, supported by the river envelopes common method		1%	MDC	GWRC	Medium
	52, 56, 61, 63, 67	Infrastructure	Emergency management	Inform asset owners of risks to infrastructure assets in this reach and encourage them to prepare contingency plans to address flood and erosion risks. GWRC and WREMO to provide advice and support if requested		>1%	Asset owners	WREMO	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
57	Upstream Water Treatment Plant (old)	Provides a low level of protection to properties in immediate vicinity	820	150	4	Low	Multiple private/public road	10%	Trees in stopbank, crest-level discontinuity with Homebush Wastewater Treatment Plant (new) stopbank	Stopbank is low criticality and does not significantly affect flood risk to Homebush Wastewater Treatment Plant	Low
61	Homebush Wastewater Treatment Plant (new)	Provides protection to the Homebush Wastewater Treatment Plant	1,900	0	2	High	MDC Wastewater Treatment Plant	1%	This is not a GWRC asset and should be removed from the asset register	MDC asset – remove from GWRC asset register	Low


MASTERTON
4
5
Henley Lake 51
50 Te Ore Ore Bridge Weirs
52 Infrastructure
River Road Major Project Response (see page 78)
River Road Cemetery 55
Masterton landfill infrastructure 56
Upstream Water Treatment Plant (Old) 57
Manaia Rd
Te Whiti Rd
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
Homebush Waste Water Treatment Plant Major Project Response (see page 80)
Waste Water Treatment Plant; Infrastructure 61
63 Lees Pakaraka Rd; Infrastructure
67 Wardells Bridge; Infrastructure
5
6
0
1.6
km
N

Major Project Response: River Road

The issue

A number of residential properties on River Road are in an erosion hazard area, and of these four are close to the current river bank. Active erosion has been observed in recent years, and during the 1998 flood some parts of these properties were eroded into the river.

While rock groynes have been built at the bank's toe for a long time, they are not specifically designed to withstand large flood events and do not provide a high level of security. The Masterton cemetery and the landfill are immediately downstream of the residential properties on River Road; they are protected by a large number of rock groynes (19) and a reasonably well-established willow buffer.

Opportunities

The opportunity to widen and deepen the overland overflow path on the left berm of the Ruamāhanga floodplain was investigated for its ability to take a greater amount of flow and become operational in smaller (50% AEP) flood events. The area is a natural overflow path based on the existing topography and observations from past floods, and cadastral plans show that historically the main channel flowed through it. However, the option offered little reductions in velocity and erosion potential.

An alternative is to widen the channel by approximately 30m and realign the current main river channel through this reach to make room for rock groynes and a planted buffer on the right bank immediately downstream of the Waipoua confluence. As well as protecting the residential properties on River Road, this would reduce the pressure on the existing rock groynes that are protecting the cemetery and landfill.

Relationship with common methods

Making room for the river is consistent with the river management responses described in the common methods, and will improve the planted buffers and rock groynes. The main channel is currently up to 10m inside the inner management line on the left bank.

Description

General

The current erosion risks at River Road, as well as the cemetery and landfill area immediately downstream, will be reduced by widening/realigning the main channel away from the current right bank by approximately 30m, and building rock groynes and planted buffers. The channel widening will need to extend for about 600m to fit with the reach's existing structures, and easements may be required to enable groynes to be built on the River Road properties.

The work will involve excavating about 40,000m³ of material, of which about half is expected to be used to realign the reach's upper end. The remaining material will be removed from the site through gravel-extraction permits.

When the channel widening is complete, a series of rock groynes (about six) could be constructed for around 150m from the confluence of the Waipoua/Ruamāhanga Rivers. Willow buffers would be planted between the groynes to improve the overall protection level.

Costs

600m of channel-widening/gravel-extraction work on the left bank of the Ruamāhanga River directly downstream of the Waipoua confluence will cost up to $60,000. This will cover bed/beach re-contouring of 20,000m³ in addition to 20,000m³ of gravel extraction assumed to be through the permit system and extracted at no cost.

Rock groyne construction will cost up to $575,000, based on each groyne being approximately 250 tonnes and including preliminary and general works and a contingency of 30% (savings are possible through reusing existing rock, if appropriate). This will include channel-widening/gravel-extraction work on the left bank of the Ruamāhanga River, bed/beach re-contouring, and strip vegetation.

Implications

The new rock groynes will be larger than the existing groynes and will need to be sufficiently keyed into the river bank to maximise their structural integrity. This will require accessing and using private land associated with the adjacent River Road properties.

To ensure the protection of and future maintenance access to these structures, easements through the affected properties will be required. Other legal requirements may apply to Crown-owned land affected by the enlargement on the left bank. This could involve confirming the accretion claim status and formalising a river works easement, and discontinuing the use of this land by the eastern river bank land owners for primary production. Affected property owners were consulted on this in late 2017.

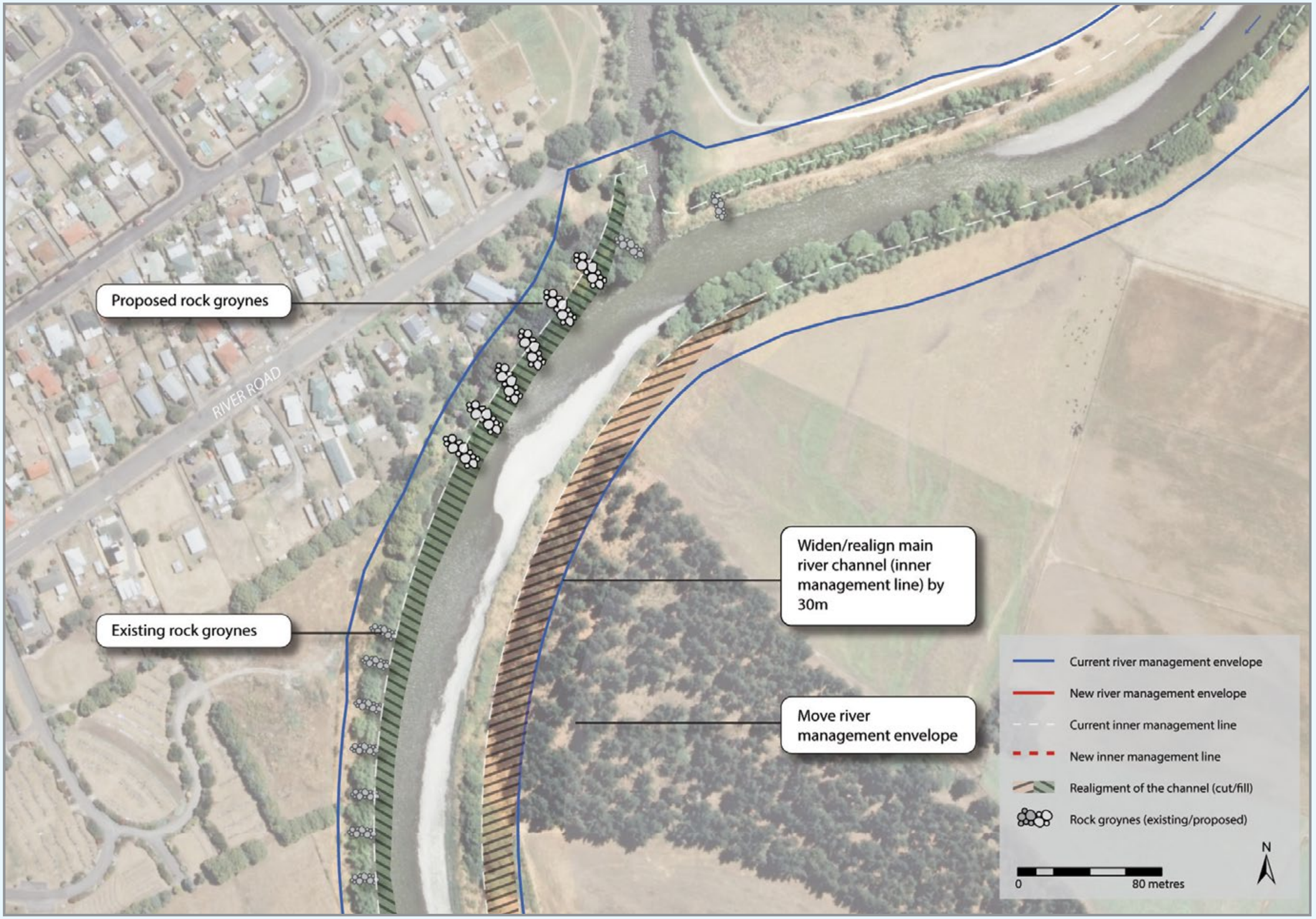
Priority

This response is classified as high importance and high priority.

Level of service

A 1% AEP level of service is proposed.

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
54	Increase bank protection to river edge at River Road and widen river channel	<5% AEP	Erosion by the river	1% AEP	To increase protection to River Road, Masterton	GWRC	High	$575,000	Capital funding TBC
53	Easements and other legal costs as required.	N/A	Erosion by the river	N/A	To allow construction/maintenance of groynes and widening of river	GWRC/MDC	High	$50,000	Capital funding TBC


Proposed rock groynes
RIVER ROAD
Existing rock groynes
Widen/realign main river channel (inner management line) by 30m
Move river management envelope
Current river management envelope
New river management envelope
Current inner management line
New inner management line
Realigment of the channel (cut/fill)
Rock groynes (existing/proposed)
0
80 metres
N

River Road

Major Project Response: Homebush Wastewater Treatment Plant

The issue

The most recent hydraulic modelling of the Upper Ruamāhanga and Waipoua Rivers (August 2014) indicates that in a 1% AEP flood event (with climate change to 2090) the stopbank adjacent to the Homebush Wastewater Treatment Plant would overtop and inundate the headworks facility (Issue ID 61). However, the base topographic data used for this model (2013 LiDAR and stopbank crest survey) was gathered before the construction of a new stopbank was completed.

The hydraulic model is being updated with the as-built survey of the new stopbank and incorporates a thorough review of the Waipoua design hydrology. Once this is complete, the flood hazard to the headworks facility will be reviewed and the need for any additional works to improve the facility's resilience considered. Based on the information currently available, it is considered prudent to allow a provisional sum for possible flood mitigation works at the headworks facility.

It is also worth noting that the newly constructed pond embankments are approximately 0.5m higher than the stopbanks so it is unlikely that the ponds would be overtopped during a large (over 1% AEP) flood event.

The current hydraulic modelling also shows that the older (lower) section of the stopbank downstream of the landfill (Issue ID 56) would overtop in a 1% AEP flood event, but the overflow would track to the west of the treatment plant in the Makoura Stream. Other issues in this reach relating to the erosion hazard to the plant's irrigation beds (Issue ID 60) and the discharge point (Issue ID 64) can be managed with common methods.

The newly upgraded stopbank is constructed on MDC land for the specific purpose of protecting an MDC asset, but it is currently recognised as a GWRC asset. The future maintenance and funding responsibilities for this asset are under discussion.

Opportunities

The updated modelling results will provide a more accurate assessment of the risks to the Homebush Wastewater Treatment Plant headworks. However, the stopbank could still overtop in an event larger than the 1% AEP flood or fail during an event smaller than the 1% AEP flood due to piping or external erosion. These residual risks could also be considered when assessing options to increase the resilience of the plant's headworks.

It would be possible to integrate the Three Rivers Trail and access to the Ruamāhanga River in this area, but health and safety and security issues around the treatment plant ponds and headworks would need to be considered carefully.

Relationship with common methods

The other issues highlighted in this reach (Issue IDs 59, 60 and 64) can be managed with common methods.

Description

General

A provisional sum of $50,000 (subject to updated hydraulic modelling) has been allowed for increasing the headworks facility's resilience. This could include an elevated plinth for the generator and raising electrical devices above flood levels.

Implications

An inundation of the Homebush Wastewater Treatment Plant headworks could result in damage to electrical equipment and the screens being overwhelmed, which would cause untreated wastewater to be discharged to the river.

Priority

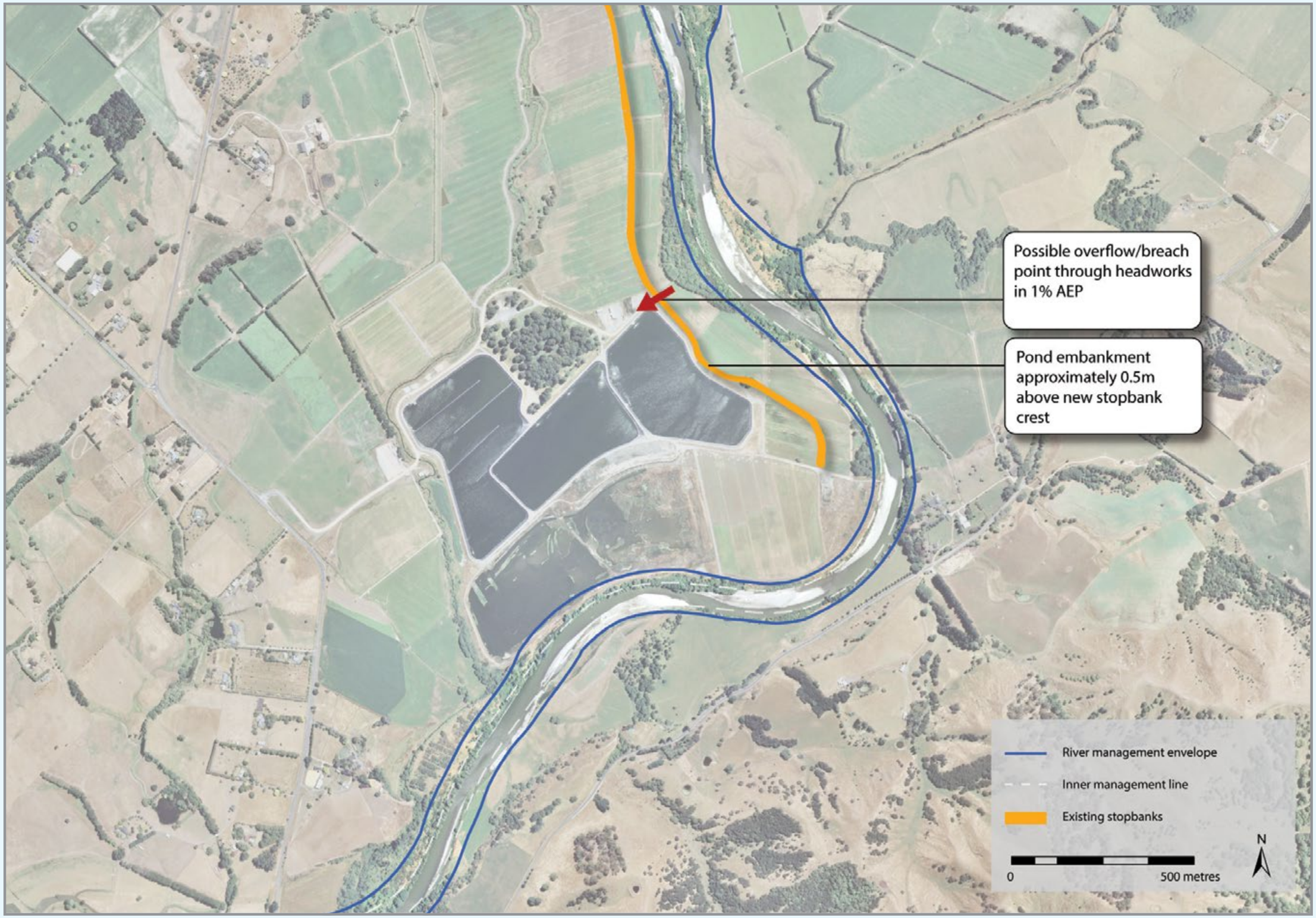
To be reviewed following an assessment of modelling.

Level of service

A 1% AEP level of service is required in Homebush Wastewater Treatment Plant resource consent.

Homebush Wasterwater Treatment Plant – Headworks Facility

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
61	Resilience works in headworks facility (plinth for generation, raising electrical works)	TBC	Stopbank overtopping	1% AEP	To increase the resilience of Homebush Wastewater Treatment Plant headworks in case of stopbank overtopping	MDC	TBC	$50,000	Capital funding TBC
59, 60 and 64	Common methods								



Homebush Wastewater Treatment Plant

Waingawa to Gladstone – Reach 6

Character

Downstream of the confluence with the Waingawa River, the Ruamāhanga River corridor widens and continues in a broad, semi-braided form. The northern part of the river skirts the western slopes of Foster's Hill before opening out into the Wairarapa Plains towards the confluence with the Taueru River to the south. There are pockets of remnant native vegetation and willow planting inside stopbanks established along the eastern river margin.

Key characteristics

Increasingly semi-braided form where waters of the Waingawa and Ruamāhanga Rivers combine

Stopbanks enclosing remnant native and willow planting

Values

This reach flows through rural land used for primary production activities and established mainly in pasture grassland. Stopbanks have been built along it, with some enclosing native vegetation along the river margin. As a result the reach has a medium/high modification level while retaining a medium level of scenic value.

Kayaking and fishing are popular along the reach as people take advantage of its pools, riffles and runs. Jet boating is also a feature, as the reach is valued for its semi-braided form that changes course often and offers opportunities to 'read' different courses of navigation. There are also several swimming sites and areas associated with jet boat access at Gladstone Bridge.

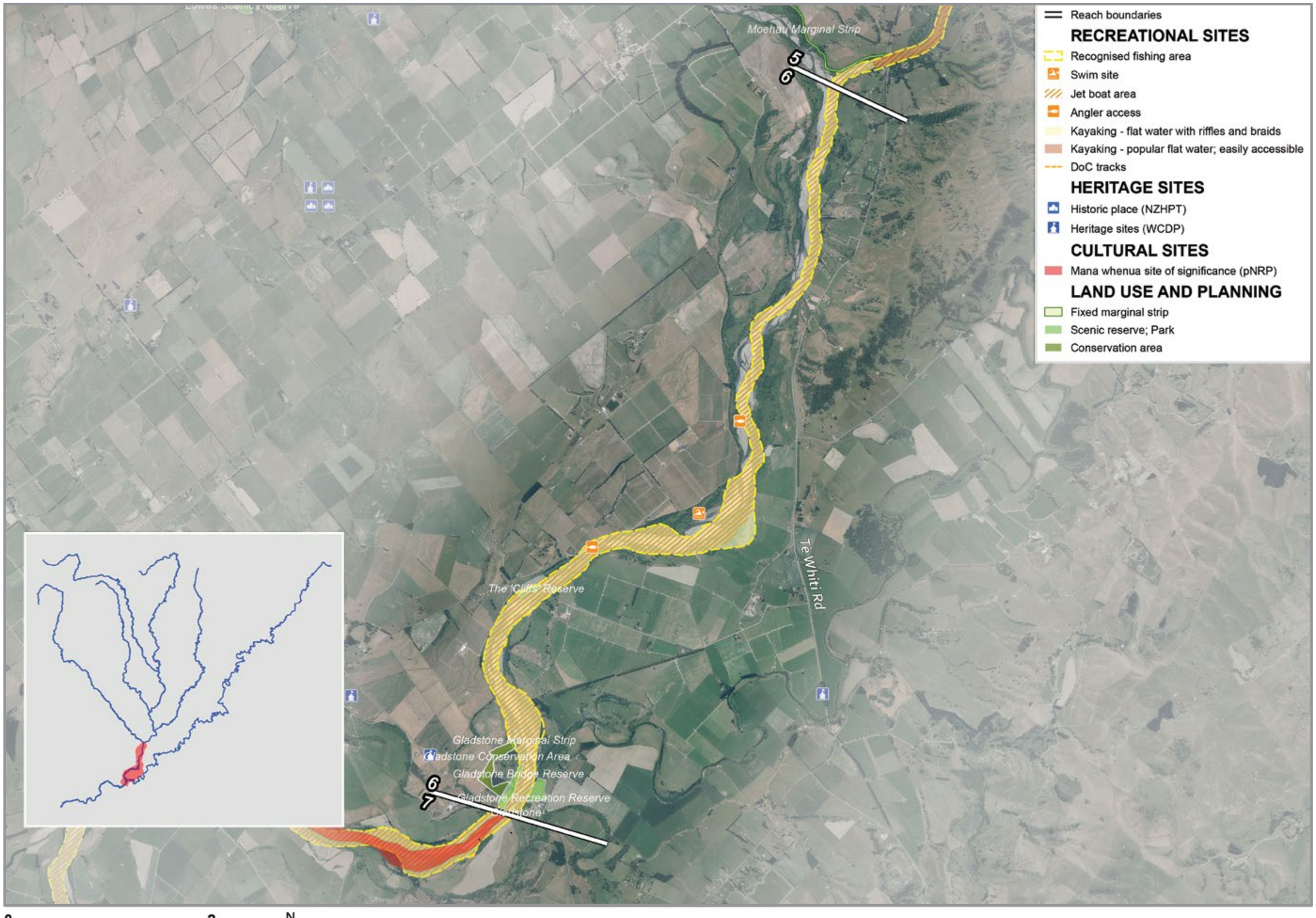
Important ecological values along this reach relate to an indigenous forest remnant on the Martinborough Masterton Road (the Ruamāhanga River terrace RAP), together with terrestrial habitats that include areas of unfenced indigenous forest, mixed exotic-indigenous forest and indigenous treeland. The reach also provides important habitat for banded dotterels, black-fronted dotterels and pied stilts in association with broad stonefield and boulderfield river margins.

The several cultural sites along the reach include wāhi tapu associated with the mixing of waters from different rivers, a historic house site and a historic spring. Gladstone Inn to the east of Gladstone Bridge is a heritage site identified in the WCDP.

Key floodplain management points

- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- The FMP will address the issues associated with river scheme stopbanks and increase river enhancement works.
- Protect the Ruamāhanga River terrace RAP site from the negative impacts of flooding and erosion.
- Recognise the importance of the confluence of the Taueru and Ruamāhanga Rivers and the Waingawa confluence.
- Work with the owner of Gladstone Bridge to protect and maintain its operation.
- Work with CDC to continue the managing the erosion risk to Dakins Road.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium/High	Medium	Angler access, kayak access, jet boat access, fishing, jet boating, swimming	Gladstone Inn (WCDP)	Washing after child birth, historic spring, historic baptism site, historic house site, mixing of mauri	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation	Ruamāhanga River terrace (RAP), unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds



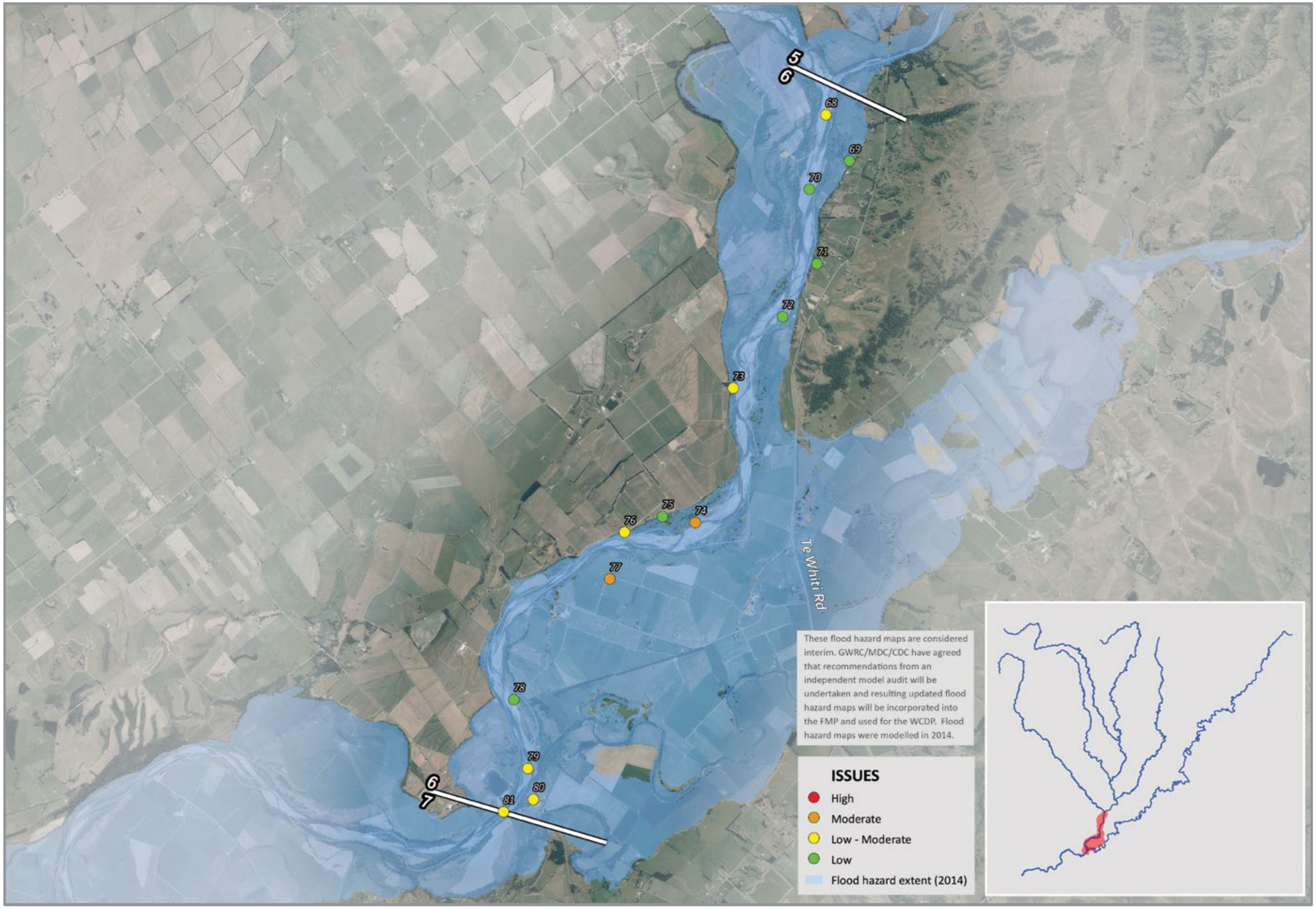
VALUES – Reach 6: Waingawa to Gladstone

Waingawa to Gladstone – Reach 6

Flood and erosion issues

A total of 14 flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Ruamāhanga River terrace RAP site [69]** The RAP site sits in the erosion study area and on the edge of the 1% AEP flood extent	**Channel alignment [78]** The buffer widths upstream of the confluence with the Taueru River are too narrow, leading to ongoing management concerns
	Channel alignment [70] The channel through the area is naturally wider than the design channel alignment	**Fish habitat [75]** A number of small springs or backwaters in the area are known to have provided fish habitat for long time. They are affected by erosive forces but are currently well protected in a buffer
	Houses [71] Several houses are located in the erosion study area. However, they sit on a relatively firm terrace that is resistant to erosion effects	
	Channel alignment [72] The channel tends towards being wider than the design channel. This creates challenging management issues, and puts pressures on the buffers on both banks of the river	
LOW TO MODERATE	**Waingawa and Ruamāhanga confluence [68]** Unstable flows caused by the meeting and mixing of the Waingawa and Ruamāhanga Rivers makes the confluence area a challenging location to manage. Gravel deposition also needs management	**Fish passage [79]** The confluence area of the Ruamāhanga and Taueru Rivers is important for fish passage which is prone to disruption by natural and artificial sediment/gravel movements
	Frost protection water intake [73] The water intake is threatened by ongoing erosion effects. The landowner has provided some of their own erosion protection to protect the structure	**Gladstone complex [80]** The Gladstone complex includes a pub, several houses and a sports field. It sits in the erosion study area and the 1% AEP flood extent and has a known history of flooding. There is no known history of erosion in the area
	Dakins Road [76] Erosion affecting the end section of Dakins Road, near Cottier Estate has been addressed in the past with rock works. These have protected the immediate area that they were installed to protect, but adjacent areas are still affected by erosion	**Gladstone Bridge [81]** There are no currently known issues with this bridge. There is an exclusion zone for gravel extraction 100m upstream and downstream. The bridge design is not believed to be particularly vulnerable to debris flows, and it has adequate freeboard to its soffit
MODERATE	**River alignment [74]** The channel needs ongoing and frequent management. Without it the river spills extra water onto the Te Whiti flats, increasing the risk of the Te Whiti stopbank overtopping	**Te Whiti stopbank [77]** The stopbank sits in the erosion study area and in some sections of the buffer. There is a risk of erosion reducing the stopbank's effectiveness. It was reported that the stopbank overtopped in a 20% AEP event in 2009/10
HIGH		



ISSUES – Reach 6: Waingawa to Gladstone

Waingawa to Gladstone – Reach 6

Response

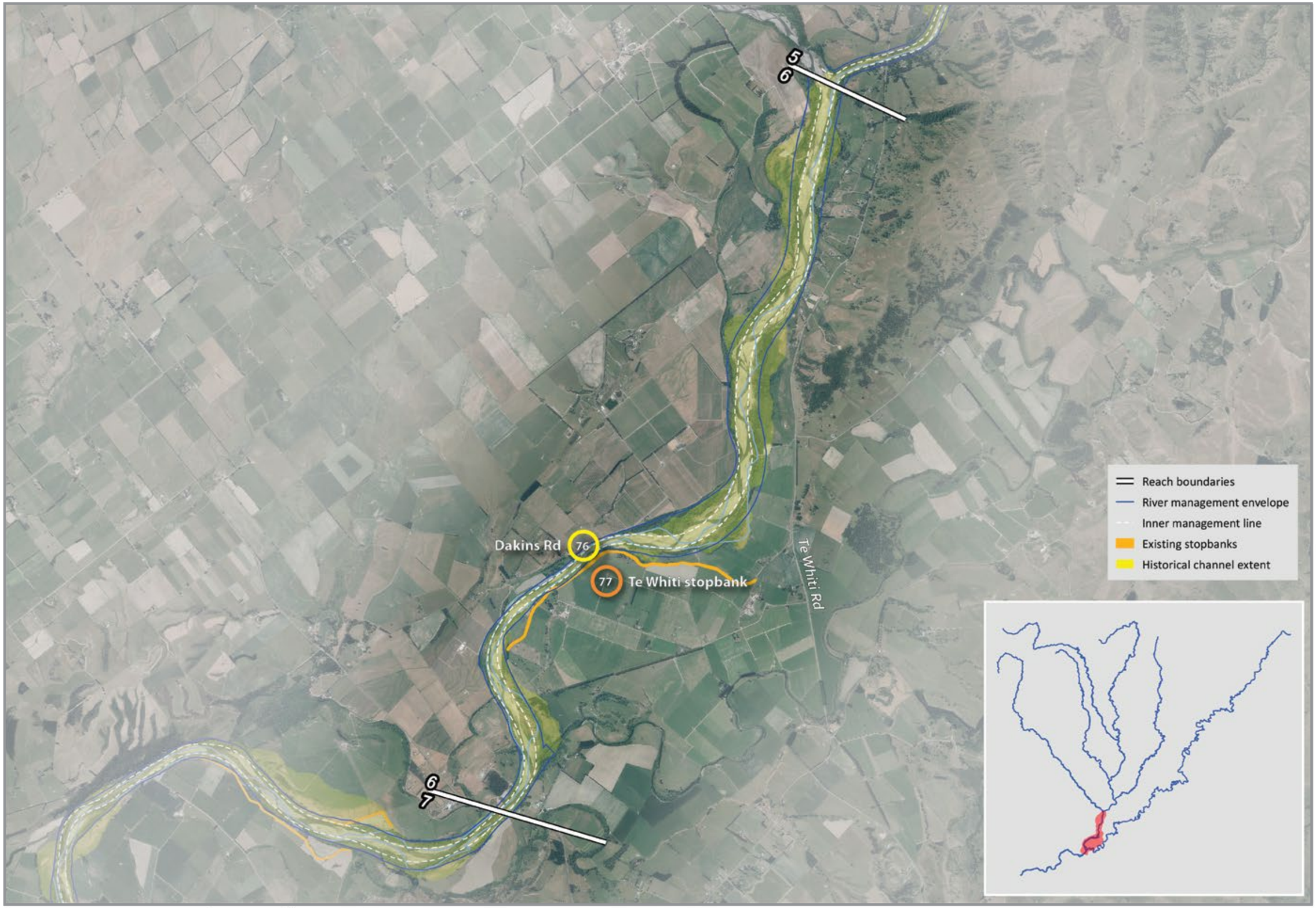
The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	77	Te Whiti stopbank	River management	Realign the Te Whiti stopbank to move it outside the river management envelopes	10%		GWRC		Medium
	76	Dakins Road	Emergency management	Local residents to prepare emergency evacuation plan in event of Dakins Road erosion. Alternative access route (a farm track) to be identified. A policy may be developed to address freedom camping on the site		>1%	CDC	WREMO	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land-use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
77	Te Whiti	Provides a level of flood protection to residential property and agricultural land and public road	3,000	220	3	Medium	Private multiple/public road	20% -5% (varies)		Continue existing asset management policy. When realigning, try to achieve more consistent level of service	Low


5
6
Dakins Rd
76
77
Te Whiti stopbank
Te Whiti Rd
6
7
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
0
2
km
N

Gladstone to Kokotau Bridge – Reach 7

Character

Located to the south of Gladstone Bridge, this reach forms a threaded single channel in a semi-enclosed farmed valley, which extends between Tiffen Hill and the eastern Wairarapa hills. The Gladstone cliffs provide a prominent backdrop along the eastern banks of the reach before the river swings west towards the base of Tiffen Hill. Willows have been planted along much of the river margin, with pockets of regenerating indigenous vegetation also established along the base of Tiffen Hill.

Key characteristics

- Semi-enclosed valley form to the east of Tiffen Hill
- Proximity between river and Gladstone cliffs
- Mix of willow planting, gorse and broom shrubland and regenerating indigenous forest

Values

This reach flows through rural land used for primary production activities and established mainly in pasture grassland. Some willow planting has been undertaken along the river margins in association with stopbanks north of Tiffen Hill. More natural patterns of regenerating indigenous forest are established near the toe of Tiffen Hill. As a result there is a medium level of landscape modification overall and a medium/high level of scenic value.

Kayaking is popular in this area owing to its flat water pools, riffles and runs – and so is fishing, including for rainbow trout and perch. Jet boating continues along this reach from access points at Gladstone and Kokotau Bridges. Swimming access is available from picnic areas adjoining these road bridges, with recreation access recently formalised at Carter Scenic Reserve.

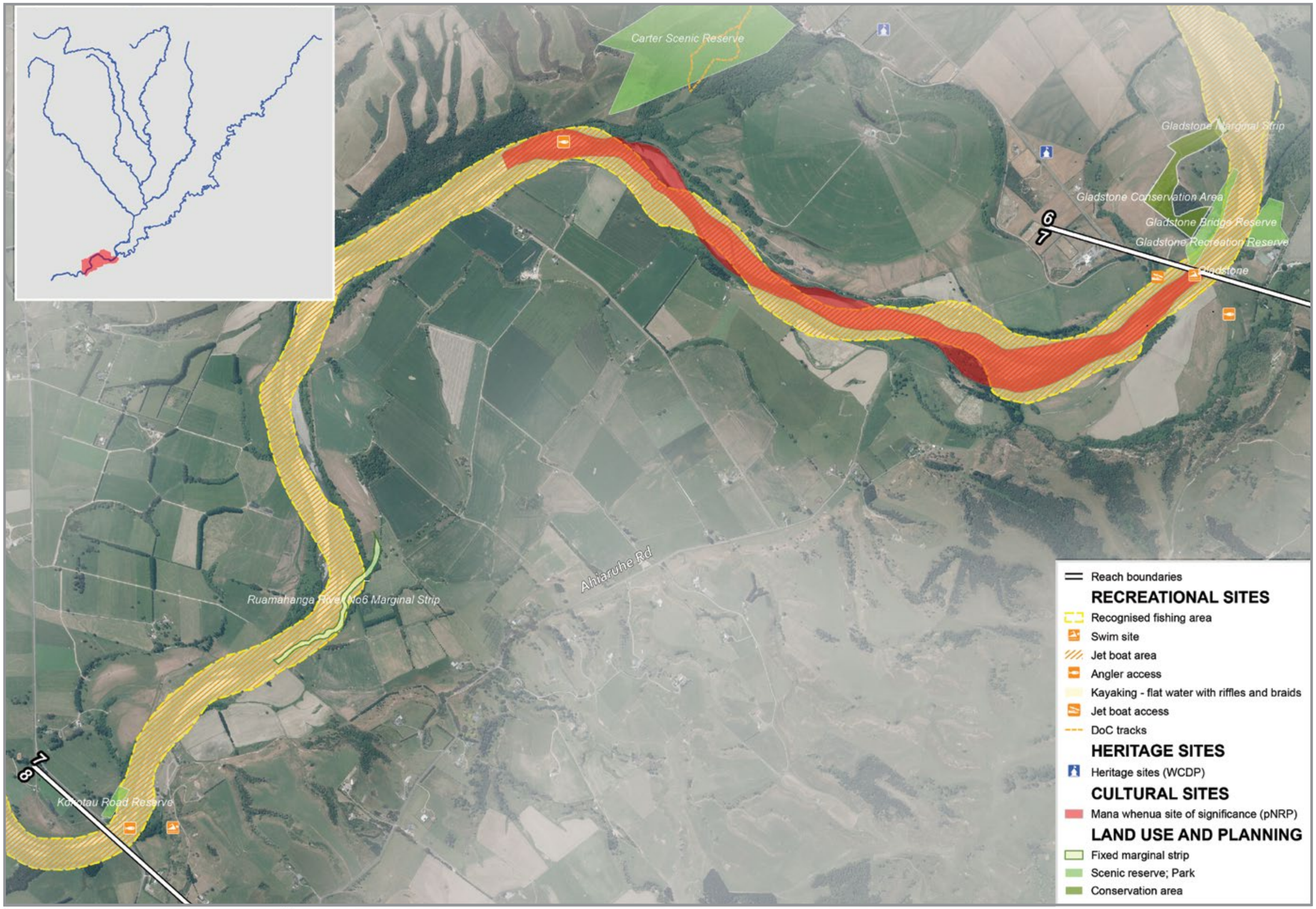
Terrestrial habitats with ecological value include areas of fenced and unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

The several cultural sites along the reach include a marae, an historic pā site, urupā sites, Parakuiti, a taniwha lair and associations with mahinga kai.

Key floodplain management points

- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- The FMP will address the issues associated with river scheme stopbanks and increase river enhancement works.
- Improve the awareness and facilitate the use of access to the Carter Scenic Reserve.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium/High	Angler access, fishing, kayaking, swimming, Gladstone Track (DoC)	-	Mana whenua sites of significance (pNRP) – marae, historic pā site, urupā sites, mahinga kai, significant ancestral place, wāhi tīpuna; water spirit and guardian, taniwha; water utilised for healing, wai ora	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation	Fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

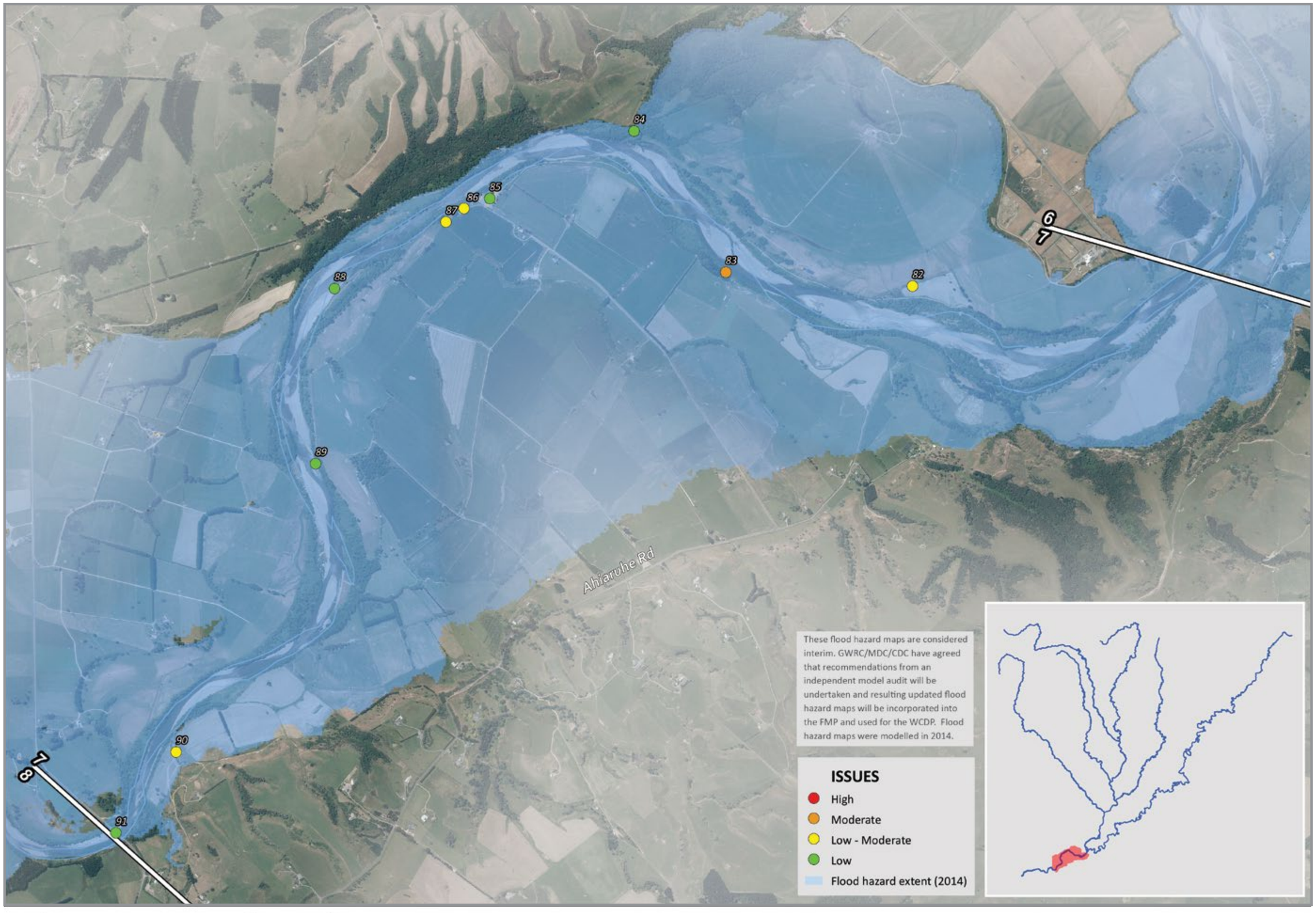

Carter Scenic Reserve
Gladstone Marginal Strip
Gladstone Conservation Area
Gladstone Bridge Reserve
Gladstone Recreation Reserve
Gladstone
6
7
Ahiāruhe Rd
Ruamahanga River No6 Marginal Strip
Kokotau Road Reserve
7
8
Reach boundaries
RECREATIONAL SITES
Recognised fishing area
Swim site
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Jet boat access
DoC tracks
HERITAGE SITES
Heritage sites (WCDP)
CULTURAL SITES
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
Scenic reserve; Park
Conservation area
0
1
km
N

Gladstone to Kokotau Bridge – Reach 7

Flood and erosion issues

A total of 10 flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Carter Scenic Reserve river access [84]** An easement and river access have been created here recently. There is a possibility that lack of use due to poor awareness will lead to issues relating to maintenance of a community facility **Ahiaruhe gravel extraction site [85]** A recognised gravel extraction site that is proposed for use in the future **Kokotau Bridge [91]** The Kokotau Bridge abutments sit in the erosion study area and the 1% AEP flood extent. This issue is not currently managed	**Channel alignment [89]** The channel naturally widens in this area, taking it outside the design channel alignment **Channel alignment [88]** The buffer is very narrow on the river's right bank and very wide on the left. The current channel alignment does not match these alignments
LOW TO MODERATE	**Ruamāhanga stopbank [82]** This stopbank protects farmland. It is of a very poor standard and overgrown with trees, so is highly susceptible to failure **Farm buildings [86]** There are farm utility buildings in the erosion study area and the 1% AEP flood extent. This issue is not currently managed	**Channel alignment [87]** The channel alignment in this area narrows, creating both upstream and downstream erosion effects that are hard to manage effectively **Outbuildings [90]** Outbuildings are located in the erosion study area and 1% AEP flood extent. This issue is not currently managed
MODERATE	**Ahiaruhe stopbank [83]** This stopbank protects farmland against small, frequent flood events. It sits in the erosion study area and is close to the river. It is full of trees and therefore at high risk of failure	
HIGH		



ISSUES – Reach 7: Gladstone to Kokotau Bridge

Gladstone to Kokotau Bridge – Reach 7

Response

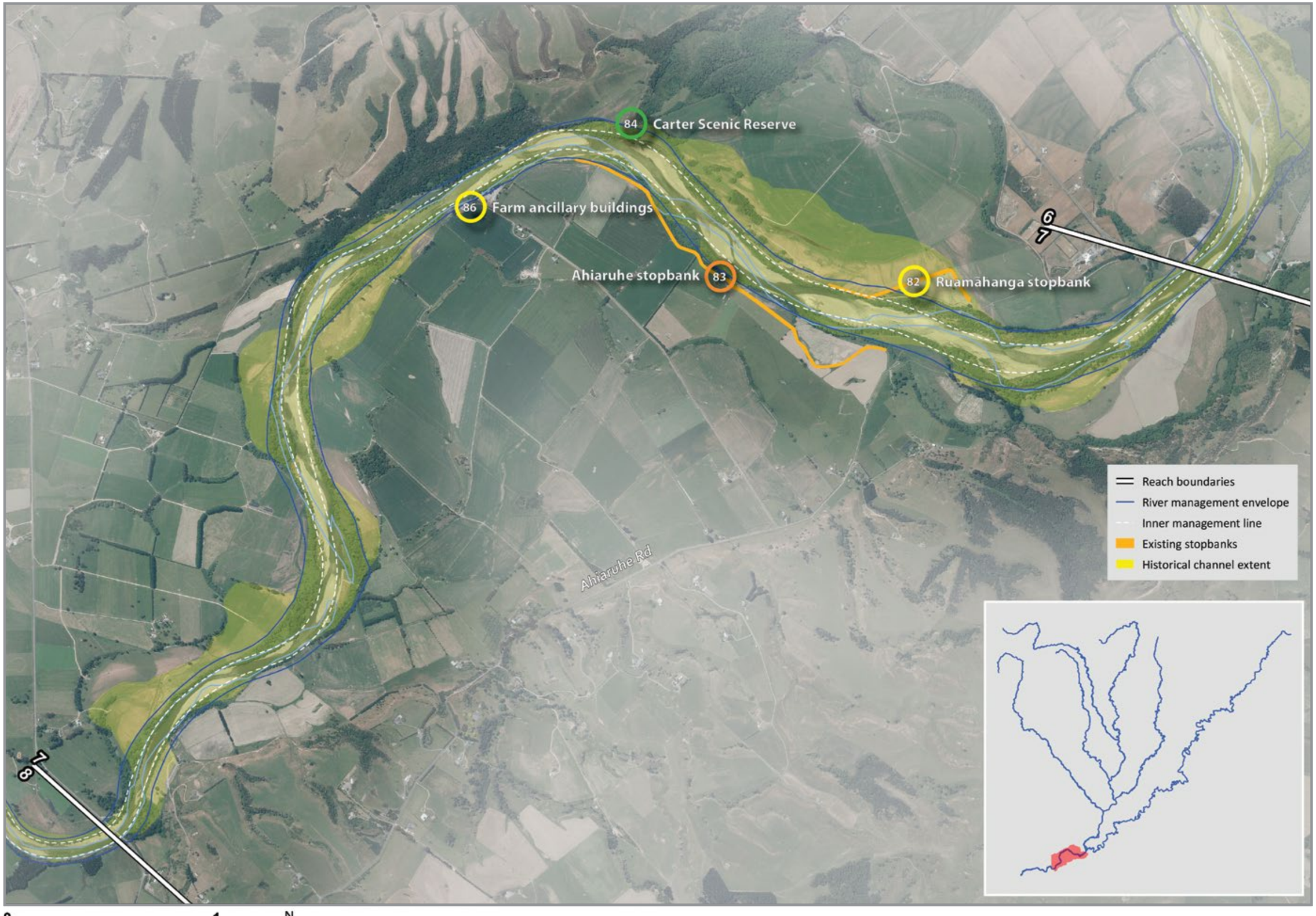
The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	82	Ruamāhanga stopbank	River management	Retire sections of the stopbank that sit in the buffer. Rebuild the retired section of stopbank outside river management envelope			GWRC	Landowners	Low
	83	Ahiaruhe stopbank	River management	Retire sections of the stopbank that sit in the buffer. Rebuild the retired section of stopbank outside river management envelope. Define the service level and criticality	10%		GWRC	Landowners	Low
	84	Carter Scenic Reserve	River management	Continue to support the Carter Scenic Reserve care group. Provide help with maintaining the access track and planting activities, and encourage the use of the area. Use the reserve as a hub from which to expand mixed riparian planting			Community	GWRC	Medium
	86	Farm ancillary buildings	Emergency management	Provide property owners with information on potential flood and erosion risks to these structures. Provide advice and support on request			GWRC	Landowners	Medium
		Ahiaruhe Settlement Road homes	Emergency management	Provide homeowners with information on flood risk. WREMO will contact homeowners, discuss lifelines and flood risk issues and help in developing home evacuation plans		>1%	WREMO	Community	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
83	Ahiaruhe	Provides limited, local protection for relatively small events	2,000	250	Range 2-4	Low	Several agricultural landowners	<10%	Trees in stopbank	Initial FMP implementation: continue existing asset management. Long-term implementation: explore legacy asset partial abandonment/isolated works	Low
82	Ruamāhanga	Provides limited, local protection for relatively small events	800	330	4	Low	Individual landowner	20%-1% (varies)		Initial FMP implementation: continue existing asset management. Long-term implementation: explore legacy asset partial abandonment/isolated works	Low


84 Carter Scenic Reserve
86 Farm ancillary buildings
Ahiaruhe stopbank 83
82 Ruamahanga stopbank
6
7
7
8
Ahiaruhe Rd
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
0
1
km
N

Kokotau Bridge to Waiōhine – Reach 8

Character

Below Kokotau Bridge the Ruamāhanga River re-enters the Wairarapa Plains to the south and flows around the northern toe of Pukengaki. A single-thread channel along a contained gravel corridor continues through this reach. Most of the reach is enclosed by continuous bands of willows established along the river margins, with isolated tōtara in some areas extending into adjoining farmland from the river margins.

Key characteristics

- Single channel along contained gravel corridor in the Wairarapa Plains
- Predominantly willow-lined margins
- Isolated tōtara in some areas

Values

This reach continues through rural land used for primary production activities and established mainly in pasture grassland. Willow and some areas of pine form continuous bands along the river corridor in association with limited stopbanks and rock groynes. Pockets of remnant tōtara extend into adjoining farmland. Overall the river has a medium level of landscape modification and a medium level of scenic value.

Fishing and kayaking are popular in this area, as people take advantage of its flat water with pools, riffles and runs. Other activities include angling for rainbow trout and perch, jet boating (which continues south along the reach from the access point at Kokotau Bridge) and swimming, accessed from picnic areas at Kokotau Road and Forman Jury Road.

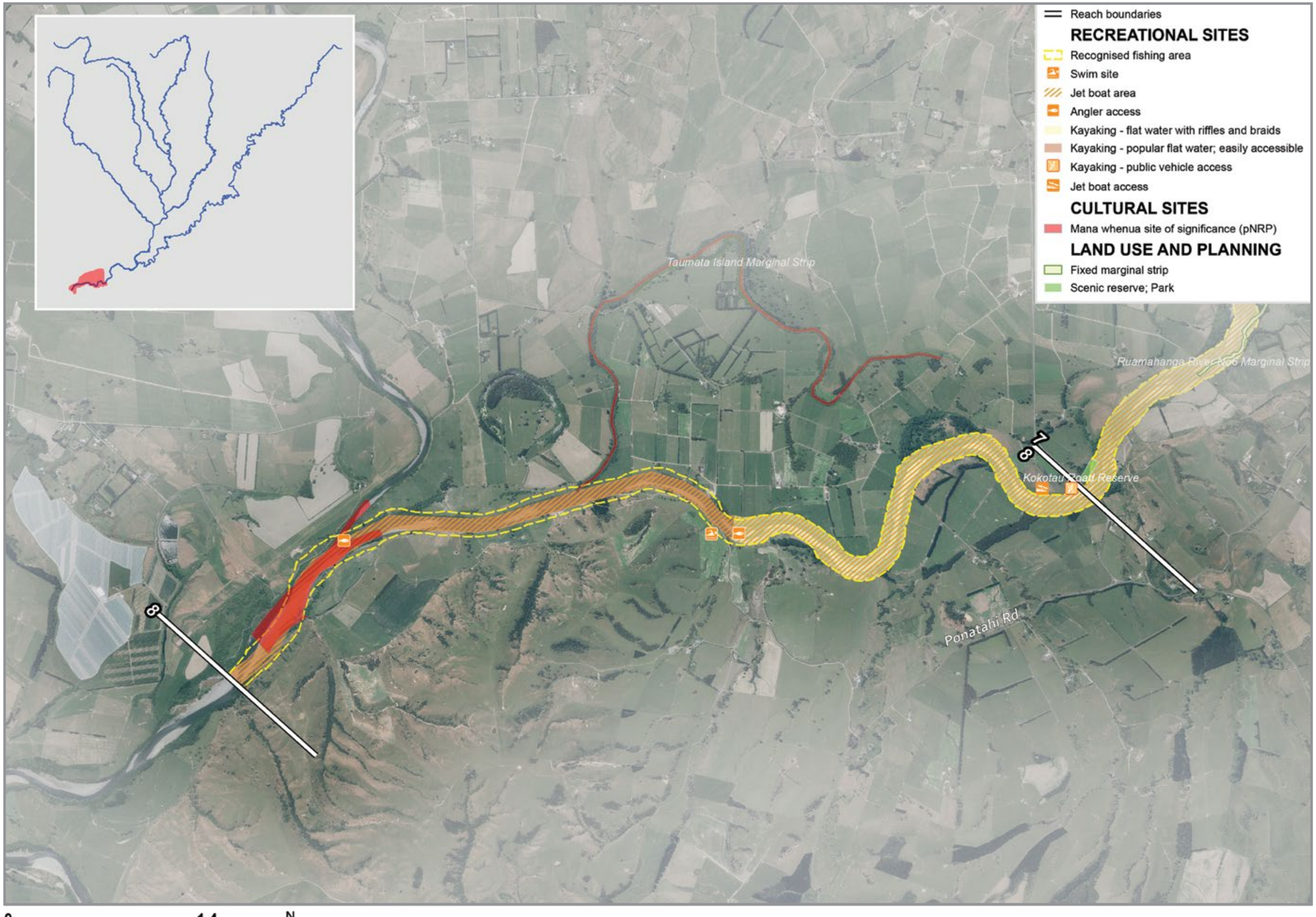
Terrestrial habitats with ecological value along the reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

The several cultural sites include the mixing of mauri at the confluence with the Waiōhine River.

Key floodplain management points

- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- This FMP will address the issues associated with river scheme stopbanks and increase river enhancement works.
- Work with the asset owner of Kokotau Bridge to protect and maintain its operation.
- Ensure that decisions on flood risk management consider the outcomes of the Waiōhine River Plan.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, kayak access, jet boat access, fishing, jet boating, kayaking and swimming	-	Mana whenua sites of significance (pNRP) – significant ancestral place, wāhi tīpuna; water utilised for healing, wai ora; source of medicinal plants, puna rongoā; source of weaving material, puna raranga; mahinga kai; eel harvesting place, mahinga tuna	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

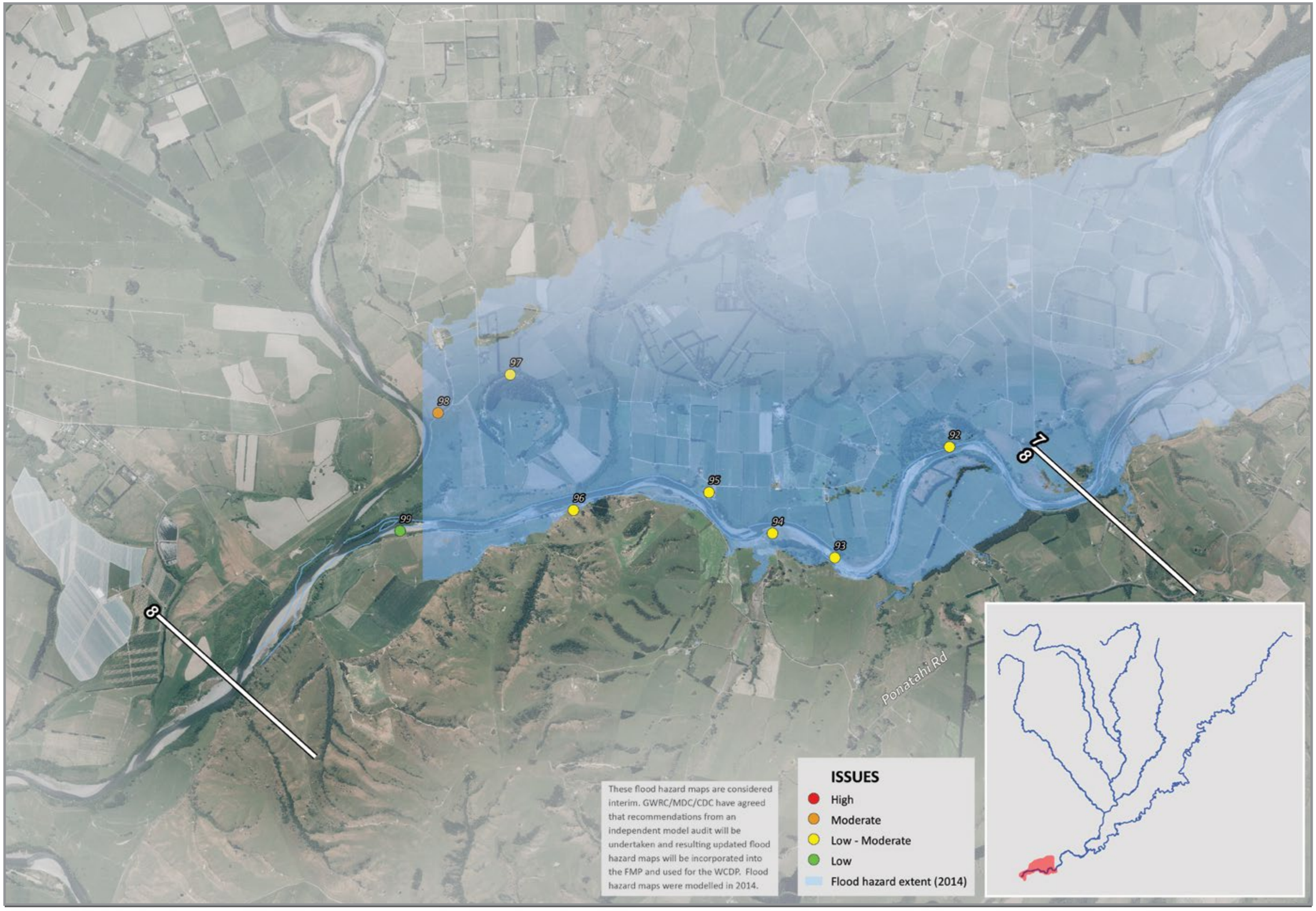

Reach boundaries
RECREATIONAL SITES
Recognised fishing area
Swim site
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - popular flat water; easily accessible
Kayaking - public vehicle access
Jet boat access
CULTURAL SITES
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
Scenic reserve; Park
Taumata Island Marginal Strip
Ruamahanga River Koo Marginal Strip
Kokotau Boat Reserve
Ponatahi Rd
7
8
8
0
1.4
km
N

Kokotau Bridge to Waiōhine – Reach 8

Flood and erosion issues

Eight flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Ruamāhanga River and Waiōhine River confluence [99]** Only a small amount of work is required in the area next to the confluence. There are few problems to manage, but river scheme members are concerned about their contribution levels versus the benefits received as a result	
LOW TO MODERATE	**Stopbank [92]** This small stopbank has a low protection level; it sits in the erosion study area and is in the current erosion management buffer **Channel alignment [93]** The buffers are very narrow through this area **Channel alignment [94]** The design channel alignment in this location is difficult to maintain. A recommended has been made that the design lines be changed	**Farm buildings [95]** A number of farm structures sit in the erosion study area. They are currently on the edge of the buffer, but it is a very thin strip of trees at this location **House [96]** Several buildings and a house sit in the erosion study area and are very close to the edge of the buffer for the river. The buffer is very thin at this location **Taumata Lagoon [97]** Taumata Lagoon is a known fish habitat site and sits in the 1% AEP extent
MODERATE	**Herrick stopbank [98]** This stopbank is modelled as outflanked by the 1% AEP flood event from the Ruamāhanga models. The stopbank is part of the Waiōhine river scheme	
HIGH		



ISSUES – Reach 8: Kokotau Bridge to Waiōhine

Kokotau Bridge to Waiōhine – Reach 8

Response

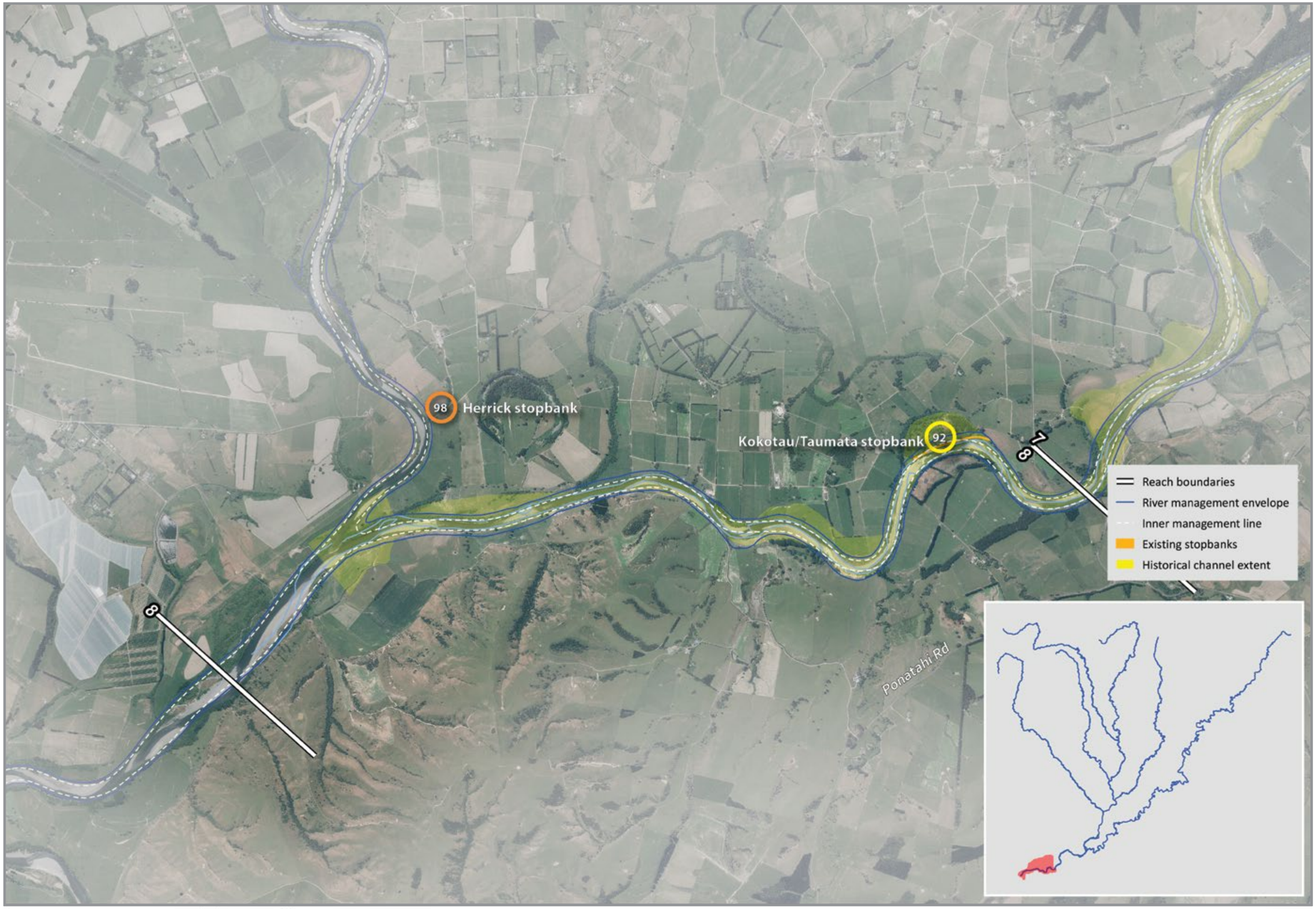
The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

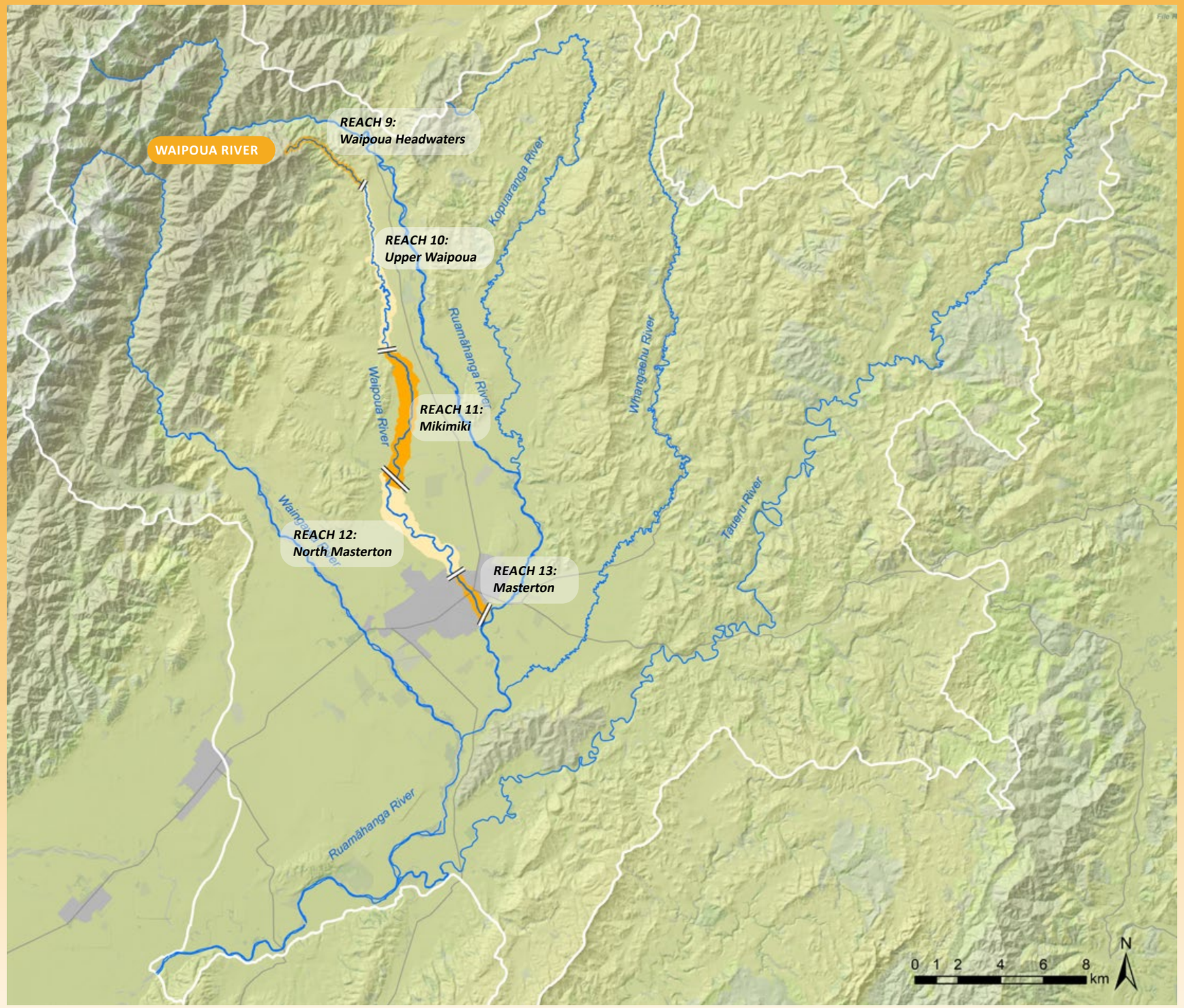
REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSE	92	Kokotau/ Taumata stopbank	River management	Retire the stopbank and remove it from the asset register	10%		GWRC	Landowners	Medium
	98	Herrick stopbank	River management	See the Waiōhine River Plan					
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historic channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
92	Kokotau/ Taumata	Historically constructed to divert water around new channel alignment. Meander cut-off c.1950s. More aptly described as a training bank	560	560	4	Low	Private individual	20%-10%	Trees in stopbank and bank is no more than an area of high ground	Retire stopbank, no further river scheme maintenance, remove from asset register	Low


98
Herrick stopbank
Kokotau/Taumata stopbank
92
7
8
8
Ponatahi Rd
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
0
1.4
km
N



Waipoua River

7. The Waipoua River

The Waipoua River has a catchment area of 149km^2, and the main river channel from its headwaters to its confluence with the Ruamāhanga River is 30km long. The headwaters originate from the Blue Range of the Tararua Range, flowing down through steep-sided gorges fringed by native forest. A large part of the catchment is in the lower foothills of the range.

The river has three major tributaries: the Kiriwhakapapa Stream, the Mikimiki Stream and the Wakamoekau Creek. These streams join the river as it flows across the Wairarapa Plains, before passing through the Masterton urban area to its confluence with the Ruamāhanga River at Te Ore Ore.

The current Waipoua River scheme covers 18km of river, from Mikimiki Bridge to the Ruamāhanga confluence. It is a steep gravel-phase river with a relatively stable and narrow single-thread channel. The Mikimiki reach and the urban Masterton reach have been straightened, steepened and shortened.

The river's name is attributed to Haunui-a-Nanaia, the great grandson of Kupe, who tested its depth with a stick before making the crossing; 'wai' means water and 'poua' means to plunge a stick in. The banks of the Waipoua housed one of the first kāinga visited by Europeans in the region, but the precise location is not known.

The siting of Kaikōkirikiri Pā close to both the Waipoua and Ruamāhanga Rivers is an indication of the cultural values associated with the area. In Tawera to Te Whiti (2005), Potangaroa and Rimene refer to Kaikōkirikiri as the main pā of the Masterton area, and note that the Waipoua River used to flow at the foot of the pā. The closeness of the pā to the Waipoua River indicates that the wider-surrounding environment would have been regularly frequented and used for a range of cultural practices.

The Waipoua floodplain soils are formed from greywacke alluvial parent materials from the Tararua Range.

General issues

The Waipoua River has multiple characteristics, and in large floods it can be devastating. The river channel itself is fairly entrenched but only small floods can be contained without spilling water onto the floodplain in the rural areas. The erosion risk posed by the Waipoua River flows is less than those posed by the other gravel rivers in the project area.

Of all the flooding rivers in Wairarapa, the Waipoua has the potential to affect the most people. It has been modelled as flooding north Masterton in a large event including climate change impacts. Work will be undertaken to assess and reduce the community's vulnerability to flooding, and modelling updates for the river will be reflected in the WDCP maps.

General issues for the river include:

- Degradation/aggradation
- Inconsistency in community acceptance of current erosion management practices
- River management works conflicting at times with the river's value for recreation and habitat (the urban Masterton reach is used heavily for water-based and riverside recreation)

Waipoua Headwaters – Reach 9

Character

The Waipoua headwaters form from a small stream that flows from an enclosed, steep, native-bush-clad gully in Tararua Forest Park and through the adjoining, largely inaccessible grazed foothills. The vegetation typically reflects changes in grazing practice. There are limited recreation opportunities in the Tararua Range, which adjoins this area outside Tararua Forest Park.

Key characteristics

Small stream in bush-lined gully

Isolated foothills stream

Values

The Waipoua headwaters form a steep, enclosed tributary stream that flows through fenced and unfenced indigenous forest on the edge of Tararua Forest Park, then extends into land used for rural primary production activities and mainly established in pasture. There is a low level of landscape modification overall, with medium/high scenic value.

Key floodplain management points

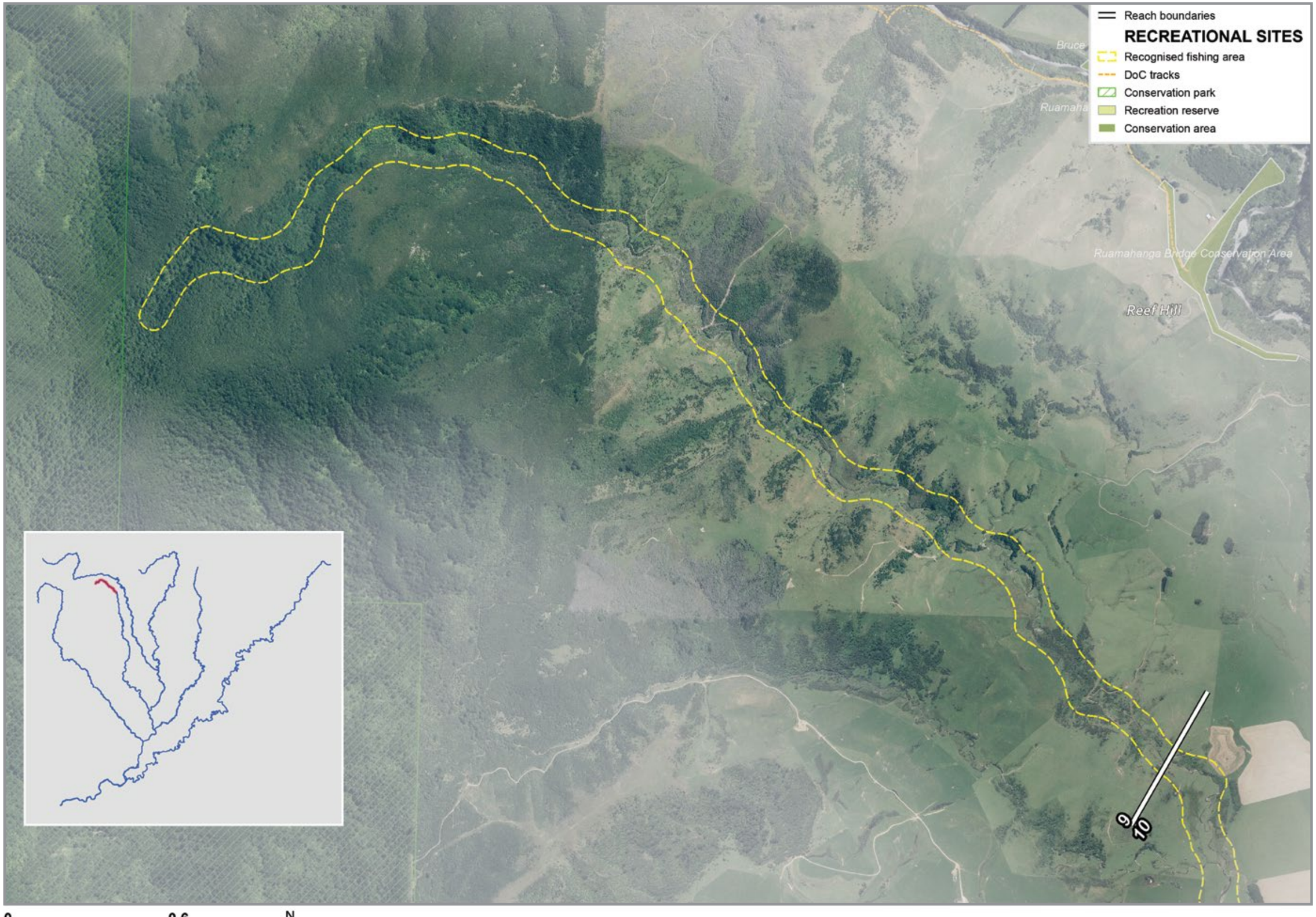
- Encourage continued recognition of the reach's values and character.
- Support initiatives that aim to preserve or improve its natural values.

There is no intention to undertake maintenance activities in this reach. No specific flood and erosion issues have been identified.

REACH-SPECIFIC RESPONSES

	SITE	TYPE OF RESPONSE	MEASURES
COMMON METHODS	Entire reach	River management	Isolated works support, Code of Practice
	Entire reach	Planning and policy	Protection against deforestation in upper catchment
	Entire reach	Emergency management	Emergency management planning, flood forecasting and warning system
	Entire reach	Environmental enhancement	Community Support Officer

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	Medium/High	Fishing	-	-	Rural (Primary Production), Road	Fenced indigenous forest, unfenced indigenous forest


Reach boundaries
RECREATIONAL SITES
Recognised fishing area
DoC tracks
Conservation park
Recreation reserve
Conservation area
Bruce
Ruamaha
Ruamahanga Bridge Conservation Area
Reef Hill
9
10
0
0.6
km
N

Upper Waipoua – Reach 10

Character

The Upper Waipoua reach forms a meandering stream that transitions from the foothills of the Tararua Range to the western edge of the upper Wairarapa Plains and on to Mikimiki Bridge. As it flows south, regenerating native vegetation gradually recedes as grazing becomes prevalent along the river margins. River terraces and cliffs are evident in some areas.

In the lower parts of the reach, areas of planting tend to be separated from the river margins, generating linear shelterbelts along paddock boundaries. Wetlands separated from the main river are also common.

Key characteristics

- Transition from a small stream in vegetated foothills to a small river along grazed valley floor
- Localised cliffs, river terraces and rock banks
- Linear shelter planting separated from meandering river course

Values

This reach continues through rural land used for primary production activities and mainly established in pasture. It meanders through gravel beaches, pools and riffles and flows through rolling farmland. It has a low level of landscape modification overall and medium/high scenic value.

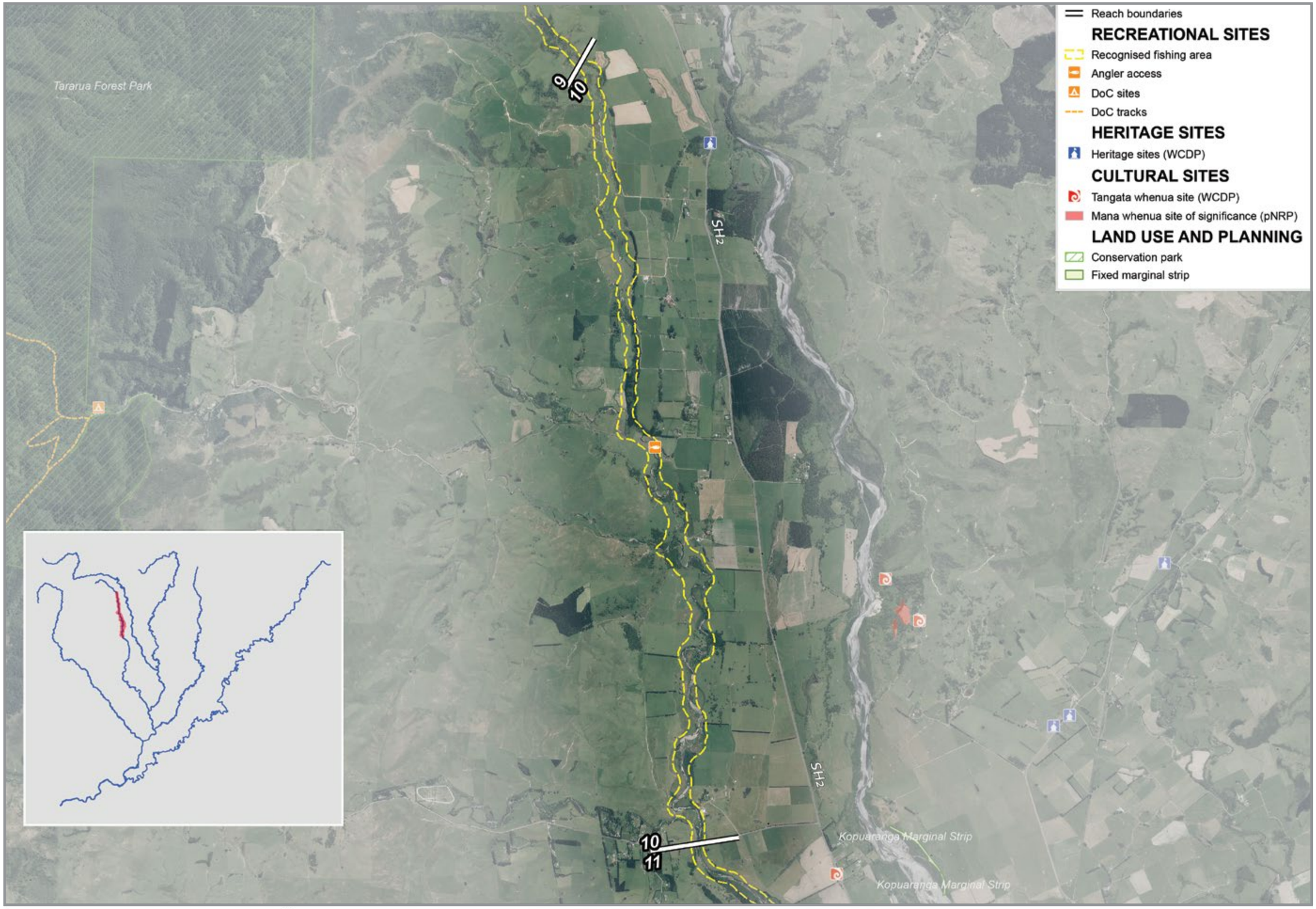
This reach of the river is known for good early-season fishing, with access from Kiriwhakapapa and Mikimiki Bridges and by negotiation with private land owners.

The terrestrial habitats with ecological value along the reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

Key floodplain management points

- Apply isolated works policy to this reach, as it has no established river scheme.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	Medium/High	Angler access, fishing	-	-	Rural (Primary Production), Rural (Special), Road, River	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

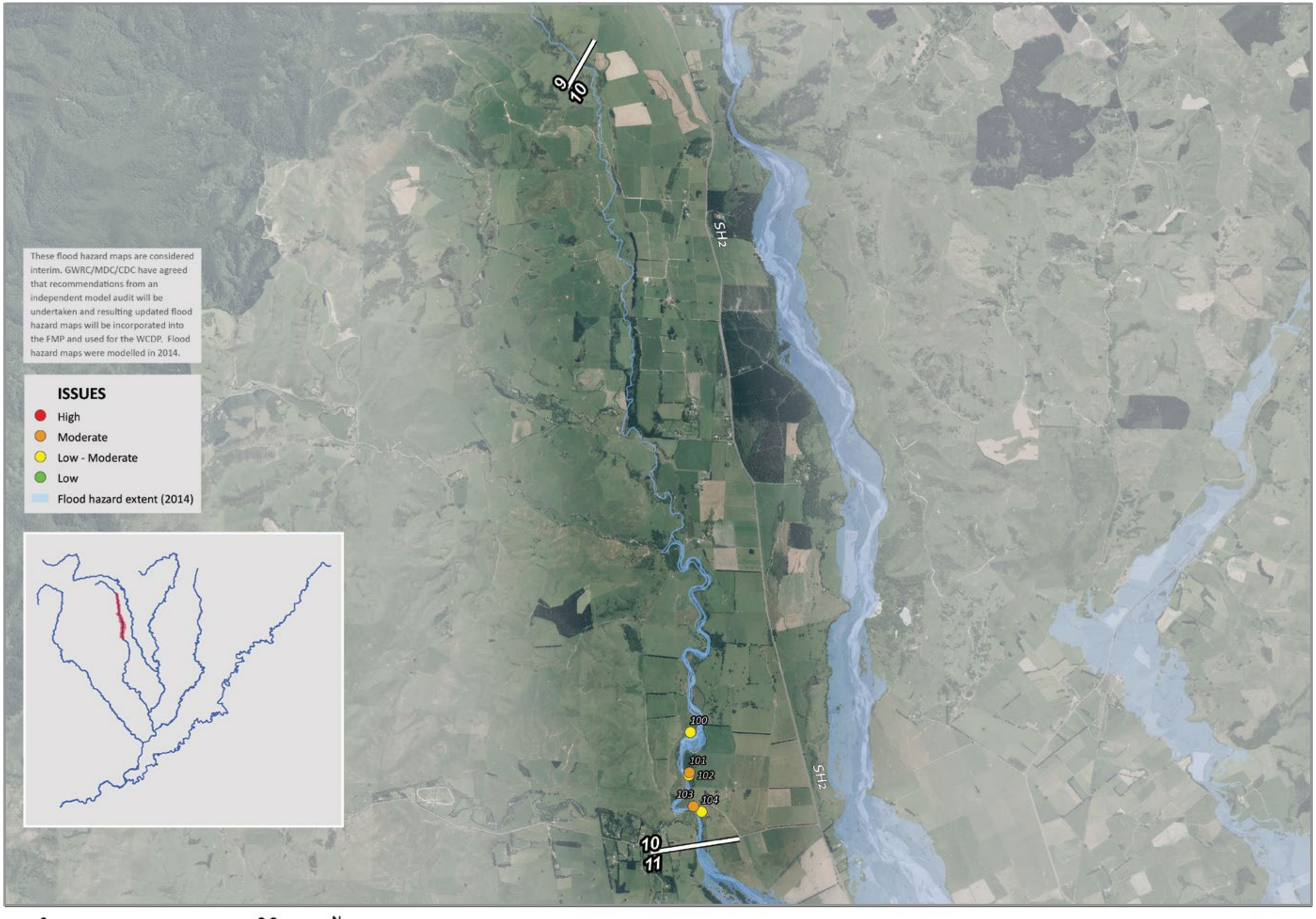

Reach boundaries
RECREATIONAL SITES
Recognised fishing area
Angler access
DoC sites
DoC tracks
HERITAGE SITES
Heritage sites (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Fixed marginal strip
Tararua Forest Park
9
10
SH2
10
11
SH2
Kopuaranga Marginal Strip
Kopuaranga Marginal Strip
0
2
km
N

Upper Waipoua – Reach 10

Flood and erosion issues

Five flood and erosion issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION
LOW	
LOW TO MODERATE	**Channel alignment [100]** The channel alignment near the lower end of the reach is significantly outside the recommended design fairway. GWRC does not currently manage this area; it is maintained privately **Design channel alignment [102]** Design channel alignments extend beyond the river scheme's upstream boundary. However, they are not used for any purpose **Massey Farms sheds and bridge [104]** Several farm buildings and an access bridge sit in the erosion study area. This issue is not currently managed
MODERATE	**River scheme boundary extent [101]** The river scheme once extended further upstream than Mikimiki Bridge. It was shortened, and upstream management taken over, by a private organisation **Massey Farms water irrigation intake [103]** The intake for the Massey Farms irrigation systems for sits in the erosion study area. No known issues exist with this intake
HIGH	



ISSUES – Reach 10: Upper Waipoua

Upper Waipoua – Reach 10

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5.*

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	104	Massey Farms sheds and bridge	River management	Communicate the potential risk to the landowner; continue monitoring the site			Landowner	GRWC	Low
	103	Massey Farms water irrigation intake	River management	Private water takes will have a low risk of damage up to a 20% AEP event. Damage to structures is more likely up to a 5% AEP event. Communicate risks to the landowner		20%	Landowner	GRWC	Low
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


9
10
SH2
Reach boundaries
River management envelope
Inner management line
Historical channel extent
SH2
103 Massey Farms water irrigation intake
104 Massey Farms sheds and bridge
10
11
0
2
km
N

Mikimiki – Reach 11

Character

To the south of Mikimiki Bridge the river straightens along the toe of the Tararua Range foothills. Much of the river follows a single channel across bedrock and gravel. Its margins are typically shaded by steep banks accommodating narrow bands of mixed willow, poplar and kōwhai. Scattered remnant tōtara are also common in adjoining areas of farmland.

Key characteristics

- Single, straightened thread along toe of Tararua Range
- Steep, shaded river-banks with continual margins of mixed willow, poplar and kōwhai
- Scattered remnant tōtara dispersed through adjoining farmland

Values

This reach continues through rural land that is mainly pasture. Some beach re-contouring is carried out, and mixed exotic and native planting extends along the river margin, fenced off from adjoining areas of farmland. This has resulted in a medium level of landscape modification overall with a medium/high scenic value.

The reach is known for its good early-season fishing, with access from Mikimiki Bridge and in other areas by negotiation with private land owners.

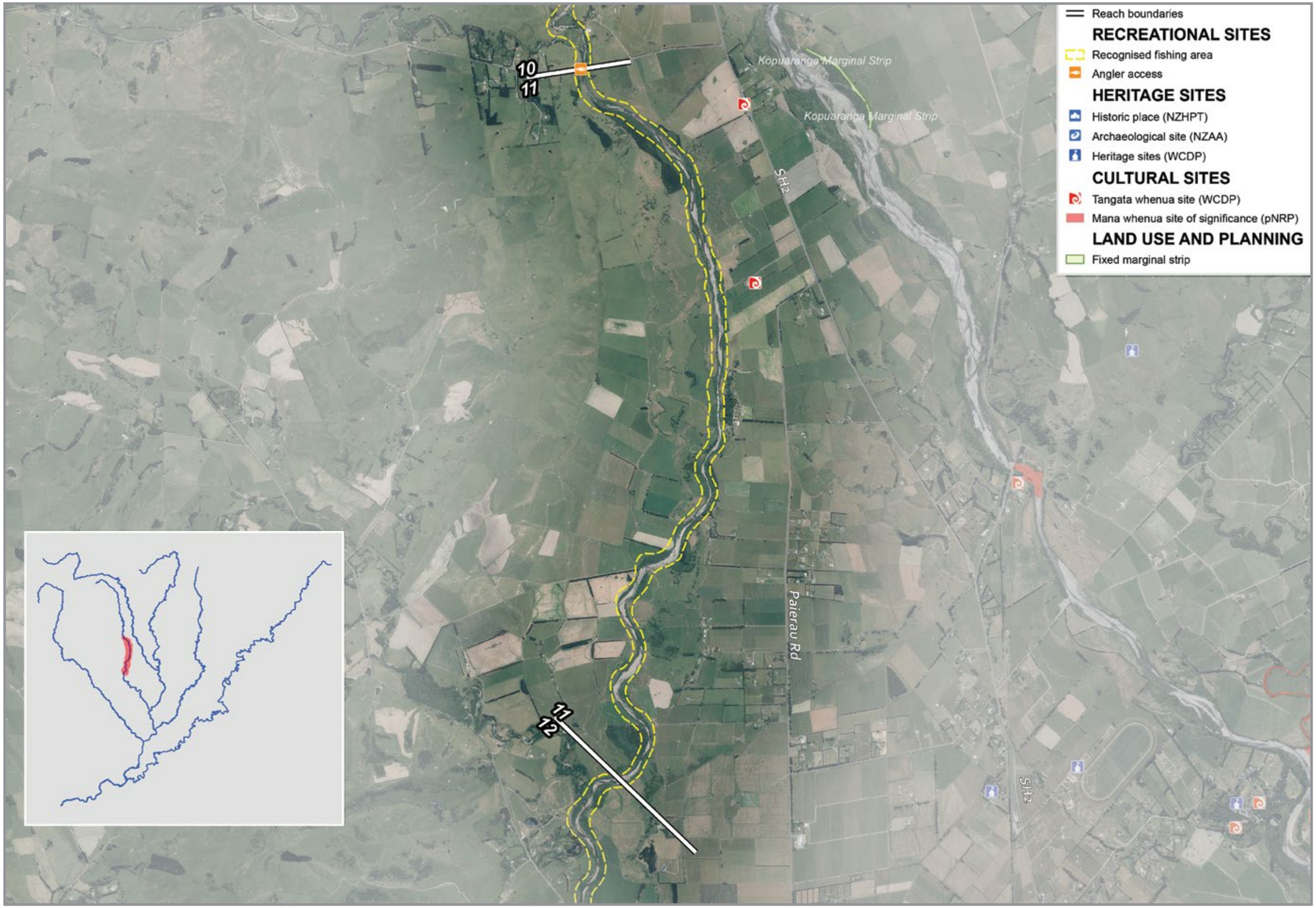
The terrestrial habitats with identified ecological value include areas of fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds.

The limited number of specific cultural sites identified along the reach include an urupā.

Key floodplain management points

- River maintenance activities will include more works to maintain stopbank condition, river enhancement opportunities will be better explored and supported, and there will be a renewed focus on buffer implementation.
- Establishment of a better flow recorder and flood warning site.
- Work with the asset owner of Mikimiki Bridge to ensure its continued protection and operation.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium/High	Angler access, recognised fishing area	-	Urupā	Rural (Primary Production), Rural (Special), Road, River	Fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

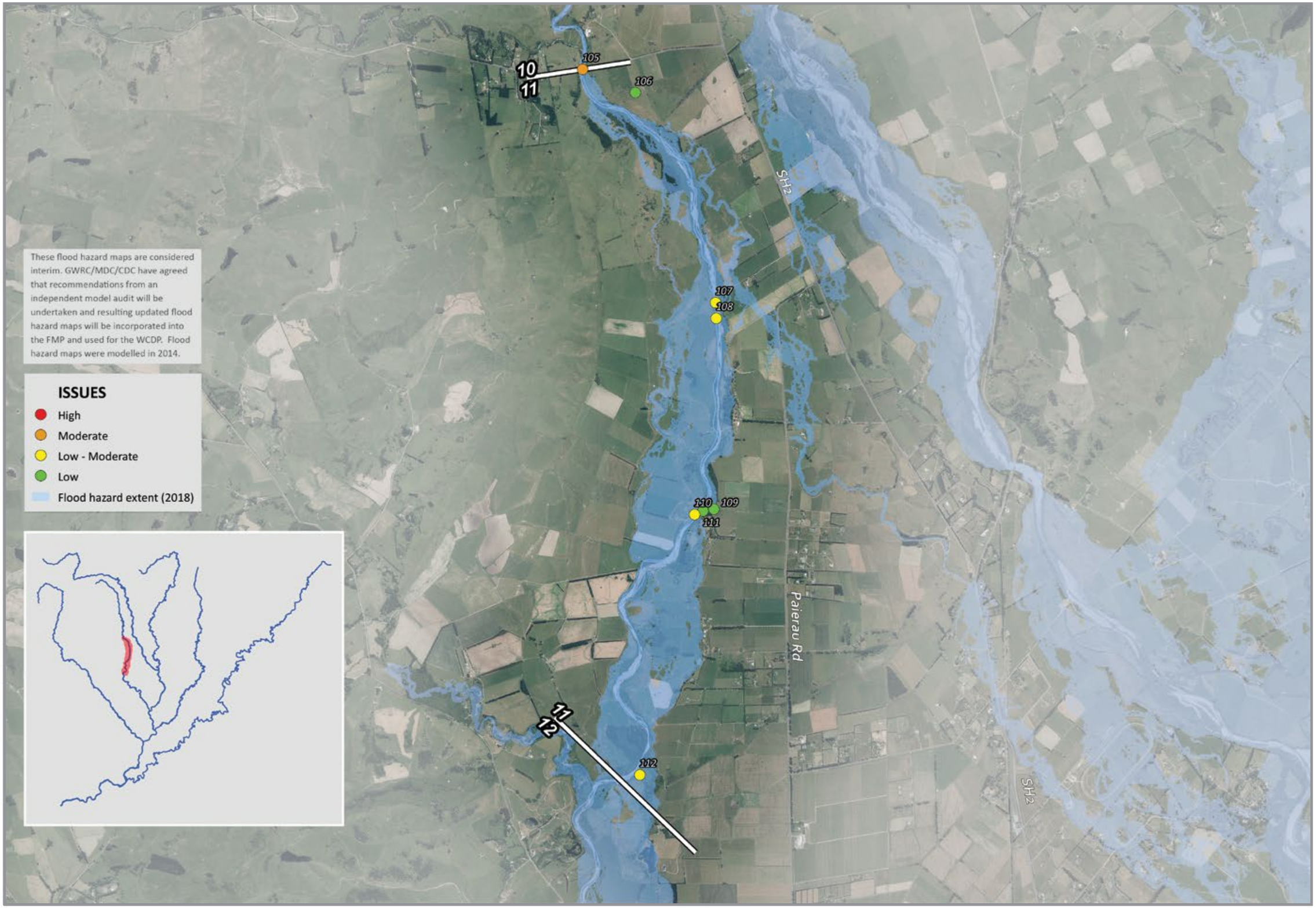

Reach boundaries
RECREATIONAL SITES
Recognised fishing area
Angler access
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
10
11
11
12
Kopuaranga Marginal Strip
Kopuaranga Marginal Strip
SH2
Paierau Rd
SH2
0
1.6
km
N

Mikimiki – Reach 11

Flood and erosion issues

Eight flood and erosion management issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION
LOW	**Farm building [106]** A farm building sits in the 1% AEP flood extent. This issue is not currently managed **Farm building [109]**A farm outbuilding is located in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Private telecom line [111]** A private telecom line runs under the river bed. It is potentially susceptible to damage from erosion and machine work in this area
LOW TO MODERATE	**Design channel alignment [107, 108]** The design fairway narrows from a width of 85m to 45m. This is unusual and further investigations are required to determine if this is a suitable design channel width **Stock bridge/private bridge [110]** A privately owned stock bridge sits in the erosion study area and is potentially at risk of damage linked to bed-level changes, bank erosion and large flood events **Private water intake [112]** A private water intake for Watson Lake is located in the erosion study area. This issue is not currently managed
MODERATE	**Mikimiki Bridge [105]** Bed degradation is ongoing in the bridge's vicinity. This affects the road, bridge and water level recorder site. Scour issues have been tackled periodically
HIGH	



ISSUES – Reach 11: Mikimiki

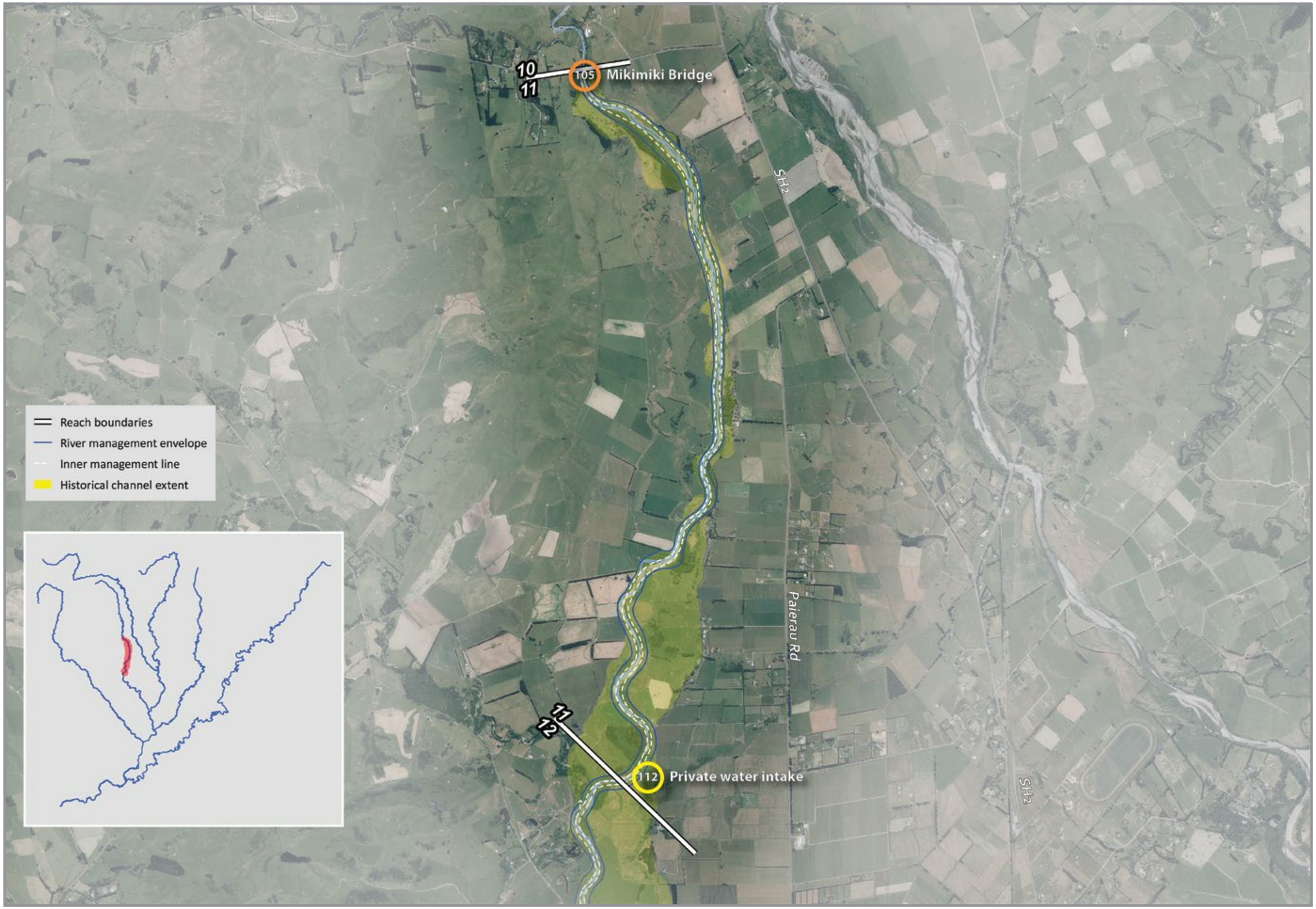
Mikimiki – Reach 11

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	105	Mikimiki Bridge	River management	Work with MDC on plans to replace or strengthen the bridge, including stabilising the water level recorder site			MDC	GWRC	Medium
	112	Private water intake	River management	River management envelopes will contribute to the security of private water intakes. Private water intakes will have low risk of damage up to a 20% AEP event. Damage to structures is more likely up to a 5% AEP event. Communicate risks to the landowner		20%	Landowners	GWRC	Low
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


10
11
T05
Mikimiki Bridge
SH2
Reach boundaries
River management envelope
Inner management line
Historical channel extent
11
12
T12
Private water intake
Paierau Rd
SH2
0
1.6
km
N

North Masterton – Reach 12

Character

To the north of Masterton, the Waipoua River moves away from the toe of the Tararua Range and takes a meandering course across the Wairarapa Plains. The margins of the river reflect increasing rural lifestyle use, with varied willow planting interspersed with poplar and shelterbelts. Bank modification also begins in the lower part of the reach.

Key characteristics

- Meandering single channel
- Increasing rural lifestyle settlement along margins
- Range of willow, shelter belt and amenity planting and hard edges along margins

Values

This reach flows through increasing rural residential settlement to the north of Masterton. Some beach re-contouring is carried out, and rock groynes have been established along the river edges. Willow and gorse are common in this area, and tōtara can be found scattered on adjoining farmland. This has resulted in a medium level of landscape modification overall, with medium scenic values.

This reach of the river offers good early-season fishing opportunities, with access via Paierau Road Bridge and by negotiation with private land owners. The Mahunga Golf Club course also occupies the true left bank.

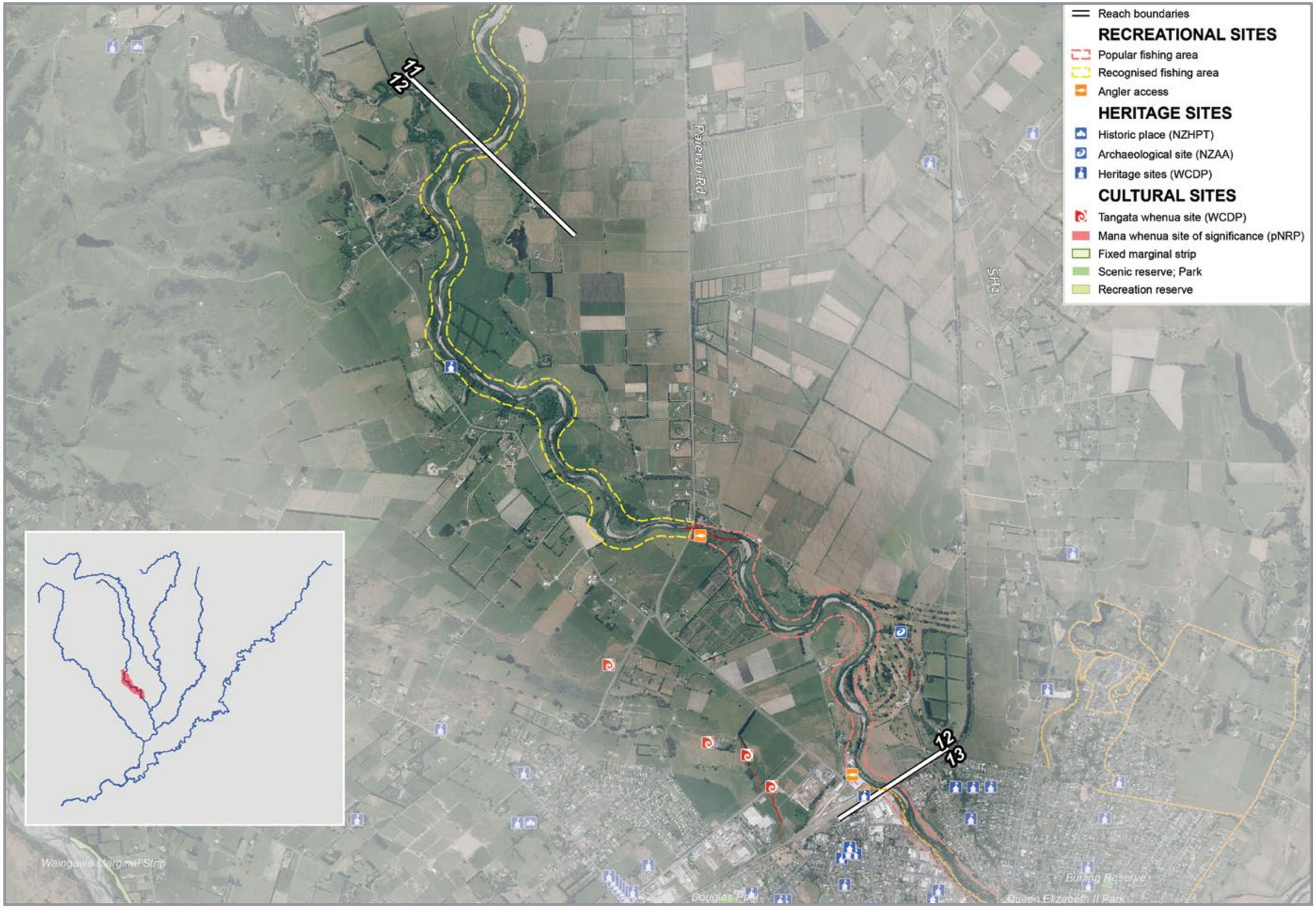
Terrestrial habitats with identified ecological values along the reach include areas of unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields and natural wetlands and ponds.

The cultural sites along this reach are relatively limited, encompassing historic pā sites. The Levin's Woolstore and Matahiwi Cottage are also identified heritage sites in the WCDP.

Key floodplain management points

- River maintenance activities will involve more works to maintain stopbank condition, river enhancement opportunities will be better explored and supported, and there will be a renewed focus on buffer implementation.
- Raise the awareness of flood risks and improve the safety of Paierau Road and Matahiwi Road during large floods.
- Work with the community in the vicinity of Paierau Road and the Serpentine Stream confluence to reduce their vulnerability to flooding.
- Work with the infrastructure owners of Paierau Road Bridge and the rail bridge to ensure their continued security and operation.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium	Medium	Angler access, popular and recognised fishing areas	Levin's Woolstore, Matahiwi Cottage (WCDP)	Historic pā sites, mahinga kai (pNRP)	Rural (Primary Production), Rural (Special), Road, River, Industrial, Railway, Flood Protection and Mitigation, Intersection Improvement	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds



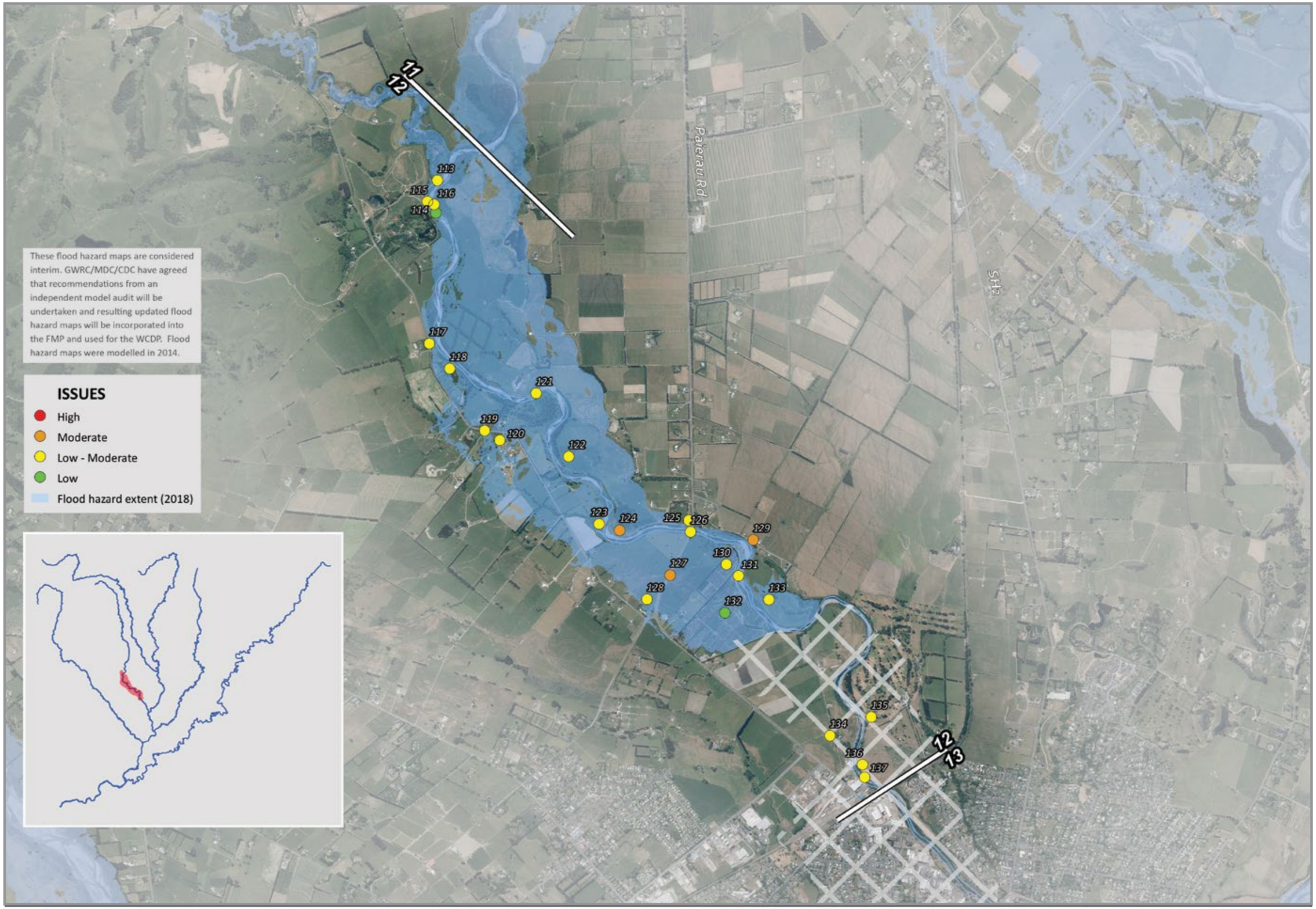
VALUES – Reach 12: North Masterton

North Masterton – Reach 12

Flood and erosion issues

A total of 25 flood and erosion issues have been identified along this reach owing to its closeness to Masterton. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Private rock line [114]** A rock line has been constructed to protect a water intake and private property. It is maintained infrequently by GWRC Flood Protection **Akura Plant Nursery [132]** Akura Plant Nursery floods from overland flows originating upstream of Paierau Road Bridge	
LOW TO MODERATE	**Channel alignment [113]** The buffer downstream of the boundary between Reach 11 (Mikimiki) and this reach has been identified as too narrow. It is recommended that a wider buffer be established **Water intake [115]** A private water intake for a lake is situated in the erosion study area. This intake has been protected by privately funded erosion protection works **Channel alignment [116]** The buffer planting on the true right bank has been protected behind a private rock line. This protection will last as long as the rock line is properly maintained **Matahiwi Road [117]** A section of Matahiwi Road sits in the erosion study area and is in the 1% AEP extent up to a depth of 0.6m. This issue is not currently managed **Houses [118, 119, 120]** Several houses are located in the erosion study area and are in the 1% AEP flood extent. This issue is not currently managed **Stopbank proximity to river [121]** The left bank stopbank sits on the edge of the active channel and in the erosion study area. Past considerations have included relocating the active channel away from this stopbank, and changing the design fairways **Low-quality stopbank [122]** The stopbank is located very close to the river and is at a high risk of erosion. Substantial tree growth makes it vulnerable to storm damage and other failure mechanisms **Serpentine confluence [123]** Aggradation at the mouth of the Serpentine Stream confluence with the Waipoua River is increasing the risk of flooding and blockages **Houses [125]** A house is located in the erosion study area. This issue is not currently managed	**Houses [128]** Houses on Matahiwi/Akura Road are at risk of flooding in a 1% AEP flood event. This issue is not currently managed **Paierau Road Bridge [126]** Paierau Road Bridge's capacity is adding to upstream flooding extents due to its limited capacity to carry flood flows **Stopbank [130]** The quality, standard, alignment and purpose of the combined flood protection works between the Serpentine Stream confluence and the vicinity of Paierau Road Bridge are not well defined **Stopbank [131]** The alignment of the stopbank on the right bank of the river downstream of Paierau Road Bridge gradually approaches the channel, and at its downstream end is located in the erosion study area **Stopbank [133]** The stopbank on the left bank of the river is in the erosion study area and has in the past required erosion protection works **Houses [134]** Houses are located in the 1% AEP flood extent. This issue is not currently managed **Mahunga Golf Club [135]** The golf course is located in the erosion study area and the 1% AEP flood extent. Areas of the golf course have eroded in the past **Channel narrowing [136]** The river channel becomes increasingly confined as it approaches the railway bridge upstream of Masterton. The channel at the railway bridge is highly constricted, limiting the flow that can pass under the bridge and into the Masterton reach. This causes modelled upstream flooding of the Mahunga Golf Club course and properties on the river's western bank **Channel alignment [137]** No design fairways have been created for the section of the Waipoua that flows through Masterton. This creates management challenges due to a lack of guidance for river engineers
MODERATE	**Serpentine stopbank [124]** The Serpentine stopbank is of concern because, while it partially protects a number of properties, the management objectives for the structure are unclear. It is also located very close to the river and in the erosion study area **Paierau Road [127]** The stopbanks upstream of Paierau Road Bridge overtop often, and the road subsequently floods. In addition, the fact that the flood-prone area is not clearly visible from the northern approach to the bridge poses potential risks to people approaching at speed **Houses [129]** Houses on the left bank are located in the erosion study area. This issue is not currently managed	
HIGH		



ISSUES – Reach 12: North Masterton

North Masterton – Reach 12

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	114	Private rock line		Formalise GWRC maintenance for the site and confirm ownership			GWRC	Landowner	Low
	132	Akura Plant Nursery	Emergency management	Inform landowner of the potential risk			GWRC		Low
	117	Matahiwi Road	River management	Inform Akura Plant Nursery of the risks to the road		1%	MDC	GWRC	Low
	122, 124, 133, 131, 130, 121	Stopbanks	River management	Apply rural stopbank common method	Varies		GWRC	Landowner	Medium
	123	Serpentine confluence	River management	Apply river-bed-level monitoring common method to identify the need for a control structure			GWRC		Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffer, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD 1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
121	Matahiwi to Serpentine	Flood protection to multiple properties and public road up to around 5%-10% AEP event	1,150	580	Ranges 2-4	Med	Private multiple/public road	20%-10%	Trees in stopbanks	Realign stopbank where it sits in the buffer. May be a retreat scenario in reaction to flood events	Medium
130, 124	Serpentine to Paierau	Flood protection to multiple properties and public road up to around 5%-10% AEP event	1,000	630	Ranges 2-3	Med	Private multiple/public road	c20%-10%	Vegetation/trees in stopbank	Realign stopbank where it sits in the buffer. May be a retreat scenario in reaction to flood events	Medium
122	Left bank to Paierau	Preventing course change? Protecting around 55ha of productive land from flooding up to a 5% AEP event	2,400	980	2	Low	Individual landowners	20%-10%		Designate land along preferred alignment (priority). Continue existing asset management until unviable (TBC at later date)	Medium
131	Akura	Preventing course change? Protecting around 40ha of productive land from flooding up to a 5% AEP event	1,050	645	3	Low	Individual landowners	20%-10%	Vegetation/trees in stopbank	Designate land along preferred alignment (priority). Continue existing asset management until unviable (criteria TBC)	Medium
133	Left bank Akura	Preventing course change? Protecting around 10ha of productive land from flooding up to a 5% AEP event	900	800	2	Low	Individual landowner	20%-10%		Initial FMP implementation: continue existing asset management. Long-term implementation: explore legacy asset partial abandonment/isolated works	Medium


11
12
Paierau Rd
SH2
Private rock line
114
Matahiwi Road
117
121
Stopbank
122
Stopbank
Stopbank
Serpentine confluence
123
124
Paierau Road Major Project Response (see page 122)
131
Stopbank
Stopbank
130
133
Stopbank
Akura Plant Nursery
132
12
13
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
0
1.4
km
N

Major Project Response: Paierau Road

The issue

The southern approach to Paierau Road Bridge is inundated to a depth of about 0.5m in a 20% AEP flood and up to 1m in a 1% AEP flood. Traffic approaching from the north has a maximum sight distance of about 100m, which is considered insufficient in a 100km/h speed limit zone. MDC currently operates a road closure procedure, but this has limited lead time as no rainfall-based flood forecasting is used for emergency notifications. This FMP proposes to install permanent warning signs at this site, as well as improved road closure warnings, to ensure the road is closed before it is significantly inundated.

Opportunities

The response will improve warnings for drivers and ensure that the road is closed promptly to avoid the risk of vehicles hitting deep-flowing water at high speed.

Relationship with common methods

The inundation is caused by low-level rural stopbanks overtopping upstream of Paierau Road (Issue ID 127). The stopbanks are considered to provide an adequate level of protection in line with the Rural Stopbanks Policy provided for in the common methods. It is noted that sections of stopbank in the buffers in this area could be retreated, particularly in response to a flood-related failure. This is also referred to in the Stopbank Summary table – Stopbank ID 124 Serpentine to Paierau.

The bridge's capacity also contributes to the road-flooding frequency (Issue ID 126). It is not considered cost effective or consistent with this FMP's vision and aims to contain floodwaters in the reach by enlarging the channel and bridge and increasing the stopbank heights.

Description

General

Permanent warning signs – 'Road May Flood' – are to be added to the northern and southern approaches, along with an improved warning system for road closures based on rainfall triggers.

Cost: $20,000 ($10,000 new signs, $5,000 improved warning system and $5,000 contingency)

Implications

Traffic will be diverted when road is inundated, resulting in longer travel times.

Priority

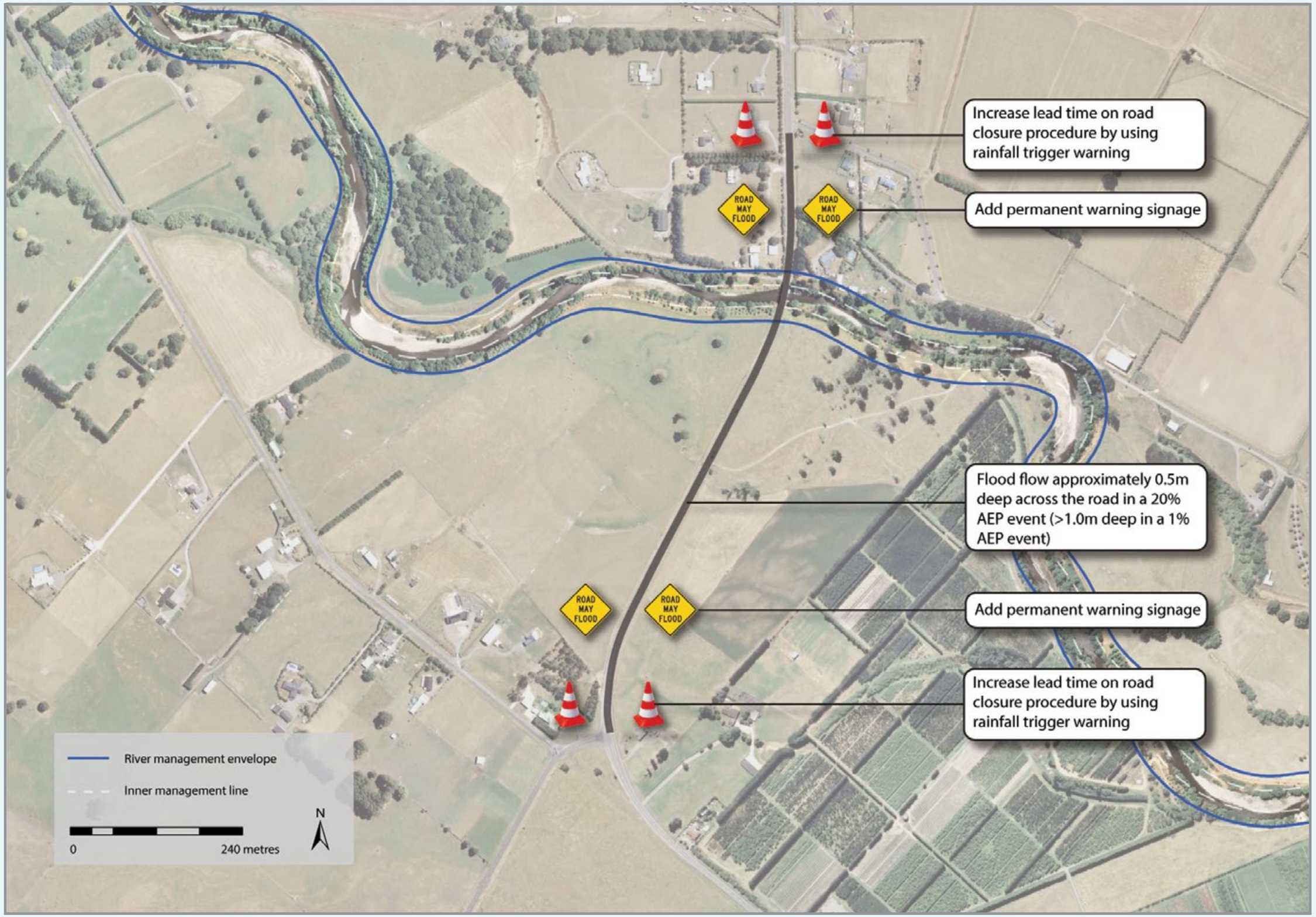
Medium

Level of service

Currently, warnings are sent to MDC roading engineers when a 20% AEP flood is exceeded at the Mikimiki flow recorder on the upper Waipoua River. Contractors then have 90 minutes to mobilise and establish manned road closures at Loopline and Matahiwi Road. A rainfall-based warning could potentially increase this warning time to 2.5 hours, enabling greater certainty of road closure completion before the road becomes inundated.

Paierau Road Bridge

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
127	Permanent warning signs and improved flood forecasting	90-minute warning from Mikimiki Stream	Risk of not responding in time	Road closure completed before inundation in 20% AEP event	To increase road users' safety by providing permanent warning signs and increasing the lead time for road closure to 2.5 hours	MDC/GWRC	Medium	$20,000	Capital funding TBC



Paierau Road

Urban Masterton – Reach 13

The following sections apply to the Masterton urban reach – Reach 13. They describe its character and values, current flood and erosion issues, responses to known flood and erosion issues (including existing river maintenance activities), and the key floodplain management aims and outcomes sought. Page 132 describes a staged approach to the flood risks in the urban reach, with Stage 1 (investigations and option consideration) outlined on page 133. Subsequent stages are not detailed; they will be determined once Stage 1 is complete.

This information should be considered in conjunction with adjoining rural reaches in the Waipoua River including North Masterton (Reach 12) given the interrelated nature of the flooding issues, and Reach 5 of the Ruamāhanga River.

Character

The Masterton urban reach extends from where the railway line crosses the Waipoua River (in north Masterton) to the confluence of the Waipoua and Ruamāhanga Rivers to the south-east of Masterton.

The river bisects most of the Masterton township, mainly on the southern bank, and from Lansdowne on the northern bank. This area has been substantially modified in the past through historical straightening and flood control works. However, it still has green space along its corridor formed by a number of parks and scatterings of vegetation.

Key characteristics:

Accessible green corridor including pedestrian pathways through the urban area

Mixed willow and amenity planting providing shading and enclosure

Values

Due to its proximity to Masterton, this reach has many values and associations with the adjoining community. Masterton itself is the largest urban settlement in Wairarapa and home to more than 20,000 people.

Much of the river corridor has been modified. Stopbanks incorporating stone pitching are common throughout, in association with bed-control weirs and erosion-protection structures around the rail and road bridges. Vegetation includes a mix of native and exotic vegetation typical of urban parks, and forms a green band through the town that adjoins larger, open space areas such as Queen Elizabeth Park. Wetland areas have been reinstated on the northern bank in Henley Lake Park.

The reach's closeness to Masterton brings with it many recreational uses common to urban centres – its linear shape allows for varying degrees of jogging, walking and dog walking, fishing, cycling and swimming, while Queen Elizabeth Park and Henley Lake Park are used for a range of water- and land-based recreation activities. The reach is also a corridor for fish passage to the northern reaches of the Waipoua River, with angling access providing popular fishing opportunities in several areas.

While much of the reach has been modified, terrestrial habitats with identified ecological values include mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields and natural wetlands and ponds.

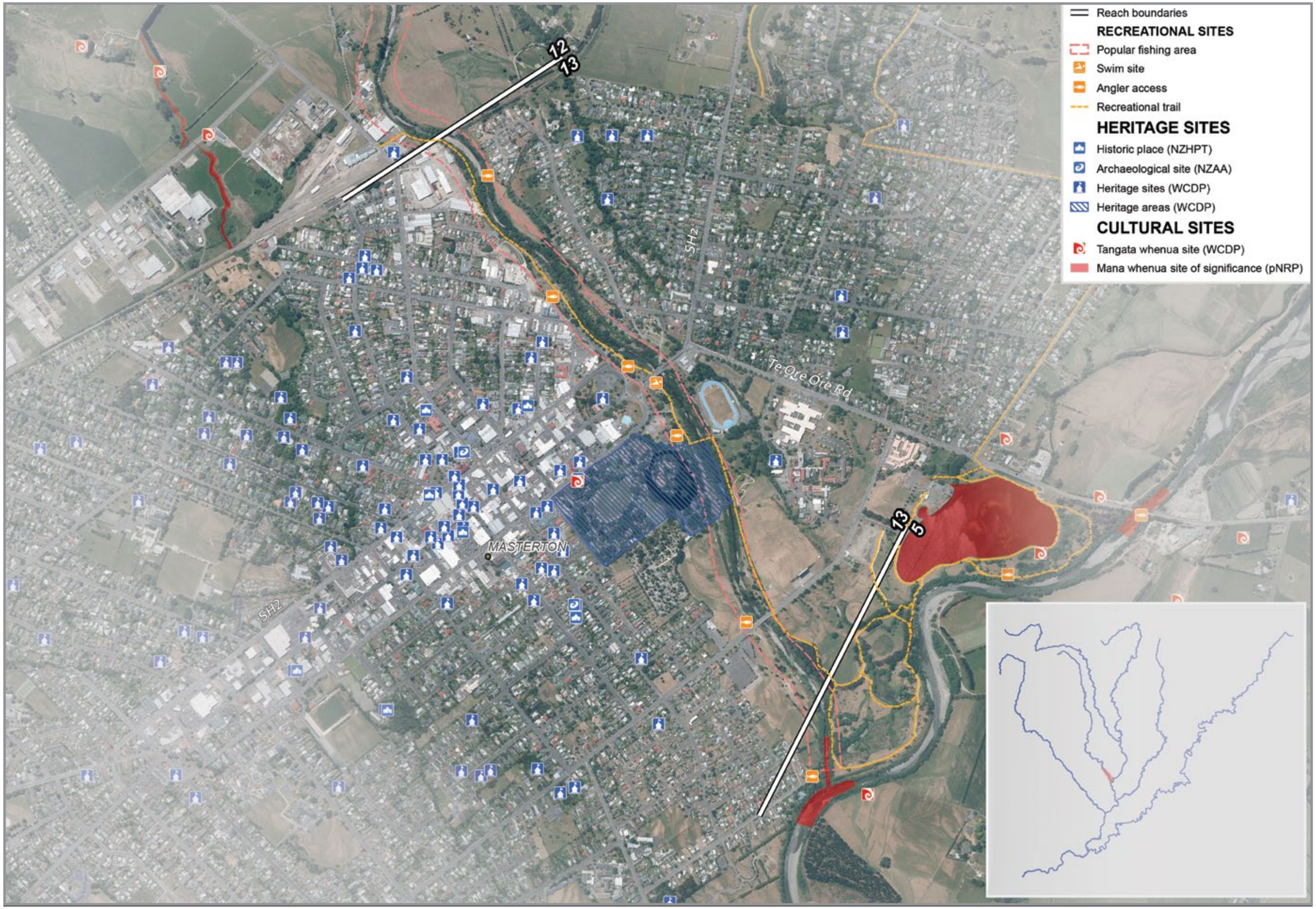
Before Masterton was founded it was a site of Māori settlement, and there are many locations of cultural value on the floodplains and in the river. Important sites have been identified at the confluence and a number of pā, settlements and adjacent sites associated with community activities can be found throughout and next to the reach. The main pā –Kaikōkirikiri Pā – is close to the Mahunga Golf Club course, and its proximity to the Waipoua River indicates the area's significance.

Heritage sites associated with European settlement in Masterton include the building façade at 4 Queen Street and Queen Elizabeth Park, which forms part of a wider heritage precinct to the south of Dixon Street.

Key floodplain management points

- Work with the community in the urban reach area to assess and reduce their vulnerability to flooding.
- Protect the Masterton community to a 1% AEP flood event including a climate change level of service.
- Manage Masterton's exposure to the residual risk of a larger flood or a failure of flood-protection measures.
- Raise awareness of flood risks.
- Ensure that the infrastructure on which the Masterton community relies is safe and efficiently protected from flooding impacts.
- Work with the infrastructure owners of State Highway 2, Colombo Road Bridge and the rail bridge to ensure their continued security and operation.
- Maintain and improve the recreation facilities along the Waipoua River next to Masterton and encompassing Henley Lake Park.
- Maintain or improve the reach's water quality, especially for contact recreation.
- Maintain or improve the environmental value and habitat diversity.
- Work toward enhancing Masterton's identity and its connection to the waterways in its vicinity.
- Explore opportunities to maintain or improve kayaking opportunities on the Waipoua River as the result of any structural upgrade works.
- Improve opportunities for the Masterton community to engage with the river, such as with recreation trails for walking, cycling and nature play.
- Improve the reach's safety for recreation.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium/High	Medium	Angler access, popular fishing area, swimming, walking and cycling	Building Facade – 4 Queen Street, Queen Elizabeth Park (WCDP)	Historic house site	Rural (Special), Road, River, Residential, Industrial, Railway, Commercial, Flood Protection and Mitigation, Recreation, Cemetery, Electricity Distribution, State Highway	Mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds



VALUES – Reach 13: Masterton

Urban Masterton – Reach 13

Flood and erosion issues

The urban reach of the Waipoua River through Masterton has a number of key issues relating to flooding and erosion hazards. Flood studies that include the impacts of climate change have identified the potential for flood risk to some of the Masterton urban area. However, the studies vary in their conclusions on the scale and extent of this risk, so GWRC, MDC and CDC are undertaking further work to provide greater certainty.

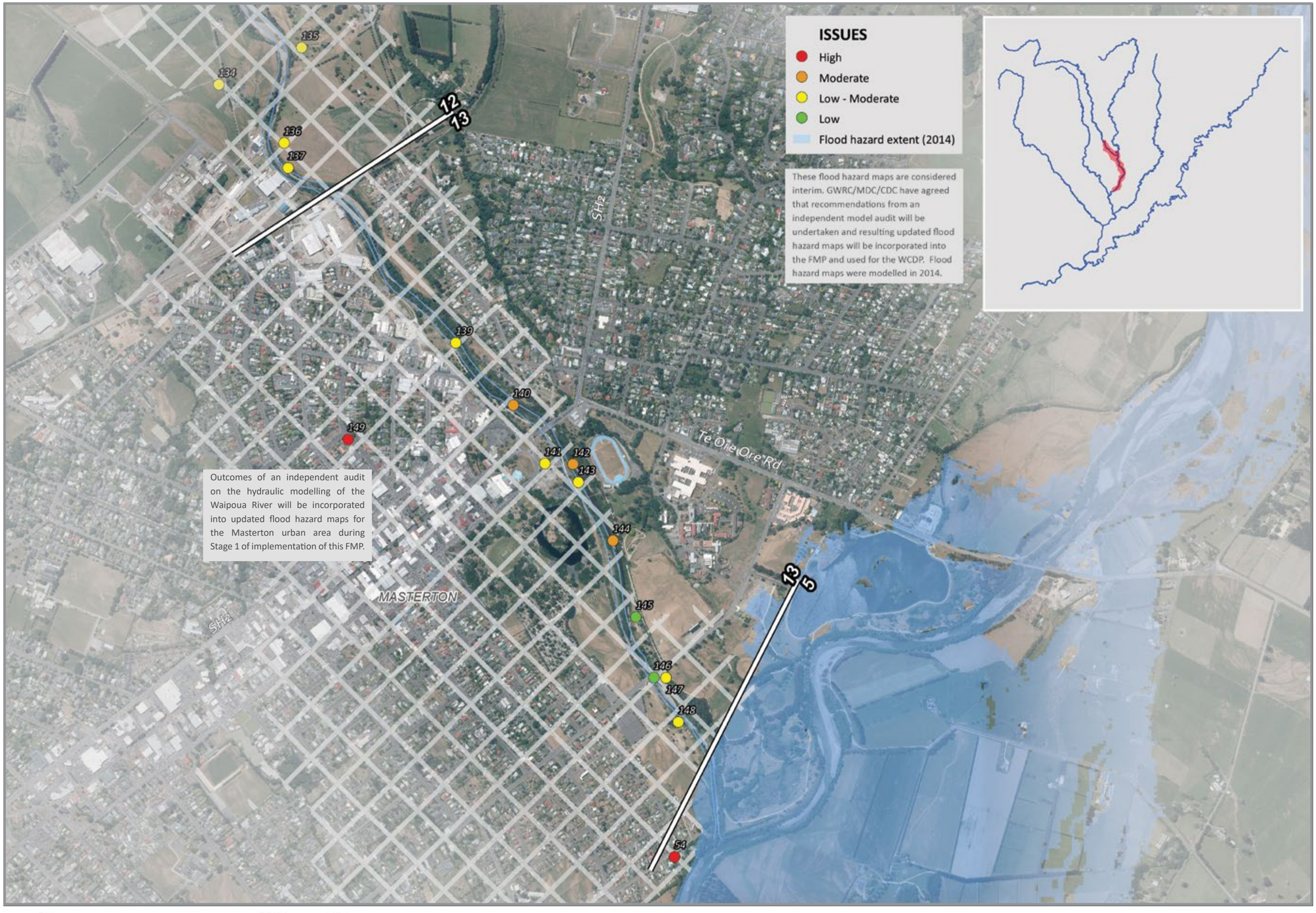
The condition and integrity of the stopbanks in the urban reach are also not well understood, so there is a risk that breaches and seepage will affect their performance in flood events. A breach is possible in an event less frequent than a 1% AEP event, and could result in more significant flooding depths with less warning time.

The flood hazard in the Masterton urban area is expected to increase in future, as the effects of climate change lead to larger and more frequent flooding events. Flood hazard maps will be updated to incorporate the outcomes of the independent model audit being undertaken in Stage 1, as detailed on page 133.

A total of 16 specific flood and erosion issues have been identified in Masterton's urban reach and the adjoining areas of the Waipoua and Ruamāhanga Rivers. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

The flood and erosion issues (and management responses) for Reach 13 are closely linked to the issues (and responses) identified for the wider Waipoua and Ruamāhanga catchment in Part 2 of this FMP. Some of those identified for north Masterton (Reach 12 of the Waipoua River [Issues IDs 134, 135, 136 and 137]) and Te Ore Ore to Waingawa (Reach 5 of the Ruamāhanga River [Issue ID 54]) are included in this section as they are particularly relevant to the Masterton urban reach. For completeness and to ensure integration, these are incorporated into the issues below (and the Major Project Response) for the reach.

RISK LEVEL	DESCRIPTION	
LOW	**Lansdowne sewer siphon [146]** The Lansdowne sewer siphon crosses the river next to Colombo Road Bridge. This structure is at risk of damage in high-flow events, and it sits in the erosion study area	**Irrigation water intake [145]** The irrigation water intake for the rugby grounds on the northern bank of the Waipoua River is located in the erosion study area. Any changes in bed level would also potentially affect its functionality
LOW TO MODERATE	**Houses [134]** Houses are located in the modelled 1% AEP flood extent. This issue is not currently managed **Mahunga Golf Club [135]** The golf course is located in the erosion study area and the modelled 1% AEP flood extent. Areas of the golf course have eroded in the past **Design channel alignment [137, 148, 143]** The design channel alignments for the Waipoua River stop before reaching Colombo Road Bridge. This leaves about 800m of river flowing through Masterton without a defined river corridor and management fairway, which is the current management technique for the rivers. This creates management challenges due to a lack of guidance for river engineers **Sewer lines [141]** On both banks of the Waipoua River, main sewer lines run underground between the stopbanks and the river channel. Their location puts them in the erosion study area of the Waipoua River and would need to be considered during any significant update to the stopbanks	**Emergency sewer discharge point [147]** An emergency sewer discharge point is located downstream of Colombo Road Bridge. This structure sits in the erosion study area **Stopbank issues [139]** Masterton's current stopbanks are relatively close to the Waipoua River's main channel, so are in the erosion study area derived from both modelled and historical erosion extents. The stopbanks have a number of known low spots that may have developed through localised settlement, but some have been lowered deliberately to improve access for mowing or maintaining parks and reserves. The stopbanks' geotechnical condition has been assessed as poor, with further investigation required to better determine their structural integrity. In addition, an old landfill site in this location (the Villa Street Landfill) needs to be considered for erosion risk and noted during any stopbank investigations or upgrades **Channel narrowing [136]** The river channel becomes more confined as it approaches the railway bridge upstream of Masterton. The channel at the Railway Bridge is highly constricted, with limits on the amount of flow that can pass under the bridge and into the Masterton reach. This causes modelled upstream flooding of the Mahunga Golf Club course [Issue 135] and properties on the river's western bank
MODERATE	**Bed control weirs [140, 142, 144]** There are a number of bed-level-control weirs along the Waipoua River in the Masterton reach. They retain their bed levels through this straightened section and counter the degradation process that would otherwise occur. The weirs themselves are at risk of damage during high-flow events, and their failure would lead to a decrease in river bed level and undermine the banks, so could also threaten the stopbanks. The current maintenance responsibility for the weirs is not well defined. Historically, additional weirs were created during summer months to create swimming holes; while this practice has dwindled, many Masterton residents remember them fondly	
HIGH	**River Road properties [54]** A total of 14 River Road properties sit in the erosion study area. Erosion was observed in the 1998 floods, when parts of some of these property sections started to erode into the river. The erosion is currently managed by a series of heavy rock groynes; however, they require ongoing maintenance and management	**Flooding in Masterton [149] – future 1% AEP flood hazard, including an allowance for climate change and modelling uncertainties** Flood studies including climate change impacts, have identified the potential for flood risk to some of the Masterton urban area. However, the studies vary in their conclusions on the scale and extent of the risk, so GWRC, MDC and CDC are undertaking further work to provide greater certainty The condition and integrity of the stopbanks in the urban reach are also not well understood, so there is a risk that breaches and seepage will affect their performance in flood events. A breach is possible in an event less frequent than a 1% AEP event, and could result in more significant flooding depths with less warning time



ISSUES – Reach 13: Masterton and overlaps with Reach 12 and 5 issues combined with flood hazard extent

Urban Masterton – Reach 13

Response

The specific responses and common methods applying to the Masterton urban reach (Reach 13), including related parts of Reach 12 (North Masterton), are set out below. The relevant common methods used to address specific issues are listed in *Appendix 5*.

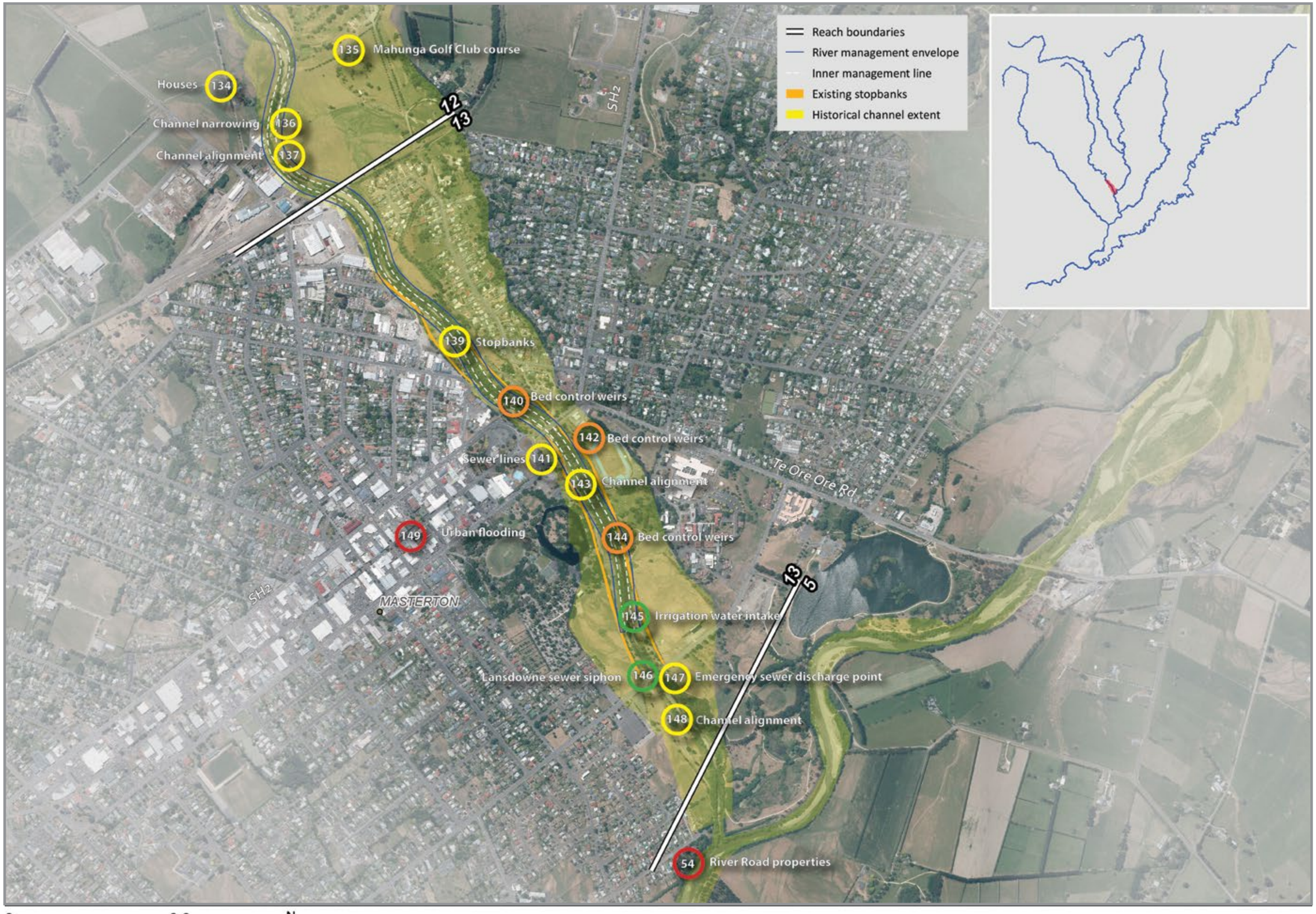
The response developed to address the identified flood and erosion issues affecting Masterton is best described as a comprehensive Major Project Response. It is to be implemented in five stages to ensure that the issues are addressed in an efficient, effective and affordable way, and to respond to future climate change issues.

Note: The erosion issues affecting properties along River Road (Issue ID 54) are addressed in the River Road Major Project Response (see page 78) and have been considered in developing responses for Masterton's urban reach.

REACH-SPECIFIC RESPONSES

SPECIFIC RESPONSES

ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
				CURRENT	TARGET	PRIMARY	SECONDARY	
146	Lansdowne sewer siphon	River management	Continue advising and supporting MDC on the operation of the sewer siphon infrastructure. Continue to provide erosion protection to the siphon			MDC	GWRC	Low
145	Irrigation water intake	River management	River management envelopes will contribute to the security of private water intakes. Private water intakes will have a low risk of damage in up to a 20% AEP event. Damage to structures is more likely in up to a 5% AEP event. Communicate risk to landowners		20%	Landowner	GWRC	Low
134	Houses	Planning and policy	Inform landowners of potential risk			Landowner	GWRC	Low/moderate
141	Sewer lines	River management	Work with MDC to improve the security of the Masterton sewer lines and consider the implications during any significant update to the stopbanks			MDC	GWRC	Low/moderate
147	Emergency sewer discharge point	River management	Continue advising and supporting MDC on the operation of the emergency sewer discharge point and infrastructure. Continue providing erosion protection to the discharge point			MDC	GWRC	Low/moderate
137, 148, 143	Design channel alignment	River management	Extend the river management envelope to the confluence of the Ruamāhanga River. Apply bed-level monitoring and river management envelope common methods to manage channel alignment			GWRC		Low/moderate
135	Mahunga Golf Club course	Planning and policy	Inform landowner of potential risk			Landowner	GWRC	Low
136	Channel narrowing	River management	Apply bed-level monitoring and river management envelope common methods to monitor channel width. This issue is also addressed in the Major Project Response on pages 131-133			GWRC		Low/moderate
139	Stopbank issues	Structural	Continue advising and supporting MDC on the need for additional stopbanks and upgrades to existing stopbanks. This issue is addressed in the Major Project Response on pages 131-133	1% AEP event	1% AEP event + climate change improvements	GWRC		Low/moderate
140, 142, 144	Bed-control weirs	River management	Apply bed-level monitoring and river management envelope common methods to identify any maintenance requirements			GWRC		Moderate
149	Flooding in Masterton	Structural	Work with MDC and a Waipoua Urban River Management Group to assess and address Masterton's flood risk			MDC	GWRC	Low/moderate
54	River Road properties	River management	Provide information, advice and support to property owners on the potential flood and erosion risks. This issue is also addressed in the Major Project Responses for Reach 5 of the Ruamāhanga River			MDC	GWRC	Moderate


Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
135 Mahunga Golf Club course
Houses 134
Channel narrowing 136
Channel alignment 137
12
13
SH2
139 Stopbanks
140 Bed control weirs
142 Bed control weirs
Sewer lines 141
143 Channel alignment
Te Ore Ore Rd
149 Urban flooding
144 Bed control weirs
SH2
MASTERTON
13
5
145 Irrigation water intake
Lansdowne sewer siphon 146
147 Emergency sewer discharge point
148 Channel alignment
54 River Road properties
0
0.6
km
N

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)	RESPONSIBILITY	PRIORITY
COMMON METHODS		Entire reach	River management	Code of Practice, river management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, mixed riparian planting with buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, alternative land uses in riparian planted buffers			
		Entire reach	Planning and policy	Land use controls, designations, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, river management access, strategic land purchases			
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system			
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs			

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
139	Oxford Street	Protects residential properties in up to ~2% AEP event and Mawley Holiday Park from a 10% AEP flood	425	220	Ranges 2-4	High	Masterton – Residential/ Recreational	10%-2%	Nil	Rebuild and extend in the next 5-10 years up to 1% AEP event. Raise height in future to allow for effects of climate change	High
139	Railway Crescent to Villa Street	Protects urban Masterton from flooding in up to a ~1% AEP event	220	130	4	High	Masterton urban area – Industrial/Commercial/ Residential	2%-1%	Overgrown with vegetation, uneven and of questionable quality	Rebuild and extend in the next 5-10 years up to 1% AEP event. Raise height in the future to allow for effects of climate change	High
139	Queen Elizabeth Park	Protects community recreational facilities from flooding in up to a <1% AEP event	930	250	Ranges 2-3	High	Masterton – Residential/ Recreational	2%-1%	Vegetation/ Trees in stopbank	Rebuild and extend in the next 5-10 years up to 1% AEP event. Raise height in the future to allow for effects of climate change	High
139	Colin Pugh Sports Bowl	Protects urban Masterton from flooding in up to a <1% AEP event	930	0	Ranges 2-4	Med	Community recreational assets	1%	Vegetation/ Trees in stopbank	Rebuild and increase height in the future to allow for the effects of climate change	Low

Major Project Response: Urban Waipoua

The issue

This response will provide protection to Masterton from a 1% AEP flood event and has the potential to be adapted in the future to include the effects of climate change. The staged approach outlined will allow a refined understanding of the current and future risks, and enable communication and engagement with the community to raise awareness of the flood hazard and better prepare those who could be affected by flooding.

Future land-use changes have the potential to reduce risks in flood-prone areas and could be designed to future-proof the river corridor and surrounding area. Changes in the catchment, such as planting, introducing wetlands and increasing the floodplain, could also help to reduce flooding issues.

Integration of the urban reach with the wider FMP

The urban reach of the Waipoua River (Reach 13) cannot be considered in isolation from the Waipoua River upper reaches (particularly Reach 12, North Masterton) or the confluence with the Ruamāhanga River.

Investigations have shown that inundation of the floodplain upstream of the urban area reduces the flood flows through Masterton and the risk of spills over the stopbanks. Conversely, flooding from Reach 12 (North Masterton) flows overland to the urban area and increases the flood risk.

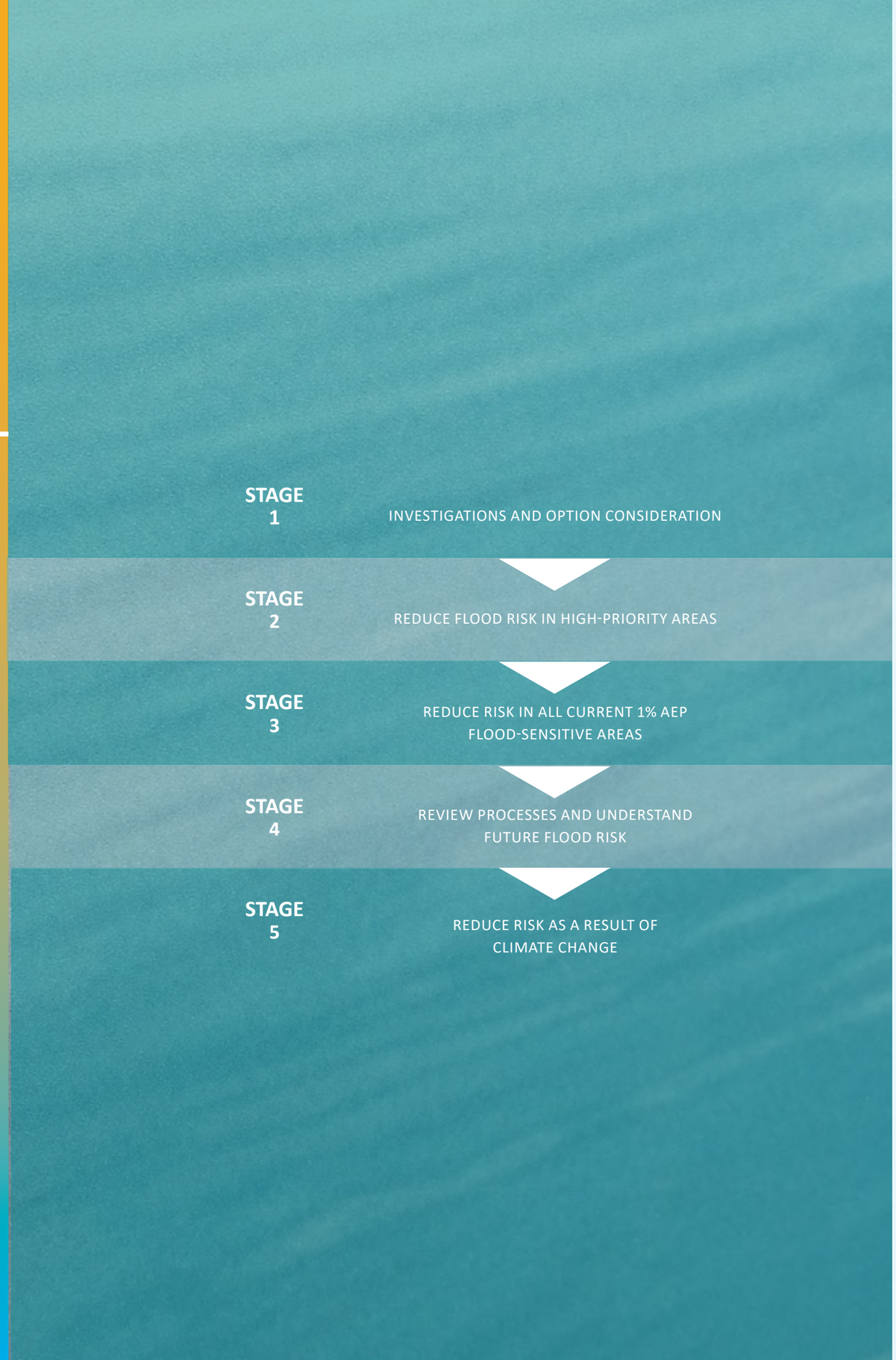
Downstream, at the confluence of the two rivers, the Ruamāhanga River level may affect the downstream end of the Waipoua River and contribute to flooding.

The development of suitable floodplain management options therefore requires an understanding of the impacts of anticipated changes in the wider Te Kāuru Upper Ruamāhanga catchment, including changes that happen as a result of common methods and Major Project Responses (as set out in Parts 1 and 2 of this FMP).

The responses in other reaches that have specific potential to influence the responses implemented in Masterton's urban reach are:

- Any work done upstream of the urban reach (Reaches 9-12 of the Waipoua River) to reduce the flood flows. This includes the installation of managed wetlands, small on-farm storage and the slowing down of the overland flow through bunds or increased vegetation
- Any work done in the upper catchment for erosion management, such as bank protection, that may change the river's characteristics and flooding
- Any development undertaken upstream – whether in the predicted flood extent or in the catchment – that would increase surface-water runoff and change significantly the catchment's characteristics. This includes developments controlling industrial and residential development and ensuring that development does not allow excess stormwater to reach the Waipoua River at a greater rate than currently
- The implementation of a flood warning system for Paierau Road (Reach 12), as the process could be applied to any flood warning system for the urban reach. While the road floods in lower return period events and therefore may not be directly related to flooding from spills from the urban reach, the information will likely be particularly useful and relevant to properties at risk of flooding from the overland flow from the upstream reaches
- The impacts of realigning the Ruamāhanga River and installing rock groynes immediately downstream of the confluence with the Waipoua River (Reach 5 of the Ruamāhanga River) as a Major Project Response to mitigate the erosion risk at River Road (see page 78). This location is also at risk of flooding and changes to this reach of the Ruamāhanga River may alter the risk and flooding mechanisms at this location

These responses have the potential to affect the timing of structural options and interventions, and the scale of works required in the Masterton urban reach. They should therefore be monitored as part of the long-term solution in this FMP.



Staged approach

This section outlines a staged approach for the Waipoua River's urban reach. At the end of each stage, an assessment will be made of whether to proceed to the next stage and what that stage will involve.

This staged approach reflects the uncertainty of managing future flood risks. It enables:

- Adaptability as new information is obtained
- Reviews of the initial stages' effectiveness
- Responses to be adapted, as information and understanding grow, to manage any residual risks or risks over and above the protection afforded under the agreed level of service

The figure at left illustrates the staged approach.

Stage 1, 'investigations and option consideration' is described on page 133. Subsequent stages are not detailed; they will be determined once Stage 1 is complete.

Costs and timing

The estimated cost for Stage 1 of this Major Project Response is $350,000. It is expected to be completed within two years.

Priority

Stage 1 is classified as of high importance and high priority.

Level of service

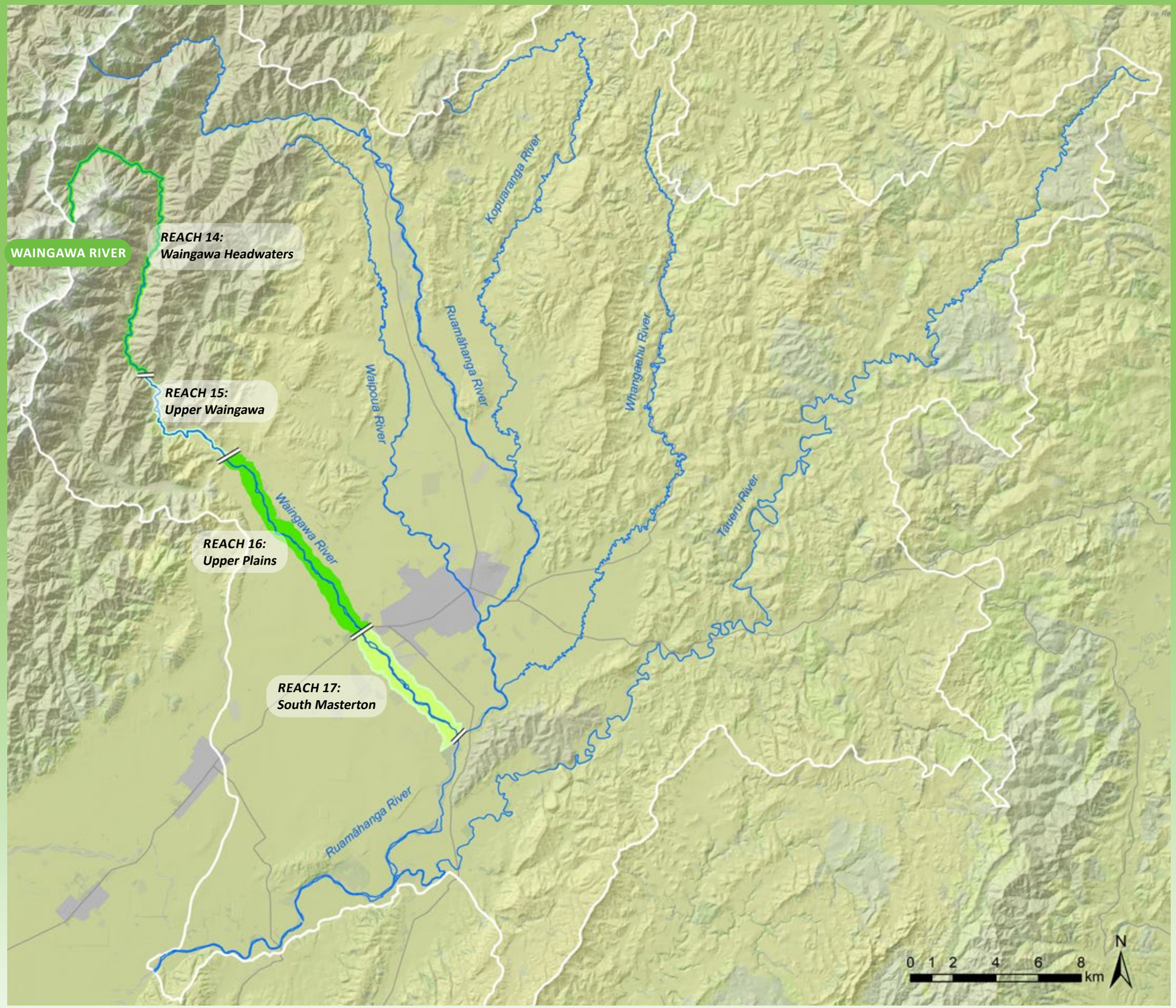
A 1% AEP level of service is initially proposed for the entire urban reach, with an allowance for increases in the future to allow for the effects of climate change and uncertainties in the model.

Stage 1: Investigations and option consideration

The purpose of Stage 1 is to investigate the condition of existing assets (such as stopbanks) and further understand the risk of flooding in the urban reach. Following this, various designs for Stages 2 and 3 will be considered, in conjunction with the local community, to ensure a sustainable and affordable outcome. This stage is expected to take up to two years.

Stage 1 has five elements.

- **Complete geotechnical investigations**
  Geotechnical investigations will provide a good understanding of the existing stopbanks' condition and structural integrity – an important step before undertaking detailed designs. The investigations will also be used to assess the soil and geology of the surrounding river environment to find out if it can be used for new stopbanks or for upgrades to existing ones.
- **Update flood hazard maps to incorporate the best information available**
  The outcomes of an independent audit of the Waipoua River's hydraulic modelling will be incorporated into updated flood hazard maps for the Masterton urban area. Other information will also be gathered, such as building floor levels of properties in the flood zone and flow records, to build on existing data. Any additional information from the community and other sources will also be incorporated to ensure that the best information is being used and the best outcome for the community is sought. It is envisaged that this information will be obtained collaboratively with the community through a Waipoua Urban River Management Group.
- **Develop the design of preferred options in conjunction with the community**
  With a detailed understanding of the existing stopbanks, flood hazards and the surrounding environment, specific risk-management options can be developed. This process will include assessing the options for stopbank locations and the levels of service for any new stopbanks, as well as timings, costs and designs. It will also consider opportunities to improve recreation, environmental and cultural values in tandem with the Environmental Strategy, through a collaborative process with a Waipoua Urban River Management Group, the community, MDC and GWRC.
- **Community preparedness**
  Supporting the community to ensure it is resilient to current and future flood risks will involve raising awareness of these risks through education, promoting community preparedness and developing emergency response plans.
- **Land use changes, land purchases and other regulatory processes**
  In considering land use in the upper catchment, wetlands will be encouraged in the upper reaches of the Waipoua River for environmental benefits and to help reduce flood peaks. Land purchases are not currently expected, but this may need to be reviewed during Stage 1 to ensure that the agreed level of service is provided to those in the flood zone. Planning restrictions will also be considered to ensure that developments in the river corridor and predicted flood-sensitive areas are regulated, especially in relation to building floor levels.



Waingawa River

8. The Waingawa River

The Waingawa River flows from the Tararua Range into the Ruamāhanga River to the south of Masterton. Its upper reaches start in Tararua Forest Park and flow out onto the Wairarapa Plains from the confluence with the Atiwhakatu Stream near Kaituna.

Historically, the Waingawa River was known to change course often – moving across the plains and sometimes leaving sections of river channel isolated. Over time these isolated river channels developed into wetland areas. The name Waingawa stems from the name given by Haunui-a-Nanaia, 'Waiawangawanga', which means troubled or uncertain waters. Like many traditional names, Waiawangawanga has been shortened to Waingawa for easy pronunciation.

In the upper Wairarapa Plains, the river widens to take a broad, semi-braided form that follows a fairly direct alignment towards the Ruamāhanga River for approximately 17km. Here the river bed is typically contained by willow margins, with further pockets of remnant forest retained on terraces that step from the river.

The Waingawa floodplain soils are formed from greywacke alluvial parent materials from the Tararua Range. Land use in the catchment is a mix of native forest in the upper catchment transitioning to a range of primary production activities in the Wairarapa Plains. The river's middle section also adjoins rural lifestyle development and urban areas (Masterton) including Hood Aerodrome.

Key recreational values include kayaking and wilderness fishing in the upper catchment, and significant reductions in these activities downstream of the foothills (although there are good vehicle access points to the river for kayakers to get out of the river). Jet boating is also a recreational activity in the lower reaches.

The Waingawa River is an important ecological corridor. Of particular note is the Atiwhakatu Stream tributary, which is a significant fish spawning area. Both waterways contribute to the diversity of native and exotic fish species in the study area, and the Waingawa River is an important nesting sites for banded dotterels. A number of other valued species have been recorded along the river, including the black shag, pied stilt, black-billed gull and New Zealand pipit.

The ecological value is reflected in the river's cultural values, which are linked to wetland areas that formed in cut-off channels and old backwaters, becoming valued for mahinga kai. It is important to note that the mahinga kai value of the Waingawa River carries across to both Parkvale Stream and Booths Creek. The cultural relationships between these streams, the Waingawa River, the Mangatārere Stream and the Waiōhine River illustrate the intricacies and complex interconnectedness in the catchments.

General issues

The Waingawa River is respected by people living nearby as a high-energy river. It is mostly entrenched in a fairly tight, naturally confined floodplain, so much of the flooding – even in a large flood event – is contained by naturally formed historical river terraces from where it enters the Wairarapa Plains until it joins the Ruamāhanga River near Te Whiti.

The erosion risk, both modelled and observed, is of much greater concern. The river's energy drives changes in the main channel, and after each flood event its bed is scattered with the remains of trees and vegetation eroded from the banks. Areas of high value – healthy native forest – in the Waingawa's upper catchment are exposed to flooding.

On the narrow floodplain in the foothills, the land use is predominantly lifestyle properties and small holdings with some primary production activities. A small band of industrial processing and production activities is located next to Masterton around the two bridges.

In a number of places, critical or high-value infrastructure sits in or near to the active river corridor – such as the water supply intake and pipeline to Masterton, and the associated treatment plant. In addition, the Masterton-Wellington railway line and State Highway 2 cross the river near Masterton.

The Hood Aerodrome runway has been threatened by erosion a number of times, and an investigation has indicated that about 210ha of land that would not previously have been classified as river channel were lost to erosion between 1941 and 2012. The Waingawa River also creates challenges for establishing vegetated buffers due to its deeply cut channel with areas of vertical river bank.

Waingawa Headwaters – Reach 14

Character

The headwaters of the Waingawa River flow through Tararua Forest Park. In this area the river passes through bush-clad gullies, with rock-lined gorges and narrow boulder gardens with rapids and pools providing a wilderness-like environment.

Key characteristics

- Bush-clad gullies
- Rock-lined gorges and boulder gardens
- Limited visible human presence

Values

The headwaters of the Waingawa River flow through fenced and unfenced indigenous vegetation protected as part of the DoC estate. Rock-lined gorges framed with native beech and podocarp forest, and very low levels of landscape modification, mean it has a very high scenic value. The entire reach is zoned Rural (Conservation) in the WCDP (2013).

The reach's wilderness and scenic values have led to the development of a number of popular walking and tramping tracks with huts, leading into the Tararua Range. It is also used for wilderness fishing and some grade 2+ kayaking along boulder gardens and sharp ends. Mitre Flats is a popular fishing and kayaking area along this reach, with foot access only.

Key floodplain management points

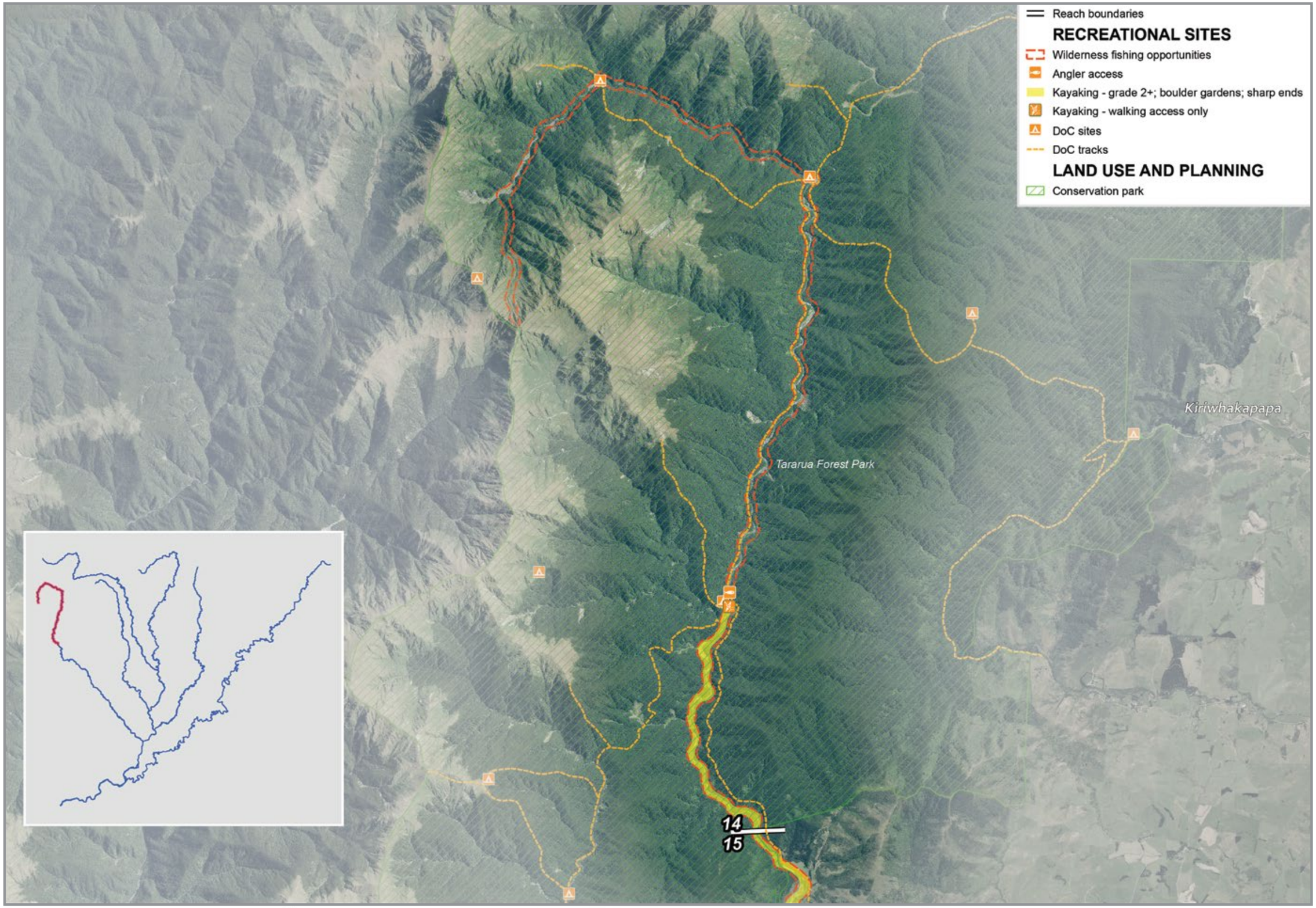
- Encourage continued recognition of the reach's values and character.
- Support initiatives that aim to preserve or improve its natural values.

This FMP has no intention to undertake any maintenance activity in the reach, and no specific flood and erosion issues have been identified.

REACH-SPECIFIC RESPONSES

	SITE	TYPE OF RESPONSE	MEASURES
COMMON METHODS	Entire reach	River management	Isolated works support, Code of Practice
	Entire reach	Planning and policy	Protection against deforestation in upper catchment
	Entire reach	Emergency management	Emergency management planning, flood forecasting and warning system
	Entire reach	Environmental enhancement	Community Support Officer

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Very low	Very high	Walking tracks and huts (DoC), angler access, wilderness fishing	-	-	Rural (Conservation), River	Fenced indigenous forest, unfenced indigenous forest, stonefield and boulderfield



VALUES – Reach 14: Waingawa Headwaters

Upper Waingawa – Reach 15

Character

The upper Waingawa River flows from the Tararua Range through an area of low-lying foothills that separate the headwaters from the wider Wairarapa Plains. As the river emerges from Tararua Forest Park, it begins to develop a semi-braided form dispersed between rock-lined gorges. Its margins continue a dominant cover of native vegetation separating the river from surrounding low-intensity, rural use. The valley floor associated with the river also includes increasing areas of rural lifestyle use.

Key characteristics

- Discrete semi-braided areas separated by narrowed rock gorges
- Continuous bands of native vegetation framing the river margin
- Recent rural lifestyle expansion along the valley floor in some areas

Values

This reach of the river is slightly more modified than the Waingawa headwaters that flow through Tararua Forest Park. Gorges with rapids and pools provide wilderness recreation opportunities along the river's course, against a backdrop of areas of native broadleaf plants. Where the river begins to widen, exotic shelterbelts and pasture grassland become established along the margins, with areas of rural lifestyle settlement also established along the lower parts of this reach. This has resulted in a low level of landscape modification overall and a retention of high scenic value.

Walking tracks that provide angler and kayak access continue from road ends along this reach, with popular semi-wilderness recreation sites identified at the Blake Stream confluence and the Pines. The latter site also forms a popular swimming area at the end of Upper Waingawa Road.

Terrestrial habitats with identified ecological values along this reach include fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland and stonefields and boulderfields.

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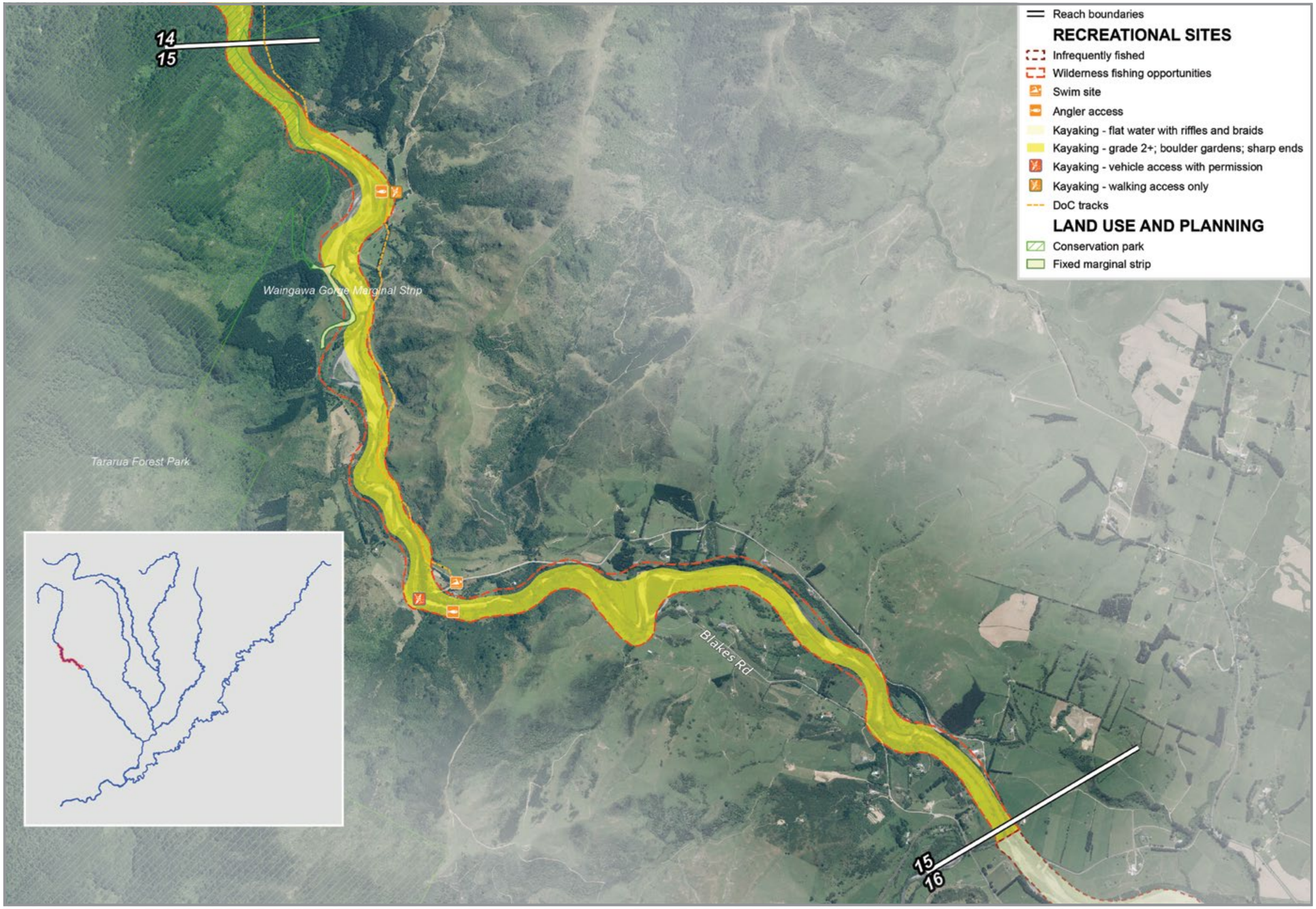
Key floodplain management points

- Work with MDC to improve the security of the Masterton water supply, including intake, pipe crossing and pipeline.
- Apply isolated works policy for all maintenance works. No river scheme is established in this reach.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low	High	Walking tracks (DoC), angler access, kayak access, swimming, kayaking, fishing	-	-	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, Water Supply Intake	Fenced indigenous forest, Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields



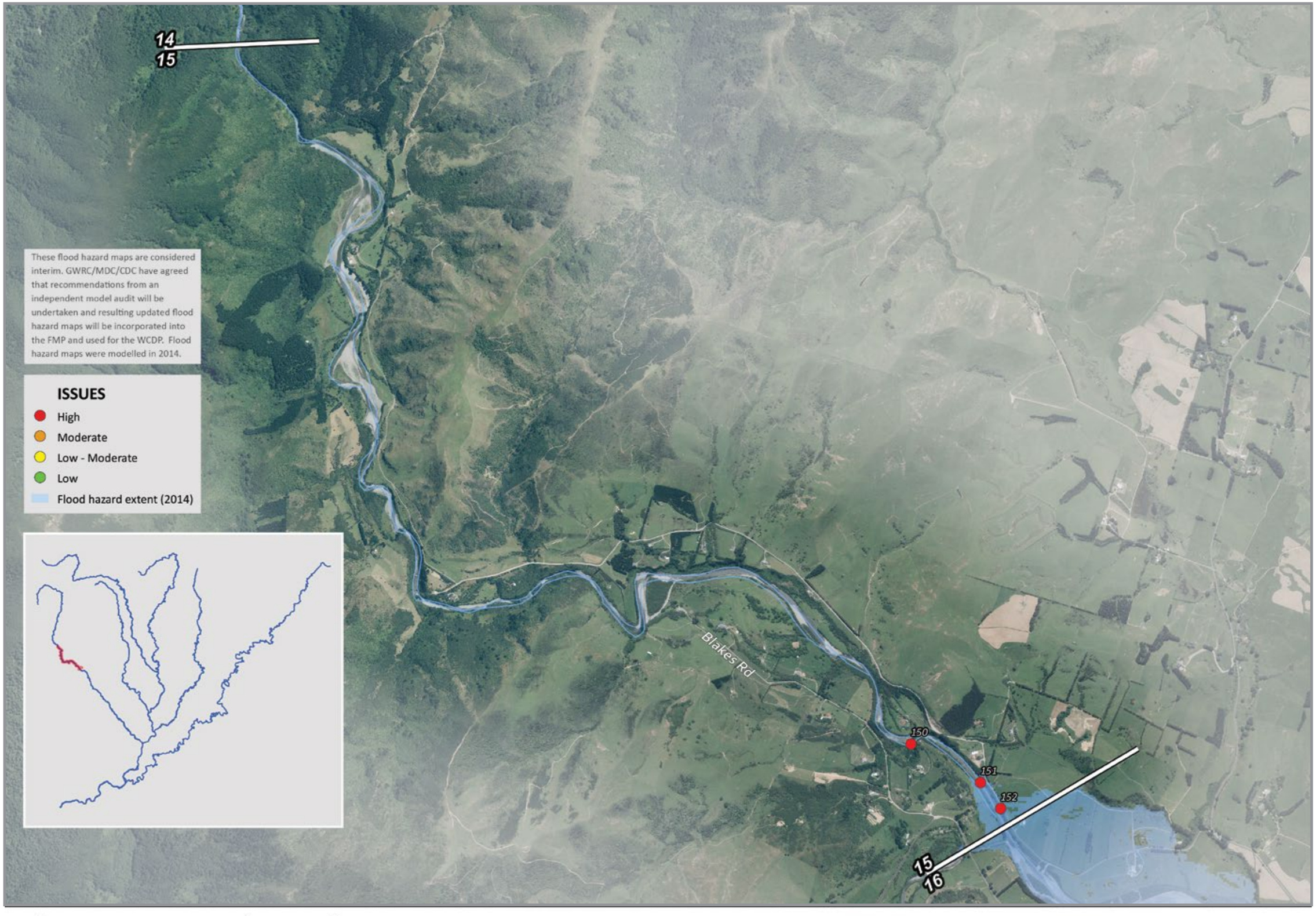
VALUES – Reach 15: Upper Waingawa

Upper Waingawa – Reach 15

Flood and erosion issues

Three flood and erosion management issues have been identified along this reach, associated with Masterton's water supply. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION
LOW	
LOW TO MODERATE	
MODERATE	
HIGH	**MDC water supply intake [150]** The water supply intake for Masterton is located in the foothills area and in a stable gorge-like section of the river. It does sit in the erosion study area. No known issues exist with this intake point **MDC water supply pipe bridge [151]** The river bed in the vicinity of the pipe bridge is subject to fluctuation, increasing the risk of debris flow or scour to the structure. Damage to this structure, possibly as part of a large flood event, would have very significant consequences for Masterton's population. For this reason the issue is considered high risk **MDC water supply pipeline [152]** The water supply pipeline runs through a narrow strip of land between the river bank and the road. It is constantly under erosion pressure, so the protection assets require ongoing management and maintenance. Damage to the structure would have significant consequences for Masterton's population



ISSUES – Reach 15: Upper Waingawa

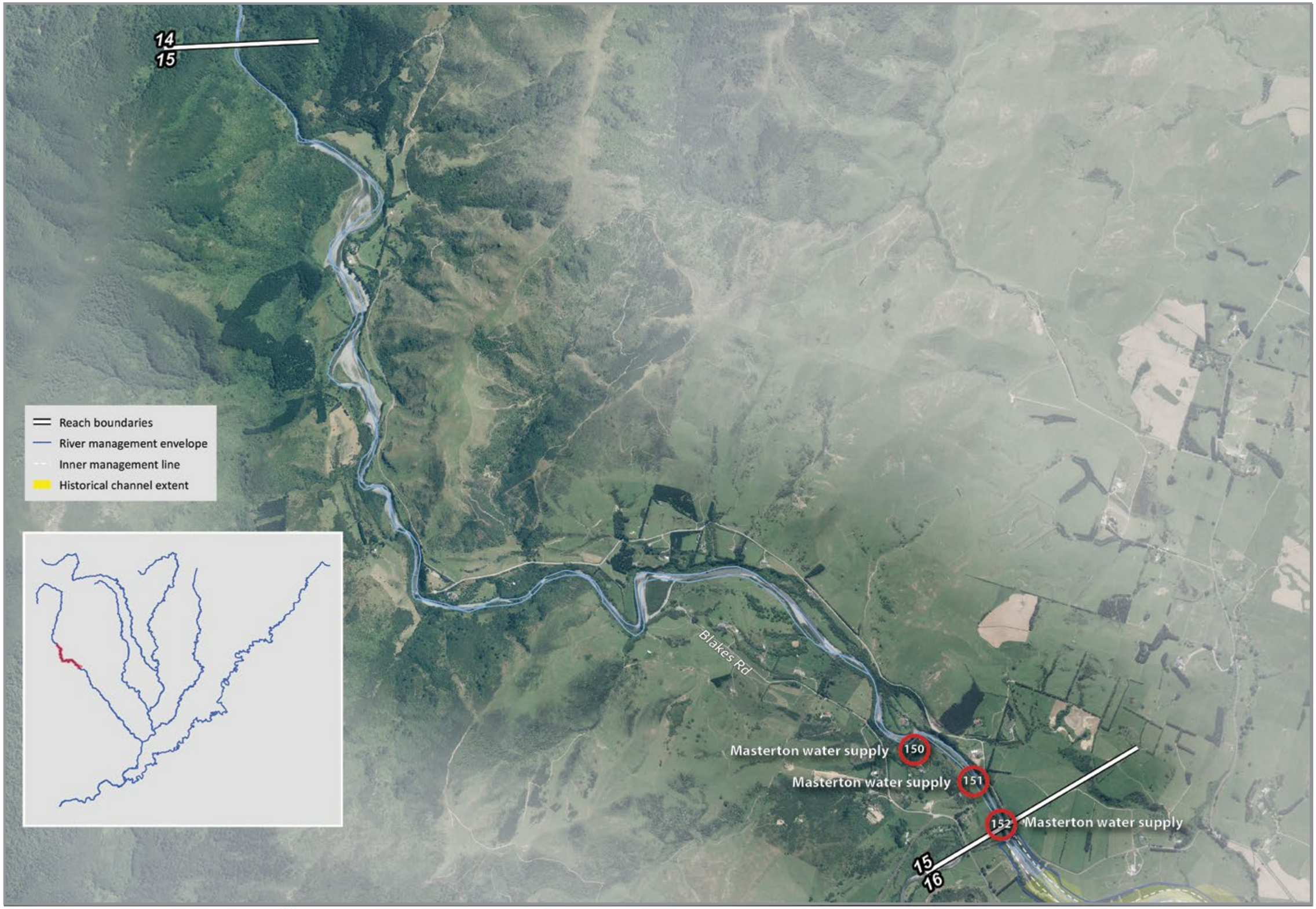
Upper Waingawa – Reach 15

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5.*

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES	150 151 152	Masterton water supply	River management	Continue advising and supporting MDC on the operation of water supply infrastructure. Continue providing erosion protection to the supply pipeline as a priority for the Waingawa River. Refer to the MDC raw water supply pipeline Major Project Response (page 150)		1%	MDC	GWRC	High
		Various sites	Environmental enhancement	Formalise an access point to the river at Upper Waingawa Road, and explore other sites such as Black Rock Road, South Road and Hughes Line. Establish a care group and work with clubs that use these locations to maintain the sites and provide suitable and safe access to the river. The community is to maintain the site with support from local authorities			GWRC	Community	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Protection against deforestation in upper catchment, land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


14
15
Reach boundaries
River management envelope
Inner management line
Historical channel extent
Blakes Rd
Masterton water supply
150
Masterton water supply
151
152
Masterton water supply
15
16
0
1
km
N

Upper Plains – Reach 16

Character

From the confluence with the Atiwhakatu Stream, the Waingawa River emerges onto the Wairarapa Plains from an area of undulating hills. The State Highway 2 bridge provides a landmark delineator between Reach 16 and the river's lower reaches. In this area the river establishes the twisted, semi-braided form from which its name is derived.

The margins of this corridor include willow planting and native vegetation, while terraces accommodating mixed agricultural use and vegetation step above the corridor. Vegetation includes a significant stand of tōtara and kahikatea surrounding the Masterton Water Treatment Plant along the bank's true left bank, and a significant stand of native forest on the true right bank. Lifestyle blocks are prevalent along Norfolk Road.

Key characteristics

- Semi-braided form with islands visible from State Highway 2 bridge
- Margins of mixed willow and remnant native forest
- Increasing settlement close to Masterton

Values

This reach continues through rural land used for primary production activities that is mainly established in pasture. River re-contouring works become more frequent in this area, alongside areas of willow planting and large areas of indigenous vegetation. Overall the reach's landscape has undergone a low/medium level of modification and it has medium/high levels of scenic value.

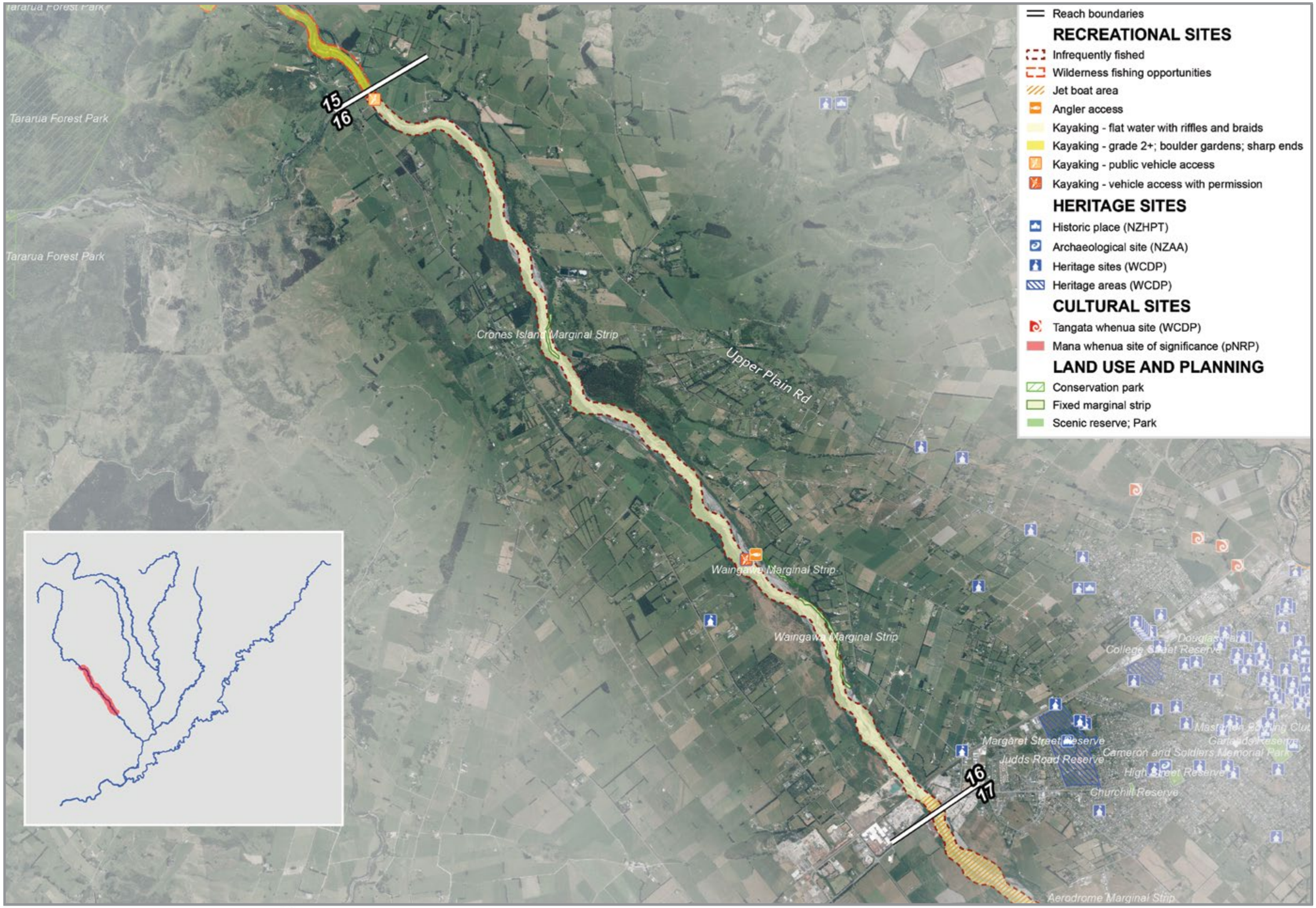
The flat water with riffles and braids enables some kayaking along the reach, while the river's naturally shifting course results in an unstable, infrequently fished environment (although the reach is important for fish passage). The end of Skeets Road provides access for kayaking and fishing.

Important ecological values identified along this reach relate to the Waingawa River bush RAP site. The identified terrestrial habitats include unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland and stonefields and boulderfields.

Key floodplain management points

- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- This FMP will increase river enhancement works.
- Protect the Waingawa River bush RAP site from the negative impacts of flooding and erosion.
- Work with MDC to improve the security of Masterton's water supply, including pipeline and treatment works.
- Maintain the additional protection for Masterton provided by the Skeets Road stopbank.
- Work with CDC to maintain the Taratahi Water Race intake's erosion security.
- Work with the asset owner of the electricity distribution network to relocate pylons outside the active channel.
- Address security concerns about the stopbank between the State Highway 2 and rail bridges, promote the idea of relocating this industrial area outside the flood zone, and possibly redefine this land area as a public recreation site.
- Work with the infrastructure owners of the railway and road bridges to ensure their continued operation and security.
- Work with Water Wairarapa on dam and irrigation proposals in the vicinity of this reach.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Low/Medium	Medium/High	Angler access, kayak access, kayaking, infrequent fishing	-	-	Rural (Primary Production), Rural (Special), Road, River, Industrial, Railway, State Highway, Flood Protection and Mitigation, Water Supply and Education	Waingawa River bush (RAP), unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields

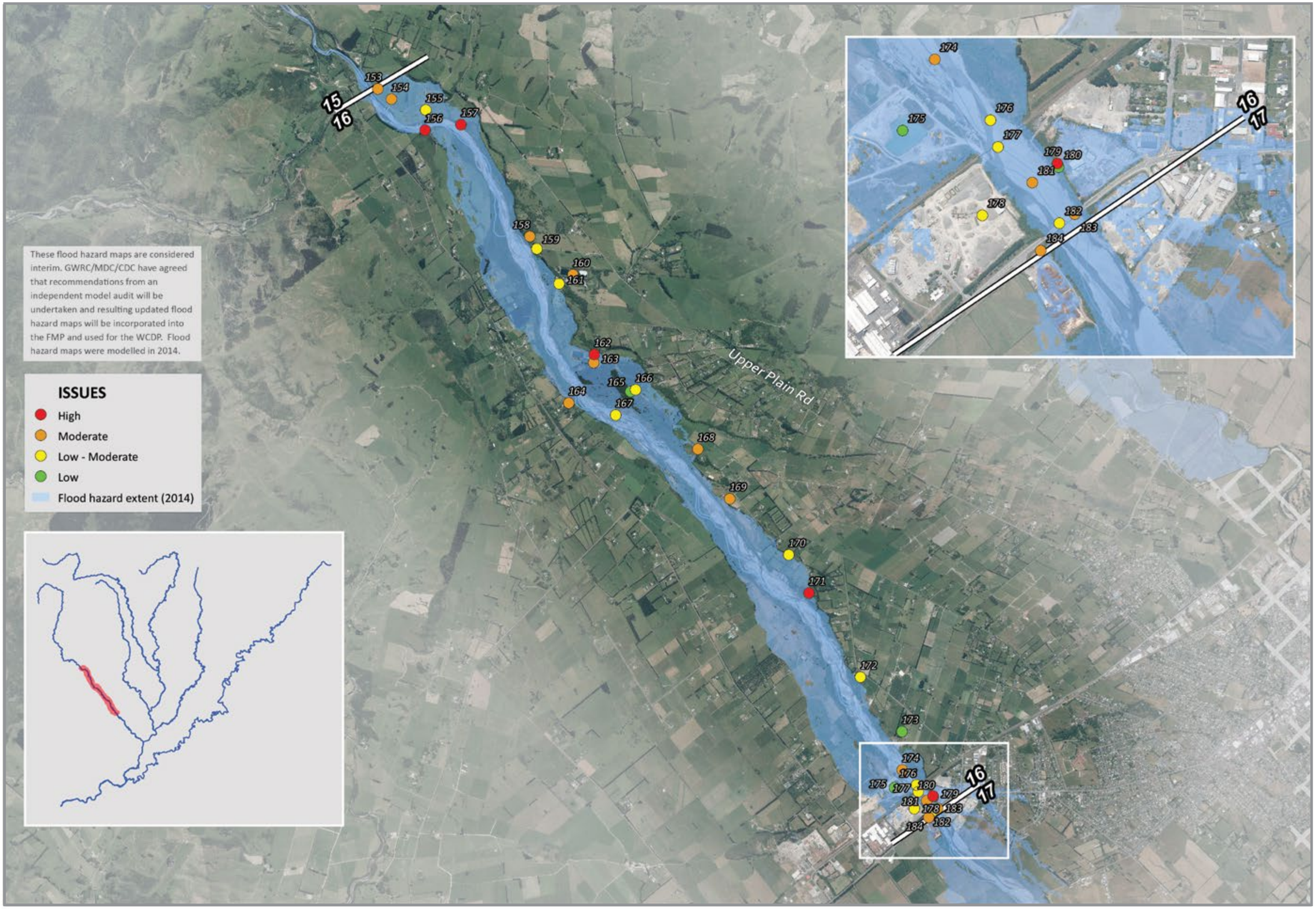

Tararua Forest Park
Tararua Forest Park
Tararua Forest Park
15
16
Crones Island Marginal Strip
Upper Plain Rd
Waingawa Marginal Strip
Waingawa Marginal Strip
College Street Reserve
Margaret Street Reserve
Judds Road Reserve
Cameron and Soldiers Memorial Park
High Street Reserve
Churchill Reserve
16
17
Aerodrome Marginal Strip
Reach boundaries
RECREATIONAL SITES
Infrequently fished
Wilderness fishing opportunities
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - grade 2+; boulder gardens; sharp ends
Kayaking - public vehicle access
Kayaking - vehicle access with permission
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
Heritage areas (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Fixed marginal strip
Scenic reserve; Park
0
2.2
km
N

Upper Plains – Reach 16

Flood and erosion issues

A total of 32 flood and erosion management issues have been identified along this reach, mainly associated with water supply and rural development west of Masterton. Each issue has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**MDC water supply future treatment site [165]** The site designated for a potential future water treatment plant sits in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Selected Land Use Register site [173]** A site on the SLUR sits in the erosion study area	**Contractors yards [175]** Contractors yards are located in the erosion study area and are affected by the 1% AEP flood event **Channel alignment [180]** The buffers on the true right bank between the two bridges are very narrow; a review has been recommended
LOW TO MODERATE	**Farm buildings [155]** A number of farm buildings, including a milking shed, sit in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Houses [159]** Houses are located in the erosion study area **MDC Water Treatment Plant – sludge treatment area [161]** The sludge-treatment sections of the MDC Water Treatment Plant are located on the lower river terraces and in the erosion study area. This issue is not currently managed **Historical river channel [166]** An old river channel sits in the overflow path of the updated 1% AEP flood extent. The old gravel river bed has been planted over and closed off with a stopbank **Channel alignment [167]** A lack of buffers at this location has created ongoing river management issues and difficulty in maintaining the river in agreed river management envelope. The true right bank erosion currently extends beyond the buffer	**Flapgates in stopbanks [170]** Two flapgates (devices that allow water to flow in one direction only through a culvert) in the Skeets Road stopbank create possible routes for backflow (unintended and undesirable reverse flows). The gates are occasionally blocked open because of misunderstandings about their purpose and use **Buildings [172]** Several buildings sit in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Sub-transmission powerlines [176]** Pylons just upstream of the railway bridge sit on the berms and are in the erosion study area. This issue is not currently managed **Rail bridge [177]** Bed degradation is a managed and known issue in the area around the railway bridge **Contractors' yards [178]** Contractors' yards are located in the erosion study area and affected by the 1% AEP flood event. This issue is not currently managed **Sewer and water supply pipeline [182]** Sewer and water pipelines are clipped to the road bridge across the Waingawa River. This issue is not currently managed
MODERATE	**Upper Waingawa Road [154]** Upper Waingawa Road is modelled to flood to a depth of up to 0.9m in a 1% AEP flood event **House [153]** A house is located in the erosion study area and the 1% AEP flood extent. This issue is not currently managed **Waingawa River bush RAP site [158]** The RAP site sits in the erosion study area and is part of the buffer strip along this bank. It is also very close to the design channel alignment. This issue is not currently managed **MDC Water Treatment Plant – main facility [160]** Parts of the MDC Water Treatment Plant sit in the erosion study area. This issue is not currently managed **House [163]** A single dwelling sits in the 1% AEP flood extent. This issue is not currently managed **House [164]** A single dwelling sits in the erosion study area and is also in the existing WCDP erosion area. It is not affected by the 1% AEP flood event. This issue is not currently managed	**Tararua Drive stopbanks [168]** The stopbanks in this location are of low level, and their crest height is monitored often **House [169]** The house and outbuildings are in the erosion study area but sit outside the 1% AEP flood extent. This issue is not currently managed **Distribution network powerlines [174]** A pole that is part of the local electricity distribution network sits in the active channel of the river bed. Adjacent pylons sit close to the river berms and are at risk of erosion **Road bridge [183]** Bed degredation is managed in the area around the road bridge **Pump station for sewer pipeline [184]** The sewer pipeline pump station is located in the erosion study area and on the edge of the 1% AEP flood extent. This issue is not currently managed **Channel alignment [181]** The buffer on the true left bank between the two bridges is very narrow. A review has been recommended
HIGH	**Taratahi Water Race intake [156]** Bed degradation in the vicinity of the water race has meant ongoing difficulties with maintaining water flow into the race. It is also difficult to achieve a balance between scour and aggradation effects due to the intake's location in relation to the channel alignment **MDC water supply pipeline [157]** Bed degradation at Black Creek is creating a risk to Masterton's water supply pipeline, which sits in the erosion study area **MDC water supply boost pump station [162]** The boost pump station for Masterton's water supply sits in the 1% AEP flood extent. This issue is not currently managed	**Skeets Road stopbank [171]** The stopbank in this location cuts off an historical overflow path that connected the Waingawa River to the Waipoua River near Ākura. It is a good-quality stopbank maintained by GWRC, but a failure could have flooding consequences for Masterton. High criticality **Stopbank [179]** The stopbank on the true left bank between the two bridges was built using a mix of wood mulch and other materials, and is therefore of very poor quality and probably a high failure risk. Flooding in this area would affect the industrial yards further along the bank edge and along the Masterton fringes. Material from the bank has been washed into the river in past events



ISSUES – Reach 16: Upper Plains

Upper Plains – Reach 16

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5.*

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES		Various sites	River management	Use the river edge envelope common method. It is difficult to establish successful buffer planting in many places along the Waingawa River due to its high, steep-sided and actively eroding banks. Shallow-profile banks are a key tool in enabling buffer establishment, as they can be planted to establish river-edge vegetation. However, some areas of the buffer will have to be sacrificed to the river to enable the formation of these gentle slope gradients	20%	5%	GWRC	Landowners	Medium
	156	Water race	River management	Ongoing maintenance plan linked to bed-level monitoring to maintain security of water race until it can be replaced or retired. Consider duplication and redundancy of water race intake through Water Wairarapa			CDC	GWRC	Medium
	157 160 161 162	Infrastructure	River management	MDC is responsible for a contingency and repair plan to address the risk of the water supply infrastructure being lost. MDC is also responsible for inspecting the infrastructure attached to bridges after flood events. Refer to the MDC raw water supply pipeline Major Project Response (page 150)		1%	MDC	GWRC	High
	171	Skeets Road stopbank	River management	The Skeets Road stopbank is built and maintained to a high standard and provide protection against overflows from the Waingawa River that would otherwise enter the Masterton urban area. It is essential to continue their asset monitoring and maintenance plan	1%	1%	GWRC		High
	154 155 163 164 169 171 172 174	Community assets and houses	Emergency management	Add Upper Waingawa Road to the WREMO register of lifelines affected by large-scale flood events. Add the asset owners for vulnerable assets at Issue ID 24 and Issue ID 25 to the WREMO register of vulnerable assets. Advise WREMO of the breach scenario consequences for the Skeets Road stopbank and develop a contingency plan		>1%	WREMO	MDC	Medium
		River access points	Environmental enhancement	Develop access at locations downstream of the State Highway 2 bridge on the river's left bank, and explore other potential sites. Formalise and monitor			GWRC	MDC	High
		Masterton Gateway	Environmental enhancement	Identify a Masterton Gateway site and develop it as an access point for amenities and recreation. This links with the South Masterton stopbank Major Project Response (page 152)			MDC	GWRC	High
		Masterton Gateway	Environmental enhancement	Support the formation of a Masterton Gateway care group, and encourage native species' planting at the gateway to Masterton. Support initiatives to improve the values of the gateway area, and work with groups to improve the quality of access points and undertake rubbish clean-ups and reporting			GWRC	MDC	High
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/ retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental strategy, Community Support Officer, Riparian Management Officer, care group and clubs					

STOPBANK SUMMARY

ISSUE ID	NAME	CURRENT PURPOSE	LENGTH OF STOPBANK (m)	LENGTH INSIDE BUFFER ZONE (m)	CONDITION RATING (2016) (GOOD1/2/3/4/5 POOR)	CRITICALITY	BENEFITING WHOM? (PRIVATE INDIVIDUAL, PRIVATE MULTIPLE, PUBLIC, OTHER)	LEVEL OF PROTECTION (AEP)	OTHER ISSUES	FMP DIRECTION	FMP PRIORITY
168	Tararua/Totatara	Protection of property and historical overflow path to Masterton	731	0	3	Low	Private multiple	Unknown – estimated 2%	Series of three stopbanks linking natural high ground. The furthest downstream of the three stopbanks appears to offer little to no additional flood protection and is basically the natural high ground – question the need to keep it as an asset	Continue existing asset management	Low
171	Skeets Road	Protection of property and overflow path to Masterton	550	0	2	Low	Private multiple	Unknown – estimated 2%	Does not seem to be significantly affected by a 1% AEP flood event	Continue existing asset management	Low
	Upper Manaia Road	Limited purpose for this stopbank – buffer is basically a gravel groyne used to divert flows and protect downstream alignment	130	40	2	High	Private multiple/public road	Unknown – estimated 2%	Training bank/gravel groyne rather than true stopbank	If threatened consider part realign	Low
179	South Masterton	Protects industrial estate and overflow path to south-west Masterton	280	280	4	Low	Industrial properties	<1%	Quality uncertain, weed and tree infestation	Major Project Response	Low


154 Community assets and houses
155 Community assets and houses
157 MDC Water supply pipeline
Water Race 156
Masterton District Council raw water supply line Major Project Response (see page 150)
15
16
160 Infrastructure
161 Infrastructure
162 Infrastructure
163 Community assets and houses
Community assets and houses 164
168 Tararua/Totatara
169 Community assets and houses
Upper Plain Rd
171 Skeets Rd Stopbank; Infrastructure
172 Community assets and houses
174 Community assets and houses
South Masterton stopbank Major Project Response (see page 152)
16
17
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
0
2.2
km
N

Major Project Response: Masterton District Council raw water supply pipeline

The issue

MDC takes potable water from the Waingawa River through an intake structure and pipeline that feed the water treatment plant located 5km downstream. Once treated, the potable water is distributed throughout Masterton.

The water supply intake is located on the right bank of the Waingawa River, about 700m upstream of the Atiwhakatu Stream confluence. About 370m downstream of the intake, the pipeline crosses to the left bank of the Waingawa River, and from this point stays close to the river's left bank in a number of locations (less than 20m in some areas) until it reaches the treatment plant. The pipeline's closeness to the river, combined with the river's highly erosive nature, put it at risk from lateral bank erosion. It has already been threatened and even exposed a number of times in the past.

Until now, the management regime has used a combination of boulder groynes (sourced from the river) and channel alignment works (bed and beach re-contouring) to provide a degree of protection. However, it is a short-term intervention, with frequent renewal required in response to changes in river alignment and bank erosion during even relatively minor flood events.

The Black Creek confluence is the main area of concern. Here the river transitions from the foothills of the Tararua Range to the alluvial floodplain, and the reach changes from a relatively confined narrow channel into a wider, more variable channel with a more semi-braided morphology. The location most under threat is the outside bend of a relatively tightly formed 'S' bend.

The river bed is naturally degrading at this location, which causes difficulties for CDC in maintaining enough water in the river to flow into the Taratahi Water Race, which is located about 250m upstream from the Black Creek confluence. CDC has built a boulder weir in the river to ensure that water levels are high enough to provide a partial weir and help the water to divert into the race. The weir has the potential to affect the river flow direction during floods by directing the main flow towards the river's left bank and increasing the erosion potential on the outside of the bend at this location, where the water pipeline is close to the current river bank.

Opportunities

In future there may be opportunities (through the Water Wairarapa project) to meet both municipal and water-race water requirements via a dam proposed in the adjacent Black Creek catchment. The project is currently being assessed for feasibility, so cannot yet be considered in this FMP.

MDC has an emergency management plan to deal with any interruption to the supply of water to the treatment plant. The water supply system can provide three days of potable water to Masterton – enough time to set up a temporary diesel-generated pumping system to deploy water directly from the river. Once set up, this temporary system could be used for as long as it takes to repair the pipeline and undertake any required emergency river works.

Relationship with common methods

River management envelopes exist and are used, but may need some modification. Where the pipe alignment is in the identified buffer, an exemption from the general buffer approach is required to recognise the importance of the asset and the associated need for a higher level of service than a vegetative edge approach at these sites. In addition, the effectiveness of vegetated buffers in the steeper, incised (deeply cut) upper reaches of the Waingawa River is somewhat limited; the vegetation will typically only slow the rate of erosion rather than prevent it all together.

Description

General

Response Part 1 (structural)

To provide a higher level of security at the most at-risk site, it is considered that at least three rock groynes are required at the Black Creek confluence. See the plan on the next page for the groynes' location and general arrangement.

Response Part 2 (coordinated river management and emergency management planning)

This response will look to establish a Memorandum of Understanding between GWRC and MDC to enable the risks associated with the pipeline to be mitigated through a combination of emergency management planning and river management specific to the MDC water pipeline. This will establish a shared organisational understanding of the expected annual level of service (implemented through the established river scheme), and the potential requirements in an emergency situation, where the pipeline is threatened or compromised by the effects of river erosion.

Costs

Part 1
Three rock groynes: up to $300,000 based on each groyne weighing about 450 tonnes. This includes preliminary and general works, a 30% contingency and design, consenting and supervision.

Part 2
Approximately $5,000-$20,000 per annum, with an emergency funding allowance of around $50,000 to respond to a significant flood event (river works only, excludes pipeline repair).

Implications

The implementation of Part 1 will enable MDC to be confident of the security of its raw water main at the location identified as having the highest likelihood of failure. It will also reduce the cost of reactive maintenance requirements.

Part 2 enables the development of improved procedures to manage the risks associated with the pipeline. In an emergency situation, it also allows for an incident recovery that minimises any impacts on the community.

Both responses should include a management strategy through which MDC would work with CDC to ensure that the work on the intake of the Taratahi Water Race minimises any potentially negative effects on the opposite bank next to the MDC pipeline.

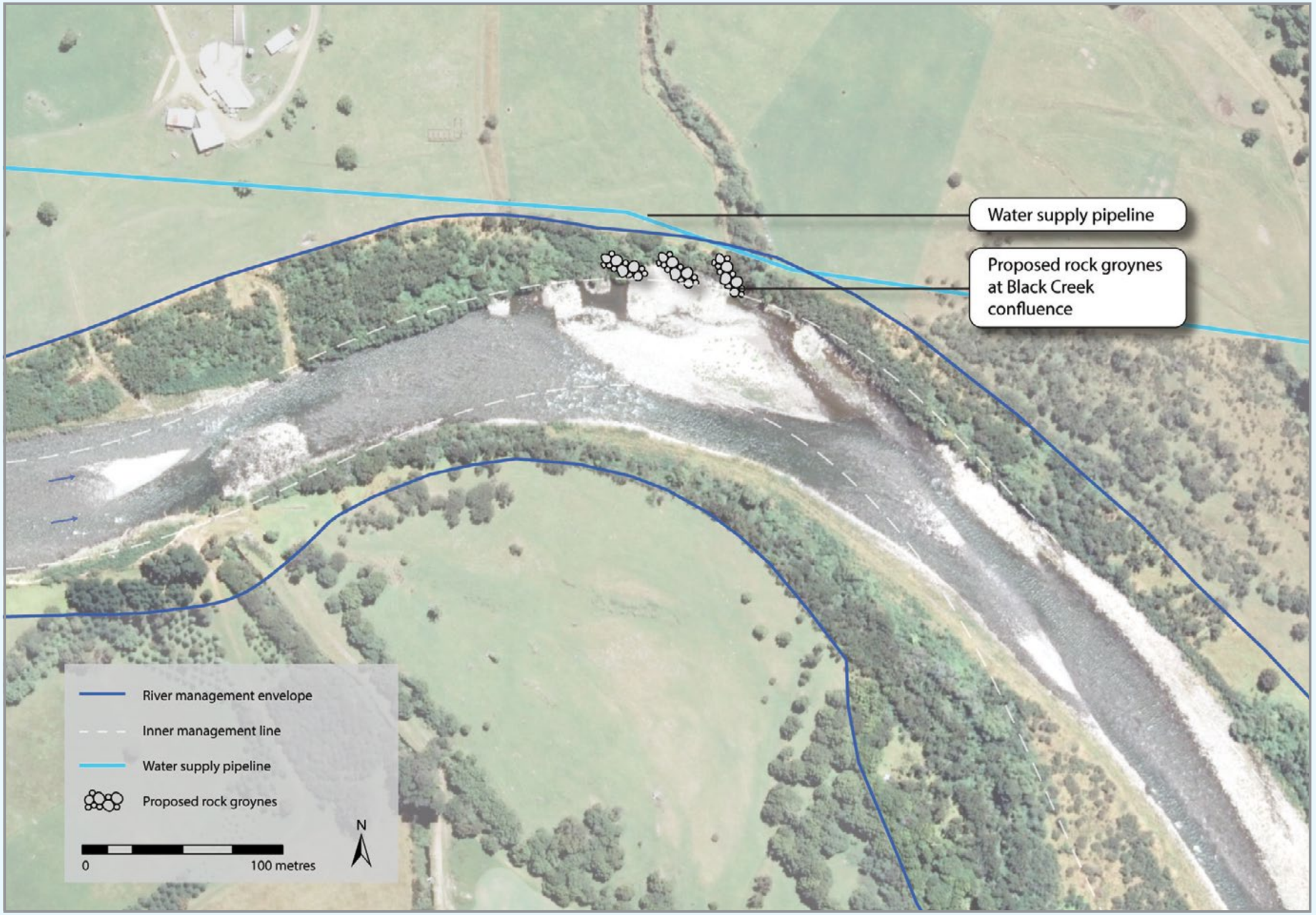
Priority

This response is classified as high priority given the importance of the asset to be protected. Part 1 is considered low priority in the early years of the FMP's implementation, but could be triggered by a changing cycle of flood events, GWRC/MDC agreement or a future FMP review. Part 2 is considered high priority.

Level of service

Up to a 1% AEP level of service, to be confirmed with MDC.

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
157	Increase bank protection to river edge at Black Creek confluence	Low/Medium	Erosion by the river	Up to 1% AEP	To further protect the water supply pipeline	MDC supported by GWRC	Low	Up to $300,000	Capital funding
157	Targeted operational river management with emergency management plan	Low/Medium	Erosion by the river	>1% AEP	To manage the risk of erosion for the water supply pipeline	GWRC (river management) MDC (emergency management plan)	High	Varying but $5,000-$20,000 per annum generally, with allowance for targeted emergency works as required	Operational funding



Masterton District Council raw water supply pipeline

Major Project Response: South Masterton stopbank

The issue

There are a number of issues associated with the section of the Waingawa River between the rail bridge and the State Highway 2 bridge.

- The stopbank on the left (north-eastern) side of the Waingawa River between the rail and State Highway 2 bridges is located in the buffer and is at risk of erosion. It is also in relatively poor condition, although it has been assessed as 'fit for purpose' as it protects a small area of industrially zoned land and is therefore not considered a critical asset. It is at risk of failure in an extreme flood event.
- Managing the channel alignment through this reach is useful for reducing the scour risk at the rail and road bridges.
- The property on the stopbank's immediate landward side has historically been used for timber treatment and has been confirmed as a contaminated site (SLUR – SN/06/141/02).

Opportunities

There are opportunities to improve the visual appearance, recreational opportunities, public access and ecological value of the river margins on the approach to Masterton from the south. This coincides with a long-term aspiration of public ownership of river margins in this key gateway area, in collaboration with willing landowners.

Relationship with common methods

Given the stopbank's location in a buffer, the options of retreating it to a less erosion-prone location or abandoning/retiring it should be considered.

Description

General

The main risk to this reach of the river is the lateral erosion of the riverbanks, which could lead to erosion and the failure of the left-bank stopbank. The consequences of this failure, in terms of flood inundation, are limited to a relatively isolated area of industrial land next to the stopbank.

There is also the potential for contaminated material to be eroded into the river or mobilised through groundwater flows. The extent of the contamination and its possible pathways is currently unknown – a detailed site investigation is required to understand both this and the environmental risks, and to assess the options for containing or remediating the contaminants on the site. Any remediation could be done in conjunction with a retreat of the stopbank beyond the buffer.

This response will seek to maintain the river management status quo, using the common methods to hold the stopbank in its current position while the risks and mitigation options associated with the site contamination are investigated in parallel with a consideration of the stopbank retreat.

Costs

Contaminated site investigation: – $100,000.

The costs of any stopbank remediation or retreat will depend on the outcomes of the contaminated site investigation.

Implications

The residual risk of the stopbank's failure or a flood larger than a 1% AEP event will need to be managed while the investigation is underway. It can likely be managed through appropriate flood warnings and education for the affected residents and businesses.

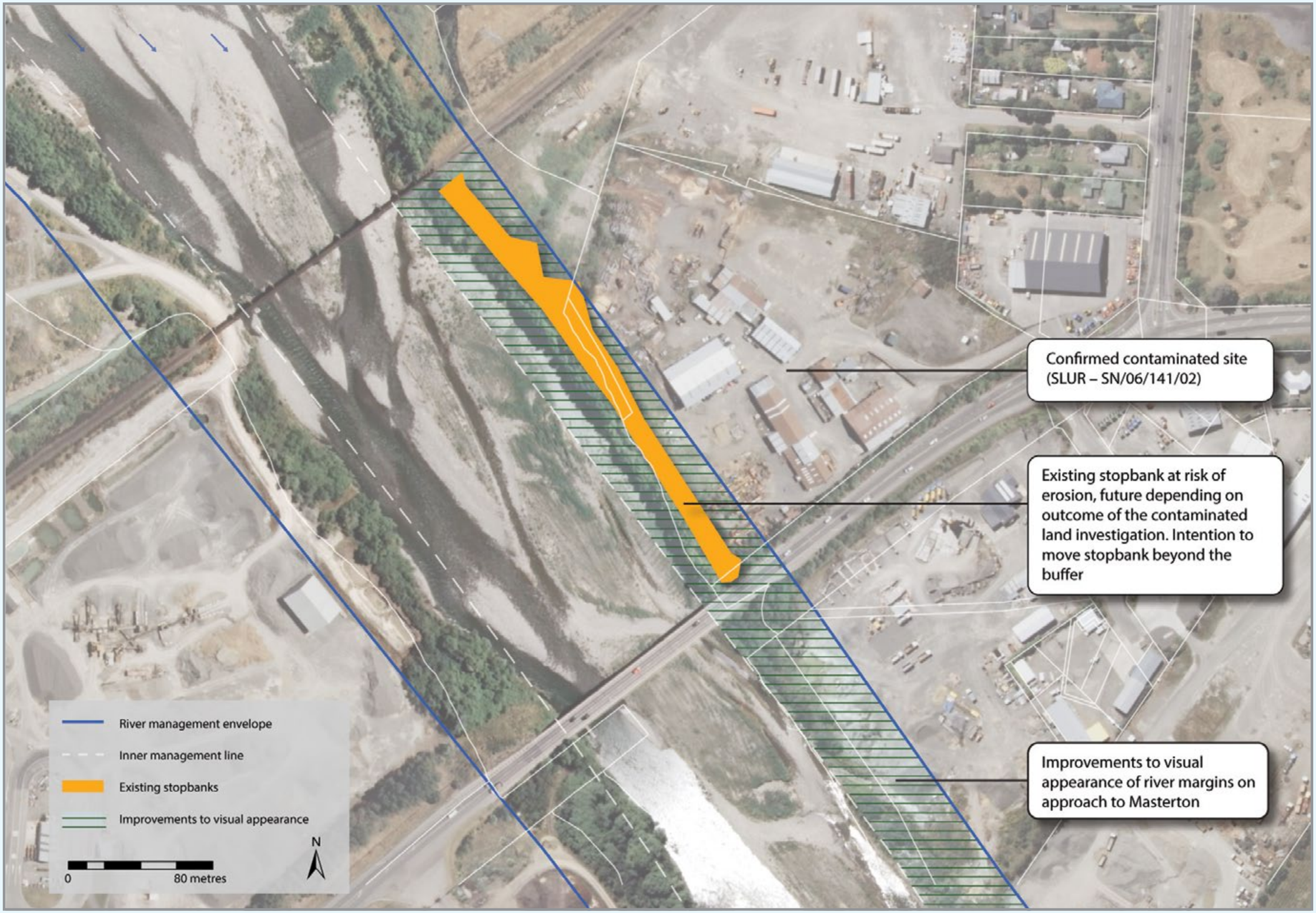
Priority

The contaminated site investigation is of medium priority, and the priority status for future works would depend on the outcomes and risks the investigation identifies. It is likely to be less than medium unless the investigation identifies serious contamination close to the river.

Level of service

The response maintains the status quo in the level of service and residual risk management through emergency management provisions. The longer-term plan for the stopbank and the wider area can be developed once there is a better understanding of the site contamination and any remediation or containment requirements.

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
179	Retreat existing stopbank to less-erosion-prone location outside the buffer	2%-10% AEP	Erosion by the river	5% AEP	Stopbank is a non-critical asset for flood hazards but may be important for preventing contaminated material entering the river	GWRC	Low	TBC	Capital funding TBC
179	Contaminated site assessment, visual improvements in the buffer, establishment of public access to the river	20%-1% AEP	Erosion by the river	TBC	Appealing gateway to Masterton, recreational access and contaminated site management	MDC/GWRC	Medium	$100,000 for contaminated site assessment	Capital funding TBC



South Masterton stopbank

South Masterton – Reach 17

Character

The Waingawa River continues in a twisted, semi-braided form to the east of the State Highway 2 bridge. The river corridor margins are more consistently established in willows, separating the river from adjoining areas of pasture and cropland. Hood Aerodrome, urban edge development and gravel extraction also influence the river's character. In other areas it retains a varied and dynamic semi-braided form.

Key characteristics

- Broad semi-braided form
- Consistent willow planting along margins

Values

The river's close proximity to Masterton's southern end, together with the gravel extraction visible from the State Highway 2 bridge, frequently detracts from its natural values. Overall this results in a perceived medium/high level of landscape modification, with medium scenic values along the wider reach.

The reach's continued flat water with riffles and braids (flowing from the upper reaches) enables some kayaking along its length, while the State Highway 2 bridge is the upper limit of jet boating along the Waingawa River.

While the reach provides an important passageway for fish, fishing is infrequent because of the river's changing, unstable course, which does not typically hold fish.

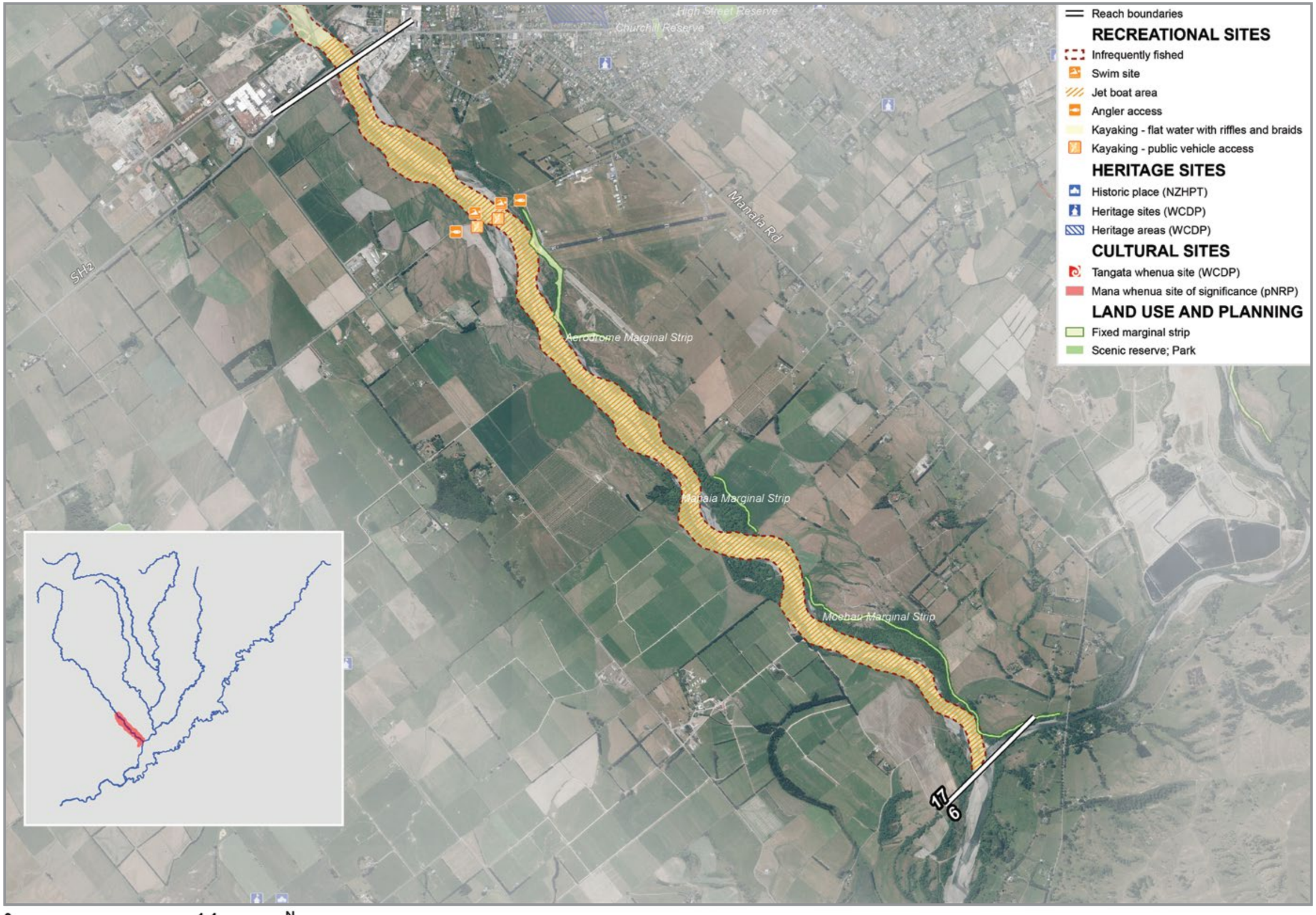
Popular swimming sites can be found at South Road and Hughes Line, on each side of the river immediately above Hood Aerodrome.

Terrestrial habitats with identified ecological values along the reach include mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, and natural wetlands and ponds. The wetlands along the margins of the Waingawa River were important for gathering mahinga kai, with cultural sites also associated with the mixing of mauri as water flows into the Ruamāhanga River at the bottom end of this reach.

Key floodplain management points

- This FMP will shift the focus of river maintenance towards a more intensive implementation of vegetated buffers that will be allowed to erode when and where appropriate. This method will replace previous practices of responding immediately to erosion issues with machinery in the channel.
- This FMP will increase river enhancement works.
- Work with the owners of Hood Aerodrome to maintain its operation and security.
- Work with MDC and CDC to address the rubbish dumping at access points along the reach.
- Continue to develop land access and retirement agreements to widen the river corridor.
- Undertake recreation management to encourage good-quality recreation opportunities.

LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
LANDSCAPE MODIFICATION	SCENIC VALUE					
Medium/High	Medium	Angler access, kayak access, kayaking, jet boating, swimming, infrequent fishing	-	Mixing of mauri	Rural (Primary Production), Rural (Special), Road, River, Industrial, State Highway, Aerodrome and Recreation Purposes	Mixed exotic-indigenous forest, indigenous treeland, stonefields and boulderfields, natural wetlands and ponds

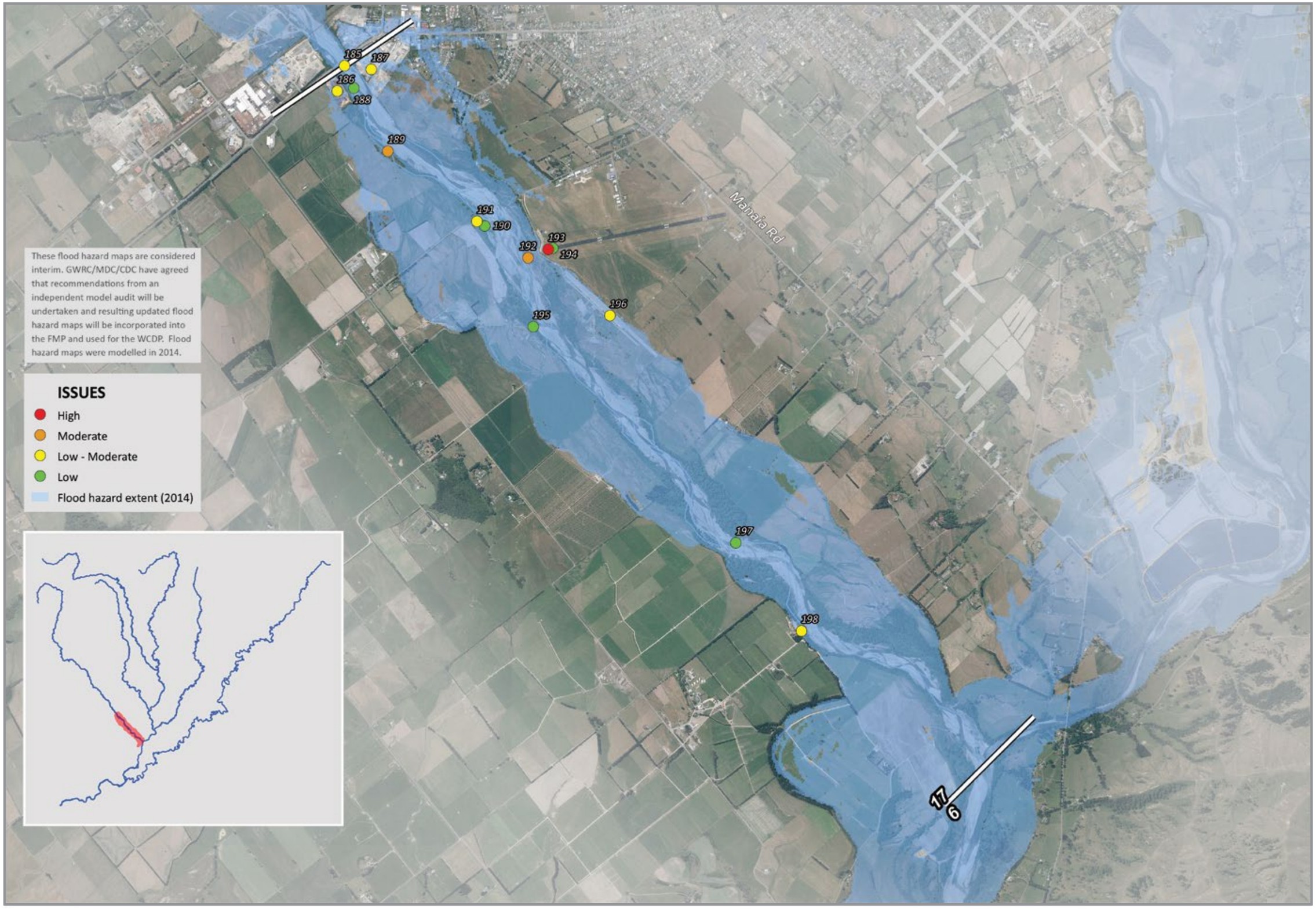

High Street Reserve
Churchill Reserve
Manaia Rd
SH2
Aerodrome Marginal Strip
Manaia Marginal Strip
Moehau Marginal Strip
17
6
Reach boundaries
RECREATIONAL SITES
Infrequently fished
Swim site
Jet boat area
Angler access
Kayaking - flat water with riffles and braids
Kayaking - public vehicle access
HERITAGE SITES
Historic place (NZHPT)
Heritage sites (WCDP)
Heritage areas (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Fixed marginal strip
Scenic reserve; Park
0
1.4
km
N

South Masterton – Reach 17

Flood and erosion issues

A total of 14 flood and erosion management issues have been identified along this reach. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION	
LOW	**Powerlines [188]** Distribution network powerline pylons are located in the erosion study area 30m downstream of State Highway 2. This issue is not currently managed **Illegal dumping site [190]** This recreation access site is affected by illegal rubbish dumping **SLUR site [194]** The aerodrome is a registered SLUR site and sits in the erosion study area	**Water intake [195]** There is a private water intake structure located in the erosion study area. This issue is not currently managed **Distribution network [197]** The pylon on the true right bank sits in the erosion study area, and the true left bank is believed to be outside the erosion study area. This issue is not currently managed
LOW TO MODERATE	**Powerlines [185]** Transmission network powerline pylons are located in erosion study area. This issue is not currently managed **Contractors' yards [186, 187**] Contractors' yards are located in the erosion study area and have a 1% AEP flood risk. Erosion management is an ongoing issue at this location **Recreation area [191]** The good access to the end of Hughes Line makes the reach popular for recreation groups. A number of interest groups have expressed interest in developing this access and area further	**Drag strip [196]** The Masterton drag strip is located in the erosion study area and is affected by the 1% AEP flood event. This issue is not currently managed **Private water intake [198]** A private water intake is located in the erosion study area. This issue is not currently managed
MODERATE	**Land retirement agreements [189]** The land use is changing in this area to increase the width of the buffer available to manage riverbank erosion **Flight path [192]** Tree height has a controlled level for aircraft taking off from Hood Aerodrome	
HIGH	**Aerodrome runway [193]** The Hood Aerodrome runway is known to be affected by erosion and has been eroded in the recent past (2000). It is situated in the erosion study area	



ISSUES – Reach 17: South Masterton

South Masterton – Reach 17

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5.*

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					CURRENT	TARGET	PRIMARY	SECONDARY	
SPECIFIC RESPONSES		Various sites	River management	Use the river management envelope common method. Buffer plantings in the Waingawa River are challenging in many places. A key tool to their establishment is the erosion of banks to create shallower profiles, which can then be planted to establish river-edge vegetation. However, some areas of the buffer will have to be sacrificed to the river	20%	5%	GWRC	Landowners	Medium
	192	Flight path	River management	Maintain tree height in the buffer and under the flight path restrictions			GWRC	MDC	High
	191 190	Recreational access sites	Environmental enhancement	Develop and formalise access points on the true right and left banks, and establish care groups to manage them			Community	GWRC	Medium
		Three Rivers Trail	Environmental enhancement	As part of the Environmental Strategy, establish the Three Rivers Trail to link Masterton to the Waingawa, Ruamāhanga, and Waipoua Rivers. Incorporate it with the larger Trails Wairarapa projects/initiatives. Link to Tourism Wairarapa			Community	GWRC	Medium
COMMON METHODS		Entire reach	River management	River management envelope, river-bed-level monitoring, gravel extraction and analysis, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, historical channel lines, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


Manaia Rd
SH2
Recreation access 190
Recreation access 191
Hood Aerodrome Major Project Response (see page 160)
192 Flight path
Reach boundaries
River management envelope
Inner management line
Existing stopbanks
Historical channel extent
17
6
0
1.4
km
N

Major Project Response: Hood Aerodrome

The issue

The Hood Aerodrome runway has been continually affected by erosion, and was close to being washed away during a flood in 2000 (see the photograph at right). Four rock groynes constructed after this flood provide some degree of protection, but they are at risk of being outflanked by the upstream river flow.

A number of small floods in 2015 and early 2016 caused erosion upstream of the runway. In response to this, 1,100 willow poles were planted and some minor in-channel works were undertaken in an attempt to realign the river to its desired design and establish a vegetated buffer. However, given the Waingawa River's steepness and dynamic character, willow protection works can only slow, rather than prevent, the rate of erosion – if the runway requires greater security it will need a 140m-long rock line to tie in with the upstream rock groyne. The rock line would act in part as a deflector groyne to direct the main flow away from the runway.

Opportunities

This response increases the runway's security, and would be particularly important if commercial flights were re-established from the site. It also avoids the risks associated with potentially contaminated land being eroded into the river (SLUR SN/06/004/02 Manawatu Aerial Topdressing, Category I).

Relationship with common methods

This reach's current management approach uses willows and in-channel works to align with the common methods of riparian planting of buffers and the Code of Practice. This and its use of a rock line/training groyne comprise a standard response provided for in the Code of Practice.

Description

General

A 140m-long rock line extending from the terrace to the existing upstream rock groyne.

Costs

$755,000 (3,650 tonnes of rock at $130 per tonne, placed with geotextile, $474,000 + $29,000 preliminary and general works, a 30% contingency, 20% design, consenting and supervision).

Implications

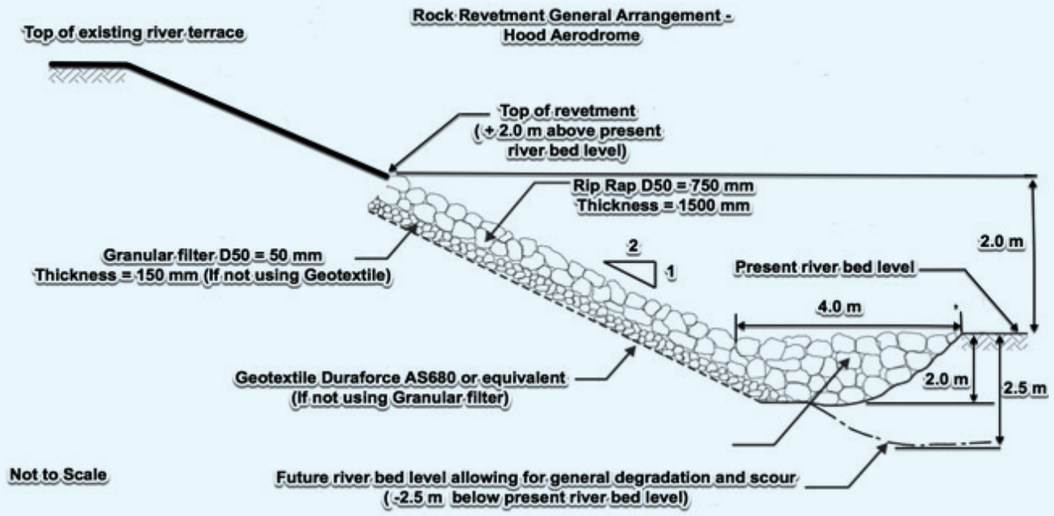
This could divert the erosion issue to the opposite side of the river by providing a hard point on the left bank.

Priority

This is currently a low priority, but that could change if a new commercial operator were found for the aerodrome.

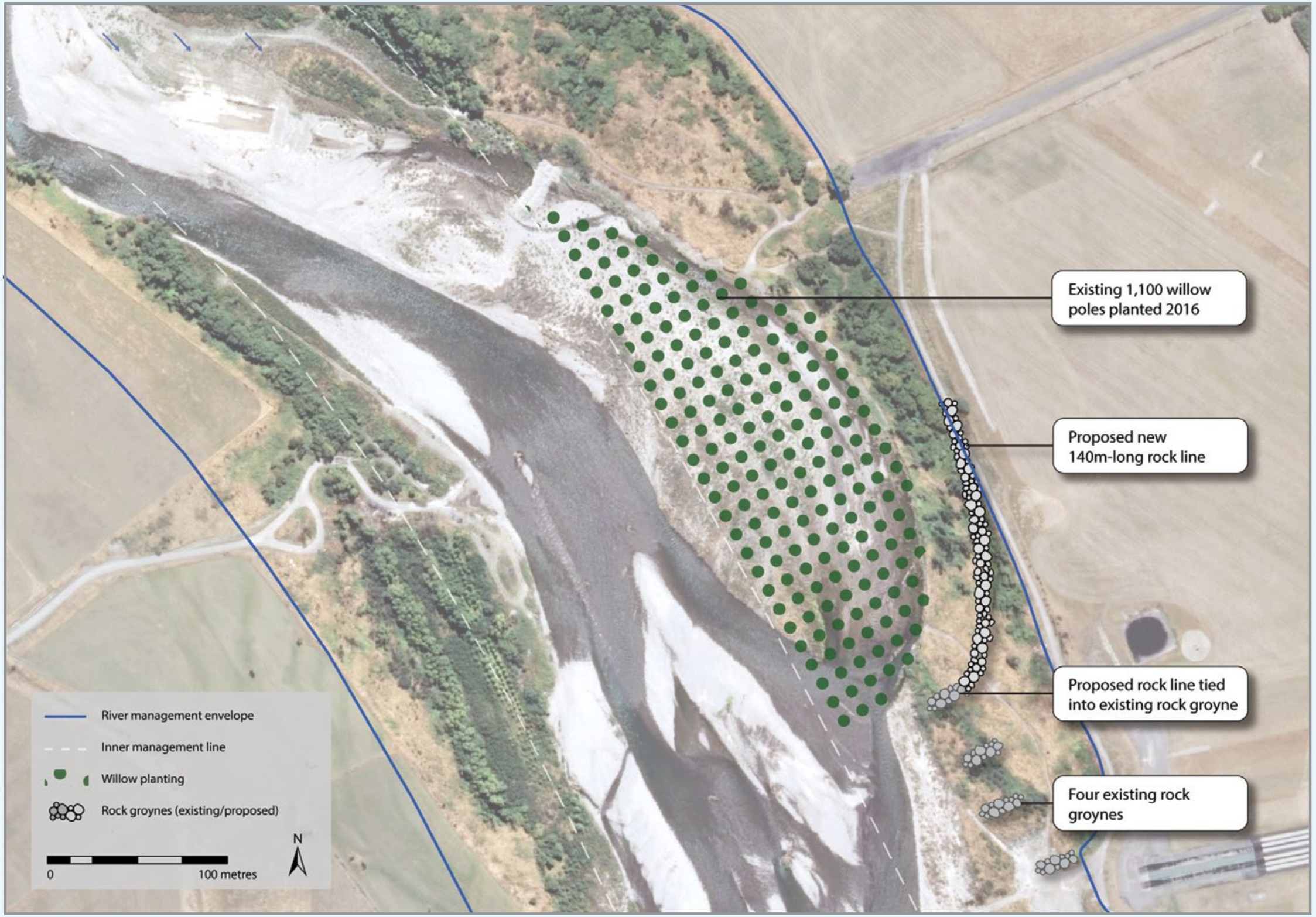
Level of service

Up to 2% AEP level of service, to be confirmed in discussion with MDC and the aerodrome's potential commerical operator.

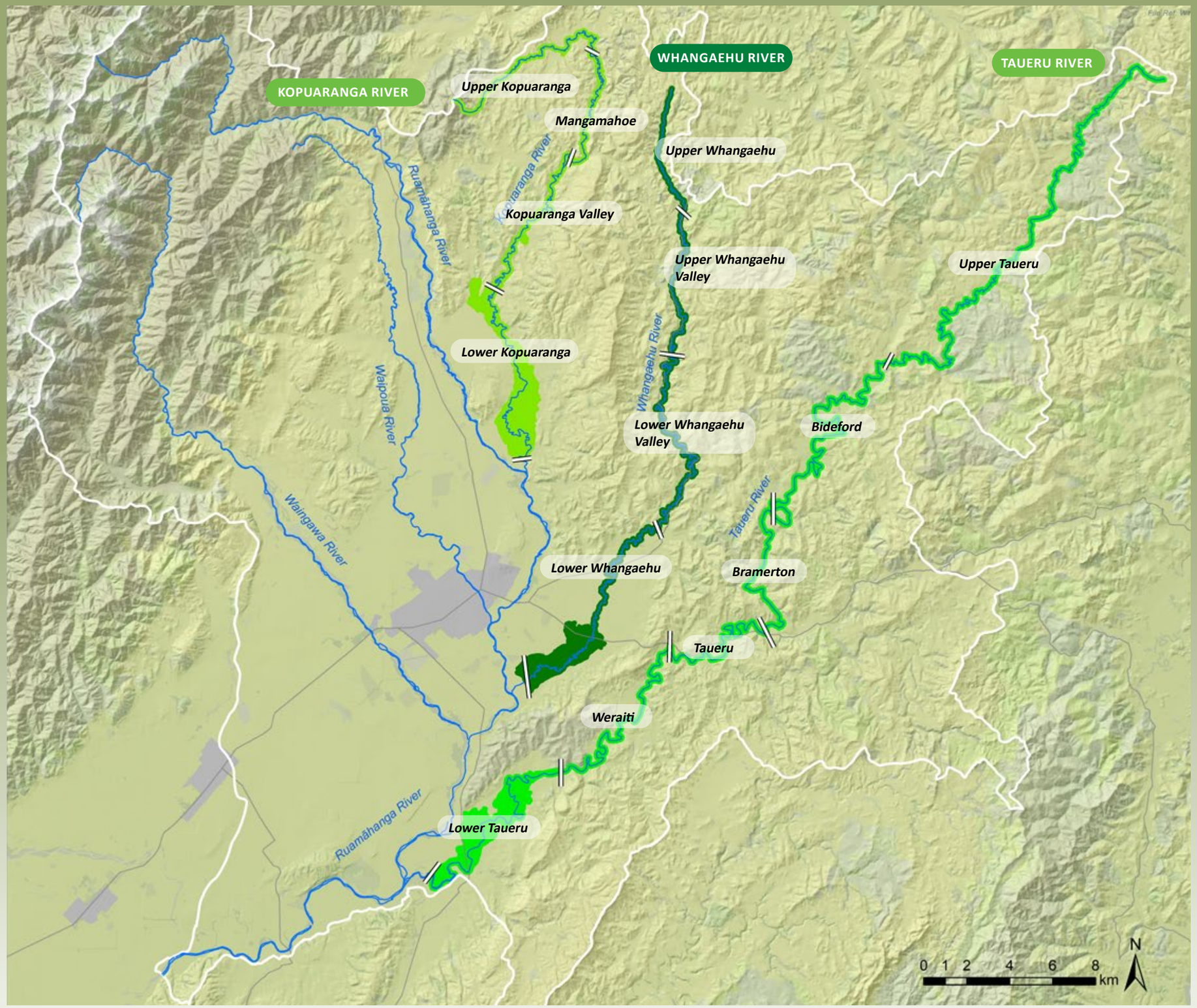


Erosion during flood event in 2000

ISSUE ID	MANAGEMENT MEASURE	CURRENT LEVEL OF SERVICE	THREATS TO CURRENT LEVEL OF SERVICE	PROPOSED LEVEL OF SERVICE	PRIMARY REASON FOR RESPONSE	RESPONSIBILITY	PRIORITY	COST	FUNDING
192, 193 and 194	Rock line connecting terrace with existing rock groyne at the end of the runway	Low	Erosion by the river	2% AEP	To increase runway protection and avoid contaminated material being eroded into the river	MDC/GWRC	Low	$755,000	Capital funding TBC



Hood Aerodrome



Eastern rivers

9. The eastern rivers

The Kopuaranga, Whangaehu and Taueru Rivers have been grouped together as the 'eastern rivers'. Their characters, values and flood and erosion issues are broadly similar, as are the management objectives and techniques used.

The eastern river floodplains are relatively sparsely populated, although population density is increasing with lifestyle block developments in the lower reaches, particularly the Kopuaranga and Whangaehu Rivers in areas close to Masterton. This is affecting informal access arrangements to recreational and cultural sites. Mauriceville, on the Kopuaranga River, is the largest settlement.

The rivers are generally considered to have low/medium levels of landscape modification, tending towards higher levels in the lower reaches. They have low/medium levels of scenic value in their lower reaches, with areas of medium/high scenic value more likely in the upper reaches (and coinciding with less modified reaches). In many areas willow trees dominate the channel form. Crack willow infestation has been controlled in the reaches with maintenance programmes, but elsewhere it is a big problem due to the channel constriction it causes.

Land use in the catchments is predominantly primary production activities (dairying, dry stock grazing, cropping and plantation forestry) with a few scattered areas of native forest. There is little evidence of lifestyle-type development in the upper catchments.

All three rivers are used for game bird hunting and fishing. The Kopuaranga River is the most fished of the three, and the lower Taueru River is also used for kayaking. There are a number of informal access arrangements for recreational access.

The eastern rivers have several sites of cultural value. They include the Kopuaranga settlement and Kohekutu Pā along the Kopuaranga River, and multiple pā and urupā along the Taueru River. While there are no specific sites recorded on the Whangaehu River, it is very significant to local Māori, containing many wāhi tapu areas and important spiritual connections with Rangitumau.

The Kopuaranga and Taueru Rivers were important routes for Māori travelling north and north-east respectively. As a result they have mahinga kai values in their channels and surrounding forested areas. In particular, the upper Taueru River is noted for freshwater crayfish and the lower Taueru River for eels. The eel fishery remains important.

Ecological information is limited on the abundance of birdlife and fish species. A number of areas have habitat value, such as natural ponds/wetlands and patches of indigenous forest (both fenced and unfenced). The lower Taueru River also contains the Te Kopi Road and Peter's Bush RAPs.

General issues

- Flooding of large areas of farmland (entire valley floors) and access routes cut off.
- Lifestyle block development near Masterton.
- Potential for greater erosion/changes in channel form in the future as a consequence of willow removal.

Kopuaranga River

Character and values

The Kopuaranga River flows into the Ruamāhanga River to the north of Masterton. The headwaters originate in the northern Wairarapa hill country to the east of Mount Bruce. The main river channel, from the river's headwaters to its confluence with the Ruamāhanga River, is 58km long.

The river has a number of small tributaries. The main channel flows on a north-east course from its source in Mount Bruce to Hastwell, where it crosses a relatively wide valley before turning south. It then flows south in a narrow valley, following the line of the West Wairarapa fault. In its lower reaches the river turns away from the fault line and follows an old course of the Ruamāhanga River, joining the Ruamāhanga east of Opaki.

The name Kopuaranga means fish in a deep or dark pool, and the river has long been associated with fishing.

In its upper reaches across the Hastwell valley, the river is an entrenched channel. It then flows in a narrow fault-formed valley in a tightly meandering channel. On its lower reaches, the channel becomes wider and straighter, with sections of tighter meandering channels.

The Kopuaranga floodplain soils are a mix of sandstone, limestone and siltstone. Vast tracts of the fertile Kopuaranga river deposits were used as gardens for centuries. Land use in the catchment is now mainly for primary production activities (dairying, dry stock grazing, cropping and plantation forestry) with a few scattered areas of native forest.

In terms of recreation values the Kopuaranga River is popular for fishing and game bird hunting, which in some areas have enhanced natural wetlands and ponds and improved the river's ecological value.

Two cultural sites have been identified along the river: the Kopuaranga settlement and Kohekutu Pā. However, the river was once part of a northwards travel corridor and it has value for mahinga kai, related to both the river and the surrounding forested area.

Key floodplain management points

This FMP provides a framework for erosion-control works at priority locations, increased planting for erosion control and river enhancement, and other limited noxious-plant-control works that are included into river maintenance activities. It also includes the implementation of an extension of the upstream river scheme boundary for 24km from Clarke Memorial Domain.

Key characteristics by reach:

Upper Kopuaranga

- Small stream corridor through rolling pastoral landscape
- Grass banks with bank slumping in areas

Mangamahoe

- Enclosed valley landform containing road and rail corridor
- Tightly meandering, willow-choked corridor
- Flax and cabbage tree planting reintroduced in some low-lying areas

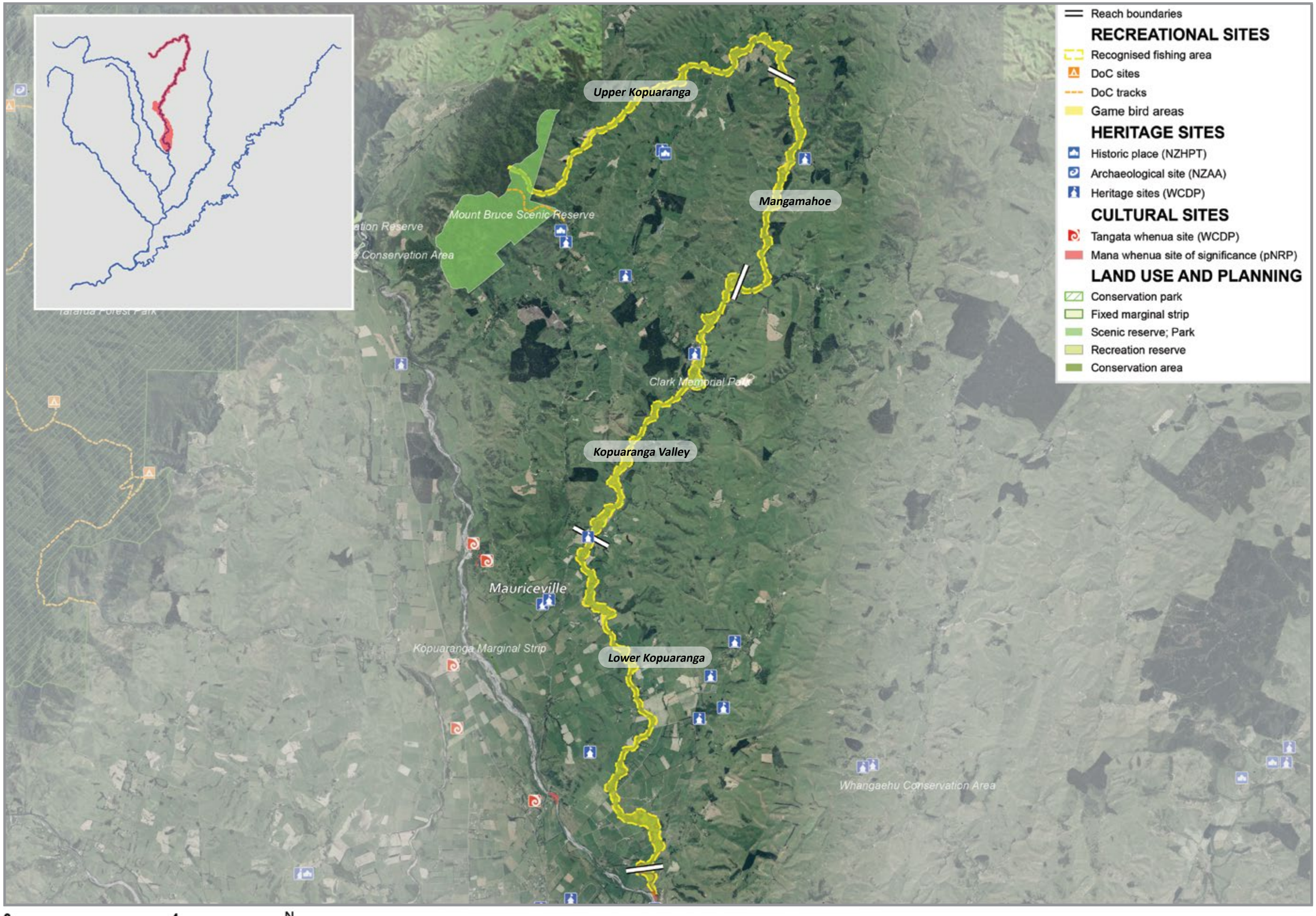
Kopuaranga Valley

- Meandering river corridor along semi-enclosed valley landform
- Increasing rural lifestyle development along river margin
- Mixed willow, exotic planting and grass margins

Lower Kopuaranga

- Meandering course along eastern edge of Wairarapa Plains
- Sparsely settled farmed margins
- Mixed poplar, willow and conifer margins

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Kopuaranga	Low/Medium	Medium	Fishing, game bird hunting	-	-	Rural (Conservation), Rural (Primary Production), Rural (Special), Road, River, Railway	Natural wetlands and ponds
Mangamahoe	Low/Medium	Low/Medium	Fishing, game bird hunting	-	-	Rural (Primary Production), Rural (Special), Road, River, Railway, Cemetery	Unfenced indigenous forest, mixed exotic-indigenous forest
Kopuaranga Valley	Medium	Medium	Fishing, game bird hunting			Rural (Primary Production), Rural (Special), Road, River, Railway, Recreation, Education, Telecommunication	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, natural wetlands and ponds
Lower Kopuaranga	Medium	Low/Medium	Fishing, game bird hunting	Kopuaranga truss bridge (WCDP)	Kopuaranga settlement	Rural (Primary Production), Rural (Special), Road, River, Railway	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, natural wetlands and ponds


Upper Kopuaranga
Mangamahoe
Kopuaranga Valley
Lower Kopuaranga
Mount Bruce Scenic Reserve
Clark Memorial Park
Mauriceville
Kopuaranga Marginal Strip
Whangaehu Conservation Area
Reach boundaries
RECREATIONAL SITES
Recognised fishing area
DoC sites
DoC tracks
Game bird areas
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Fixed marginal strip
Scenic reserve; Park
Recreation reserve
Conservation area
0
4
km
N

Kopuaranga River

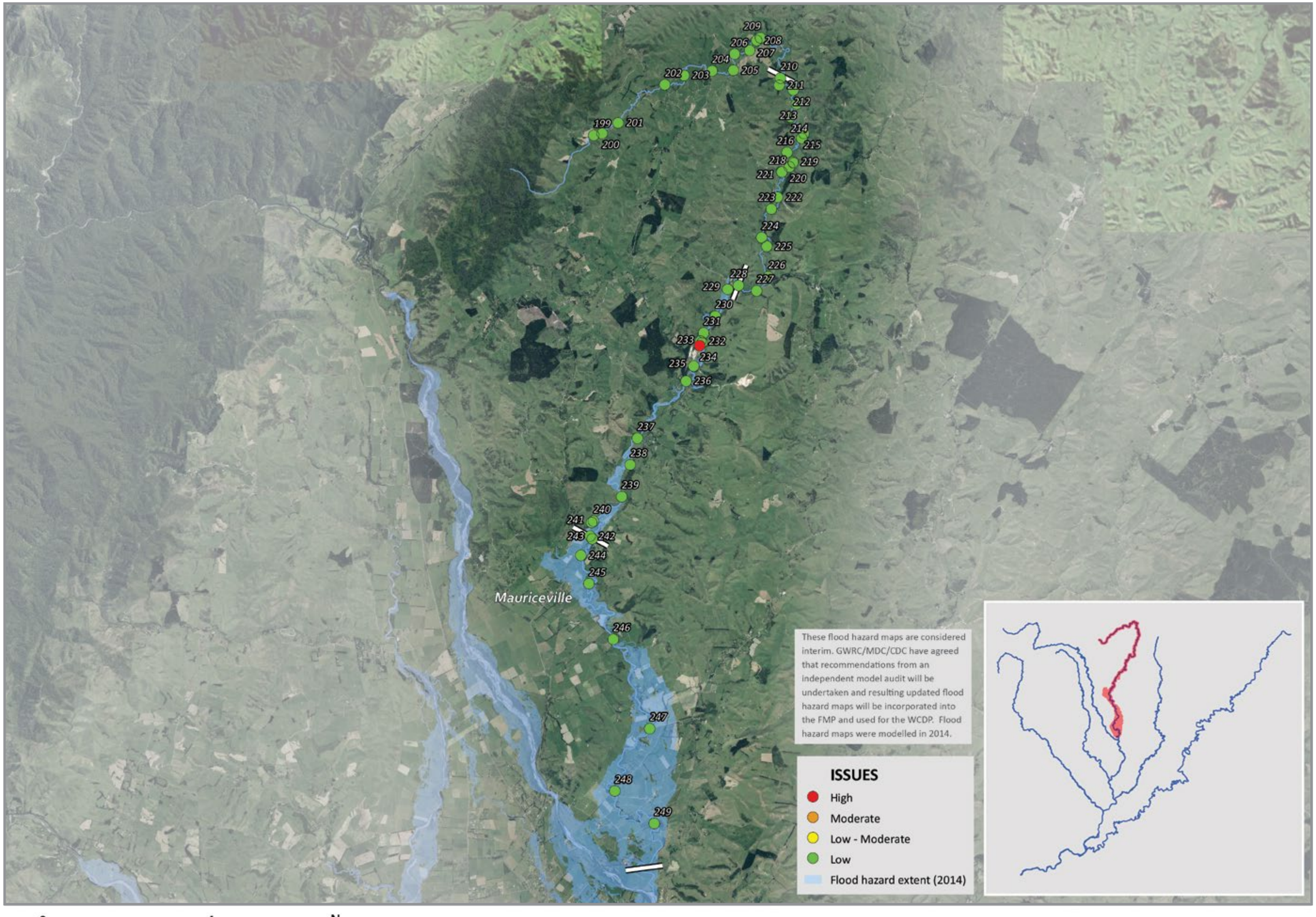
Flood and erosion issues

The Kopuaranga River is prone to overtopping the banks of its incised channel and spilling out onto the floodplain, even in relatively small flood events. This, combined with a channel choked with willows, can lead to extensive flooding across the plains affecting farms, homes and a number of rural roads.

The river poses minimal erosion risk, although there are concerns about silt washed from the banks and into the stream from its upper reaches. In its lower reaches the river sits in a remnant overflow path of the Ruamāhanga River. A number of rural assets, structures, farm tracks and buildings are located in the erosion study area.

A total of 50 flood and erosion issues have been identified along this river. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

RISK LEVEL	DESCRIPTION			
LOW	**Road [199]** In erosion study area	**Road [213]** In erosion study area	**Road [227]** In erosion study area	**Private access bridge [242]** In erosion study area
	Road [200] In erosion study area	**Rail [214]** In erosion study area	**Rail and private access [228]** In erosion study area	**Railway bridge [243]** In erosion study area
	Road [201] In erosion study area	**Road [215]** In erosion study area	**Private bridge [229]** In erosion study area	**Private access bridge [244]** In erosion study area
	Road [202] In erosion study area	**Private access/bridge [216]** In erosion study area	**Private access/outbuildings [230]** In erosion study area	**Private access bridge [245]** In erosion study area
	Culvert/road [203] In erosion study area	**Rail [217]** In erosion study area	**Road [231]** In erosion study area	**Donovans Road bridge [246]** In erosion study area
	Private road/culvert [204] In erosion study area	**Road [218]** In erosion study area	**Road bridge [232]** In erosion study area	**Stock bridge [247]** In erosion study area
	Road [205] In erosion study area	**Private bridge [219]** In erosion study area	**Rail bridge [233]** In erosion study area	**Stock bridge [248]** In erosion study area
	Outbuildings [206] In erosion study area	**Woolshed [220]** In erosion study area	**Private access [235]** In erosion study area	**Private access bridge [249]** In erosion study area
	Road [207] In erosion study area	**House and buildings [221]** Potential oxbow cut-off	**Rail and road access [236]** In erosion study area	
	Private access/culvert [208] In erosion study area	**Private access/bridge [222]** In erosion study area	**Stock bridge [237]** In erosion study area	
	Outbuildings [209] In erosion study area	**Shed [223]** In erosion study area	**Rail [238]** In erosion study area	
	Road/bridge and graveyard? [210] In erosion study area	**Rail [224]** In erosion study area	**Road bridge [239]** In erosion study area	
	Rail bridge [211] In erosion study area	**Private access/bridge [225]** In erosion study area	**Private access bridge [240]** In erosion study area	
	Road [212] In erosion study area	**Road [226]** In erosion study area	**Road [241]** In erosion study area	
LOW TO MODERATE				
MODERATE				
HIGH	**Mauriceville settlement [234]** In the 1% AEP flood extent and affected by the erosion study area			



ISSUES – Kopuaranga River

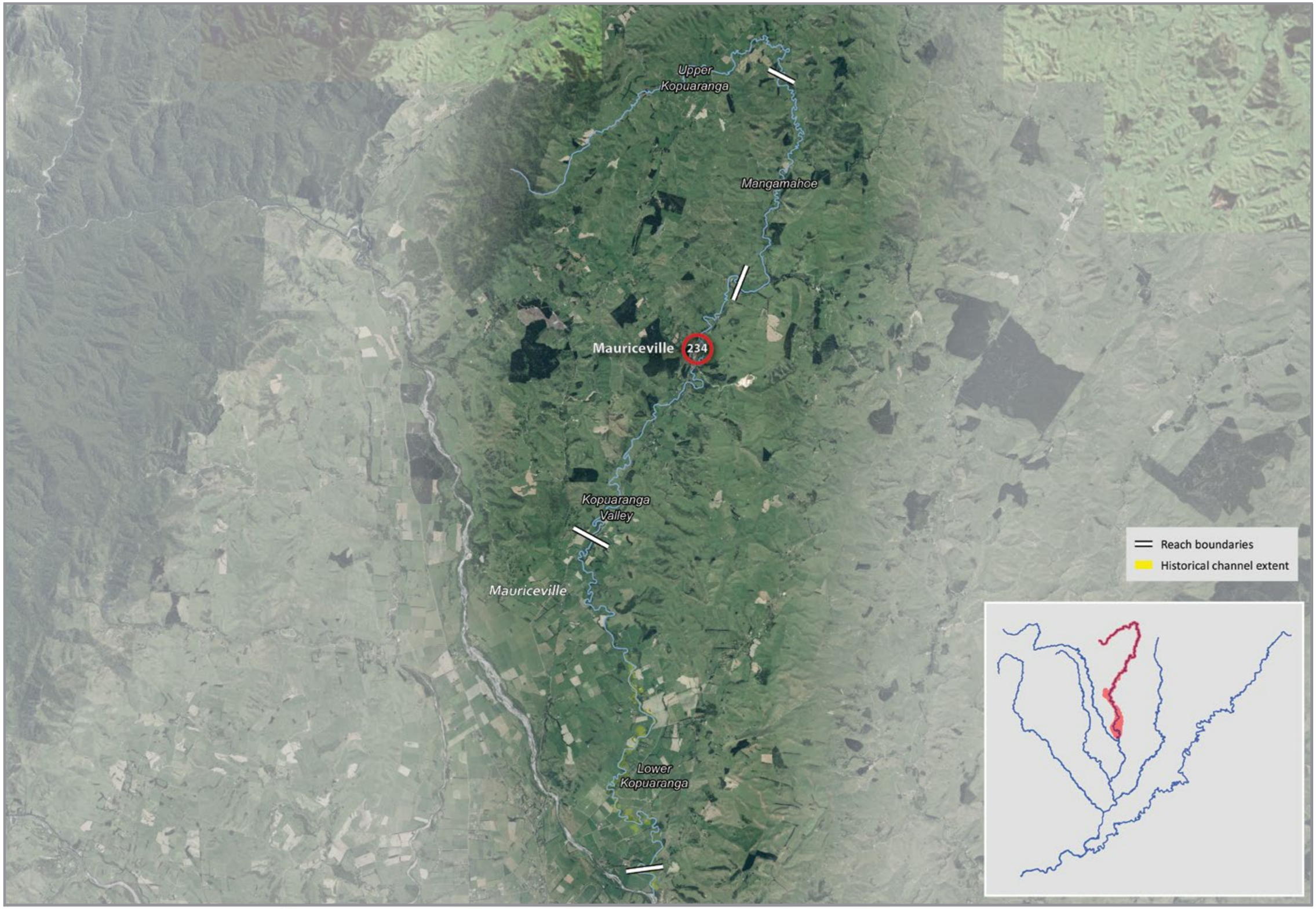
Kopuaranga River

Response

The specific responses and common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	ISSUE ID	SITE	TYPE OF RESPONSE	MEASURES	LEVEL OF SERVICE (AEP)		RESPONSIBILITY		PRIORITY
					Current	Target	Primary	Secondary	
SPECIFIC RESPONSES	234	Mauriceville	Emergency management	Provide flood hazard advice to Mauriceville	20%	5%	GWRC	Landowners	Medium
		In river scheme	River management	River scheme boundary extension to include Mauriceville. 10-year development phase in upper reach (upstream 24km) prioritising willow removal and constriction-point widening. Provision of erosion control management at priority locations in river scheme (targeting downstream affected areas as a result of upstream drainage improvements)			GWRC	Landowners	Medium
COMMON METHODS		In river scheme	River management	River management envelope, recognition of vegetated edge protection as a river management tool, pest management in riparian planted buffers, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers					
		Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases					
		Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system					
		Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs					


Upper Kopuaranga
Mangamahoe
Mauriceville
234
Kopuaranga Valley
Mauriceville
Lower Kopuaranga
Kopuaranga
Reach boundaries
Historical channel extent
0
4
km
N

Whangaehu River

The Whangaehu River extends from the northern area of the upper Wairarapa valley to the Ruamāhanga River to the south-east of Masterton. The Whangaehu catchment altitude ranges from approximately 410m in the headwaters to 90-95m at the lower end of the Te Ore Ore plains.

The river flows some 32km from its upper reaches in steep hill country near Ihuraua to the Ruamāhanga River. It heads due south in the middle of a long rectangular catchment following the line of the ancient Alfredton fault. The steep catchment sides contain the river in a narrow valley in this area. In the lower reaches it meanders across the Te Ore Ore plains east of Masterton.

Formalised access to the river is limited, although a number of informal access agreements have been established between fishing and hunting recreation groups or individuals and landowners.

The Whangaehu River is very significant to Māori, with several cultural sites both along it and in the adjacent hills.

Soils in the Whangaehu catchment are formed from a mix of sandstone, limestone and siltstone. Land use in the catchment is mainly primary production activities – dairying, dry stock grazing, cropping, and plantation forestry – with a few scattered areas of native forest. There is little evidence of lifestyle-type development in the upper catchment, but a number of subdivided lifestyle-sized lots have been created on the Te Ore Ore plains closer to Masterton.

Key floodplain management points

This FMP provides a framework for erosion control works at priority locations, increase planting for erosion control and river enhancement, and other limited noxious-plant-control works, which are included in river maintenance activities.

Key characteristics by reach:

Upper Whangaehu

- Meandering stream through strongly rolling hills
- Mixed forestry and pastoral land use
- Open stream margins with sporadic willow and regenerating vegetation in upper reaches

Upper Whangaehu Valley

- Transition from stream to river
- Strongly rolling valley floor
- Steep gorges with mixed indigenous and willow vegetation

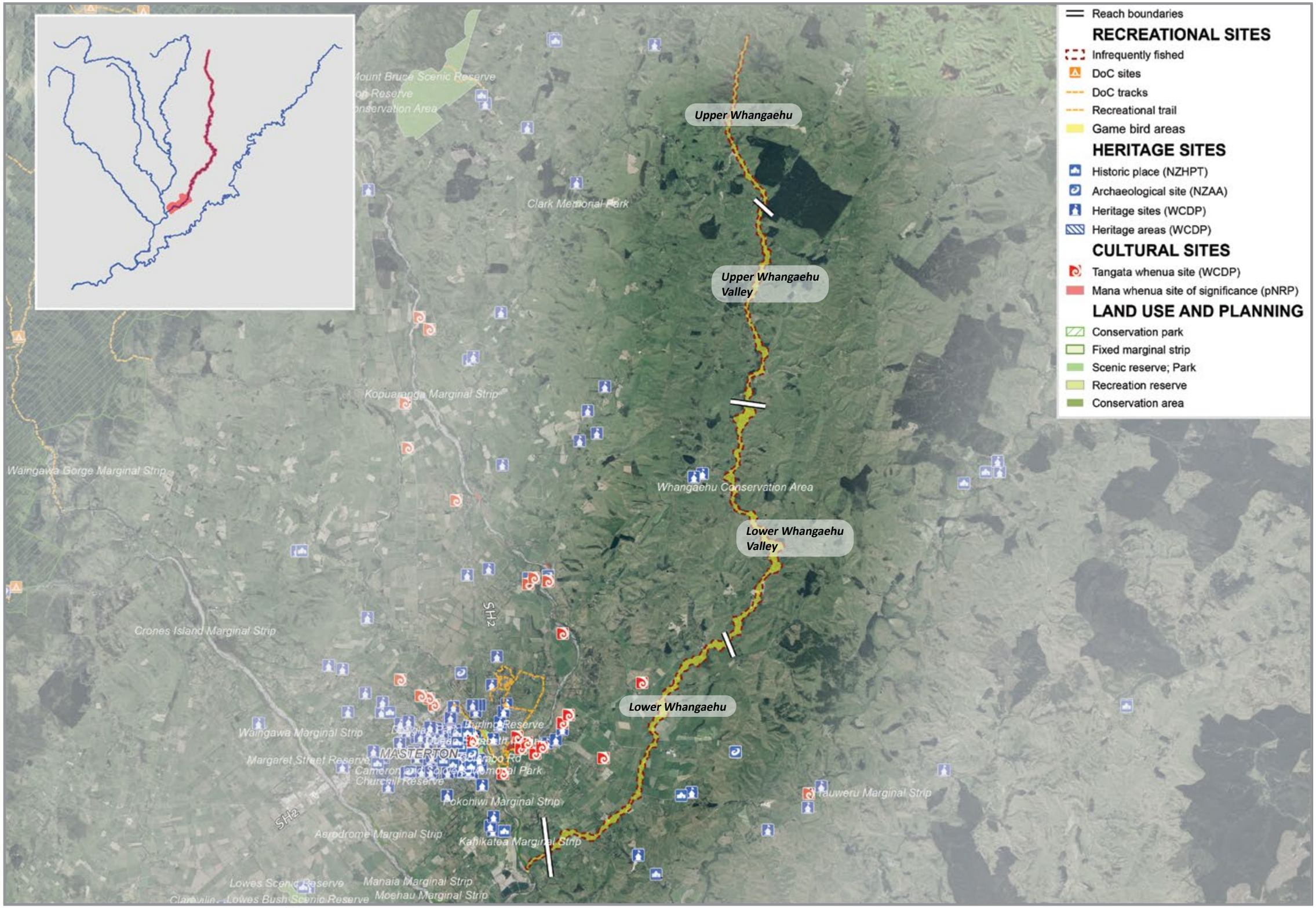
Lower Whangaehu Valley

- Meandering valley floor course
- Mixed willow and kānuka along margins

Lower Whangaehu

- Steeply incised grass banks
- Stock fencing separating river margins from surrounding areas
- Mixed poplar, willow and alder planting

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Whangaehu	Low/Medium	Medium/High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River	-
Upper Whangaehu Valley	Low/Medium	Medium/High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River	Indigenous forest, nfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland
Lower Whangaehu Valley	Medium	Medium/High	Game bird hunting, infrequent fishing			Rural (Primary Production), Road, River	Fenced indigenous forest, unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland
Lower Whangaehu	Medium	Low/Medium	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Rural (Special), Road, River	Mixed exotic-indigenous forest, indigenous treeland


Reach boundaries
RECREATIONAL SITES
Infrequently fished
DoC sites
DoC tracks
Recreational trail
Game bird areas
HERITAGE SITES
Historic place (NZHPT)
Archaeological site (NZAA)
Heritage sites (WCDP)
Heritage areas (WCDP)
CULTURAL SITES
Tangata whenua site (WCDP)
Mana whenua site of significance (pNRP)
LAND USE AND PLANNING
Conservation park
Fixed marginal strip
Scenic reserve; Park
Recreation reserve
Conservation area
Upper Whangaehu
Upper Whangaehu Valley
Lower Whangaehu Valley
Lower Whangaehu
Clark Memorial Park
Kopuaranga Marginal Strip
Whangaehu Conservation Area
Waingawa Gorge Marginal Strip
Crones Island Marginal Strip
Waingawa Marginal Strip
MASTERTON
Margaret Street Reserve
Churchill Reserve
Tokoniwi Marginal Strip
Aerodrome Marginal Strip
Kahikatea Marginal Strip
Tauweru Marginal Strip
Lowes Scenic Reserve
Lowes Bush Scenic Reserve
Manaia Marginal Strip
Moehau Marginal Strip
SH2
SH2
0
6
km
N

Whangaehu River

Flood and erosion issues

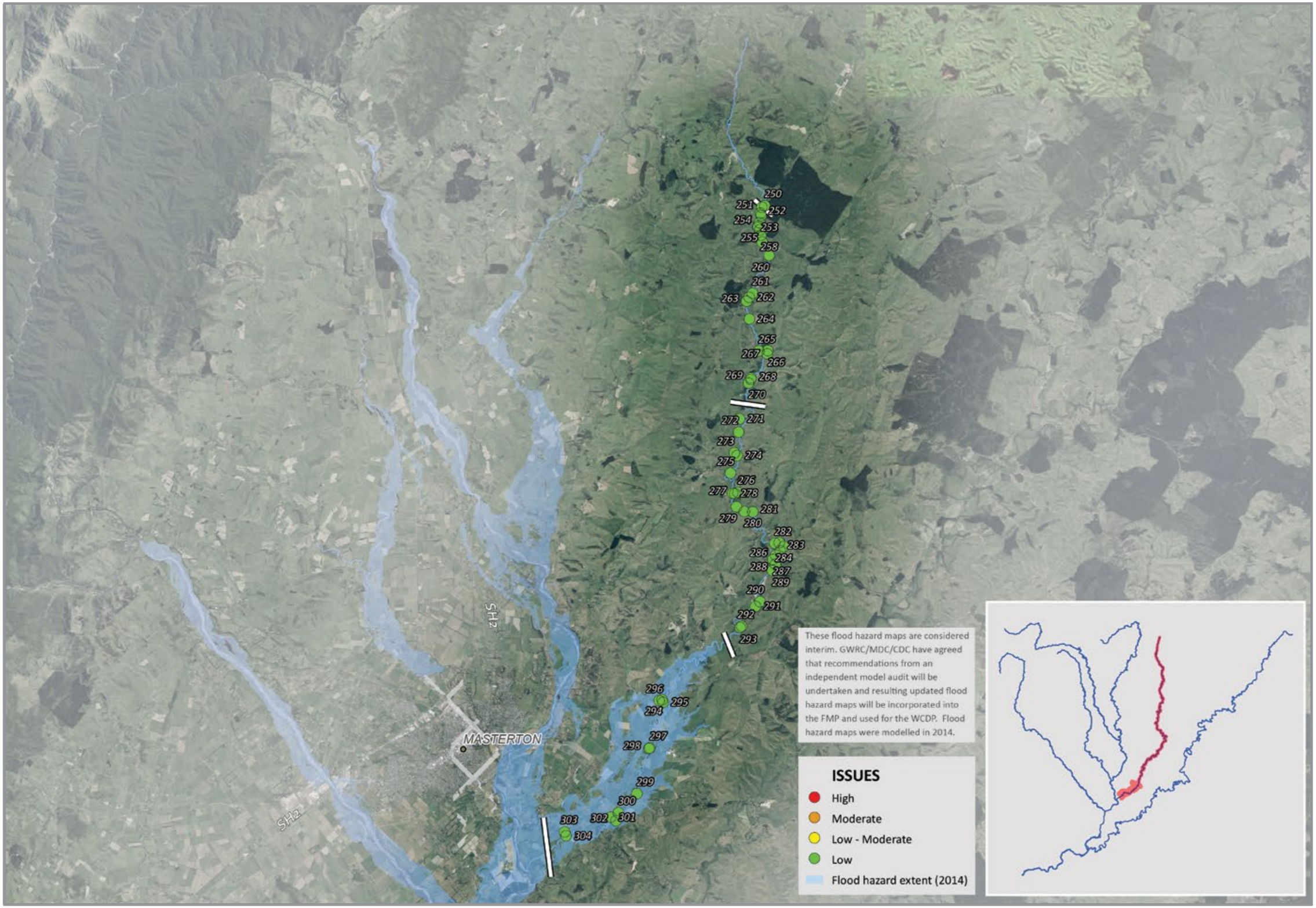
A total of 55 erosion issues have been identified along this river. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

The Whangaehu River's main channel capacity is often exceeded during heavy rainfall or storm events. When the river overtops its banks, the floodwaters flow across the large, flat area of the floodplain and into secondary or historical channels. Historically, this flooding would have been exacerbated by blockages in the confined channel.

Today, flooding on the east-west roads from Masterton cuts off a number of communities. While bridges in many places are high enough to stay dry, the roads on either side are covered with water deep enough to create a severe hazard for motor vehicles.

The erosion risk is relatively small due to the river's low energy and its limited ability to modify the surrounding geology. However, it is susceptible to silting from its banks and the hills in the catchment. A number of bridges, sections of rural roads, and farm outbuildings are included in the erosion hazard study area.

RISK LEVEL	DESCRIPTION			
LOW	**Road [250]** In erosion study area **Road bridge [251]** In erosion study area **Outbuildings [252]** In erosion study area **Road and private access [253]** In erosion study area **Road [254]** In erosion study area **Private access/bridge [255]** In erosion study area **House and buildings [256]** In erosion study area **Road [257]** In erosion study area **Road bridge [258]** In erosion study area **Stock bridge [259]** In erosion study area **Private access/bridge [260]** In erosion study area **Road [261]** In erosion study area **Road [262]** In erosion study area **Road [263]** In erosion study area	**Stock bridge [264]** In erosion study area **Road [265]** In erosion study area **Private access [266]** In erosion study area **Stock bridge [267]** In erosion study area **Outbuildings [268]** In erosion study area **Outbuildings [269]** In erosion study area **Private access bridge [270]** In erosion study area **Outbuildings [271]** In erosion study area **Stock bridge [272]** In erosion study area **Stock bridge [273]** In erosion study area **Access bridge [274]** In erosion study area **Woolshed [275]** In erosion study area **Road [276]** In erosion study area **Access bridge [277]** In erosion study area	**Outbuildings [278]** In erosion study area **Private access bridge [279]** In erosion study area **Road [280]** In erosion study area **Road [281]** In erosion study area **House and buildings [282]** In erosion study area **Road [283]** In erosion study area **Road and bridge [284]** In erosion study area **Road [285]** In erosion study area **Road [286]** In erosion study area **Road bridge [287]** In erosion study area **Outbuildings [288]** In erosion study area **Road bridge [289]** In erosion study area **Road [290]** In erosion study area **Road [291]** In erosion study area	**Road [292]** In erosion study area **Stock bridge [293]** In erosion study area **Road bridge [294]** In erosion study area **Outbuildings [295]** In erosion study area **Road [296]** In erosion study area **Outbuildings [297]** In erosion study area **Road bridge [298]** In erosion study area **Road bridge [299]** In erosion study area **Road bridge [300]** In erosion study area **Stock bridge [301]** In erosion study area **Stock bridge [302]** In erosion study area **Private access bridge [303]** In erosion study area **Private access [304]** In erosion study area
LOW TO MODERATE				
MODERATE				
HIGH				



ISSUES – Whangaehu River

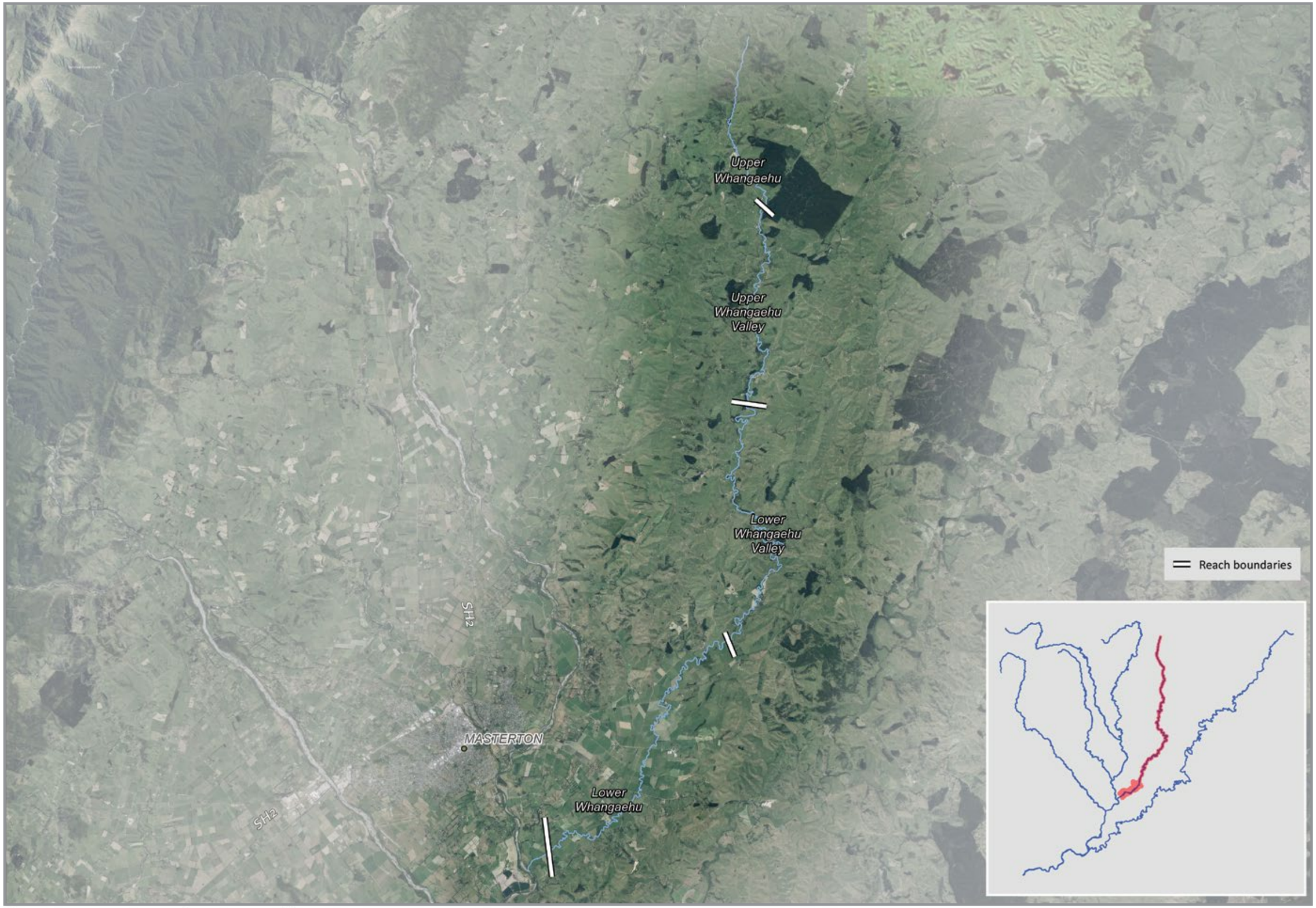
Whangaehu River

Response

The common methods applying to this reach are set out below. Those used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	SITE	TYPE OF RESPONSE	MEASURES
COMMON METHODS	In river scheme	River management	River management envelope, riparian planting of buffers, pest management in riparian planted buffers, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers
	Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision making-policy, asset abandonment/retirement, strategic land purchases
	Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system
	Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs


Upper Whangaehu
Upper Whangaehu Valley
Lower Whangaehu Valley
Lower Whangaehu
MASTERTON
SH2
SH2
Reach boundaries
0
6
km
N

Taueru River

The Taueru (also known as Tauweru) River is the eastern-most river in the study area. It flows through the eastern Wairarapa hills before connecting with the Ruamāhanga River to the west of Gladstone along the eastern edge of the wider Wairarapa Plains. The catchment area covers 498km^2 and the main channel is 69km long.

The river has a number of small tributaries, and comparably for its size a relatively small and narrow river channel. Its upper reaches pass through strongly rolling terrain used for pasture and forestry activities. The main channel in the lower reaches has a relatively low gradient with a meandering pattern.

The Taueru River's can be translated as 'hanging in clusters'.

The Taueru River catchment has a mix of soils formed from sandstone, limestone and siltstone in the eastern Wairarapa hill country. Land use in the catchment is mainly primary production activities (dairying, dry stock grazing, cropping, and plantation forestry), with a few scattered areas of native forest.

Farming activity that dominates the catchment's land use has had a substantial impact on the river's landform. However, pockets of good-quality remnant native vegetation remain in some less accessible steep-sided gully areas, including isolated locations where remnant tōtara and kahikatea can be found. In the river's managed area, introduced vegetation (clumps of willow and poplar) dominates the channel form, while outside the area much of the floodplain and banks are grazed. This diverse character mix mean the reaches are generally classified as having a medium modification level.

The Taueru River's floodplain is relatively sparsely populated; development is spread evenly along the river length and generally confined by the topography of the narrow valley.

The river is particularly significant to Māori due to its history as a travel route to the north-east and the coastal areas along the eastern side of New Zealand, which led to the formation of a number of settlements. Several cultural sites have been identified along the river, including locations of pā, urupā and mahinga kai. The river was also a particularly abundant source of freshwater crayfish, and eels were more abundant in lower reaches. Today these parts of the river remain a valued fishery.

The remnant pockets of native vegetation and the river's form make it important in some locations for recreational pursuits such as game bird hunting, fishing and kayaking.

The lower reaches have several RAP sites, including Te Kopi Road and Peter's Bush.

Key characteristics by reach:

Upper Taueru

- Mixed forestry and farmland
- Meandering stream with open grazed margins
- Corridors and clumps of willow and poplar trees

Bideford

- Meandering willow-lined corridor
- Isolated gorges with remnant tōtara and kahikatea

Bramerton

- Sweeping river form, semi-enclosed river corridor
- Open grazed pasture banks
- Pockets of remnant indigenous forest

Taueru

- Meandering course cut below river terraces
- River terracing containing historic settlement
- Open grazed margins with sporadic willow, poplar and eucalypts

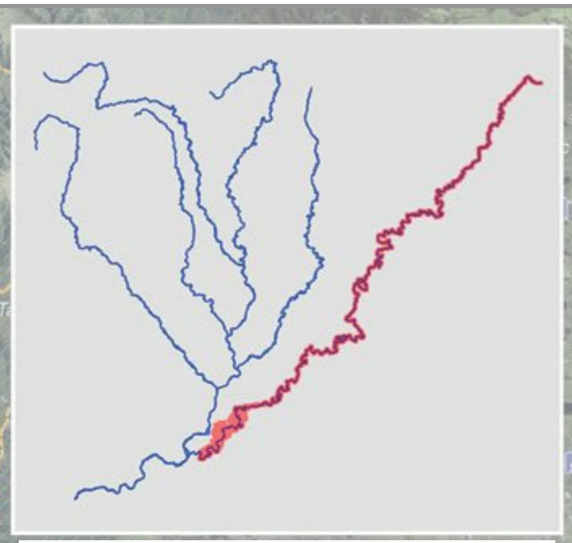
Weraiti

- Incised channel meandering through enclosed river terraces
- Mixed willow and pasture margins

Lower Taueru

- Incised channel meandering through the Wairarapa Plains
- Grassed margins separated from surrounding rural land use

REACH	LANDSCAPE VALUES		RECREATION VALUES	HERITAGE VALUES	CULTURAL VALUES	LAND USE AND PLANNING	ECOLOGICAL VALUES
	LANDSCAPE MODIFICATION	SCENIC VALUE					
Upper Taueru	Medium	Medium/High	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland
Bideford	Low/Medium	Medium	Game bird hunting, infrequent fishing	-	-	Rural (Primary Production), Road, River	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous vegetation
Bramerton	Medium	Medium	Game bird hunting, infrequent fishing			Rural (Primary Production), River	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous vegetation
Taueru	Medium	Medium	Angler access, game bird hunting, infrequent fishing	-	Historic pā site, urupā and mahinga kai	Rural (Primary Production), Road, River	Unfenced indigenous forest, mixed exotic-indigenous forest, Indigenous treeland, natural wetlands and ponds
Weraiti	Medium	Low/Medium	Angler access, game bird hunting, low/moderate value fishing	-	-	Rural (Primary Production), Rural (Special), Road, River	Unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland
Lower Taueru	Medium	Medium	Kayak access, kayaking, game bird hunting, excellent fishing	Memorial Oaks (WCDP)	Urupā	Rural (Primary Production), Rural (Special), Road, River, Flood Protection and Mitigation	Te Kopi Road (RAP), Peter's Bush (RAP), unfenced indigenous forest, mixed exotic-indigenous forest, indigenous treeland, natural wetlands and ponds



Key floodplain management points

This FMP provides a framework to supply erosion control works at priority locations, increase planting for erosion control and river enhancement, and other limited noxious plant control works which are included in river maintenance activities.

Taueru River

Flood and erosion issues

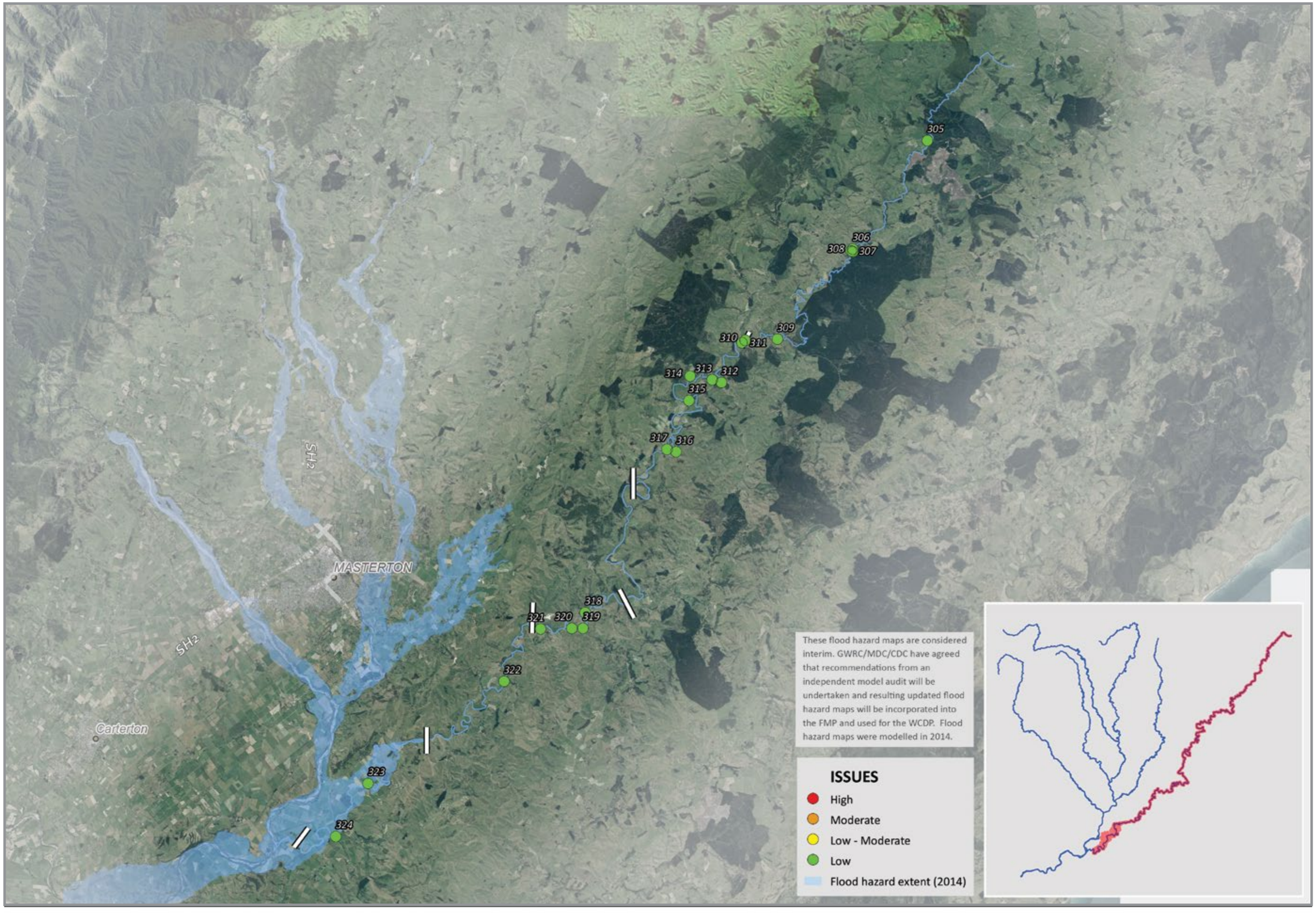
A total of 20 erosion issues have been identified along this river. Each has been ranked according to its consequences and likelihood (risk) and assigned an ID number [xx].

Flooding frequently overtops the Taueru River's banks to flow across the floodplain, and to a lesser extent through secondary channels.

The river's large catchment has led to some significant floods in the past. The key risks relate to flooding of productive land, access routes to residential properties, and the flood risk for rural homes.

The river's erosion risk is very limited, and there are only a small number of bridges and structures in the erosion study area. However, the river is susceptible to heavy silting from sediments washed from its banks and hills in the catchment.

RISK LEVEL	DESCRIPTION			
LOW	**Road and bridge [305]** In erosion study area	**Road bridge [310]** In erosion study area	**Private access bridge [315]** In erosion study area	**Stock bridge [320]** In erosion study area
	House and outbuildings [306] In erosion study area	**Road [311]** In erosion study area	**Private access [316]** In erosion study area	**Private access bridge [321]** In erosion study area
	House and outbuildings [307] In erosion study area	**Road [312]** In erosion study area	**Private access bridge [317]** In erosion study area	**Road bridge [322]** In erosion study area
	Private access bridge [308] In erosion study area	**Private access bridge [313]** In erosion study area	**Road bridge [318]** In erosion study area	**Private access bridge [323]** In erosion study area
	Private access bridge [309] In erosion study area	**Private access bridge [314]** In erosion study area	**Stock bridge [319]** In erosion study area	**Road bridge [324]** In erosion study area
LOW TO MODERATE				
MODERATE				
HIGH				



ISSUES – Taueru River

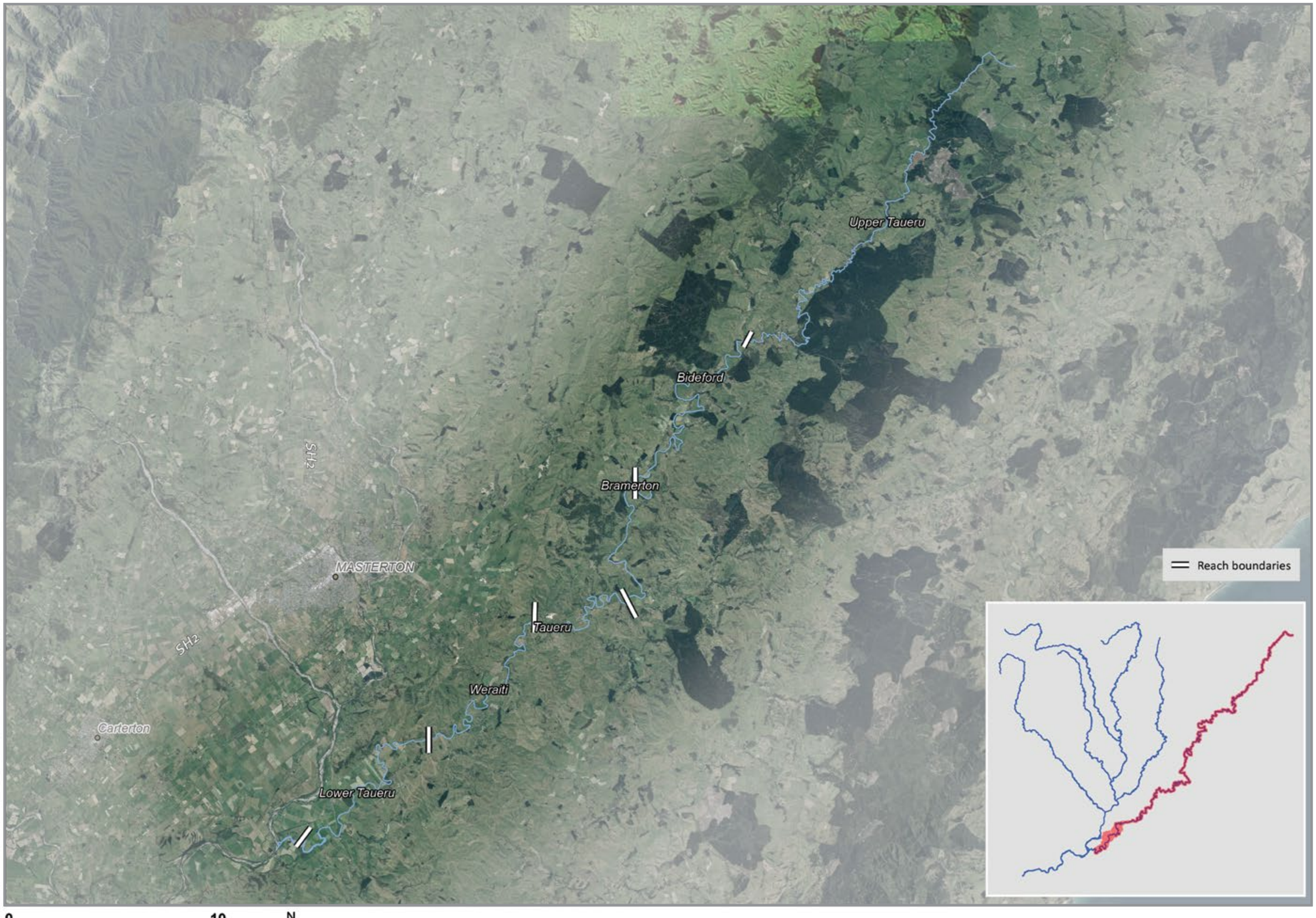
Taueru River

Response

The common methods applying to this reach are set out below. The common methods used to address specific issues are listed in *Appendix 5*.

REACH-SPECIFIC RESPONSES

	SITE	TYPE OF RESPONSE	MEASURES
COMMON METHODS	In river scheme	River management	River management envelope, river-bed-level monitoring, riparian planting of buffers, pest management in riparian planted buffers, pool-riffle-run envelope, isolated works support, Code of Practice, mixed riparian planting in buffers, alternative land uses in riparian planted buffers
	Entire reach	Planning and policy	Land use controls, flood hazard maps, rural stopbank policy, river scheme funding decision-making policy, asset abandonment/retirement, strategic land purchases
	Entire reach	Emergency management	Emergency management planning, community resilience, flood forecasting and warning system
	Entire reach	Environmental enhancement	Environmental Strategy, Community Support Officer, Riparian Management Officer, care group and clubs


Upper Taueru
Bideford
Bramerton
SH2
MASTERTON
SH2
Taueru
Weraiti
Carterton
Lower Taueru
Reach boundaries
0
10
km
N

Appendix 1: Floodplain management planning process

Floodplain management planning aims to create a plan to keep people and property safe from floodwaters, while at the same time preparing people to cope with floods. Specifically, it recognises:

- The need to manage risks to life and property
- The economic effects of flooding on the community
- The impacts of river management practices on environmental, cultural and social wellbeing

Work on this FMP began in 2012, and since then information has been gathered from a range of sources and ideas have been discussed by the FMP Subcommittee. The development process had three phases, and followed the '*Guidelines for Floodplain Management Planning*' (GWRC, 2013).

Phase 1 – Investigation

This phase involved collecting data and establishing and understanding:

- The flood and erosion problems along the rivers and the adjacent floodplain
- The relationships between flood hazards, people and communities – including the values that are shared and the ways in which the interactions between these are managed

On a technical level, it involved processes such as hydrological/climatic assessments, cultural values' assessments, ecological and landscape assessments, hydraulic modelling and flood hazard mapping, flood damage assessments and assessments of the implications for existing zoning. During this phase, a significant flood risk was identified for the Masterton urban area from the flooding of the Waipoua River.

Affected parties and the community were kept informed through briefings, an open day and letter drop, and a presentation of the flood hazard maps in Masterton.

The Te Kāuru Upper Ruamāhanga Floodplain Management Plan Subcommittee

The FMP Subcommittee, made up of community and local government representatives, was also established during Phase 1 as a focus and governance group to help with the different phases of this FMP's development.

The FMP Subcommittee is chaired by Bob Francis, Masterton's longest-serving mayor, and made up of:

- The GWRC Councillor for the Wairarapa constituency
- One other GWRC Councillor
- One elected member each nominated by MDC and CDC
- One member nominated by Ngāti Kahungunu ki Wairarapa
- One member nominated by Rangitāne ō Wairarapa
- Up to two members nominated by the existing river scheme committees
- Up to four community members appointed for their skills and experience relevant to the subcommittee's work, who are all appointed by the Council

During the FMP development process a few members joined and left the Subcommittee for different reasons. We would particularly like to acknowledge Councillor Gary McPhee and Siobhan Garlick, who passed away during the development of this FMP. Altogether 15 members contributed to the FMP Subcommittee process:

BOB FRANCIS (CHAIR)

Community

STEPHANIE GUNDERSEN-REID

Community

CLLR GRAHAM MCCLYMONT

MDC

FORMER CLLR GARY MCPHEE

GWRC

KATE HEPBURN

Community

CLLR BRIAN DELLER

CDC

CLLR BARBARA DONALDSON

GWRC

JANINE OGG

Community

CLLR ADRIENNE STAPLES

GWRC

DAVID HOLMES

River scheme

RAWIRI SMITH

Ngāti Kahungunu ki Wairarapa

MICHAEL WILLIAMS

River scheme

HORIPO RIMENE

Rangitāne o Wairarapa

SIOBHAN GARLICK

Rangitāne o Wairarapa

FORMER CLLR MIKE PALMERS

CDC

Phase 2 – Identify and assess management options

This phase involved detailed information-gathering and considerable consultation with interested parties and stakeholders through meetings, open days, letters, radio coverage, participation in A&P Shows, and workshop sessions. It also involved accessing technical studies and a variety of other reports and documents, which contributed to the decision-making process and provided evidence-based information on how the river can best be managed to control the risks associated with flooding and erosion.

During this phase the FMP Subcommittee developed the plan's aims in consultation with the community; these are outlined in Section 2.5. The overarching aims for the catchment were then used to develop more specific aims for the individual reaches.

Using these identified aims, a 'multi-criteria analysis' (MCA) was developed specifically for the Te Kāuru Upper Ruamāhanga catchment to evaluate the river management options. It tested the options against the overarching FMP aims and identified areas requiring improvement to lift their performance to levels acceptable to the subcommittee.

The process identified more than 300 issues associated with the rivers and the risks of flooding and erosion. These are detailed in the Vision and Aims report, and Part 2 of this FMP.

The technical studies and consultation investigations helped in identifying the flood management options. These were considered through a series of workshops run by the FMP Subcommittee, which included field visits and discussions about the community's needs and appropriate solutions. The subcommittee then evaluated a series of structural and non-structural options against the FMP's aims, with the process and outcomes focused on reducing the potential risks of flooding and erosion.

The table below outlines the FMP Subcommittee workshop topics and the associated key decisions.

DATE	WORKSHOP TOPICS	KEY DECISIONS
20 October 2015	MCA establishment	
15 March 2016	MCA recap Common methods applied across Waingawa River	Use of MCA
14 April 2016	Common methods: • River buffer (banks) • River buffer (beds) • Pool-riffle-run count • Retreat or retirement of assets • Governance and funding	Support pool-riffle-run count and asset retreat
17 May 2016	Common methods: • Governance and funding • Mixed vegetation planting • Emergency management • Private bridges across river • Community groups	Support mixed vegetation planting, emergency management and community groups
17 June 2016	Rathkeale stopbank Common methods endorsement/feedback	Support high-level application of all common methods
26 July 2016	Waingawa State Highway 2 gateway/stopbank River Road Properties	
25 August 2016	Rathkeale stopbank options Waingawa stopbank update South Masterton Gateway Mauriceville	Support improvements to amenity at South Masterton Gateway Support inclusion of Mauriceville in river scheme
13 September 2016	Overview of MDC assets and flood risk implications	Approve structure and preparation of working draft of FMP
6 December 2016	Issue first working draft of FMP	
7 February 2017	Feedback on working draft FMP	
7 March 2017	Summary of feedback on the working draft FMP, and outcomes of the feedback	
4 April 2017	Governance MCA summary of Major Project Responses Common methods by river	Approval of outcomes of MCA process with major projects Support identification of use of common methods across each river
13 June 2017	Science of hydrological assessment Management of water courses	
22 August 2017	Waipoua Masterton Urban Area Project Group August meeting Feedback from Whaitua consultation regarding 'managing the rivers' Benefits of wider river active bed and vegetated buffers Design lines/river management envelopes – how were they developed? And how will they be implemented? Major Project Response updates a. River Road b. MDC raw water supply pipeline c. South Masterton stopbank discussion	
12 September 2017	Buffer management report Funding Kopuaranga river scheme expansion Rathkeale stopbank	Acceptance of proposed buffer management approach Agreement to include Kopuaranga river scheme expansion in the draft FMP
24 October 2017	Implementation of buffers River management descriptions	Acceptance of implementation process for buffer management Draft FMP to have preferred options not multiple options Detail of river management descriptions and level of service descriptions to remain as a supplementary report Confirmed that the preferred river management approach is to generally work in the existing river management envelopes Desire to include designation of the buffers in the draft FMP
28 November 2017	Draft FMP Volumes 1 and 2	Confirm general structure of FMP Review general and more specific comments on content of FMP, covering: • Non-statutory status • Relationship to NPS-FM • Reliance on mixed vegetation • Adaptive management • Relationship to Code of Practice • Terminology
13 February 2018	Responses to draft FMP feedback Rathkeale update Consultation	Confirm feedback responses have been identified Review draft responses That genuine and honest feedback from the community is being sought
12 March 2018	Review updates to FMP Volumes 1 and 2 Confirm corrections to be updated in working drafts Consultation responses	MDC and CDC to endorse draft for consultation

DATE	WORKSHOP TOPICS	KEY DECISIONS
10 April 2018	Communication and engagement plan Wide design lines Whaitua update	Focus on implementing flexible, vegetated buffers
8 May 2018	Plant species Engagement plan Rathkeale Funding Future flooding and climate change	Seek agreement with iwi regarding plant selection List of changes to be circulated ahead of next meeting
5 June 2018	Draft FMP Volumes 1 and 2	FMP endorsed for community engagement
3 July 2018	Engagement documents/activities Whaitua Implementation Design Team Waipoua update	Environment Committee endorsement for engagement
8 August 2018	Feedback from coffee group meetings Waipoua River modelling	Recognise importance of addressing weeds in buffers MDC and GWRC to proceed collectively
11 September 2018	Stage 1 engagement summary Waipoua option development	Working group to progress with developing urban Major Project Response for Masterton
15 October 2018	Sustainable Wairarapa discussion – Ian Gunn Engagement summary report Project manager's report Draft hazard maps for Waipoua Rathkeale update	
1 November 2018	Waipoua flood hazard engagement feedback Oxford Street engagement Waipoua option development Major workstream responding to feedback	Long list of Waipoua approaches' development
10 December 2018	Community involvement Flood hazard maps FMP project manager's report Whaitua update Water Wairarapa update	Support for approach to community engagement
29 January 2019	Urban Waipoua identified approach Buffer benefits report – Russell Death Updates to Volume 1	
13 February 2019	Volume 1 updates Volume 2 updates Volume 3 updates Engagement	Planting and weed control key outcomes
21 February 2019	Updates to FMP Volume 1 for re-engagement	Volume 3 endorsed for public engagement
5 March 2019	Engagement on Volume 3 Outline of proposed FMP as one volume	
13 March 2019	Summary of engagement Draft proposed FMP Consultation	FMP endorsed for consultation
11 April 2019	Engagement report Submissions so far Phase 2 summary report	Establish hearings panel
29 April - 22 May 2019	Hearing and deliberations	
28 May 2019	Summary of submissions and responses Draft independent audit	
5 June 2019	Resolve updates to FMP	

Several key constraints had to be considered when assessing management options, including:

- The locations of existing assets (such as bridges, roads, houses)
- The need to balance the environmental and cultural value of allowing the river to behave more naturally with the economic costs of the potential loss of productive land

In particular, the FMP Subcommittee promoted a river management approach that sought to allow the rivers to behave more naturally, with less frequent intervention, in the current envelopes. This was an explicit attempt to strike a balance between improving the river environments and recognising the economic value of the adjacent land (and the views of its landowners).

In addition to the workshops outlined above, about 20 FMP Subcommittee meetings were held in Masterton (and open to the public) where the subcommittee endorsed various steps of the project development. All the reports are publicly available on the GWRC website.

Phase 3 – Prepare draft floodplain management plan

Based on the evaluation of options against the FMP's vision and aims, the FMP Subcommittee selected the preferred option combinations and presented them to the community for feedback as a 'draft' FMP in three separate volumes.

Consultation

The FMP development process maintained a constant focus on engaging with the community, especially those who lived on or owned flood-prone land. The result brings together several years of intensive work by:

- Key stakeholders and affected parties
- The rural community
- The urban community of Masterton
- The FMP Subcommittee
- GWRC, CDC and MDC
- Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa
- Various interest groups, public agencies and businesses

The FMP Subcommittee was a crucial component of consultation on the river's future management, made decisions on detailed technical investigations, and endorsed preferred options for addressing the flood and erosion risks at specific locations. These decisions form the basis of this FMP.

Details of how to contribute to the draft FMP were outlined in the draft FMP Volumes 1 and 3, under the heading 'How can the community contribute?'.

Appendix 2: Previous river management practices

‘River management’ refers to works in the bed of a river and on the riverbanks, and the maintenance of stopbanks.

In the past 50 years, various river schemes have been proposed, developed and maintained based on the wishes and with the support of the local community. Their purpose: to reduce, mitigate or manage the risks of flooding and erosion with the aim of protecting people, property, infrastructure and productive rural land.

Previously two distinct river scheme types operated in the Te Kāuru Upper Ruamāhanga catchment. One covered the western side of the valley and dealt with its larger, gravel-bedded rivers (the Waingawa, Waipoua and Ruamāhanga Rivers) and the other covered the smaller, silt-bedded rivers on the eastern side, including the Kopuaranga, Whangaehu and Taueru Rivers.

Activities and approaches

The earlier approach to flood risk management in the catchment primarily addressed erosion concerns. The western river schemes used a ‘river management envelope’ as a tool to ensure the river channels could accommodate flood flows. The aim was to keep the channels in a design alignment and plant each side of the active river beds in appropriately wide vegetated buffers, to enable channel maintenance over time.

Today, modern, sterile willow varieties are the preferred vegetation for buffers along fast-flowing, erosion-prone rivers. With their robust nature, vigorous growth and ability to resist erosion, the buffers can provide the bulk of the erosion protection, leaving river scheme managers to manage break-outs in river alignment before they damage assets and the productive land behind the buffers and stopbanks. In comparison with earlier willow plantings, such as those done historically on the Whangaehu, Taueru and Kopuaranga Rivers, modern management takes a hands-on approach to establishing and managing the willow plantations so that they do not impinge on the river channel or otherwise cause a nuisance.

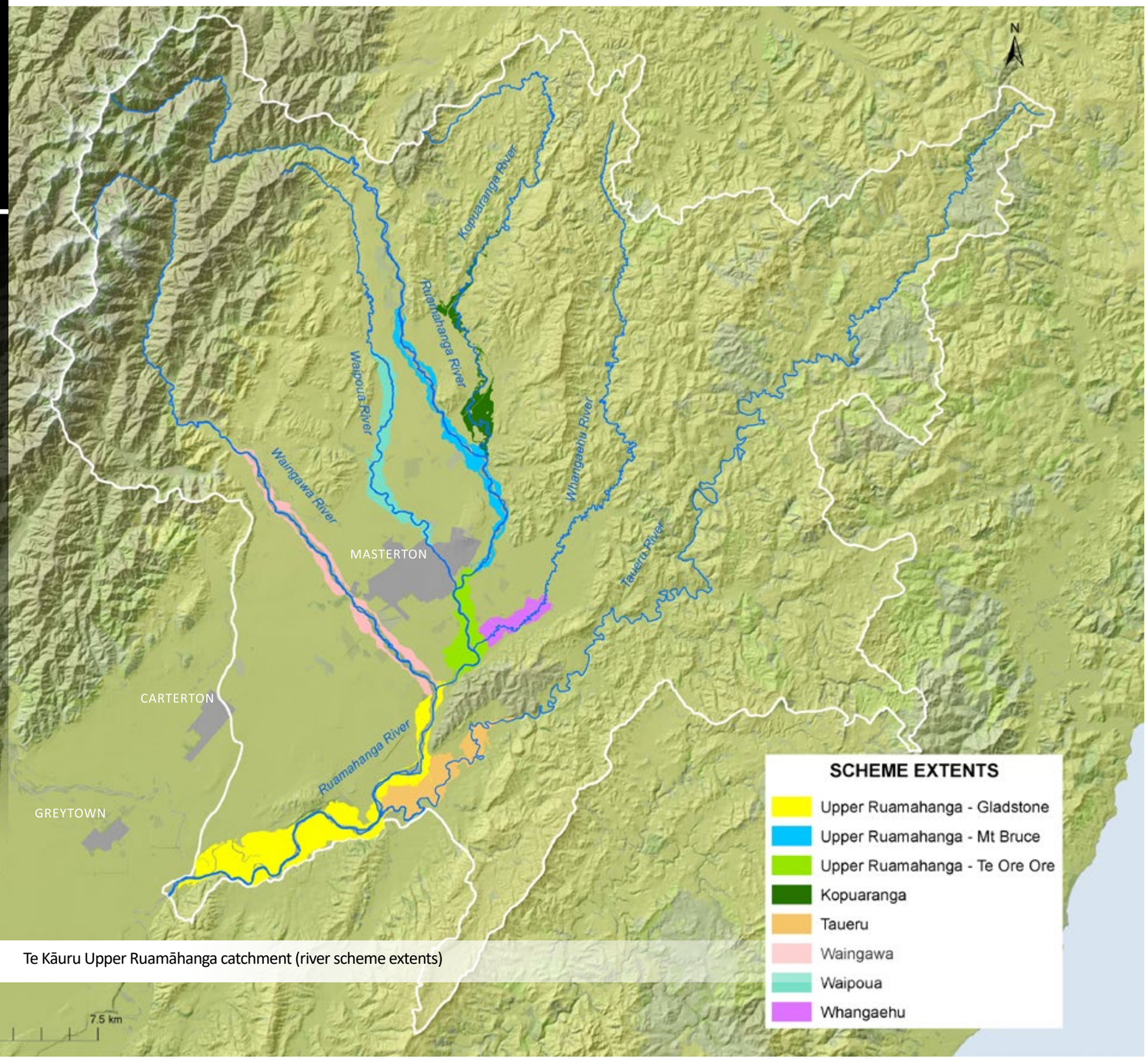
Other, complementary river management activities used throughout the Te Kāuru Upper Ruamāhanga catchment have included:

- Gravel extraction
- Riverbed and/or beach re-contouring
- Rock rip-rap (placing rock lines along the river edge/bank)
- Rock groynes (placing rock built out from the river edge/bank)
- Vegetation clearance to prevent the build-up of islands in the river channel. This involves using machinery such as diggers and bulldozers on the edge of the river, or sometimes in the river channel itself

Previous river management focused on economic development – minimising the impacts of flooding and erosion on agricultural land and maximising the productive capacity of that land. Today, agricultural land use remains one of the key drivers of river and erosion management and creates the greatest demands on management resources.

In recent years, people have become concerned about the sustainability of river management techniques, and the impacts that these techniques and river schemes have had on the river environment and cultural values. As a result, and owing to collaborative work between the river schemes and community representatives, steps have been taken to change or modify these management practices. This FMP aims to build on these improvements and includes the concept of giving the river more room to develop a natural form. It also recognises the full range of river and floodplain values as part of the assessment and option development process.

Gravel management and willow cabling are examples of many works that take place in the rivers



Te Kāuru Upper Ruamāhanga catchment (river scheme extents)

Appendix 3: The story of river schemes in the Te Kāuru Upper Ruamāhanga catchment – past to present

Upper Ruamāhanga River schemes

The upper Ruamāhanga River has a long history of river management associated with human settlement and people's desire to protect themselves and their assets (land and structures) from the negative effects of flooding.

The modern Upper Ruamāhanga River Scheme was established in 1982 and covered 58km of the Ruamāhanga River from Mount Bruce downstream to the Waiōhine River confluence. It was designed to protect about 2,760ha of rural land and a number of public utilities using a combination of stopbanks, vegetated buffers and heavy bank protection. The guiding philosophy was based on an established set of design lines.

The river scheme underwent a major review in 2001/02 in response to a number of issues, particularly the river management approach and rating classifications, which were considered inequitable in certain reaches of the river scheme. The review resulted in the Upper Ruamāhanga River Scheme being split into three sections – the Mount Bruce River Scheme (25km), the Te Ore Ore River Scheme (9km) and the Gladstone River Scheme (24km) – to reflect the typical works required and the subsequent relative rating requirements of each section of the river.

Waingawa River scheme

The Waingawa River Scheme, covering 17km, stretches from the Atiwhakatu Stream to the Ruamāhanga River confluence downstream. The river is bisected by a number of geological fault lines that influence its natural characteristics. The floodplain is generally well defined by clear river terraces that indicate where the river has been in a geologic timeframe, although cross-country overflows towards Masterton were possible before the construction of stopbanks in the vicinity of West Bush/Skeets Road.

After a series of floods in 1988, local landowners and the district councils requested that a river scheme be set up to manage the effects and to provide ongoing protection for land and community assets. At that time, any work in the river to mitigate flood and erosion damage was carried out by individual landowners or the utility owners at their own expense. The river scheme was established in 1992.

A significant aspect of the river scheme was a mechanism for encouraging the retirement of private land next to the river to allow the creation of a vegetated buffer. Owners who agreed received 10% of the assessed value of the land, and the remaining 90% of the assessed value was credited to the river scheme rating district to partially offset river scheme costs. In the first 15 years, infrastructural assets were developed to mitigate erosion damage, course changes and flood hazards in Masterton. After this the river scheme focused on maintenance works.

Waipoua River scheme

The Waipoua River Scheme covers the 18km between Mikimiki Bridge and the Ruamāhanga River confluence downstream.

The river scheme was originally established in 1954 as the Waipoua River Scheme, to mitigate flooding and erosion hazards for rural land and the Masterton urban area. It was designed to protect about 770ha from flooding and consists of stopbanks, grade-control weirs, vegetated buffers, protective willow plantings and rail-iron groynes.

The river scheme has two parts: the rural reaches and the Masterton urban reach. GWRC is responsible for implementing and maintaining both components, but the funding of maintenance works in the Masterton urban area is split 50/50 between GWRC and MDC. Three grade-control weirs in the Masterton urban reach maintain the river's water level to ensure that Queen Elizabeth Park has a sufficient water supply. These weirs are in the GWRC list of assets.

Kopuaranga River scheme

The Kopuaranga River Scheme covers around 27km from just downstream of Mauriceville to the confluence with the Ruamāhanga River at Matapihi. It was established in 2007 in response to flood events during 2004 and 2005 in which willows in and near the Kopuaranga River channel were impeding river flows and reducing channel capacity. The effect of this willow growth was more frequent flooding, particularly on properties in the lower sections of the Kopuaranga catchment.

Following community consultation, the river scheme was established to fund the removal of selected willows and a re-planting of native and exotic species in the lower catchment, as well as an ongoing maintenance programme in which willows are sprayed or cut as required. Since the river scheme was established, willows have been progressively removed and re-planted.

Whangaehu River scheme

Covering 9km of river, the Whangaehu River Scheme is relatively small in its scope of works and expenditure.

It was established in 1995 in response to worsening flooding as a result of increased congestion in the river channel caused by willows and other debris. The river scheme extends from the river's confluence with the Ruamāhanga River up to Masterton Castlepoint Road.

Taueru River scheme

The Taueru River Scheme covers 18km of the river and is similar in scope to the Whangaehu River Scheme. It was established in 1994 to reduce the incidence of flooding in the area due to excessive willow growth in the river channel. The river scheme extends from the river's confluence with the Ruamāhanga River (just upstream from Gladstone Road Bridge) to the end of Te Kopi Road. The cause of the flooding (such as willow growth reducing the capacity of the river channel) and the resulting river scheme works (such as the original removal of willows and debris, followed by spraying to control regrowth) have many similarities with the Whangaehu River.

Cost of management work (2017) and key protected areas

RIVER	COST OF MANAGEMENT WORK	KEY PROTECTED AREAS
Ruamāhanga	Mt Bruce $125,000 – typical annual maintenance cost $1.5 million – flood protection assets value Te Ore Ore $150,000 – typical annual maintenance cost $2.5 million – flood protection asset value Gladstone $160,000 – typical annual maintenance cost $3 million – flood protection asset value	Mt Bruce ($5,000/km), Te Ore Ore ($17,000/km), and Gladstone areas ($7,000/km) Average $ spent per kilometre is indicative of the three river schemes' relative levels of service (low, high, medium respectively)
Waingawa	$179,000 – annual maintenance cost $1.4 million – flood protection asset value	Masterton water supply intake and the water supply pipeline The railway and state highway bridges The bank edge at the end of the Hood Aerodrome runway Local and regional utilities infrastructure
Waipoua	$110,000 with around $20,000 identified for the urban reach $3,664,087 asset value	Urban Masterton and other public and private assets
Kopuaranga	$23,000 – annual maintenance No flood protection assets here	The river scheme covers 27km upstream of the confluence with the Ruamāhanga River
Whangaehu	$7,000 – annual budget No flood protection assets here	Covers 9km upstream of the confluence with the Ruamāhanga River
Taueru	$5,000 – annual budget No flood protection assets here	Extends for 17.7km from the confluence with the Ruamāhanga River

Appendix 4: Legislative and policy/principle context

This appendix provides an outline of the legislation, policies and principles relevant to the preparation of the Te Kāuru Upper Ruamāhanga FMP.

Legislation

Four key statutes are particularly relevant to floodplain management: the RMA; the LGA; the Soil Conservation and Rivers Control Act 1941; and the Local Government (Rating) Act 2002.

Each has a distinct and important role in flood risk management, including the ability to introduce a range of regulatory and non-regulatory measures that enable central and local government to manage such risks more effectively (including structural measures such as stopbanks, policy and planning measures such as land use controls, and river management responses such as river management envelopes and riparian planting of buffers).

Resource Management Act

Natural hazards are a relevant planning concern under the RMA, with the "management of significant risks from natural hazards" recognised as a matter of national importance (s.6(h)).

To achieve this, regional and city/district councils have specific natural-hazard-related functions under the Act, with regional councils responsible for controlling the "use of land for the purpose of avoiding or mitigating natural hazards" (s.30(1)(c)(iv)) and city/district councils responsible for controlling "any actual or potential effects of the use, development, or protection of land for the purpose of avoiding or mitigating natural hazards" (s.31(1)(b)(i)).

Functionally, regional councils have a lead role in hazard management, with the allocation of responsibilities between agencies outlined in their regional policy statements (s.62(1)(i)).

These requirements, along with other relevant matters in Part 2 of the RMA, provide a regulatory context for regional and city/district councils to control land use to avoid or mitigate natural hazards such as flooding. They are typically realised through purpose-designed objectives, policies and rules contained in the respective regional and district plans (ss.67/68 and 75/76), and in considering and determining any associated resource consent applications (Part 6 and s.106).

Local Government Act

Under the LGA regional and city/district councils are required to have particular regard to the contribution that the core service of "avoidance or mitigation of natural hazards" makes to their communities (s.11A).

A key requirement under the Act is the preparation of Long Term Plans. These provide a vehicle for regional and city/district councils to outline their key activities (expenditure) in the following 10-year planning horizon. They also provide a basis for accountability through identifying and setting required levels of service and performance measures in relation to groups of activities, such as flood protection (s.93).

As part of their Long Term Plans, councils are also required to prepare financial strategies, including an indication of the "expected capital expenditure on network infrastructure, flood protection and flood control works that is required to maintain existing levels of service" (s.101A(3)).

The Long Term Plans and associated asset management planning process enable councils to determine the natural hazard-protection levels to be provided by their assets (in the case of flood protection works), and the event levels they are intended to withstand (in the case of network infrastructure).

Soil Conservation and Rivers Control Act

While much of the original Soil Conservation and Rivers Control Act has been repealed, it still empowers regional councils to undertake catchment works to promote soil conservation or minimise and prevent damage by floods and erosion (ss.10 and 133).

Although the Act provides a mandate to undertake works for the purposes of flood protection and erosion control, it does not compel or require regional councils to act on these matters. Furthermore, any proposed works (such as stopbanks) are subject to the requirements of the RMA if the activity is not permitted as of right or a resource consent is required under a relevant district or regional plan (s.10A).

The Local Government (Rating) Act

The Local Government (Rating) Act replaced the Rating Powers Act 1988, but does refer to it in various sections.

Section 23 of the Local Government (Rating) Act outlines the procedure for setting rates. Rates must be set in accordance with the relevant provisions of Long Term Plans, including the funding impact statements for each financial year.

For public transport, river management, pest management and Wellington regional strategy rates, the Council bases its differential rating categories on those used by each of the territorial authorities in the Wellington Region. Differential rating categories for the Wairarapa river schemes, Wairarapa catchment schemes and Wairarapa drainage schemes are based on areas identified in the approved classification registers held by the Council.

National Policy Statement for Freshwater Management (NPS-FM, 2014 (amended 2017))

The NPS-FM is a regulatory instrument issued by the Government under the RMA that provides direction to local authorities on managing freshwater through the establishment of:

- A framework that considers and recognises Te Mana o te Wai (the integrated and holistic wellbeing of the water) as an integral part of freshwater management
- A set of objectives and policies that direct water to be managed in an integrated and sustainable way, with provision made for economic growth in set water quality and quantity limits

Particular provisions in the NPS-FM of relevance to floodplain management are:

- Objective C1 and associated Policies C1 and C2 – These relate to improving the integrated management of freshwater and the use and development of land in a catchment. This in turn requires regional councils to review the way they manage land use impacts on water quality and quantity, including the management of sediment input and land uses that alter water yield (Policy C1), and to recognise the relationship between the management of land use and water and the provision of all forms of infrastructure, including stopbanks (Policy C2)
- Objective CA1 and associated Policies CA1 and CA2 – These relate to the identification of freshwater management units incorporating all freshwater bodies in a region, along with the establishment of a nationally consistent approach to setting relevant freshwater objectives for these units (the National Objectives Framework)

Ecosystem health and human health for recreation are compulsory values for consideration when developing specific objectives for freshwater management units. Aside from these, regional councils may consider a range of other values where appropriate to their local/regional circumstances. These values can include natural form and character (such as biophysical, ecological, geological, geomorphological and morphological aspects), mahinga kai, wāhi tapu and water supply (Policy CA2(b) and Appendix 1).

Regional Policy Statement for the Wellington Region (RPS)

The RPS has a specific topic on natural hazards, with river flooding identified as one of the three most significant natural hazards in the region. It also contains three natural-hazard-related objectives:

- Objective 19 – The risks and consequences to people, communities, their businesses, property and infrastructure from natural hazards and climate change effects are reduced
- Objective 20 – Hazard mitigation measures, structural works and other activities do not increase the risk and consequences of natural hazard events
- Objective 21 – Communities are more resilient to natural hazards, including the impacts of climate change, and people are better prepared for the consequences of natural hazard events

To achieve these objectives the RPS relies on four key policies: two that direct district and regional plans that apply in the region, and two that set out matters that councils need to consider when processing and determining a resource consent/notice of requirement or a change/variation in, or replacement of, a plan. These policies are as follows:

- Policy 15 – Minimising the effects of earthworks and vegetation disturbance – district and regional plans
- Policy 29 – Avoiding subdivision and inappropriate development in areas at high risk from natural hazards – district and regional plans
- Policy 51 – Minimising the risks and consequences of natural hazards – consideration
- Policy 52 – Minimising adverse effects of hazard mitigation measures – consideration

The RPS states that these responsibilities are shared between the regional council and city/district councils (Policy 62), and identifies a range of regulatory and non-regulatory methods, including the following.

Regulatory

- Method 1 – District plan implementation (city and district councils)
- Method 4 – Resource consents, notices of requirement and when changing, varying or reviewing plans (GWRC and city and district councils)

Non-regulatory

- Method 14 – Information about natural hazard and climate change effects (GWRC, city/district councils and Civil Defence Emergency Management Group)
- Method 22 – Information about areas at high risk from natural hazards (GWRC and city/district councils)
- Method 23 – Information about natural features to protect property from natural hazards (GWRC and city/district councils)

Any regional plan or district plan prepared under the RMA is required to put the RPS into practice. These plans help the respective regional and city/district councils to carry out their resource management functions, including managing natural hazards and their associated effects, and to develop ways to deal with the full range of floodplain management planning issues.

FMP principles

The FMP approach adopted and implemented by GWRC is premised on a set of four core principles that reflect:

- The evolving nature of Council practice in preparing and implementing FMPs throughout the region and the corresponding lessons learnt
- The political and economic realities associated with any prospective change to its current approach to managing flood hazard risk (such as managed retreat vs building or upgrading flood protection structures)

The principles also reinforce and complement the RPS objectives and policies, as well as the Council's operational floodplain management guidelines.

The core principles are:

- **Avoid building in areas at high risk of flood hazard**
  Avoiding the construction of residential and other buildings vulnerable to flooding in undeveloped urban and rural areas (such as a 'greenfields' situation) exposed to a high level of flood hazard is the most effective way of managing flood risk in these locations in the long term. In areas subject to a lesser degree of flood hazard, activities and development should be appropriate to the circumstances and should not exacerbate flood risk
- **Only consider new flood protection infrastructure where existing development is at risk**
  Where existing urban or rural land use and/or development (such as dwellings, irrigation infrastructure or dairy sheds) is subject to an unacceptable degree of flood risk the construction of new structural protection measures (such as stopbanks and elevating existing buildings) will be considered. This includes circumstances where, for example, there is an elevated risk to human life or safety or where the impact on lifeline utilities or the local/regional economy is judged to be significant
- **Establish standards of flood protection relative to the degree of risk**
  In designing and implementing structural and/or non-structural measures in areas subject to flood risk, the following standards are to be applied by GWRC and city/district councils subject to their regulatory processes.
  - » Protection of all habitable buildings and urban areas:
    - › A minimum 1% AEP flood standard to floor levels for habitable buildings and new developments in existing urban areas, along with the provision of safe access
  - » Stopbank protection
    - › Where required to protect existing urban areas and associated land use, stopbanks will be constructed to achieve a minimum 1% AEP flood standard
    - › Where required to protect rural areas and associated land use, stopbanks are generally constructed up to a 5% AEP flood standard to alleviate frequent or nuisance flood events
- **Plan for climate change in assessing the degree of flood hazard risk and in determining an appropriate response.**
  In assessing flood hazard risk and determining appropriate structural and/or non-structural responses in areas subject to flood risk, GWRC will apply the following current allowances for climate change predicted to occur in the next 100 years in the design criteria for its flood hazard investigations
  - » Current allowances
    - › Increases in rainfall intensity – 20%
    - › Sea level rise – 0.8m

The manner in which these principles are applied to specific catchments is largely determined in discussion with individual communities during the process of preparing an FMP. It includes, for example, considering matters such as:

- What constitutes 'an unacceptable level of risk' to the local community and what structural and non-structural measures are available to reduce exposure to these risks
- How estimates of potential flood damage are derived (for example, current land use and potential future losses under existing development conditions vs increased development opportunities and economic growth resulting from the introduction of structural measures)

Appendix 5: Issues summary

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

ISSUE ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
1	Ruamāhanga	2	State Highway 2 (SH2)	SH2 runs close to a gorge section of the Ruamāhanga River and sits in the erosion study area. The risk of erosion is considered low due to the natural rock control. Further information on geology may clarify any risk	Erosion	Infrastructure	Low	River management envelope	Code of Practice		3rd party asset owner liaison	
2	Ruamāhanga	2	SH2 bridge	SH2 crosses the Ruamāhanga and the abutments sit in the erosion study area. This section of the river is well entrenched and gorge-like and risk to the structure is considered low	Erosion	Infrastructure	Low	River management envelope	Code of Practice		3rd party asset owner liaison	
3	Ruamāhanga	2	River scheme upstream boundary location	The river scheme's upstream boundary sits below the river's gorge area. Tt is recommended that this be reviewed in consultation with landowners in the area	Erosion	Flood protection	Low/Moderate	River management envelope				River scheme expansion unlikely
4	Ruamāhanga	2	House	A house at 2036A SH2 sits in the erosion study area, but outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
5	Ruamāhanga	2	House	A house at 1986 SH2 sits in the erosion study area extent, but outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
6	Ruamāhanga	2	House	A house at 1964 SH2 sits in the erosion study area extent, but outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
7	Ruamāhanga	2	Private stock bridge	A stock bridge that crosses the river sits in the erosion study area and is potentially at risk of damage from debris flows, bed-level changes and flood events	Flood an erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
8	Ruamāhanga	2	House	A habitable structure sits in the erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
9	Ruamāhanga	2	SH2	SH2 sits in the erosion study area extent, but is considered to be at low risk because of the area's geology and its distance from an active channel	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice		3rd party asset owner liaison	
10	Ruamāhanga	2	Channel alignment	No design channel exists for upstream of the river scheme boundary	Erosion	Flood protection	Low	River management envelope				
11	Ruamāhanga	2	Private bridge	A private bridge structure crossing the river with abutments is in the erosion study area. It may be susceptible to debris flows, erosion issues and bed-level changes	Flood and erosion	Infrastructure	Low/Moderate	River-bed-level monitoring	Emergency management planning			
12	Ruamāhanga	2	Dunvegan Forest remnants RAP sites	Dunvegan Forest remnants are in erosion study area and in the 1% AEP flood extent	Flood and erosion	Environment	Low	River management envelope	Protection against deforestation in the upper catchment	Flood hazard maps		
13	Ruamāhanga	3	Site of regional significance	The Hidden Lakes area is a site of regional significance. It is in the erosion study area and current regional planning is unclear as to whether there will be a requirement to protect it against possible future erosion	Erosion	Cultural value	Moderate	River management envelope	Code of Practice	Environmental strategy		
14	Ruamāhanga	3	Outbuildings	Possible farm ancillary buildings are in the erosion study area and in the 1% AEP flood extent	Flood and erosion	Business	Low/Moderate	River management envelope	Flood hazard maps	Emergency management planning		
15	Ruamāhanga	3	House	A house at 65 Fenemor Road is located in the erosion study area but outside the 1% AEP flood extent	Flood	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
16	Ruamāhanga	3	Houses	Houses near 1158 SH2 are in the erosion study area. The properties around them are in the 1% AEP flood extent	Flood and erosion	House	Moderate	River management envelope	Flood hazard maps	Emergency management planning		
17	Ruamāhanga	3	House	A house at 1050 SH2 sits in erosion study area. It is not in the 1% AEP flood extent but areas of the surrounding property are affected	Flood and erosion	House	Low/Moderate	River management envelope	Flood hazard maps	Emergency management planning		
18	Ruamāhanga	3	Gravel extraction site	This location is a good gravel-extraction point with good current access, and it is used and licensed by GWRC Flood Protection	Land use	Flood protection	Low	River-bed-level monitoring	Code of Practice			
19	Ruamāhanga	3	Houses	Houses at 8 Opaki Kaiparoro Road and 212 Opaki Kaiparoro Road are in the erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		

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20	Ruamāhanga	3	SH2	SH2 sits in the erosion study area but is considered at low risk because of the geology	Erosion	Infrastructure	Low/Moderate	River management envelope	Emergency management planning		3rd party asset owner liaison	
21	Ruamāhanga	3	Railway line	The main north-south railway line sits in the erosion study area; the natural rock control in this area is currently protecting the line. The line is infrequently used	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
22	Ruamāhanga	3	Double bridges	The SH2 and rail bridges are susceptible to bed-level changes. Current bed levels provide adequate freeboard for the bridge soffits; however, there are concerns about scour around the piers. The bridge abutments are protected by natural rock controls	Flood and erosion	Infrastructure	Moderate	River-bed-level monitoring	Code of Practice	Emergency management planning	3rd party asset owner liaison	
23	Ruamāhanga	3	Houses	The houses in the vicinity of the southern bridge abutment are in the erosion study area; however, are likely to be protected by the natural rock controls around the SH2 and rail bridges	Erosion	House	Low/Moderate	River management envelope	Emergency management planning			
24	Ruamāhanga	4	Opaki water race intake	This water race intake is reasonably stable and requires only occasional maintenance to ensure it operates	Erosion	Infrastructure	Low/Moderate	River-bed-level monitoring	Code of Practice	Emergency management planning	3rd party asset owner liaison	
25	Ruamāhanga	4	Swimming hole	The Double Bridges swimming hole is very popular, but it is also a hazardous swimming location	Land use	Recreation	Low/Moderate	Environmental Strategy	Community Support Officer			
26	Ruamāhanga	4	Bluff Rangitumau Road	The road sits in the erosion study area but is likely to be of low risk due to natural rock control	Erosion	Infrastructure	Low/Moderate	River management envelope	Emergency management planning			
27	Ruamāhanga	4	Stopbank	Stopbank in the buffer. It needs to be moved to the buffer's outer extent and away from erosion pressures from the river	Flood and erosion	Flood protection	Low	River management envelope	Rural stopbank policy			
28	Ruamāhanga	4	Erosion control works	Erosion control works for the Rathkeale stopbank are used to maintain the design fairway in this area	Erosion	Flood protection	Moderate	River management envelope			3rd party asset owner liaison	Major Project Response
29	Ruamāhanga	4	Stopbank	The Rathkeale stopbank is located in the erosion study area. It currently requires protection from bank erosion	Erosion	Flood protection	Moderate	River management envelope			3rd party asset owner liaison	Major Project Response
30	Ruamāhanga	4	Urupā	A historic urupā site sits on the edge of a cliff above the Ruamāhanga River and is located in the erosion study area	Erosion	Cultural	Moderate	River management envelope	Environmental Strategy			
31	Ruamāhanga	4	House	A house at 143A Matapihi Road sits in the erosion study area, but is outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
32	Ruamāhanga	4	Rathkeale College buildings	Rathkeale College sheds are located in the erosion study area and the 1% AEP flood extent	Flood and erosion	Business	Low/Moderate	Flood hazard maps	Emergency management planning	Community resilience	3rd party asset owner liaison	Major Project Response
33	Ruamāhanga	4	Rathkeale College sewage pond	The sewage treatment ponds for Rathkeale College are located in the erosion study area and are in the 1% AEP flood extent	Flood and erosion	Business	Moderate	Flood hazard maps	Emergency management planning	Community resilience	3rd party asset owner liaison	Major Project Response
34	Ruamāhanga	4	Bed armouring	The river bed is becoming armoured (hard packed) due to finer sediments falling onto it from the cliffs above	Erosion	Flood protection	Low/Moderate	River-bed-level monitoring	Isolated works support			
35	Ruamāhanga	4	House	A house at 7 Matapihi Road is located in the erosion study area but outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Emergency management planning			
36	Ruamāhanga	4	Houses	The house at 365 Black Rock Road is located in the erosion study area and sits on the edge of the 1% AEP flood extent	Flood and erosion	House	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
37	Ruamāhanga	4	Private water take	A private water intake for an irrigation system is located in erosion study area. There are no known issues	Erosion	Infrastructure	Low/Moderate	River management envelope	Community resilience			
38	Ruamāhanga	4	Outbuilding	A farm storage or utility building is located in the erosion study area but outside the 1% AEP flood extent	Erosion	Business	Low/Moderate	River management envelope	Code of Practice			
39	Ruamāhanga	4	Road	Black Rock Road is in the erosion study area at this location. It has required erosion protection in the past decade	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	

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40	Ruamāhanga	4	Houses	Houses at 147-240 Black Rock Road sit in the erosion study area. The houses on these properties sit outside the 1% AEP flood extent	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
41	Ruamāhanga	4	Water intake	The subsurface gallery intake consent application is at risk of channel degrade	Erosion	Infrastructure	Low	River-bed-level monitoring	Code of Practice			
42	Ruamāhanga	4	Private frost protection intake	The private water intake for the frost protection system sits in the erosion study area	Erosion	Infrastructure	Low	River management envelope	Code of Practice	Emergency management planning		
43	Ruamāhanga	4	Channel alignment	Hard edge protection holds a narrow design channel alignment at this location. The river may naturally tend to a wider channel	Erosion	Flood protection	Low	River management envelope	Code of Practice			
44	Ruamāhanga	4	House	138 Gordon Street sits in the erosion study area, but is well set back from the river channel behind a high bank	Erosion	House	Low	River management envelope	Emergency management planning			
45	Ruamāhanga	4	Henley Lake water intake	The channel alignment and bed levels in this area cause intake problems for water to Henley Lake	Erosion	Infrastructure	High	River management envelope	River-bed-level monitoring		3rd party asset owner liaison	
46	Ruamāhanga	4	Te Ore Ore stopbank	The stopbank is believed to offer a low standard of protection, but several properties behind it are affected by the 1% AEP flood event	Flood	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice	Flood hazard maps		
47	Ruamāhanga	4	Industrial yards	Sheds, machinery possible contaminants are sitting in the erosion study area and the 1% AEP flood extent	Flood and erosion	Environment	Low/Moderate	River management envelope	Flood hazard maps	Community resilience		
48	Ruamāhanga	4	Powerlines north of Te Ore Ore Bridge	Sub-transmission lines are located north of Te Ore Ore Bridge. The pylons are located outside the river bed but may be affected by the erosion study area	Erosion	Infrastructure	Low	River management envelope	Emergency management planning		3rd party asset owner liaison	
49	Ruamāhanga	4	Te Ore Ore Bridge	This bridge is relatively new and therefore unlikely to be at risk of scour issues. It may be affected by changes to weir arrangements, and abutments sit in erosion study area	Flood and erosion	Infrastructure	Low	River-bed-level monitoring	River management envelope			
50	Ruamāhanga	4	Te Ore Ore weir	The ongoing effects of damaged rock and rail weirs across the river are visually unattractive and a safety concern for the river's recreation users	Erosion	Recreation	High	Code of Practice	Environmental Strategy			
51	Ruamāhanga	5	Henley Lake	The Henley Lake Park area is being eroded and has historically been threatened by erosion. A staged land retreat is in progress to allow more room for the river	Erosion	Recreation	High	River management envelope	Code of Practice			
52	Ruamāhanga	5	Powerlines	Distribution lines cross the river. The pylons are located outside the river bed but in the erosion study area		Infrastructure	Low/Moderate	River management envelope	Emergency management planning		3rd party asset owner liaison	
53	Ruamāhanga	5	Narrow river channel	River flows regularly break out onto paddocks on the river's true left bank. This alleviates some of the flood and erosion risks to River Road properties	Flood and erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
54	Ruamāhanga	5	Houses	Approximately 14 River Road properties are at risk of erosion from the Ruamāhanga River. They have historically been threatened in floods	Flood and erosion	House	High	River management envelope	Code of Practice	Emergency Management Planning		Major Project Response
55	Ruamāhanga	5	Cemetery	The cemetery sits in the erosion study area. It has historically suffered from erosion and light rock protection is in place to manage some of the effects	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice			
56	Ruamāhanga	5	Closed landfill	There is potential for the erosion of contaminated material. This area has eroded previously; it is now protected with light rock and willows	Erosion	Environment	Moderate	River management envelope	Code of Practice			
57	Ruamāhanga	5	Stopbank	A 10- to 20-year stopbank infested with trees has an increasing risk of failure which would affect the wastewater treatment plant	Flood and erosion	Flood protection	Moderate	Code of Practice	Rural stopbank policy			
58	Ruamāhanga	5	Channel alignment	The true left bank of the channel in this location is maintained by groynes on an alignment outside the design fairway	Erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
59	Ruamāhanga	5	Stopbank	This stopbank's level of service is unclear from downstream of the closed landfill	Flood	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice			

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60	Ruamāhanga	5	Wastewater treatment plant irrigation beds	A proposed irrigation area is protected by a vulnerable ~two-year stopbank. These irrigation beds currently sit in the buffers and are in the erosion study area and 1% AEP flood extent	Flood and erosion	Infrastructure	High	Recognition of buffers as a river management tool	Flood hazard maps		3rd party asset owner liaison	
61	Ruamāhanga	5	MDC wastewater treatment plant	The wastewater treatment plant sits in both the erosion study area and the 1% AEP flood area. Some 1% AEP stopbanks are protecting the asset however they are outflanked further upstream	Flood and erosion	Infrastructure	Moderate	Flood hazard maps	River management envelope	Emergency management planning	3rd party asset owner liaison	Major Project Response
62	Ruamāhanga	5	House	A house at 374A Lees Pakaraka Road sits in the erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
63	Ruamāhanga	5	Road	Lees Pakaraka Road sits in the erosion study area and on the edge of the 1% AEP flood extent	Flood and erosion	Infrastructure	Moderate	River management envelope	Flood hazard maps	Emergency management planning	3rd party asset owner liaison	
64	Ruamāhanga	5	Wastewater treatment plant discharge point	The wastewater treatment plant discharges treated water to the Ruamāhanga River	Land use	Environment	High	River management envelope	Code of Practice		3rd party asset owner liaison	
65	Ruamāhanga	4	Channel alignment	Historically the channel was wider at this location than the current very narrow design channel alignments	Erosion	Flood protection	Low/Moderate	River management envelope	Historical channel lines			
66	Ruamāhanga	5	Three houses	Three houses in the erosion study area are considered at lower risk than the road upstream due to high bank and cemented deposits. There is no history of erosion	Erosion	House	Low	River management envelope	Code of Practice	Emergency management planning		
67	Ruamāhanga	5	Wardells Bridge	The river bed in the location of this bridge is observed to be very stable, with low risk of erosion or scour. The road to the north of the bridge is in the 1% AEP flood extent	Flood and erosion	Infrastructure	Moderate	Code of Practice	Flood hazard maps		3rd party asset owner liaison	
68	Ruamāhanga	6	Waingawa-Ruamāhanga confluence	Instability from Waingawa River flows influences the Ruamāhanga at this location making it a very challenging area to manage. The river management envelope is very difficult to achieve	Erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
69	Ruamāhanga	6	Ruamāhanga River terrace RAP site	A RAP site is in erosion study area and on the edge of the 1% AEP flood extent	Flood and erosion	Environment	Low	River management envelope	Environmental Strategy	Flood hazard maps		
70	Ruamāhanga	6	Channel alignment	The channel is naturally wider than the design channel alignment in this location	Erosion	Flood protection	Low	River management envelope	Code of Practice			
71	Ruamāhanga	6	Houses	Several houses are located in the erosion study area on reasonably firm material, on a high terrace that is unlikely to erode	Erosion	House	Low	River management envelope				
72	Ruamāhanga	6	River alignment	This section of the river has proved a challenge to manage to the river management envelope, and pushes out towards the edge of its buffers on both banks	Erosion	Flood protection	Low	River management envelope	Code of Practice			
73	Ruamāhanga	6	Frost protection water intake	There is an erosion threat to a private water intake located in the erosion study area, the landowner has provided some protection	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
74	Ruamāhanga	6	River alignment	The river alignment in this location needs constant management and if alignment is not well managed, it spills extra water onto Te Whiti flats. The Te Whiti stopbank is at risk of overtopping	Flood and erosion	Flood protection	Moderate	River management envelope	Code of Practice			
75	Ruamāhanga	6	Fish habitat	This is a site for fish habitat	Land use	Environment	Low	Land use controls	Environmental Strategy			
76	Ruamāhanga	6	Dakins Road – public road	Erosion affecting the end section of Dakins Road, near Cottier Estate has been addressed in the past with rock works. These have protected the immediate area they were installed to protect, but adjacent areas are still affected by erosion	Erosion	Infrastructure	Low/Moderate	River management envelope	Isolated works support	Emergency management planning		
77	Ruamāhanga	6	Te Whiti stopbank	The stopbank sits in the erosion study area and in places in the current buffers. There is a risk of it eroding and exposing protected areas. It currently protects a known flooding area	Flood and erosion	Flood protection	Moderate	River management envelope	Code of Practice			
78	Ruamāhanga	6	Channel alignment	Buffer widths upstream of the Taueru River confluence require review	Erosion	Flood protection	Low	River management envelope				

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

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79	Ruamāhanga	6	Fish passage	This is an important confluence between the Ruamāhanga and Taueru Rivers	Land use	Environment	Low/Moderate	Environmental strategy				
80	Ruamāhanga	6	Gladstone complex	The Gladstone pub, sports fields and several houses sit in the erosion study area and are in the 1% AEP flood extent. Despite these risks there is no recorded history of flooding or erosion	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
81	Ruamāhanga	6	Gladstone Bridge	There are no known issues of scour or erosion at this bridge; however, an exclusion zone applies to 100m upstream and downstream. Freeboard to soffit is OK and debris flow risk is OK	Flood and erosion	Infrastructure	Low/Moderate	Code of Practice				
82	Ruamāhanga	7	Stopbank	This stopbank protects farmland and is of very poor quality. It is overgrown with trees and believed to be susceptible to failure	Flood and erosion	Flood protection	Low/Moderate	Rural stopbank policy				
83	Ruamāhanga	7	Ahiaruhe stopbank	This stopbank protects farmland against small, frequent flood events. It is located in the erosion study area and close to the river. It is full of trees and has a high risk of failure	Flood and erosion	Flood protection	Moderate	Rural stopbank policy				
84	Ruamāhanga	7	River access	An easement has been created to allow access to Carter Scenic Reserve. This site is not being promoted and there is a risk that disuse may lead to the loss of future opportunities	Land use	Recreation	Low	Care groups and clubs	Environmental Strategy	Land use controls		
85	Ruamāhanga	7	Gravel extraction site	Ahiaruhe gravel extraction site	Land use	Flood protection	Low	Code of Practice				
86	Ruamāhanga	7	Outbuildings	Farm and other utility buildings are located in the erosion study area and 1% AEP flood extent	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope			
87	Ruamāhanga	7	Channel alignment	The channel in this locations narrows and widens out and creates erosion issues upstream and downstream of the location	Erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
88	Ruamāhanga	7	Channel alignment	The buffer width on true right bank of river is very narrow and on the true left is very wide. The currently managed alignment does not match design alignments	Erosion	Flood protection	Low	River management envelope				
89	Ruamāhanga	7	Channel alignment	The channel naturally widens in this area outside the design channel alignment	Erosion	Flood protection	Low	River management envelope	Code of Practice			
90	Ruamāhanga	7	Outbuildings	There are outbuildings in the erosion study area and the 1% AEP flood extent	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope			
91	Ruamāhanga	7	Kokotau Bridge	There are no known issues with this bridge. Abutments sit in erosion study area and the road to the north is in the 1% AEP flood extent	Flood and erosion	Infrastructure	Low	Code of Practice	River-bed-level monitoring	Flood hazard maps		
92	Ruamāhanga	8	Stopbank	A small stopbank with a low protection level is in the erosion study area	Flood and erosion	Flood protection	Low/Moderate	Rural stopbank policy				
93	Ruamāhanga	8	Channel alignment	The buffer strip in this area is very narrow; it needs to be wider	Erosion	Flood protection	Low/Moderate	River management envelope				
94	Ruamāhanga	8	Channel alignment	The design channel alignment in this location is difficult to maintain. It has been recommended that the river management envelope be reviewed	Erosion	Flood protection	Low/Moderate	River management envelope				
95	Ruamāhanga	8	Farm buildings	250 Taumata Road contains a number of structures at risk of erosion on the edge of a thin buffer It is also in the 1% AEP flood extent	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
96	Ruamāhanga	8	House	A house at 142 Foreman-Jury Road is in the erosion study area and on the edge of the 1% AEP flood extent. Several buildings near the address are in the buffer	Flood and erosion	House	Low/Moderate	River management envelope	Flood hazard maps	Emergency management planning		
97	Ruamāhanga	8	Taumata Lagoon	A potential fish habitat site is in the 1% AEP flood extent	Flood	Environment	Low/Moderate	Land use controls	Environmental Strategy	Flood hazard maps		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

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99	Ruamāhanga	8	Kokotau to Waiōhine river scheme reach	There is little funding spend in this area. The landowners who contribute to the wider river schemes have questions about value for money for them	Flood and erosion	Flood protection	Low	Code of Practice	Community Support Officer			
100	Waipoua	10	Channel alignment	The channel alignment in this area has been identified as significantly outside the recommended design fairway	Erosion	Flood protection	Low/Moderate	River management envelope				
101	Waipoua	10	River scheme upstream boundary expansion	The river scheme has previously been longer, extending upstream into the Massey Farms property	Flood and erosion	Flood protection	Moderate	River management envelope	River scheme decision-making policy			River scheme expansion unlikely
102	Waipoua	10	Design lines	Design lines are in place for the Waipoua River upstream of the river scheme boundary. However, they are not used for any purpose	Erosion	Flood protection	Low/Moderate	River management envelope				
103	Waipoua	10	Massey irrigation water intake	The intake for the irrigation system sits in the erosion study area	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice			
104	Waipoua	10	Massey farm sheds and bridge	Several farm buildings and an access bridge sit in the erosion study area	Erosion	Business	Low/Moderate	River management envelope	Code of Practice			
105	Waipoua	11	Mikimiki bridge	There is observed ongoing bed degradation which affects the bridge, the road and the water level recorder site. Work has been carried out in the past to tackle issues with scour	Erosion	Infrastructure	Moderate	River-bed-level monitoring	Code of Practice		3rd party asset owner liaison	
106	Waipoua	11	Farm building	A farm outbuilding is located in the modelled 1% AEP flood extent	Flood	Business	Low	Flood hazard maps	Community resilience			
107	Waipoua	11	Channel alignment	The design fairway narrows at this location and may require revision – narrows to a 45m design width	Erosion	Flood protection	Low/Moderate	River management envelope				
108	Waipoua	11	Design lines	The current design lines have been identified as possibly too narrow	Erosion	Flood protection	Low/Moderate	River management envelope				
109	Waipoua	11	Farm outbuilding	A farm outbuilding is located in the erosion study area and in the 1% AEP flood extent	Flood and erosion	Business	Low	Flood hazard maps	Community resilience			
110	Waipoua	11	Bridge	A private bridge is located on this property. There are possible issues with the abutments creating an obstruction to flow and being susceptible to erosion	Erosion	Infrastructure	Low	Code of Practice	Community resilience			
111	Waipoua	11	Telecom line	A private telco line that runs beneath the river bed is potentially susceptible to damage by machinery or scour	Erosion	Infrastructure	Low	River-bed-level monitoring	Code of Practice	Emergency management planning		
112	Waipoua	11	Water intake	A private water intake for Watson Lake is in the erosion study area	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice			
113	Waipoua	12	Channel alignment	The buffer strip in this area has been identified as too narrow. It is recommended that a wider buffer be established in accordance with the recommended design channel alignments	Erosion	Flood protection	Low/Moderate	River management envelope				
114	Waipoua	12	Private erosion protection structures	These erosion protection structures were privately constructed, but have from time to time been maintained by GWRC operations	Erosion	Flood protection	Low	Code of Practice	Isolated works support			
115	Waipoua	12	Water intake	A private water intake for a lake on private property is situated in the erosion study area	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice			
116	Waipoua	12	Channel alignment	The buffer planting on the true right bank has been reinforced with a rock line. This has made the buffer strip narrow in this area; however, due to the protection a review of the appropriate buffer may be appropriate	Erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
117	Waipoua	12	Road	A section of Matahiwi Road is in erosion study area and modelled to be 0.6m deep in a 1% AEP flood event	Flood and erosion	Infrastructure	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning	3rd party asset owner liaison	
118	Waipoua	12	House	A house at 236 Matahiwi Road is situated in the erosion study area and the 1% AEP flood extent	Flood and erosion	House	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

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119	Waipoua	12	Houses	A number of properties on Matahiwi Road are in the 1% AEP flood extent	Flood	House	Low/Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
120	Waipoua	12	Road	The road at risk of flooding during a 1% AEP event to a depth of 0.3m to 0.8m	Flood	Infrastructure	Low/Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
121	Waipoua	12	Stopbank	The stopbank on the true left bank sits on the edge of the active channel and in the erosion study area. In the past a revision of the design lines has been considered in this location, to relocate the active channel away from the structure	Erosion	Flood protection	Low/Moderate	Rural stopbank policy	River management envelope			
122	Waipoua	12	Low-quality stopbank	This stopbank is very close to the river and at risk of erosion. Substantial tree growth makes it vulnerable to storm damage and piping effects along root pathways	Erosion	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice			
123	Waipoua	12	Serpentine confluence	Aggradation in the area of the Serpentine Stream confluence with the Waipoua River increases the likelihood of flooding and blockage	Flood	Flood protection	Low/Moderate	River-bed-level monitoring	Code of Practice			
124	Waipoua	12	Serpentine stopbank	This stopbank is of concern because it partially protects a number of properties. However, the structure's management objectives are unclear. It is very close to the river and in the erosion study area	Flood and erosion	Flood protection	Moderate	Rural stopbank policy	Emergency management planning			
125	Waipoua	12	Houses	There are houses in erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
126	Waipoua	12	Bridge capacity	Paierau Road Bridge is potentially creating additional flooding problems upstream	Flood	Infrastructure	Low/Moderate	Flood forecasting and warning system			3rd party asset owner liaison	
127	Waipoua	12	Paierau Road	The stopbanks upstream of Paierau Road Bridge overtop and flood the road frequently, creating a hazard to life	Flood	Infrastructure	Moderate	Flood forecasting and warning system	Emergency management planning	Community resilience	3rd party asset owner liaison	Major Project Response
128	Waipoua	12	Houses	Matahiwi Road/Akura Road homes are at risk of flooding in a 1% AEP flood event	Flood	Infrastructure	Low/Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
129	Waipoua	12	Houses	There are houses in erosion study area	Erosion	House	Moderate	River management envelope	Code of Practice	Emergency management planning		
130	Waipoua	12	Stopbank	The quality, standard of protection, alignments and purpose of the flood protection infrastructure in the area of the Serpentine Stream confluence are variable and have been of concern for sometime	Flood and erosion	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice			
131	Waipoua	12	Stopbank	The stopbank on the true right bank of the river gets close to the river channel and in the erosion study area at its downstream extent	Flood and erosion	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice			
132	Waipoua	12	Akura Plant Nursery	The Akura Plant Nursery floods from overland flow originating from upstream of Paierau Road Bridge	Flood	Land use	Low	Flood forecasting and warning system	Emergency management planning	Community resilience		
133	Waipoua	12	Stopbank	The stopbank on the true left bank of the river is inthe erosion study area and has required protection to reduce risk	Flood and erosion	Flood protection	Low/Moderate	Rural stopbank policy	Code of Practice			
134	Waipoua	12	Houses	There are houses located in the 1% AEP flood extent	Flood	House	Low/Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
135	Waipoua	12	Golf course	The golf course is in the erosion study area and in the 1% AEP flood extent	Flood and erosion	Land use	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
136	Waipoua	12	Narrowed channel	The river channel becomes more confined as it approaches the railway bridge upstream of Masterton	Flood	Land use	Low/Moderate	River management envelope				

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY												
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137	Waipoua	13	Channel alignment	No design fairways have been created for the section of the Waipoua River that flows through Masterton. This creates management challenges due to a lack of guidance for river engineers	Erosion	Flood protection	Low/Moderate	River management envelope				
139	Waipoua	13	Stopbank	The alignment of the stopbank puts it close to the active channel and in the erosion study area. The stopbank is modelled to overtop in a 1% AEP flood event. There are known low spots along its length that may have created flooding issues in paddocks	Flood and erosion	Flood protection	Low/Moderate	Flood hazard maps				
140	Waipoua	13	Bed control weirs	Structures that cross the channel to prevent channel degradation are susceptible to damage in high-flow events and to erosion	Erosion	Flood protection	Moderate	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
141	Waipoua	13	Sewer lines	Sewer lines run down both banks of the Waipoua River along its length through Masterton. These are located on the river side of the stopbanks and in erosion study areas	Erosion	Infrastructure	Low/Moderate	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
142	Waipoua	13	Bed control weirs	Structures that cross the channel to prevent channel degradation are susceptible to damage in high-flow events and to erosion	Erosion	Flood protection	Moderate	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
143	Waipoua	13	Channel alignment	There is a mismatch between the fairways and the extents of the bed control weirs in the urban reach of the Waipoua River	Erosion	Flood protection	Low/Moderate	River management envelope	Code of Practice			
144	Waipoua	13	Bed control weirs	Structures that cross the channel to prevent channel degradation are susceptible to damage in high-flow events and to erosion	Erosion	Flood protection	Moderate	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
145	Waipoua	13	Irrigation water intake	The rugby ground's irrigation water intake is located in the erosion study area	Erosion	Infrastructure	Low	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
146	Waipoua	13	Sewer siphon	The Landsdowne sewer siphon crosses the river and is at risk of flood damage and is in the erosion study area	Flood and erosion	Infrastructure	Low	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
147	Waipoua	13	Emergency sewer discharge point	An emergency sewer discharge point is located on the river bank	Land use	Environment	Low/Moderate	Code of Practice	River-bed-level monitoring	River management envelope	3rd party asset owner liaison	
148	Waipoua	13	Channel alignment	No design fairways have been created for the section of the Waipoua River that flows through Masterton. This creates management challenges due to a lack of guidance for river engineers	Erosion	Flood protection	Low/Moderate	River management envelope				
149	Waipoua	13	Future flooding in Masterton	There are many properties in the future flood hazard area (1% AEP extent including climate change)	Flood	House	High	Flood hazard maps				Major Project Response
150	Waingawa	15	MDC water supply intake	Part of the Masterton water supply network is located in the headwaters of the Waingawa River, in a relatively stable gorge section	Erosion	Infrastructure	High	Emergency management planning				
151	Waingawa	15	MDC water supply pipe bridge	There are problems with the build-up of the river bed level, and the risk of debris flow damage. This poses a risk to the Masterton's water supply	Erosion	Infrastructure	High	River-bed-level monitoring	Emergency management planning			Major Project Response
152	Waingawa	15	MDC water supply pipeline	The erosion risk to the main water supply pipeline is already managed. It is located between the river bank and the road	Erosion	Infrastructure	High	River management envelope	Code of Practice	Emergency management planning		Major Project Response
153	Waingawa	16	House	A house at 114 Waingawa Road is in the erosion study area and the 1% AEP flood extent	Flood and erosion	House	Moderate	Flood hazard maps	River management envelope	Emergency management planning		
154	Waingawa	16	Upper Waingawa Road	The upper Waingawa Road is modelled to be flooded to a depth of 0.9m in a 1% AEP flood event	Flood	Infrastructure	Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

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155	Waingawa	16	Farm buildings	A dairy shed and other outbuildings are in the erosion study area and flood risk area	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
156	Waingawa	16	Taratahi Water Race intake	Bed degradation means achieving water intake levels is difficult. River alignment is difficult to maintain with the current alignment. It is necessary to balance scour and aggradation to keep the intake clear	Erosion	Infrastructure	High	River-bed-level monitoring	Pool-riffle-run envelope	River management envelope		
157	Waingawa	16	MDC water supply pipeline	Bed degradation at Black Creek is creating a risk to the Masterton water supply pipeline. The pipeline also sits in the erosion study area at this location	Erosion	Infrastructure	High	River-bed-level monitoring	River management envelope	Emergency management planning		Major Project Response
158	Waingawa	16	Waingawa River bush RAP sites	The Waingawa River bush RAP site is in the design channel buffer and close to the edge of the design channel alignment	Erosion	Environment	Moderate	River management envelope	Environmental Strategy			
159	Waingawa	16	Houses	Houses are located in the erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		
160	Waingawa	16	MDC Water Treatment Plant – main facility	Parts of the MDC Water Treatment Plant are in the erosion study area. The main plant is not affected by this	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
161	Waingawa	16	MDC Water Treatment Plant – sludge area	The sludge treatment sections of the MDC Water Treatment Plant are located on the lower terraces in the erosion study area	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
162	Waingawa	16	MDC water supply – boost pump station	The boost pump station for the Masterton water supply is located in the 1% AEP flood extent	Flood	Infrastructure	High	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
163	Waingawa	16	House	There is a house in the flood hazard area – the address is unclear	Flood	House	Moderate	Flood hazard maps	Flood forecasting and warning system	Emergency management planning		
164	Waingawa	16	House	A house at 636D Norfolk Road sits in the erosion study area and WCDP erosion area. It is not affected by the 1% AEP flood event	Erosion	House	Moderate	River management envelope	Code of Practice	Emergency management planning		
165	Waingawa	16	MDC water supply	An area designated for potential future water treatment that sits in the erosion study area and the 1% AEP flood extent	Flood	Infrastructure	Low	Land use controls	Code of Practice		3rd party asset owner liaison	
166	Waingawa	16	Historical river channel	An old river channel once flowed through this location and an overflow path in the updated 1% AEP flood extent. The old gravel river bed has been planted over and closed off with a stopbank	Erosion	Flood protection	Low/Moderate	Historical channel lines	Land use controls	Rural stopbank policy		
167	Waingawa	16	River alignment	Buffer zones are an issue at this location. There has been ongoing trouble managing the river to within the river management envelope. Erosion on the true right bank is currently beyond the buffer extents	Erosion	Flood protection	Low/Moderate	River management envelope				
168	Waingawa	16	Tararua Drive stopbanks	The stopbanks in this location are of low level and crest height is monitored. It is recommended that the levels be confirmed	Flood	Flood protection	Moderate	Rural stopbank policy				
169	Waingawa	16	House	At 65 Totara Park Drive the house and outbuildings are in the erosion study area. They are not in the 1% AEP flood extent	Erosion	House	Moderate	River management envelope	Code of Practice			
170	Waingawa	16	Flapgates in stopbank	Two flapgates in the Skeets Road stopbank create possible back flow routes. These are occasionally blocked open because of misunderstandings	Flood	Flood protection	Low/Moderate	Code of Practice				
171	Waingawa	16	Skeets Road stopbank	This stopbank protects against and overflow path that has historically connected the Waingawa River to the Waipoua River. It is currently maintained by GWRC Flood Protection but a failure could have flood consequences for Masterton	Flood	Flood protection	High	Code of Practice	River management envelope			
172	Waingawa	16	Buildings	Several buildings are part of 123 and 161 Upper Manaia Road which sit in the erosion study area	Erosion	House	Low/Moderate	River management envelope	Code of Practice	Emergency management planning		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY												
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173	Waingawa	16	SLUR site	A site at 81 Upper Manaia Road is registered on the SLUR database and sits in the erosion study area	Erosion	Environment	Low	River management envelope	Code of Practice	Emergency management planning		
174	Waingawa	16	Distribution powerlines	Poles just upstream of the rail bridge. One pole is currently situated in the river bed; the others are at risk of erosion on berms	Erosion	Infrastructure	Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
175	Waingawa	16/17	Contractors' yards	Contractors yards in the erosion study area and are in the 1% AEP flood extent. They are in a known erosion management area	Flood and erosion	Business	Low	Flood hazard maps	River management envelope	Emergency management planning		
176	Waingawa	16	Sub-transmission powerlines	Pylons just upstream of the rail bridge sit on the edge of the erosion study area	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
177	Waingawa	16	Rail bridge	Contractors' yards are in the erosion study area and the 1% AEP flood extent. They are in a known erosion management area	Flood and erosion	Infrastructure	Low/Moderate	River-bed-level monitoring	Code of Practice		3rd party asset owner liaison	
178	Waingawa	16	Contractors' yards	Contractors' yards are in the erosion study area and the 1% AEP flood area. They are in a known erosion management area	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
179	Waingawa	16	Stopbank	This stopbank is believed to be a high failure risk	Flood and erosion	Flood protection	High	River management envelope	Emergency management planning			Major Project Response
180	Waingawa	16	Channel alignment	The buffer zones between the two bridges are very narrow, and have been recommended for review	Flood and erosion	Flood protection	Low	River management envelope				
181	Waingawa	16	Channel alignment	The buffer zones between the two bridges are very narrow and have been recommended for review	Erosion	Flood protection	Moderate	River management envelope				
182	Waingawa	16	Sewer, water on road bridge	Key infrastructure is at low risk of being damaged by flood and debris flows attached to the road bridge	Flood and erosion	Infrastructure	Low/Moderate	Flood hazard maps	Emergency management planning		3rd party asset owner liaison	
183	Waingawa	16	Road bridge	Bed degradation is a managed problem in the area around the road bridge	Flood and erosion	Infrastructure	Moderate	River-bed-level monitoring	Code of Practice		3rd party asset owner liaison	
184	Waingawa	17	Pump station for sewer line	The pump station is located in the erosion study area and on the edge of the 1% AEP flood extent	Flood and erosion	Infrastructure	Moderate	Flood hazard maps	River management envelope	Emergency management planning	3rd party asset owner liaison	
185	Waingawa	17	Powerlines	Transmission network pylons are located in the erosion study area, 200m downstream of SH2	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
186	Waingawa	17	Contractors' yards	Contractors' yards are in the erosion study area and the 1% AEP flood extent. They are in a known erosion management area	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
187	Waingawa	17	Contractors' yards	Contractors' yards are in the erosion study area and the 1% AEP flood extent. They are in a known erosion management area	Flood and erosion	Business	Low/Moderate	Flood hazard maps	River management envelope	Emergency management planning		
188	Waingawa	17	Powerlines	Distribution network power line pylons are located in erosion study area, 30m downstream of SH2	Erosion	Infrastructure	Low	River management envelope	Code of Practice	Emergency management planning	3rd party asset owner liaison	
189	Waingawa	17	Land retirement agreements	Work is ongoing to manage buffers through land use change to planted willow buffers	Land use	Flood protection	Moderate	River management envelope	Mixed vegetation planting			
190	Waingawa	17	Illegal dumping	The good access and relatively secluded location make this site popular for illegal rubbish dumping	Land use	Environment	Low	Environmental Strategy	Community Support Officer	Care groups and clubs		
191	Waingawa	17	Recreation area	The good access to the end of Hughes Line makes it a popular area for recreation groups. There is interest among a number of interest groups in developing this access and area further	Land use	Recreation	Low/Moderate	Community Support Officer	Care groups and clubs	Environmental Strategy		
192	Waingawa	17	Flight path	There is a controlled tree height level for aircraft taking off from Hood Aerodrome	Land use	Flood protection	Moderate	Code of Practice				Major Project Response

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY												
ISSUE ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
193	Waingawa	17	Aerodrome runway	The aerodrome runway is known to be affected by erosion and has been eroded in the recent past (2000). It is situated in the erosion study area	Erosion	Infrastructure	High	River management envelope			3rd party asset owner liaison	Major Project Response
194	Waingawa	17	SLUR site	Hood Aerodrome is a registered SLUR site and sits in the erosion study area	Erosion	Environment	Low	Emergency management planning	Land use controls	Environmental strategy		
195	Waingawa	17	Private water intake	A private water intake is located in the erosion study area	Erosion	Infrastructure	Low	River management envelope	Code of Practice			
196	Waingawa	17	Drag strip	The drag strip sits in the erosion study area and is in the 1% AEP flood extent	Flood and erosion	Environment	Low/Moderate	River management envelope	Flood hazard maps			
197	Waingawa	17	Distribution powerlines	Pylons for a distribution network area are located in the erosion study area on the true right bank and may be close to the erosion study area boundary on the true left bank	Erosion	Infrastructure	Low	River management envelope	Emergency management planning	Community resilience	3rd party asset owner liaison	
198	Waingawa	17	Private water intake	A private water intake is located in the erosion study area	Erosion	Infrastructure	Low/Moderate	River management envelope	Code of Practice			
199	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
200	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
201	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
202	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
203	Kopuaranga	Kopuaranga River	Culvert/Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
204	Kopuaranga	Kopuaranga River	Private road/Culvert	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
205	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
206	Kopuaranga	Kopuaranga River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
207	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
208	Kopuaranga	Kopuaranga River	Private access/ Culvert	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
209	Kopuaranga	Kopuaranga River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
210	Kopuaranga	Kopuaranga River	Road/Bridge and graveyard	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
211	Kopuaranga	Kopuaranga River	Rail bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
212	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed

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ISSUE ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
213	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
214	Kopuaranga	Kopuaranga River	Rail	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
215	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
216	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
217	Kopuaranga	Kopuaranga River	Rail	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
218	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
219	Kopuaranga	Kopuaranga River	Private bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
220	Kopuaranga	Kopuaranga River	Woolshed	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
221	Kopuaranga	Kopuaranga River	House and buildings	Potential oxbow cut-off	Erosion	House	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
222	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
223	Kopuaranga	Kopuaranga River	Shed	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
224	Kopuaranga	Kopuaranga River	Rail	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
225	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
226	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
227	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
228	Kopuaranga	Kopuaranga River	Rail and private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
229	Kopuaranga	Kopuaranga River	Private bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
230	Kopuaranga	Kopuaranga River	Private access/ Outbuildings	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed

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231	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
232	Kopuaranga	Kopuaranga River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		River scheme expansion proposed
233	Kopuaranga	Kopuaranga River	Rail bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
234	Kopuaranga	Kopuaranga River	Mauriceville settlement	In the erosion study area and the 1% AEP flood extent	Flood and erosion	Houses	High	Flood hazard maps	Code of Practice	Isolated works support		
235	Kopuaranga	Kopuaranga River	Private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
236	Kopuaranga	Kopuaranga River	Rail and road access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
237	Kopuaranga	Kopuaranga River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
238	Kopuaranga	Kopuaranga River	Rail	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
239	Kopuaranga	Kopuaranga River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
240	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
241	Kopuaranga	Kopuaranga River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
242	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
243	Kopuaranga	Kopuaranga River	Rail bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
244	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
245	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
246	Kopuaranga	Kopuaranga River	Private access bridge (may be MDC maintained – Donovans Road)	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
247	Kopuaranga	Kopuaranga River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
248	Kopuaranga	Kopuaranga River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

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249	Kopuaranga	Kopuaranga River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
250	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
251	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
252	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
253	Whangaehu	Whangaehu River	Road and private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
254	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
255	Whangaehu	Whangaehu River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
256	Whangaehu	Whangaehu River	House and buildings	In erosion study area	Erosion	House	Low	Code of Practice	Emergency management planning	Isolated works support		
257	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
258	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
259	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
260	Whangaehu	Whangaehu River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
261	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
262	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
263	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
264	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
265	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
266	Whangaehu	Whangaehu River	Private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

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267	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
268	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
269	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
270	Whangaehu	Whangaehu River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
271	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
272	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
273	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
274	Whangaehu	Whangaehu River	Access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
275	Whangaehu	Whangaehu River	Woolshed	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
276	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
277	Whangaehu	Whangaehu River	Access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
278	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
279	Whangaehu	Whangaehu River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
280	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
281	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
282	Whangaehu	Whangaehu River	House and buildings	In erosion study area	Erosion	House	Low	Code of Practice	Emergency management planning	Isolated works support		
283	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
284	Whangaehu	Whangaehu River	Road and bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

RESPONSES SPECIFIC TO INDIVIDUAL ISSUES – FOR GENERAL RESPONSES FOR EACH REACH REFER, TO THE RESPONSE SUMMARY

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285	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
286	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
287	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
288	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
289	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
290	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
291	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
292	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
293	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
294	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
295	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
296	Whangaehu	Whangaehu River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
297	Whangaehu	Whangaehu River	Outbuildings	In erosion study area	Erosion	Business	Low	Code of Practice	Emergency management planning	Isolated works support		
298	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
299	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
300	Whangaehu	Whangaehu River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
301	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
302	Whangaehu	Whangaehu River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
303	Whangaehu	Whangaehu River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

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304	Whangaehu	Whangaehu River	Private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
305	Taueru	Taueru River	Road and bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
306	Taueru	Taueru River	House and buildings	In erosion study area	Erosion	House	Low	Code of Practice	Emergency management planning	Isolated works support		
307	Taueru	Taueru River	House and buildings	In erosion study area	Erosion	House	Low	Code of Practice	Emergency management planning	Isolated works support		
308	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
309	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
310	Taueru	Taueru River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
311	Taueru	Taueru River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
312	Taueru	Taueru River	Road	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
313	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
314	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
315	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
316	Taueru	Taueru River	Private access	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
317	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
318	Taueru	Taueru River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
319	Taueru	Taueru River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
320	Taueru	Taueru River	Stock bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
321	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
322	Taueru	Taueru River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

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ISSUE ID	RIVER	REACH	NAME	ISSUE DESCRIPTION	THREAT	AT RISK	RANK	PRIMARY COMMON METHOD	SECONDARY COMMON METHOD	TERTIARY COMMON METHOD	3RD PARTY ASSET OWNER LIAISON	COMMENT
323	Taueru	Taueru River	Private access bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		
324	Taueru	Taueru River	Road bridge	In erosion study area	Erosion	Infrastructure	Low	Code of Practice	Emergency management planning	Isolated works support		

Appendix 6: Glossary

1% AEP (ANNUAL EXCEEDANCE PROBABILITY) FLOOD EVENT	A flood event that has a 1% or one in 100 chance of being equalled or exceeded in any given year.
1% AEP FLOOD EXTENT	This is the area modelled to be inundated in the event of a 1% flood.
ACTIVE BED	The area of a river channel that is affected by the river processes of flows, sediment transport and the alteration of bed form during flood events. Outside flood events, the active bed of a gravel bed river is normally only partially covered by flowing water (see 'Wetted Channel' below).
AGGRADATION	An increase in the general level of the active bed through a build-up of bed material sediments. This may arise because a pulse of bed material has moved through a reach or due to changes in river processes affecting the transport of bed material.
ANNUAL EXCEEDANCE PROBABILITY	The chance of a flood occurring in any given year. The probability is expressed as a percentage. For example, a large flood that may be calculated to have a 1% chance to occur in any one year is described as a 1% AEP flood.
ASSET/FLOOD PROTECTION ASSET	An item that has potential value to an organisation such as a stopbank, rock lines, bridge, or road. Flood Protection assets are managed by GWRC Flood Protection.
AVULSION	The rapid abandonment of a river channel and the formation of a new river channel.
BANK	A defined feature at the edge of an active river bed, generally marked by a steep change in slope.
BEACH	A general term for an area of deposited bed material in an active river bed that is relatively clear of vegetation, often lying between the low-flow channel(s) and the banks.
BED	See 'River Bed' below.
BED LEVEL ENVELOPE	A management tool referring to an area between defined limits in which the measured height of a river bed is allowed to vary.
BERM	An area of relatively low-lying land in a waterway beyond the active bed, and generally from a bank landwards to a higher natural feature, or flood-containing stopbank. Berms generally have some form of vegetative cover. They are flooded relatively frequently and provide additional flood capacity, while accommodating erosion and active bed migration.
BOULDERFIELD	Land in which the area of unconsolidated bare boulders (>200mm diameter) exceeds the area covered by any one class of plant growth-form.
BUFFER/RIPARIAN PLANTED BUFFER	A defined area along the margin of a river that may be prone to erosion, in order to guide priorities for river management purposes. Buffers planted with vegetation to control bank erosion are called riparian planted buffers.
CATCHMENT	The land area draining through a main stream, as well as tributary streams, to a particular site. It relates to an area above a specific location.
CHANNEL/RIVER CHANNEL	A topographic feature that contains, or has contained, flowing water. The term can be used in a variety of ways depending on the context. Channels can exist in the active bed of a river, or may refer to the entire active bed. See 'Wetted Channel' below.
CODE OF PRACTICE FOR RIVER MANAGEMENT ACTIVITIES	A document developed by GWRC that guides all river management activities undertaken by GWRC for the purposes of flood and erosion protection in the Wellington Region.
COMMON METHODS	A suite of methods identified in this FMP in response to flood and erosion issues, and used selectively throughout the catchment.
CREST	The highest elevated point of a section of stopbank lining one side of a river (see 'Stopbank' below).
CROSS-SECTION	A term that refers to the shape, layers and physical dimensions of a river that would be seen if one was to measure and plot river depths against river width for a single location. Commonly taken perpendicular to flow.
DEGRADATION	A decrease in the general level of an active river bed through the removal of bed material sediments. This may happen because a pulse of bed material has moved through a reach or due to changes in river processes affecting the transport of bed material.
DEPOSITION	The process by which sediment or other material that is being transported by a river drops to the river bed upon a change of slope or loss in energy.
DESIGN CHANNEL/ FAIRWAY	A management term referring to a defined alignment and width for the active bed of a river reach. The design channel width is derived from an understanding of the particular form and behaviour of the river along a given reach. It is based on the actual form and behaviour of the reach over time, and relationships between flood flows, channel slope and bed material size. The layout of a design channel in a river corridor is guided by an understanding of channel migration and meander wave forms, taking account of natural and artificial controls and constraints on the existing (actual) bed width and alignment. The outer boundaries of the design channel are intended to provide a guideline for management of the river, while allowing for changes in the river bed from actual channel migration and meandering. The term design fairway is used when flow channels can migrate, split and re-form in the defined active bed area. Generally, braided and semi-braided river reaches would have design fairways, while meandering and alternating beach reaches would have design channels. The design width and alignment should be re-examined if there are significant changes to the river form following flood events.
DESIGNATION	A planning technique used by Ministers of the Crown, local authorities and network utility operators approved as requiring authorities under s167 of the RMA. Only requiring authorities can seek designations for land. A designation is a form of 'spot zoning' over a site, area or route in a district plan. The 'spot zoning' authorises the requiring authority's work and activity on the site, area or route without the need for land use consent from the relevant territorial authority (i.e. s9(3) of the RMA does not apply). A designation has a similar effect to a plan change establishing a permitted activity as it: • identifies the land affected in the district plan • enables a requiring authority to undertake the works within the designated area without the need for a land use consent • sets the parameters under which the activity can occur
EMERGENCY	A situation that is the result of flood and causes or may cause loss of life or injury or illness or distress or in any way endangers the safety of the public or property.
EMERGENCY MANAGEMENT (CIVIL DEFENCE EMERGENCY MANAGEMENT)	The application of knowledge, measures and practices for the safety of the public or property. Emergency management responses are designed to guard against, prevent, reduce, recover from or overcome hazards that may be associated with an emergency. Emergency management includes, without limitation, the planning, organisation, co-ordination, and implementation of those measures, knowledge and practices.
ENVIRONMENTAL STRATEGY	A strategy that sets the direction for the management and development of the upper Ruamāhanga rivers and their margins. Will be developed in the early stages on implementation of the Te Kāuru FMP.
EROSION	The process of removing material from a channel, bank or berm by river flows.
EROSION STUDY AREA	An area that has been identified as being susceptible to erosion as part of the 'Methodology for UWVFMP Phase 1 Erosion Hazard' report (2013).
FLOOD	The inundation of an area outside a river's active bed or banks, baseflow channel or channels, due to runoff from a rainfall event or events.
FLOOD HAZARD MAP	A map showing flood hazards in terms of depth of inundation, flow velocities or combined hazard categories for events of different probability. The maps are produced based on computer modelling.
FLOODPLAIN	The low-lying, flat or gently sloping land adjacent to a river channel that is covered with water during floods.
FLOODPLAIN MANAGEMENT PLAN	A long-term plan for the sustainable management of flood and erosion risks. It details a regional council's priorities for flood protection works for specific rivers in the region and sets a vision for managing those rivers. The plan has a 40-year planning horizon with planned reviews every 10-15 years.
FLOOD STANDARD	The defined flood (volume, peak, shape, duration, timing) that a flood defence system and its associated facilities are designed to pass safely.
FREEBOARD	An allowance used when setting floor levels, stopbank crest levels, etc, that takes account of: • Uncertainties in the precision of the hydraulic modelling • Physical processes that may not have been allowed for in the design water level, e.g.debris build-up, wave action and changes in bed level • Uncertainties in the prediction of physical processes (e.g. rainfall patterns) that affect the design water level The inclusion of a freeboard allowance provides an upper confidence level that water levels will have a high degree of certainty of not being exceeded.
HABITAT	The place or type of site where an organism or population normally occurs.
HABITAT QUALITY INDEX	An index for measuring the ecological health of a river and is often used for comparative purposes.
HAZARD (FLOOD OR EROSION)	A flood or erosion occurrence, the action of which can have negative impacts on human life, property or other aspects of the environment.
HEADWORKS FACILITY	A structure that is at the head or inlet to a wastewater treatment plant where the primary treatment of the water takes place.

INFRASTRUCTURE ASSETS	Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service through the continual replacement and refurbishment of its components. The network may include assets as components.
ISOLATED WORKS	Privately owned flood or erosion protection works partly funded by GWRC that are constructed outside areas where GWRC manages river schemes.
KAITIAKITANGA	Guardian or steward, or to have guardianship or stewardship.
LEVEL OF SERVICE	The outputs or objectives an organisation or activity intends to deliver to its customers.
LIFELINES	Utilities that provide services essential for the ongoing functioning of a community during and following an emergency. They include utility services (telecommunications, gas, electricity and water) and the transportation network (road, rail, port and airport services). Other essential services include hospitals and medical centres, and emergency services such as the police, ambulance and fire services.
MAURI	The life essence present in things as a result of their being imbued with that character.
MEANDERING RIVER	A river with a curved channel as opposed to a braided river with multiple channels in the river bed. In planform a meandering river has a wave form, where a meander refers to a single bend. Meanders move due to river flows, sediment transport and associated scour and deposition of the channel and banks.
MITIGATION	For this FMP, the act of moderating or reducing the effects of flood or erosion hazards or flood protection works.
PROPOSED NATURAL RESOURCES PLAN (PNRP)	The Natural Resources Plan for the Wellington Region (the Plan) is produced by GWRC in accordance with the Resource Management Act 1991 (the RMA). It sets out the objectives, policies and methods for people and organisations that use the region's resources for a variety of purposes. It is currently in a 'decisions' version form as a number of the decisions are being appealed to the Environment Court.
NON-STRUCTURAL RESPONSES (OR MEASURES)	Actions that keep people away from flood waters and help a community to cope when flooding occurs. They include planning and policy responses (policies and rules in district plans), voluntary actions (information and advice to help people make their own decisions), emergency management responses, and other.
OPERATIONAL MANAGEMENT PLAN	A plan developed by GWRC for a specific river to provide detailed guidance on the implementation of an FMP at a reach-by-reach scale. The Operational Management Plan identifies the management objectives and reach-specific values that must be considered in the selection of the most appropriate river management methods to be used for each reach.
OVERFLOW PATHS (OR FLOW PATHS)	Areas in the river corridor and on the adjacent floodplain where a large volume of water could flow during a major event. They are often areas of land that lead fast-flowing water away from the river corridor and over the floodplain. The depth and speed of flood waters are such that development could sustain major damage, and there may be danger to life. The rise of flood water may be rapid. It would be dangerous and difficult to evacuate people and their possessions, and social disruption and financial loss could be high. A blocked overflow path could potentially cause a significant redistribution of flood flows to other areas of the floodplain. Due to water depths and speeds, overflow paths are generally unsuitable for development, unless adequate provisions are made for flood avoidance and/or mitigation.
PONDING AREA	An area where flood waters would pond either during or after a major flood event. Water speed is slow in ponds, but water levels can rise rapidly. It may be difficult to evacuate people and their possessions, especially on foot, and it may need to be by boat. There could be danger to life. Social disruption may be high. Generally, ponding areas are unsuitable for development unless adequate avoidance and mitigation provisions are made.
POOL-RIFFLE-RUN	The areas in a river channel characterised by a diverse mix of flows and depths. 'Pool' is an area of a low-flow channel where its depth is relatively greater and flow speed is lower than in the surrounding parts of the river. 'Riffle' is an area of a low-flow channel that is shallow and steep, with higher flow speeds and unbroken standing waves over the river bed material. 'Run' is an area of a low-flow channel with relatively fast, consistent flow and shallow depths. Runs form downstream of riffles or between pools.
REACH	A length or section of a river that has a uniformity or consistency in terms of its physical and biological characteristics or is delineated by specific river features.
RECOMMENDED AREA FOR PROTECTION (RAP)	An area identified in the Protected Natural Areas Programme (PNAP) produced by the Department of Conservation, 1981-2001. By dividing New Zealand into 268 ecological districts to survey, representative examples of the full range of indigenous biodiversity in New Zealand could be identified and preserved.
REGIONAL POLICY STATEMENT FOR THE WELLINGTON REGION (RPS)	A document developed by GWRC that sets out the framework and priorities according to the RMA. Outlines how minerals, energy and ecosystems will be managed in a sustainable way. The second generation RPS was made operative on 24 April 2013.
RESIDUAL RISK	The risk of flooding that exists despite the protection provided by flood protection structures. In other words, the additional or 'leftover' risk due to possible breaching and overtopping of structures such as stopbanks.
RIPARIAN	The interface between land and a river or stream.
RIPARIAN MARGIN	A strip of land along the edges of a natural watercourse such as a river, stream, lake or wetland – the transitional area between land and water.
RIPARIAN PLANTED BUFFER	A buffer planted with vegetation to control bank erosion.
RISK (FLOOD OR EROSION)	The combination of the likelihood and the consequences of a hazard.
RIVER	A continually or intermittently flowing body of fresh water. It includes a stream and modified watercourse, but does not include any artificial watercourse.
RIVER BANK	A sloped edge along the side of a river.
RIVER BED	The RMA defines a river bed as 'The space of land which the waters of the river cover at its fullest flow without overtopping its banks'. Often the horizontal extent of a river bed corresponds to the extent of the active bed.
RIVER BED ENVELOPE	A management term referring to an area between defined limits in which the measured height of the river bed is allowed to vary, with a minimum of management intervention.
RIVER CORRIDOR	Land immediately next to a river channel that is the minimum area able to contain a major flood and allow the water to pass safely downstream. The extents are identified based on the modelled depths and speeds of a 1% AEP flood event. The depths and speeds of flood waters in the river corridor represent a potential danger to people and structures.
RIVER MANAGEMENT ENVELOPE (DESIGN LINE)	An area between defined limits. Within that area, the outer edge of the design channel is allowed to migrate into the buffer under different flow conditions, with a minimum of management intervention.
RIVER SCHEME	A designated section of river that receives protection from flooding, riverbank erosion and channel movement through various works undertaken by GWRC. Sections 126, 141, 142 of the Soil Conservation Rivers Control Act cover the powers that a catchment board (now a regional council) has in relation to works undertaken for flood and erosion control. These powers provide the mandate for the GWRC to establish and maintain river schemes (of work).
RUAMĀHANGA WHAITUA	Whaitua is the Māori word for space or catchment The Ruamāhanga Whaitua Committee has developed the Whaitua Implementation Programme recommends the ways in which fresh water will be managed in the Ruamāhanga catchment.
SCOUR	The process of material removal by hydrodynamic forces from around an object situated in a river such as the piers of a bridge.
SELECTED LAND USE REGISTER (SLUR)	A GWRC register of sites that are known (or suspected) to have been involved (historically or currently) in the use, storage or disposed of hazardous substances and as a consequence may contain residues of those substances.
SERVICE	As in 'utility service', a system and its network infrastructure that supply a community need.
STONEFIELD (OR GRAVELFIELD	Land in which the area of unconsolidated bare stones (20-200mm diameter) and/or gravel (2-20mm diameter) exceeds the area covered by any one class of plant growth form. The appropriate name is given depending on whether stones or gravel form the greater area of ground surface.
STOPBANK	An engineered bank aligned beside a river to prevent floodwater flowing into floodplain areas. It is also known as a flood defence.
STRUCTURAL RESPONSES	Structures or other physical works designed to keep floodwaters away from existing developments. Stopbanks and floodwalls are obvious examples of structural responses.
SUSTAINABLE MANAGEMENT	As defined by Section 5 of the Resource Management Act: 'Managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while: Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment.'
TERRACE	A stepped landform, consisting of flat or gently sloping top surface, bounded by a steeper ascending slope. Terraces can be formed by rivers cutting through a floodplain over time.
WAIRARAPA MOANA	The Wairarapa Moana Wetlands is made up of the beds of Lake Wairarapa and Lake Onoke and the publicly owned reserves around them. This covers over 9,000 hectares, from Lake Domain in the north to Onoke Spit, 30km away, at Palliser Bay.
WETTED CHANNEL	The area in the active bed currently containing flowing water.
WHAITUA IMPLEMENTATION PROGRAMME (WIP)	The WIP describes the ways people from the catchment want to manage their water now and for future generations through a range of integrated tools, policies and strategies. The WIP includes recommendations on managing contaminants, water allocation and river management and sets freshwater objectives and limits for each freshwater management unit (FMU) - the many varied waterbodies that make up the catchment.

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All reports are available online at http://www.gw.govt.nz/search-committee-meetings/

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