RiverLink

Assessment of Effects on the Environment

August 2021

Document title	Assessment of Effects on the Environment: RiverLink Project
Version	Final
Prepared by:	Louise Allwood, Rasmus Altenkamp, Emma Cairncross, Sarah Jenkin, Caitlin Kelly, Rachel Signal-Ross and Shannon Watson
Peer reviewed by:	Mary O'Callahan
Approved by:	Sarah Jenkin

Disclaimer

Table of contents

Table index

Figure index

Appendices

1. Introduction

Overview

Greater Wellington Regional Council (GW), Waka Kotahi NZ Transport Agency (Waka Kotahi) and Hutt City Council (HCC) are lodging Notices of Requirement (NoRs) and applications for resource consent (collectively referred as the Application) for the RiverLink Project.

RiverLink involves the construction, operation and maintenance of infrastructure and associated works within the Lower Hutt city centre around Te Awa Kairangi to improve flood resilience, transport connections and to facilitate urban renewal and regeneration of the city.

This Assessment of Environmental Effects (AEE) assesses the actual and potential effects of the Project to support the NoRs and resource consent applications submitted for approval under the Resource Management Act 1991 (RMA).

1.1 Introduction to this report

RiverLink is a partnership project between Greater Wellington Regional Council (GW), Waka Kotahi NZ Transport Agency (Waka Kotahi) and Hutt City Council (HCC), together with Mana Whenua partners Taranaki Whānui ki Te Upoko o Te Ika (Taranaki Whānui) and Ngāti Toa Rangatira (Ngāti Toa), collectively known as the Project Partners.

RiverLink is the brand adopted by the Project Partners for the collective and integrated approach to a series of projects within a 3-kilometre section of the Te Awa Kairangi/Hutt River (Te Awa Kairangi or the river) between Kennedy Good Bridge and Ewen Bridge and the immediate urban environs on either side, including the edge of Lower Hutt as it meets the city centre.

GW, Waka Kotahi and HCC are lodging Notices of Requirement and applications for resource consent (collectively referred as the Application) for the RiverLink Project.

RiverLink has developed since 2014[1] to address flood protection issues within the Te Awa Kairangi floodplain between Kennedy Good and Ewen bridges; transport resilience, accessibility, efficiency and safety issues at the Melling intersection on State Highway 2 (SH2); and urban renewal and regeneration of Lower Hutt's city centre. RiverLink seeks to address these issues by providing an integrated design solution with a focus on achieving strong positive outcomes for Lower Hutt.

RiverLink involves a number of significant infrastructure projects to be built within the Project area and in and around Te Awa Kairangi:

- Flood protection works
- Roading and interchange works for SH2
- A new road bridge across Te Awa Kairangi
- A new pedestrian and cycle bridge across the river
- Renewal and regeneration within the Lower Hutt city centre, and
- A new location for a new Melling Station.

This report has been prepared to support the Application for the Project, covering a new Melling interchange and associated works, changes to the stopbanks and river channel and upgrades to the Lower Hutt city centre.

[1] Refer to Chapter 7 for background on the Project development

1.2 Vision

The vision for the RiverLink Project derives from a set of principles developed for the Project and set out in the Project's Kaitiaki Strategy. The Kaitiaki Strategy was prepared by Mana Whenua advisors from Taranaki Whānui and Ngāti Toa and its purpose is to provide a holistic guide for all stages of the Project, to enhance the mana and mauri of Te Awa Kairangi.

This vision takes a 'whole of landscape' approach to understand how the river influences the wider landscape and how the wider landscape influences the river:

"The ancient Te Awa Kairangi, its many tributaries, aquifer and harbour, the surrounding hills and plains; and the people, flora and fauna that call this place home are drawn together with Te Awa Kairangi at the heart to regenerate river and city.

Lifting the mana and mauri of the river.

Re-establishing Lower Hutt as a vital and connected river city with strengthened community and culture."[2]

The measure of success for RiverLink is its legacy contribution to *"the transformation of the river as it is currently, described by mana whenua as a 'dead tree' into a 'bountiful tree' of life and vitality."* This can be achieved by "…*focusing on the synergies between transport, urban design, land use, wellbeing, recreation, open space, the natural environment, infrastructure and flood risk management*".[3]

To successfully deliver the vision the Project Partners agree that a single Project focus is required. Each part of the RiverLink story is connected and is intended to be delivered by its responsible Project Partner in a 'best for project' and fully integrated manner.

1.3 Why RiverLink?

An Urban and Landscape Design Framework (ULDF) has been prepared for RiverLink and forms Volume 2 of the Application documents. The ULDF includes a description of 'why' the various components of the RiverLink Project[4] are important for Lower Hutt.

GW - for GW, RiverLink will support the delivery of the HRFMP (2001) and Te Awa Kairangi/Hutt River Environmental Strategy, which aims to protect the Lower Hutt city centre from flooding and provide for the delivery of community aspirations for better ecological, amenity and recreational outcomes for the river. At a broader level RiverLink also delivers, to varying degrees, three priority outcomes for GW's Long-Term Plan 2018-2028 regional resilience, public transport, freshwater quality and biodiversity.

Waka Kotahi - for Waka Kotahi, RiverLink will deliver on its Melling Transport Improvements project, to provide safer journeys for road users, improved access between SH2 and the Lower Hutt city centre, better access to quality transport choices, and improved security and availability of the road network. The Melling Transport Improvements project is funded by the Government's NZ Upgrade Programme, and supports the delivery of the primary purpose of Waka Kotahi - to provide an affordable, integrated, safe, responsive and sustainable land transport system.

HCC - for HCC, RiverLink will deliver key parts of the vision of the Making Places Strategy for the city centre, and the more recent Central City Transformation Plan - relating to enabling good development, growth and amenity, and repositioning the city for growth and a redefined contemporary identity (urban renewal and revitalisation). It will also provide upgrades sought by the Hutt City Infrastructure Strategy and Environmental Sustainability Strategy.

[2] Project vision (from draft Urban Landscape and Design Framework)
[3] RiverLink ULDF, page 13, August 2020
[4] RiverLink ULDF, page 9, August 2020

1.4 The Requiring Authorities/Applicants

There are three requiring authorities and applicants applying for resource consents and Notices of Requirement to implement the RiverLink Project application, being GW, Waka Kotahi and HCC.

Relocation of the railway corridor and associated railway infrastructure on the Melling Line (designated in the District Plan by KiwiRail) requires an alteration to KiwiRail's designation. A separate Notice of Requirement on behalf of KiwiRail to alter designation NZR1[5] has been lodged concurrently with this application.

1.4.1 GW

Flood protection

GW has statutory responsibilities under the RMA and the Soil Conservation and Rivers Control Act 1941 to identify and manage the effects of natural hazards, including flooding.

GW is a network utility operator under the RMA, and it is approved as a requiring authority under section 166 of that Act. Under section 168 of the RMA GW, as a local authority with financial responsibility for public works, may give notice of its requirement for a designation for:

"(a) a public work; or

(b) In respect of any land, water, subsoil, or airspace where a restriction is necessary for the safe or efficient functioning or operation of a public work".

GW, in its capacity as a requiring authority, is giving notice of a requirement for, and is also lodging resource consent applications for, the proposed construction, operation and maintenance of those aspects of the Project, including those associated with flood protection, that fall within its responsibilities.

Public Transport

GW has responsibilities under the Land Transport Management Act 2003 to manage and operate the public transport network in its region. In addition, GW (through its wholly owned subsidiary Greater Wellington Rail Ltd which is a Railway Operator under the Railway Operator Amendment Order (No 2) 2012) holds a long-term lease over the existing Melling railway station (as well as all stations in the Wellington network). GW has responsibility for all customer facing infrastructure (station structures, furniture, access, lighting, park and ride and cycle storage facilities, etc).

GW, in its capacity as a requiring authority, is giving notice of a requirement for, and is also lodging resource consent applications for, the proposed construction, operation and maintenance of those aspects of the Project, including those associated with public transport, that fall within its responsibilities.

1.4.2 Waka Kotahi

Waka Kotahi is a Crown entity established on 1 August 2008 under the Land Transport Management Act 2003 (LTMA). As a Crown entity it must give effect to government policy as directed by the Minister of Transport.

The statutory objective of Waka Kotahi, as set out in section 94 of the LTMA is:

"to undertake its functions in a way that contributes to an effective, efficient, and safe land transport system in the public interest."

---

[5] Held by New Zealand Railways Corporation on behalf of KiwiRail for Railway Purposes – Melling Branch

This objective also forms one of the functions of Waka Kotahi as defined in section 95(1)(a) of the LTMA. Another key function of Waka Kotahi of relevance to the Project is:

"to manage the State highway system, including planning, funding, design, supervision, construction, and maintenance and operations, in accordance with this Act [the LTMA] and the Government Roading Powers Act 1989"[6]

In meeting its objectives and undertaking its functions Waka Kotahi must adhere to, amongst others, the operating principles set out in section 96 of the LTMA. It must also comply with its organisational direction as set out in its Statement of Intent 2018-2022 (SOI 2018). The SOI 2018 states that:

"Working with our central and local government partners and with iwi, we will integrate transport and land use planning to create health, connected and thriving communities that provide different ways for people to move around. We will align transport system investment with the government's priorities to provide better connections to social and economic opportunities in our cities and regions." (NZ Transport Agency, 2018, p. 3)

Waka Kotahi is guided by the Government Policy Statement on Land Transport which sets out the government's priorities for expenditure from the National Land Transport Fund over a ten-year period.

Waka Kotahi is a network utility operator under the RMA and a requiring authority under section 167 of the RMA for the purpose of constructing, operating, and maintaining state highways and motorways and cycleways and shared paths. The approval of Waka Kotahi as a requiring authority includes:

"the construction and operation (including the maintenance, improvement, enhancement, expansions, realignment and alteration) of any State highway or motorway pursuant to the Government Roading Powers Act". [7]

"the purpose of constructing or operating (or proposing to construct or operate) and maintaining cycleways and shared paths in New Zealand pursuant to the Government Roading Powers Act 1989 and the Land Transport Management Act 2003." (gazette.govt.nz, 2015)

Waka Kotahi, in its capacity as a requiring authority for the above mentioned purposes, is giving notice of a requirement for, and is also lodging resource consent applications for, the proposed construction, operation and maintenance of those aspects of the Project that fall within the responsibilities of Waka Kotahi.

1.4.3 HCC

HCC is a local authority with responsibility under section 11 of the Local Government Act 2002 (LGA) to give effect to the purpose of local government, which is:[8]

"*…to promote to social, economic, environmental and cultural well-being of communities in the present and for the future."*

HCC is a network utility operator under the RMA, and it is defined as a requiring authority under section 166 of that Act. Under section 168 of the RMA HCC, as a local authority with financial responsibility for public works may give notice of its requirement for a designation for:

"(a) a public work; or

[6] Section 95(1)(c) of the Land Transport Management Act
[7] See Resource Management (Approval of Transit New Zealand Limited as Requiring Authority) Order 1992; Resource Management (Approval of Transit New Zealand as Requiring Authority) Notice 1994; and Resource Management (Approval of NZ Transport Agency as a Requiring Authority) Notice 2015.
[8] Local Government Act 2002, section 10

(b) In respect of any land, water, subsoil, or airspace where a restriction is necessary for the safe or efficient functioning or operation of a public work.

HCC, in its capacity as a requiring authority, is giving notice of a requirement for, and is also lodging resource consent applications for the proposed construction, operation and maintenance of those urban renewal and revitalisation and local road aspects of the Project that fall within its responsibilities.

1.5 The RiverLink Project

RiverLink's three separate but interdependent projects include:

- Flood protection (GW) - widening Te Awa Kairangi channel and berms and raising the height of the stopbanks;
- Melling Transport Improvements (Waka Kotahi) - a new grade separated interchange and river bridge at Melling, new intersections with local roads and realignments, enhanced pedestrian and cycle routes and better public transport integration at a new Melling Station (aligned with KiwiRail and GW Public Transport); and
- Urban renewal and revitalisation (HCC) - urban renewal and revitalisation through improved access from the city centre to and alongside the river through the creation of a promenade, a new pedestrian and cycle bridge, a riverside park and supporting development.

A more detailed Project description is provided in Chapter 4 of this application. Figure 1 is a visualisation of the completed Project.

Figure 1 - Key Project components

1.6 NoRs to be confirmed and resource consents sought

To enable the construction, operation and maintenance of the Project, three new designations are proposed, along with alterations to existing designations and resource consents are sought.

1.6.1 GW

NoR

Flood Protection

The extent of GW's proposed designation is from Kennedy Good Bridge in the north to Ewen Bridge in the south. The proposed designation covers a total area of approximately 70.66 hectares. Noting that it will join an existing designation to the north of Mills Street on the eastern side of the river.

The extent of the proposed designation is sufficient to construct, operate, and maintain GW's aspects of the Project, and it includes land required for access to construction sites, construction compounds and to enable mitigation of adverse effects.

Once the Project is operational GW will review the extent of the designation boundary and may remove any parts that are not required for the long-term operation and maintenance of the RiverLink flood protection infrastructure. GW will inform HCC (as territorial authority) of its intention to remove parts of the designation (if required) following the process set out in section 182 of the RMA.

The proposed designation boundary is shown on the designation drawings reference number A16-4381-D201 to A16-4381-D203 in Volume 5 (Drawing Set) of the application documents.

Public Transport

The extent of GW's proposed designation covers the new Melling Station and its customer surrounds (including park and ride and bus facilities). The proposed designation covers a total area of approximately 1.14 hectares.

The extent of the proposed designation is sufficient to construct, operate, and maintain GW's aspects of the Project.

The proposed designation boundary is shown on the designation drawings reference number A16-4381-D201 to A16-4381-D203 in Volume 5 (Drawing Set) of the application documents.

Resource consents

Various resource consents are required for the construction, operation and maintenance of the Project as detailed in Chapter 6 of this AEE. In summary, the following resource consents are required:

From GW:

- Land use consent in accordance with section 9(2) of the RMA;
- Land use consent in accordance with section 13 of the RMA and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NESFW);
- Water permit in accordance with section 14 of the RMA; and
- Discharge permits to land, water and air in accordance with section 15 of the RMA.

From HCC

- Land use consent under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES Soil) in accordance with section 9(1) of the RMA.

1.6.2 Waka Kotahi

NoR

The extent of the proposed designation of Waka Kotahi and the alteration to existing designation TNZ1 is located immediately south of the existing Melling intersection. The proposed new designation covers a total area of approximately 8.3 hectares and the altered designation increases in area by 3.65 hectares.

The extent of the proposed designation is sufficient to construct, operate, and maintain the Waka Kotahi aspects of the Project, and it includes land required for access to construction sites, construction compounds and mitigation of effects.

Once the Project is operational Waka Kotahi will review the extent of the designation boundary and may remove any parts that are not required for the safe and efficient long-term operation and maintenance of the state highway. Waka Kotahi will inform HCC (as territorial authority) of its intention to remove parts of the designation (if required) following the process set out in section 182 of the RMA.

The proposed designation boundaries for the new and altered Waka Kotahi designations are shown on the designation drawings reference number A16-4381-D201 to A16-4381-D203 in Volume 5 (Drawing Set) of the application documents.

Resource consents

Various resource consents are required for the construction, operation and maintenance of the Project as detailed in Chapter 6 of this AEE. In summary, the following resource consents are required:

From GW:

- Land use consents in accordance with section 9(2) of the RMA;
- Land use consents in accordance with section 13 of the RMA and the NESFW;
- Water permits in accordance with section 14 of the RMA;
- Discharge permits to land, water and air in accordance with section 15 of the RMA; and

From HCC

- Land use consents under the NES Soil in accordance with section 9(1) of the RMA.

1.6.3 HCC

NoR

The HCC's proposed designation relates to the southern and central portions of the Project area. The proposed designation covers a total area of approximately 1.85 hectares. The designation alteration relates to reconfiguration of the Riverbank carpark designated as HCC4 which will alter and reduce in area to 1.64 hectares.

The extent of the proposed designation is sufficient to construct, operate, and maintain HCC's aspects of the Project, and it includes land required for access to construction sites, construction compounds and to enable the mitigation of adverse effects.

Once the Project is operational HCC will review the extent of the designation boundary and may remove any parts that are not required for the safe and efficient long-term operation and maintenance of the urban renewal and revitalisation works. HCC will inform HCC Resource Consents (as territorial authority) of its intention to remove parts of the designation (if required) following the process set out in section 182 of the RMA.

The proposed designation boundaries for the new and altered HCC designations are shown on the designation drawings reference number A16-4381-D201 to A16-4381-D203 in Volume 5.

Resource consents

Various resource consents are required for the construction, operation and maintenance of the Project as detailed in Chapter 6 of this AEE. In summary, the following resource consents are required:

From GW:

- Land use consent in accordance with section 9(2) of the RMA;
- Land use consent in accordance with section 13 of the RMA and the NESFW;
- Water permit in accordance with section 14 of the RMA;
- Discharge permits to land, water and air in accordance with section 15 of the RMA; and

From HCC

- Land use consent under the NES Soil in accordance with section 9(1) of the RMA.

1.7 Structure of the Application and supporting documents

This application and associated technical reports, design drawings and support information, contains the information required by the RMA, the Proposed Natural Resources Regional Plan (PRNP) and the City of Lower Hutt District Plan (District Plan). The structure of the application is set out in Table 1.

Table 1 - Structure of the application

Volume	Name	Contents
1	Notices of Requirement	Forms for Notices of Requirement (Form 18) Gazette Notices Schedule of land directly affected by the Notices of Requirement
1	Resource consent application forms	Forms for resource consents (Form 9) Schedule of land directly affected by the resource consents
1	Summary of application and assessment of effects	Summary AEE (executive summary of AEE)
2	Full assessment of effects on the environment	AEE (this report) Proposed designation and resource consent conditions
3	Urban and Landscape Design Framework	ULDF
4	Supporting Technical and Assessment Reports	Technical reports assessing the effects of the construction and operation of the Project
5	Drawing Set	Indicative design drawings for all aspects of the Project including road alignment, stopbank alignment, location of bridges and other structures

1.8 Structure of this AEE

In accordance with the requirements of the RMA (and particularly Schedule 4), this AEE provides the following information, and it is structured as shown in Table 2 below.

Table 2 - Structure of the AEE

Chapter	Name	Contents
1	Introduction	An introduction to the Application, Applicants and Project, including summary of required approvals and structure of the AEE and application
2	Background and strategic context for the Project	Sets out the background and strategic context and need for the Project and the Project objectives
3	Description of the existing environment	Description of the existing environment
4	Description of the Project	Description of the Project
5	Construction of the Project	An outline of the indicative method to construct the Project
6	Statutory context	Identification of the legal framework that applies to the Application, and identification of the required approvals
7	Consideration of alternatives	The methodology by which alternatives to the various Project elements have been considered
8	Consultation	An outline of the consultation that has occurred during preparation of the Application, feedback received and responses to issues raised
9	Assessment of effects on the environment	Outline of the methodology and assessment of the actual and potential effects on the environment, including consideration of measures proposed to avoid, remedy or mitigate adverse effects
10	Management of effects on the environment	Proposed measures to manage the identified effects, including a management plan framework
11	Statutory assessment	An assessment of the Project against the matters set out in applicable provisions of the RMA. An assessment of the Project against the relevant provisions of relevant national, regional and local statutory and non-statutory documents.
12	References	References

2. Background and strategic context for the Project

Overview

Over 105,000 people live in Lower Hutt, which contains significant investment in building, businesses and utilities that contribute to the Wellington regional economy. Te Awa Kairangi flows through Lower Hutt, and is important as a recreational resource to the local and wider community. However, the floodplain is an evolving physical environment and its proximity and risk to the community was the key catalyst for the RiverLink Project.

GW, Waka Kotahi and HCC seek to improve flood protection, promote population and commercial growth in the Lower Hutt city centre, improve access and safety between SH2 and central Lower Hutt, and provide an accessible and upgraded railway station. This integrated programme is guided by Project objectives, the Kaitiaki Strategy and multiple strategic drivers, which will produce benefits to the local and regional community. This chapter outlines the background and strategic context for the Project.

2.1 Overview

The Hutt Valley covers an area of contrasting land uses. The upper valley and hill areas, which occupy over 65 percent of the full Te Awa Kairangi catchment, are mainly covered in mixed regenerating native forests with some exotic plantations[9]. The lower catchment, once itself densely forested, is today heavily developed. Over 105,000 people live in Lower Hutt. This vibrant urban community contains a high level of personal, business and public investment in buildings, businesses and utilities, which form a major component of the Wellington regional economy. Te Awa Kairangi is also an important recreational resource, with over one million visitors each year, more visits than any regional park[10] within the Wellington Region. Because of its proximity to major urban areas Te Awa Kairangi is a unique resource, highly valued by the community and appreciated by travellers and visitors. But the floodplain is an evolving physical environment. Active geological, alluvial and climatic processes continue to shape the river valley and its headwater environment. It is the changeable nature of the river, combined with its proximity to the community that is a catalyst for RiverLink.

This section of the Application sets out the background to the Project and the basis for the Project objectives. It provides an overview and description of:

- How the Project Partners came together
- The Project objectives
- The Kaitiaki Strategy
- The need for the RiverLink Project components, and
- The Project benefits.

2.2 The RiverLink partnership

In 2013, GW and HCC came together to develop an integrated project concept for their respective interests. GW, HCC and Waka Kotahi began to undertake consultation on the

[9] Hutt River Flood Plain Management Plan 2001
[10] Hutt River Flood Plain Management Plan 2001

combined Project from 2014 onwards[11]. Riverlink branding emerged in 2016. Mana whenua joined to form the Project Partners in 2019.

The integrated nature of the Project will assist in delivering the three Project elements in a cohesive manner that could not be achieved if designed and constructed separately. The benefits for Lower Hutt will be greater than the individual Project components because of this.

2.3 Project objectives

The overall and specific Project Partner objectives for this Project, in accordance with section 171(1)(c) of the RMA, are outlined below.

2.3.1 Overall

To integrate the flood protection works, transport works, and urban renewal and revitalisation along Te Awa Kairangi / Hutt River between Ewen Bridge and Kennedy Good Bridge, which collectively:

a. Increase the level of flood protection for Lower Hutt's city centre and adjacent residential areas;

b. Improve safety, resilience and efficiency along SH2 at Melling, and the connection between SH2 and Lower Hutt city centre, and improve accessibility between transport modes;

c. Support the urban renewal and revitalisation of the Lower Hutt city centre by promoting Te Awa Kairangi / Hutt River as the centre piece of Lower Hutt city; and

d. Enhance the mana and mauri of Te Awa Kairangi / Hutt River and its people between Ewen Bridge and Kennedy Good Bridge through design and the practice of kaitiakitanga.

2.3.2 Greater Wellington Regional Council: Te Pane Matua Taiao

a. To protect Lower Hutt's city centre and adjacent residential areas from flood flows of up to 2,800 cumecs by improving flood protection along Te Awa Kairangi between Ewen Bridge and Kennedy Good Bridge.

b. To design and develop the flood protection works so that they integrate with and support the transport works and the urban renewal and revitalisation of Lower Hutt city centre.

c. To enhance rail public transport at the new Melling Station and access to the new Melling Station for users, by:

   (i) Providing safe, modern, connected and accessible multi modal access and associated facilities (including park and ride) for people using the new Melling Station

   (ii) Maintaining and operating the new Melling Station and associated facilities.

2.3.3 Waka Kotahi NZ Transport Agency

To provide for an improved cycleway/shared path, an interchange on SH2 at Melling, and a new Melling bridge, which:

a. Improves the safety and resilience of SH2 at Melling;

b. Enhances modal accessibility and transport connections at Melling, including to the new Melling station, and to the Lower Hutt city centre;

[11] Chapter 7 provides a history of the project development and consideration of alternatives.

c. Improves travel time reliability along SH2, and to the Lower Hutt city centre and the Western Hills; and

d. To design and develop the transport works so that they integrate with and support the flood protection works and the urban renewal and revitalisation of Lower Hutt city centre.

2.3.4 Hutt City Council

Support the urban renewal and revitalisation of Lower Hutt city centre by promoting Te Awa Kairangi, between Ewen Bridge and Kennedy Good Bridge, as the centre piece of the city through:

a. Enhancing walking and cycling connections and amenity along and across Te Awa Kairangi and to the city centre;

b. Providing opportunities for future mixed-use development and public space that integrate the city centre with Te Awa Kairangi; and

c. To promote the urban renewal and revitalisation of Lower Hutt city centre so that it integrates with and supports the flood protection works and the transport works.

2.4 Kaitiaki Strategy

The RiverLink Kaitiaki Strategy has been prepared by Taranaki Whānui and Ngāti Toa advisors. Its purpose has been to provide a holistic guide across all stages of the Project to enhance the mana and mauri of Te Awa Kairangi. It is a living document which will evolve with the Project. The strategy states:

"Everything that is here has a whakapapa which is long and deep – within that whakapapa lies our understanding of the world around us. When we re-build that connection we will come to realise that nature has its own way of doing things, of acting, responding and we the ira tangata are only one piece of that story. Our responsibility within that piece is to co-exist with our environment and deeply this strategy considers how that may be achieved as it relates to Te Awa Kairangi and RiverLink. We are not above the environment - we are pieces of an interconnected and interdependent web of tupuna (ancestors) and uri (descendants).

This kaitiaki strategy seeks to correct the relationship we have with our environment through the articulation of our ways of being which are sourced from our mana whenua association with Te Awa Kairangi and in particular the creation of our new RiverLink project."

The following principles have been developed as part of the Kaitiaki Strategy to inform the behaviours and actions taken to achieve a relationship with Mana Whenua which is just and fair:

- **Ranginui:** The connection to the various spiritual realms of the great and vast heavens, the ultimate link to the celestial family that created our great tupua
- **Mouri:** The mouri of Te Awa Kairangi – the living relationship between the ngahere, the cliffs, waterways, hinemoana and everything that lives within that environment
- **Wa tai, wai Māori:** The connection between the springs, streams, aquifers, rivers and all waterways that bring with them their life, mouri and mana
- **Ahua:** The character of Te Awakairangi is seen, the beauty, the mystique, the wonder, the wild, the rawness, the unforgiving
- **Tatai Whakapapa:** The history, connections, relationships and friendships which shape the land and the people
- **Whānau:** The care of manuhiri and people is embedded in the identify of Te Awa Kairangi, seeking to ensure the act of responsibility towards Te Awa Kairangi

- **Mana Whenua:** RiverLink is seen as a living piece of the identity of Mana Whenua who take pride in this space, taking on the obligation of care and responsibility, and
- **Papatuanuku:** The mountains, the cliffs, the landforms, the geology, ngāhere, trees, birds – they all need each other to exist.

The Kaitiaki Strategy has informed the partnership with Mana Whenua and the development of the design for the Project and the AEE. In particular, it is reflected in the ULDF (Isthmus, 2021) prepared for RiverLink. The ULDF forms part of the Application (Volume 3) and the Kaitiaki Strategy has particularly influenced the decision to move away from willows to natives (over time) as a flood protection tool in this reach of the Te Awa Kairangi.

2.5 The drivers for the Project

2.5.1 Problem identification

A number of strategic investigations, scoping studies, scheme assessment and business case processes have been undertaken between 2015 and 2019 which identified the following key problems, which are sought to be addressed through RiverLink:

- The existing level of service for flood protection is compromised, which has the potential to cause flooding within Lower Hutt
- The existing transport infrastructure has resilience, accessibility, efficiency and safety issues at the Melling Intersection on SH2, and
- There has been difficulty encouraging investment in the Lower Hutt city centre resulting in a lack of renewal and revitalisation of Lower Hutt's central area.

Flood Protection

The HRFMP, released in 2001, provided a detailed assessment of the costs and risks of flooding in Te Awa Kairangi. It established that the level of protection provided by existing stopbanks was mixed; upstream of Kennedy-Good Bridge, with the exception of a few reaches, stopbanks were adequate to contain a 2800 cumec flood, however, reaches downstream of Kennedy-Good Bridge (including the RiverLink Project area) had a much lower capacity and security, with some sections of stopbank that could be breached during an event as small as a 50-year ARI event (Wellington Regional Council, 2001).

In terms of costs, the Hutt City Centre Upgrade Project – River Corridor Options report (Paul & Wallace, 2015) estimated at that time the number of properties affected and the tangible economic damage that would result from a 440-year ARI flood event. These estimates are reproduced at Table 3 below. Note that it is likely one or other of the stopbanks would be breached in such a flood event, rather than both.

Table 3 - Estimated cost of a 440-year ARI flood

Corridor breach	Property types affected				Estimated tangible damages
	Commercial	Residential	Schools	Industrial	
West bank at Melling Bridge (Pharazyn Street)	462	2,111	4	91	$1.1 billion
Breach of east stopbank at Melling Bridge (left stopbank)	126	3,115	5	596	$1.06 billion

Figure 2 and Figure 3 summarise the flood problem of the Hutt Valley; they show the potential extent of flooding in a 2800 cumec flood with stopbank breaches. A flood of this scale affecting an under-prepared community would, without RiverLink, was reported to inundate approximately 2,668 (left bank breach) or 3,842 (right bank breach) buildings (including homes) and roads that could take many months to repair, significantly impacting the day-to-day functioning of the Hutt Valley community (Paul & Wallace, 2015). Recovery from such a flood would likely be slow and would impact on the regional and possibly national economy. Social and psychological impacts would likely cost individuals and the community at least as much as the physical or tangible damages.

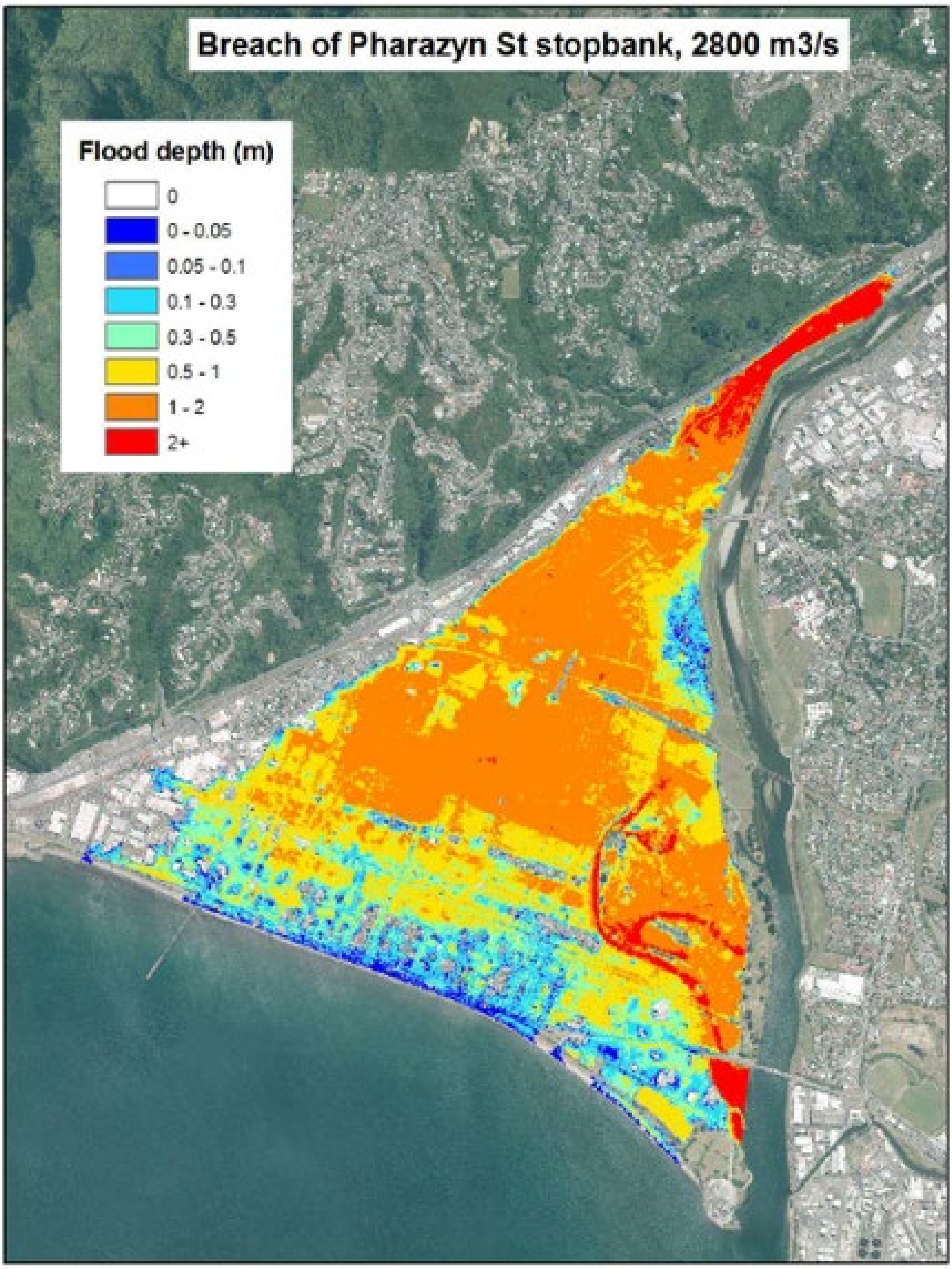


Figure 2 - 2800 cumec flood with right bank stopbank breach at Pharazyn Street[12]

[12] From Paul & Wallace, 2015

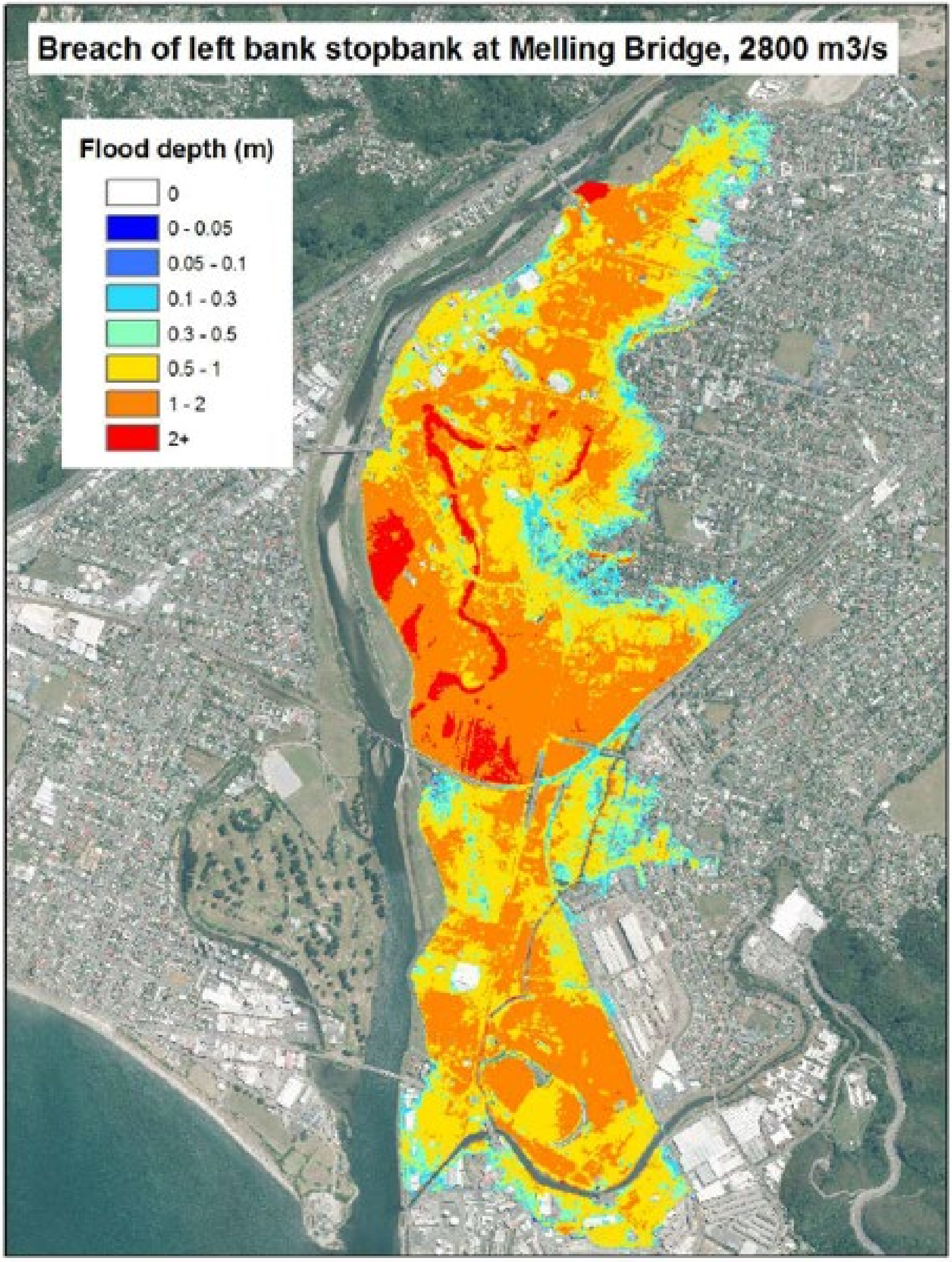


Figure 3 - 2800 cumec flood with right bank stopbank breach at Melling Bridge (Paul & Wallace, 2015)

Transport Infrastructure

The Melling Gateway Strategic Case (GHD 2014) outlined the context and case for a co-ordinated investment programme to improve the resilience, accessibility and safety of Hutt City in the Melling Bridge area. An Investment Logic Map (GHD Limited, 2014), produced by a panel of stakeholders from GW, Waka Kotahi and HCC, identified and agreed on the following key problems:

- Capacity constraints at Melling Bridge and the immediate vicinity result in exacerbated flood risk and inefficient multi modal network performance

- A constrained river corridor is increasing the flood risk and the potential economic and social impacts, and
- The disconnect between the city, river corridor and transport has undermined the status of the access from SH2 as the main gateway to the city centre.

The strategic case identified that the HRFMP recommended flood protection standard (protecting against a 440-year ARI flood) could not be achieved in the Lower Hutt central area until the Melling Bridge was replaced, since the existing Melling Bridge is a flood constraint and can only accommodate flood events up to a 65-year ARI event (approximately) without causing flooding outside stopbanks.

From a transport perspective, the strategic case identified that Melling Bridge and the adjacent intersection with SH2 is at capacity in peak periods, and that the bridge does not provide a safe, segregated path for cyclists. Additionally, it identified that the intersection of SH2 and Melling Link has significant reliability and safety issues. Reliability issues result from conflicting state highway and local traffic, as well as capacity issues in the right turn lane from SH2 into the Lower Hutt city centre. Safety issues result from the queuing effects of the right turn from SH2 into Lower Hutt, presenting a high number of rear-end/obstruction type crashes.

Lower Hutt Central City

HCC released the CBD Making Places report in 2009, which outlined a vision to transform the CBD towards 2030. This report outlined a programme that aims to make Lower Hutt city centre a more attractive place for people to live, work and play. The vision encouraged new investment in development and urban renewal of the city centre to benefit Hutt City and the region, with a particular focus on the city’s interface with the river (Hutt City Council, 2009).

Building on Making Places, the Central City Transformation Plan (CCTP) approved by HCC in 2019 identifies that the Lower Hutt city centre has no distinct or overriding pattern of land uses, displays unclear arrival points, and turns its back on the river (Hutt City Council, 2019).

In summary, there is a sense that the Lower Hutt CBD is stagnating and requires investment and urban renewal to reach its full potential as a regional city centre. In particular, the above strategies seek to turn Te Awa Kairangi from a flood liability into an economic asset that attracts life into the Lower Hutt city centre.

2.5.2 The need for the Project

The issues summarised above warrant significant investment, as detailed in various business case and optioneering processes outlined in Chapter 7 of this AEE. Upgrading of existing stopbanks and instream works to widen and deepen the bed of Te Awa Kairangi will improve flood protection. Grade separation of SH2 and a new vehicle bridge across Te Awa Kairangi will improve the safety, resilience and travel time reliability of SH2 at Melling, enhance transport connections, and provide for flood protection by removing the flood constraint of the existing Melling Bridge. The integration of flood protection works with urban redevelopment in the Lower Hutt city centre will provide opportunities for future mixed-use development and public space that integrates the city centre with Te Awa Kairangi, as well as enhanced walking and cycling connections along and across Te Awa Kairangi.

RiverLink coordinates all of these works in one project. Flood protection works and safety and resilience improvements to SH2 are interdependent, as they both rely on the upgrade of Melling Bridge. Redevelopment of the Lower Hutt city centre is dependent on both flood protection works and state highway upgrades, as future development must integrate with the upgraded stopbanks to address the lack of integration between urban development and the river. Furthermore, the project will achieve enhanced connectivity across Te Awa Kairangi to a new Melling Station due to the new Melling interchange. RiverLink therefore pulls together the three goals of flood protection, SH2 safety and resilience upgrades, and revitalisation of the Lower Hutt city centre, and delivers a single project to achieve the desired outcomes.

2.6 The Project benefits

The RiverLink Project will achieve significant flood protection, transport, amenity, environmental, river maintenance and economic benefits, including:

2.6.1 Flood Protection

Construction of RiverLink will result in upgraded flood protection measures in Lower Hutt, with improved protection provided to the city's major urban areas in floods up to 2,800 m^3/s:

- The change in river hydraulics will result in a substantial reduction in flooding outside of the river channel, which reduces flood damage and erosion vulnerability for the surrounding river banks, soils and geomorphological features, and significantly reduces the area of residential, commercial and industrial land in Lower Hutt and surrounding suburbs that will experience flooding in a substantial flood event.
  - For a 100-year Average Recurrence Interval (ARI) flood event in a current (2020) climate, a total of 4,030 buildings are estimated to be functionally compromised (building cannot be used for its intended use immediately after a flood) without Project works. With Project works, in the same scenario, only 104 buildings are estimated to be functionally compromised; a 97% reduction.
  - For a 100-year ARI event in a future (2130) flood event, a total of 8,652 buildings are estimated to be functionally compromised without Project works. With Project works, in the same scenario, only 1,027 buildings are estimated to be functionally compromised; an 88% reduction.
- A reduction in the duration of inundation upstream of and within the RiverLink reach, i.e. between Kennedy Good and Ewen bridges, which reduces flood risk.
- Improvements to flood protection will improve the social wellbeing of the Lower Hutt community as a result of increased resilience to flood events and increased confidence in flood control measures.

2.6.2 Transport

Construction of RiverLink will result in improved safety performance for road users, increased resilience and journey reliability for SH2 and Lower Hutt central city, and will support modal shift, improve safety and connectivity for pedestrians and cyclists, create more reliable public transport and less congestion:

- The high standard, grade separated Melling intersection and SH2 improvements are anticipated to reduce deaths and serious injuries. The quantitative assessment[13] undertaken showed a significant safety benefit for road users, with modelling predicting an annual injury crash rate of 0.3 per annum, compared to the existing environment which shows a recorded injury crash rate averaging 4 per annum over the past 5 years, a 92.5% reduction.
- Travel time savings of about 1 minute in the morning peak and 5.5 minutes in the evening peak are predicted for the route from Lower Hutt central city to SH2 north, and savings of about 1.5 minutes in the morning peak and 3 minutes in the evening peak are predicted for the route from Lower Hutt central City to SH2 south.
- Positive effect on public transport and multi-modal access to the new Melling Station and between the new Melling Station and central Lower Hutt as the new pedestrian and cycle bridge provides a more direct connection over Te Awa Kairangi which is segregated from vehicular traffic.

[13] See Appendix K of the Traffic Impacts and Transport Integration Assessment

- The Project will support and enable an increase in the mode share for active and public transport modes.
- Improved safety to cyclists and pedestrians within Lower Hutt central city as a result of the additional paths and crossing facilities delivered by the Project.
- Improved pedestrian and cycling connectivity in and around Te Awa Kairangi and the Lower Hutt city centre, across the new pedestrian bridge to the new Melling Station and via new shared paths and crossing facilities.
- More reliable bus journeys arising from the signalisation of current roundabouts in central Lower Hutt.
- A safer and less congested environment in central Lower Hutt as a result of more through traffic movements occurring on SH2, since the delays at Melling interchange are removed by the proposed grade separation.

2.6.3 Amenity

Following construction of RiverLink, the following improvements in amenity in and around Te Awa Kairangi and the Lower Hutt city centre are anticipated:

- Improved amenity, natural landscape and public access to Te Awa Kairangi through reorientation of the Lower Hutt city centre towards the river, areas of planting and increased opportunities for informal recreation.
- The Project will have significant enduring benefits for recreation including walking and cycling improvements, new open spaces, children’s playgrounds, and improved access to the River.
- Road traffic noise levels resulting from changes to the local road network, when compared to noise levels that would occur without the Project, are predicted to lead to a reduction in noise levels at 60 of the 74 noise sensitive receivers assessed. The reduction in noise level at a number of these properties is sufficient to be noticeable, i.e. equal to or greater than 5 dBA.

2.6.4 Environmental

Construction and operation of RiverLink is predicted to have the following environmental benefits:

- Improvements to the water quality of Te Awa Kairangi through stormwater treatment, which will reduce discharges of sediment and contaminants into the freshwater environment. Improvements in water quality will improve marine ecological values and coastal avifauna, as it will reduce contaminants affecting marine species and reduce bioaccumulation effects on coastal avifauna. Water quality improvements are also culturally significant to Mana Whenua.
- The new stormwater culverts will improve fish passage in Tirohanga Stream, which will support indigenous freshwater species.
- Indigenous vegetation planting and changes to the morphology of Te Awa Kairangi will improve the natural character of the river, which has cultural significance to Mana Whenua. Key morphological improvements include deeper pools, greater lateral freedom in the upper reach, more natural alignment and meander form in the lower reach and more channel features (scatter rock, large woody debris, rock spurs). The installation of these features will improve in-river ecological values by increasing habitat diversity, especially for fish to use as refugia during the day and during flood flows, and to maintain spawning habitat for key fish species.

2.6.5 River maintenance

Following construction of RiverLink, the following benefits are predicted with regard to river maintenance:

- The river shaping works will reduce the frequency and volume of gravel extraction required to maintain flows within Te Awa Kairangi, particularly in the lower reach below the new Melling Bridge. Bed material deposition will occur more frequently in the upper reach of Te Awa Kairangi (above the Transpower substation). This will allow for more gravel extraction to occur from gravel bars above low flow water level, although extraction in wet or from the active bed may still be required along the upper reach. This in turn will reduce the effects of gravel extraction activity on the active bed of Te Awa Kairangi and allow for easier and less disruptive sediment management regime.
- The proposed rock lining and vegetation buffers on the riverbanks, once established, will provide a much greater degree of security against bank erosion effects than at present. Therefore, flood damage within the river corridor will be reduced and more easily remedied following flood events.

2.6.6 Economic

Construction and operation of RiverLink is predicted to generate the following economic benefits:

- Economic growth and employment benefits for Lower Hutt through construction job demand, expenditure by workers in the local area and provision of infrastructure for new business ventures or places of work.
- Indirect economic benefits to the local and regional economy due to an increase in night time and visitor expenditure, improved access to employment and travel for skilled workers, and improved workforce amenity through revitalisation of the Lower Hutt city centre and reorientation towards Te Awa Kairangi.
- Urban renewal and revitalisation of the Lower Hutt central area, by better connecting the city with Te Awa Kairangi.
- Ensuring economic and social activity continuity during a flood event, by safeguarding and protecting up to 3,000 homes, five schools and 600 businesses from flood events.

.

3. Description of the existing environment

Overview

The Project is located in Lower Hutt, within the Wellington Region. The Project area extends from the Ewen Bridge in the south and Kennedy Good Bridge in the north, and from SH2 in the west across Te Awa Kairangi to the interface with Lower Hutt city centre in the east. The Project area contains sites of cultural significance, diverse landforms, ecological values and water, important transport networks and a varied built environment. The Project area intersects with five residential suburbs, which include Belmont, Alicetown, Normandale, Tirohanga, Boulcott and Melling. There are industrial, commercial and recreational land uses within the Project area.

This chapter contains a description of the existing physical and human environment within which the Project is proposed to be constructed and operated.

3.1 Introduction

This section provides a description of the existing environment within which the Project will be constructed and operated. The Project area extends from the Ewen Bridge in the south to Kennedy Good Bridge in the north, and from SH2 in the west across Te Awa Kairangi to the interface with Lower Hutt city centre in the east. The Project area is illustrated in Figure 4. The specialist technical assessment reports found in Volume 4 of the Application provide additional detailed descriptions of specific environmental features relevant to each discipline.

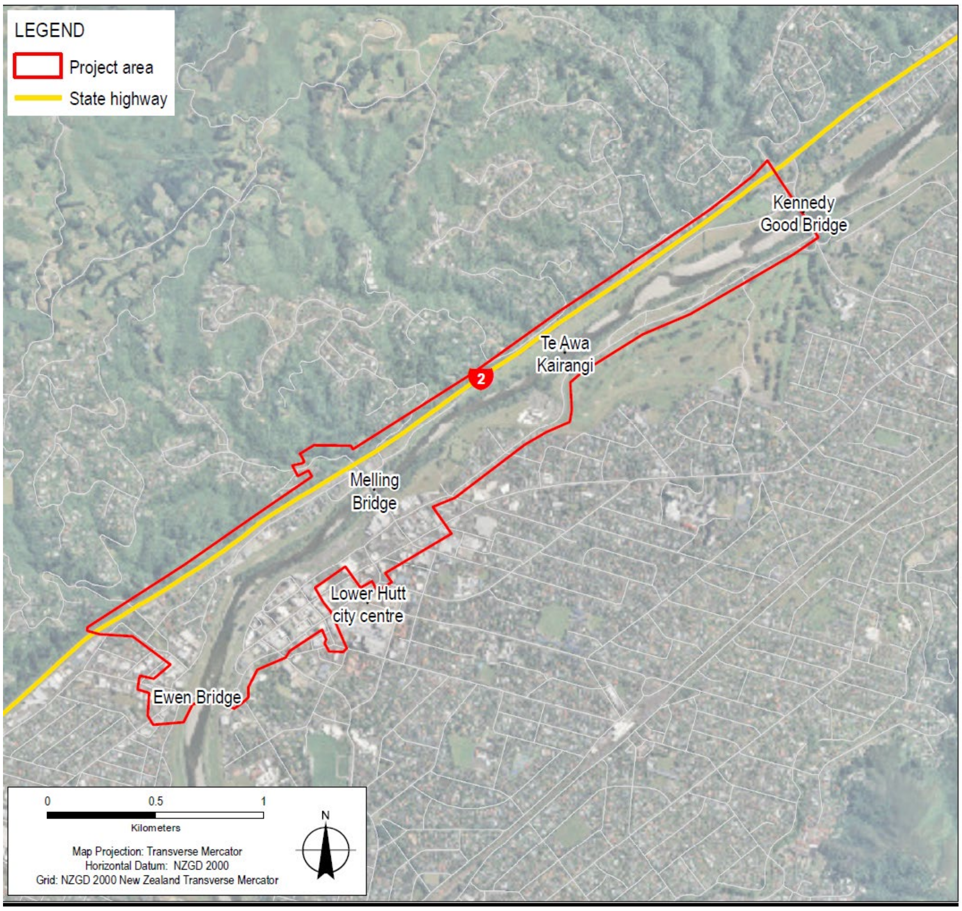


Figure 4 - Project area

The description of the existing environment covers the Project area as well as areas beyond the Project area that are impacted by the Project. It is broken into the following themes:

- Cultural
- Landform
- Water
- Ecology
- Transport, and
- Built environment.

3.2 Cultural

3.2.1 Creation of Te Awa Kairangi

The creation of Te Awa Kairangi is recounted in the ULDF as follows:

"Mythological history tells of two taniwha, Ngake and Whāitaitai who lived in Te Whanganui - a-Tara (Wellington Harbour) when it was just a lake. The lake eventually became too small for the taniwha, and they longed to escape into the ocean to the south. Ngake positioned himself on the northern edge of the lake and using his tail as a spring thrust himself towards the southern shores, smashing a passage-way through to what is today known as Cook Strait. The force of the release of Ngake's coiled tail carved Awa Kairangi – river of food from the sky."

Te Awa Kairangi is Ngā Taonga a Nui to tangata whenua (large freshwater entity from which Mana Whenua derive cultural and spiritual identity), treasured by Māori for the abundant food resources it provided, and the access it gave to the vast forest across the valley floor.

3.2.2 History

As described in the Kaitiaki Strategy outlined in section 2.4 of this AEE, Taranaki Whānui hold Mana Whenua over Te Awa Kairangi and derive cultural and spiritual identify from the river. Prior to European settlement, Māori travelled in the Hutt Valley largely by waka – many kāinga and pā were close to the river. Te Awa Kairangi linked the settlements and provided a food supply. Mahinga kai were found along the river such as at Petone (Pito-one), which was a wetland that held abundant resources of birds, tuna and other food sources. Waka were carved from forest trees felled for that purpose close to the river.

Maraenuka and Motutawa pā sites are of particular relevance, as they are positioned within the Project area on the left bank of Te Awa Kairangi at the present site of the Lower Hutt substation off Connelly Street.

Ngāti Toa also have long-standing associations with Te Awa Kairangi. Ngāti Toa's association with the river began from the time of their participation in the invasion of the Hutt Valley during 1819 and 1820. Although Ngāti Toa Rangatira did not initially remain in the area after this invasion, Te Awa Kairangi continued to be important to the iwi following their permanent migration and settlement in the lower North Island in the late 1820s and early 1830s.

The Cultural Impact Assessment prepared by Raukura Consultants (Technical Report #16 in Volume 4 of the Application documents) outlines the significance of the area around Boulcott. Conflicts occurred in this area early in colonial history over the New Zealand Company's sale of rural acres to settlers, and the resulting displacement of iwi. The Boulcott Farm stockade and Maraenuku Pā were important sites in this conflict.

As European settlement began in the 1840s and intensified, Te Awa Kairanga and its surrounds were particularly shaped by the colonial conflict - marked by the construction of the Taita

Blockhouse near Motutawa Pā, Boulcott Stockade near Maraenuku Pā, and Fort Richmond near Te Ahi Monono kāinga.

From the 1900s, European settlement patterns on the valley floor began on the True Left Bank near what is now Ewen Bridge, with large rural blocks set out east of High Street aligned with the western escarpment and configured as diagonal parallelograms. From the 1950s, finer-grain street patterning occurred as rural blocks were subdivided for residential uses. By the 1970s Lower Hutt's settlement pattern was largely defined and marked by an intricate and complex intersecting grid/parallelogram street patterns - adjacent to but largely unconnected to Te Awa Kairangi.

3.2.3 Values

Te Awa Kairangi is today valued by both tangata whenua and the wider population of Lower Hutt.

As outlined in the Cultural Impact Assessment, Māori historically used Te Awa Kairangi to travel through the Hutt Valley in their waka, and used the hinterland to hunt, gather kai and timbers for works including the building of waka, pā palisades and other structures. Today, the river is still regularly used in summer by waka and for fishing through iwi traditional harvesting rights, including for whitebait – juvenile inanga, kokopu and eeling. The river therefore continues to be valued for the provision of mahinga kai. Historically, the flora and fauna of the river was vital for survival of Māori and although this significance has lessened over time, the cultural significance remains.

The Project area is also of historical and cultural significance associated with the colonisation of Wellington Harbour and surrounds, which resulted in conflict at Boulcott Farm in 1846. Both Motutawa Pā and Maraenaku Pā are identified as sites with significant Mana Whenua values to Taranaki Whānui in Schedule C4 of the Proposed Natural Resources Plan (PNRP). Te Awa Kairangi is subject to a statutory acknowledgement for both Taranaki Whānui and Ngāti Toa.

Te Awa Kairangi is listed as Ngā Taonga Nui a Kiwa for both Taranaki Whānui and Ngāti Toa within the PNRP for the following reasons:

- Ngā Mahi a ngā Tūpuna (the interaction of Mana Whenua with freshwater for Mana Whenua purposes)
- Te Mahi Kai (places where Mana Whenua manage and collect food and resources)
- Wāhi Whakarite (sites and activities where particular practices and activities take place) (Taranaki Whānui)
- Te Mana o te Tangata (a water body with value to all those who interact and rely upon it)
- Te Manawaroa o te Wai (the potential for a water body to be restored following historic pollution)
- Te Mana o te Wai (a water body inherently connected to the identity and mana of the area), and
- Wāhi Mahara (a place of learning where local knowledge and history are etched) (Taranaki Whānui).

The wider Lower Hutt community value Te Awa Kairangi for the sense of place it provides and its recreational and scenic values, embodied in the popularity of the Hutt River Trail, which provides opportunities for recreation in the environs of the river.

3.3 Landform

3.3.1 Landscape

The Hutt Valley comprises a broad valley, formed within a wider landform system of steep and elevated ridges, hill country, valleys and basins, and lower coastal areas influenced by Wellington Harbour and coastal processes.

The Tararua and Remutaka Ranges broadly enclose the Hutt Valley to the distant north and east. Landforms surrounding the Hutt Valley to the east and west comprise steep-rolling hill country – being the hills between Upper Hutt and Mangaroa, the Belmont/Haywards Hills, and the eastern hills between Hutt Valley and Wainuiomata. To the immediate west of Te Awa Kairangi is the Wellington Fault – expressed as the prominent, steep eastern edge of the Belmont Hills.

Within the Project area, Te Awa Kairangi's path follows the Belmont Hills escarpment/Wellington Fault, and only starts to separate from this landform in the lower reaches, as it runs through to Wellington harbour and adapts to tidal influences.

3.3.2 Natural hazards[14]

The Project area sits across the Wellington Fault. Fault rupture, ground-shaking, liquefaction, lateral spreading, regional uplift/subsidence, tsunami, slope instability on the Lower Hutt hillside and slope instability on riverbanks are all seismic risks associated with the Wellington Fault.

Fault rupture

The Wellington Faultline Study zone[15] is located within the Project area, being approximately 150m wide covering the area between Te Awa Kairangi and the Western Hills. This zone covers 75m either side of the inferred trace of the Wellington Fault on ground level, reflecting the uncertainty of the exact location of the fault below ground and where fault rupture will express itself at ground surface should the fault rupture.

Rupture of the Wellington Fault will result in the Hutt Valley moving towards the harbour relative to the hills to the west, with up to 5m of horizontal displacement at the true right bank of Te Awa Kairangi, and subordinate and variable vertical displacement up to 2m at ground surface.

Ground shaking

In addition to the Wellington Fault, the Wairarapa Fault, Ohariu Fault and Hikurangi Subduction Zone are other significant known active faults nearby. A summary of the main features of these faults is provided in Table 4.

Table 4 - Summary of significant nearby known active faults[16]

Fault	Direction from site	Distance from site	Max. likely magnitude	Estimated Average Recurrence Interval
Wellington	Below	0km	~7.3-7.9	550-770 years
Wairarapa	Southeast	17km	~8.1	~1200-2200 years
Ohariu	West	8km	~7.1-7.5	~2200 years

[14] Flood risk is addressed in section 3.4.2 below as part of the description of the river
[15] An area where land use is managed for natural hazard risk in the District Plan
[16] From Geotechnical Interpretive Report, which is appended to Technical Assessment No. 15 Natural Hazards and Geotechnical Assessment

Fault	Direction from site	Distance from site	Max. likely magnitude	Estimated Average Recurrence Interval
Hikurangi Subduction Zone	East, southeast and below	32-100km	~8.0-8.5	~875 years

Rupture of any of the above faults would result in varying levels of ground shaking at the subject site.

Liquefaction

The liquefaction vulnerability is variable across the site, likely due to changes in groundwater and ground conditions. Vulnerability also varies significantly between different earthquake events. Liquefaction vulnerability maps for the Project area is mapped below in Figure 5.

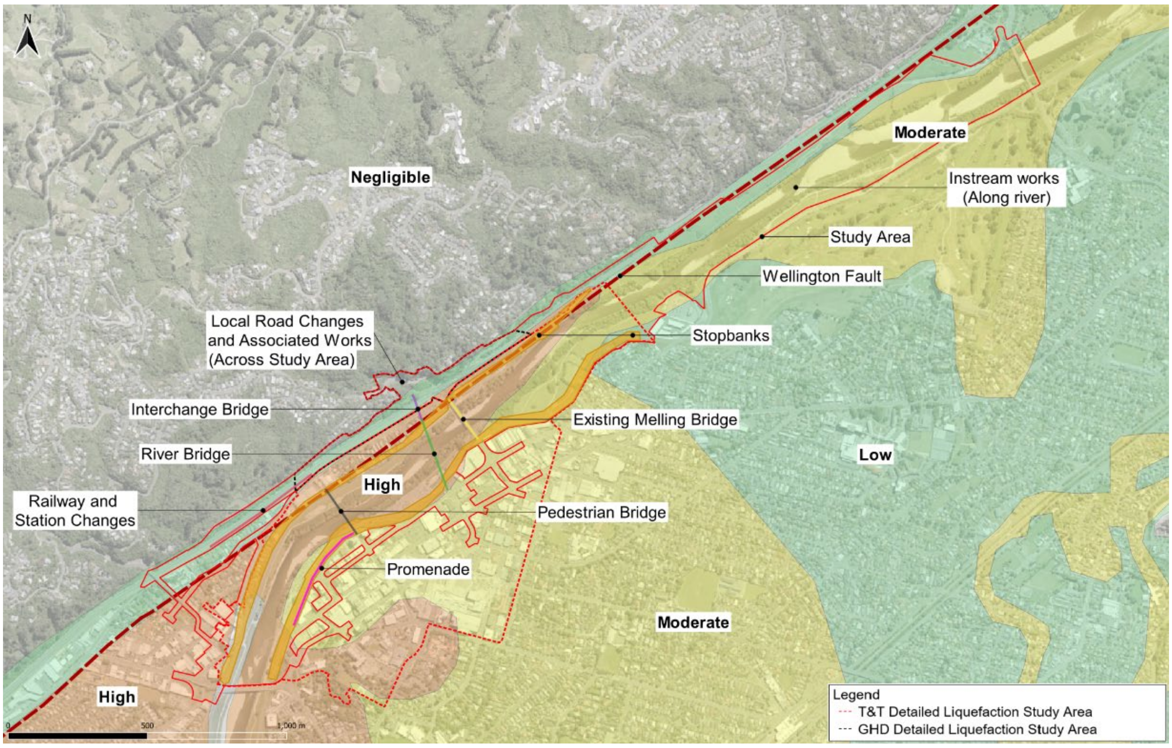


Figure 5 - Liquefaction vulnerability (from GW web portal)

Lateral spreading

Lateral spreading is the movement of ground down slope or towards a free edge as a result of shearing of weak liquified ground under seismic forces. Assessment of lateral spreading risk in the Project area shows that lateral spreading has the potential to occur in localised areas for earthquake scenarios at 1 in 150 year or greater events[17].

Regional uplift/subsidence

Faulting in the wider region has resulted in regional uplift and subsidence in the past, a recent example being the 1855 Wairarapa Fault earthquake with uplifted the Hutt Valley/Petone area by 1.2-1.5m.

[17] From Geotechnical Interpretive Report, which is appended to Technical Assessment No. 15 Natural Hazards and Geotechnical Assessment

Tsunami

The site has the potential to be impacted by a large tsunami following an earthquake. A 1 in 100-year earthquake would result in a 2-4m tsunami height, a 1 in 1,000-year earthquake would result in a 6-8m tsunami height, and a 1 in 2,500 year earthquake would result in an 8-10m tsunami height.

GW's tsunami hazard map is reproduced at Figure 6 (Greater Wellington Regional Council, 2021).

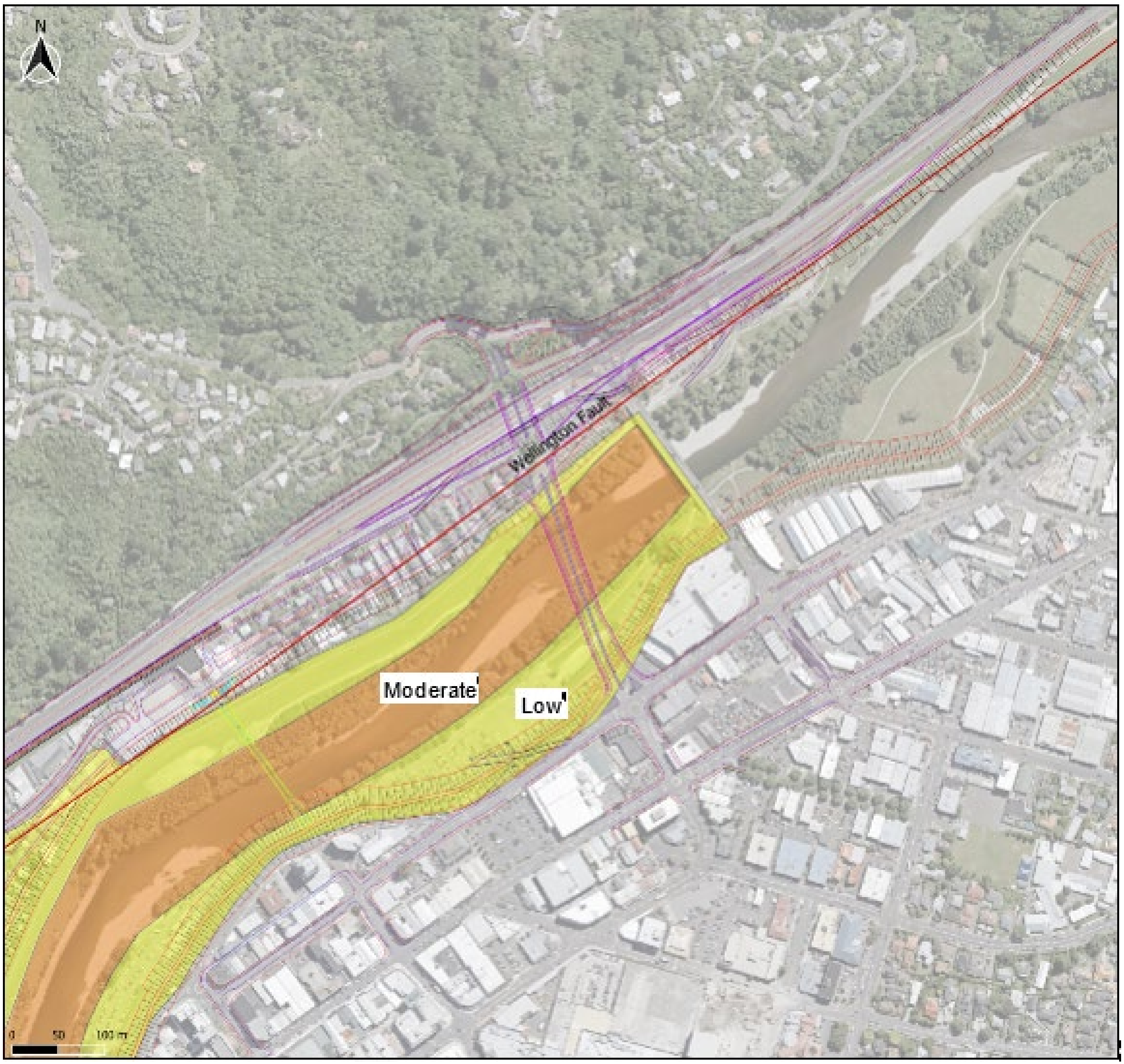


Figure 6 - GW tsunami hazard map

Slope instability

GW has produced a hazard map showing seismically induced slope failure risk, reproduced at Figure 7.

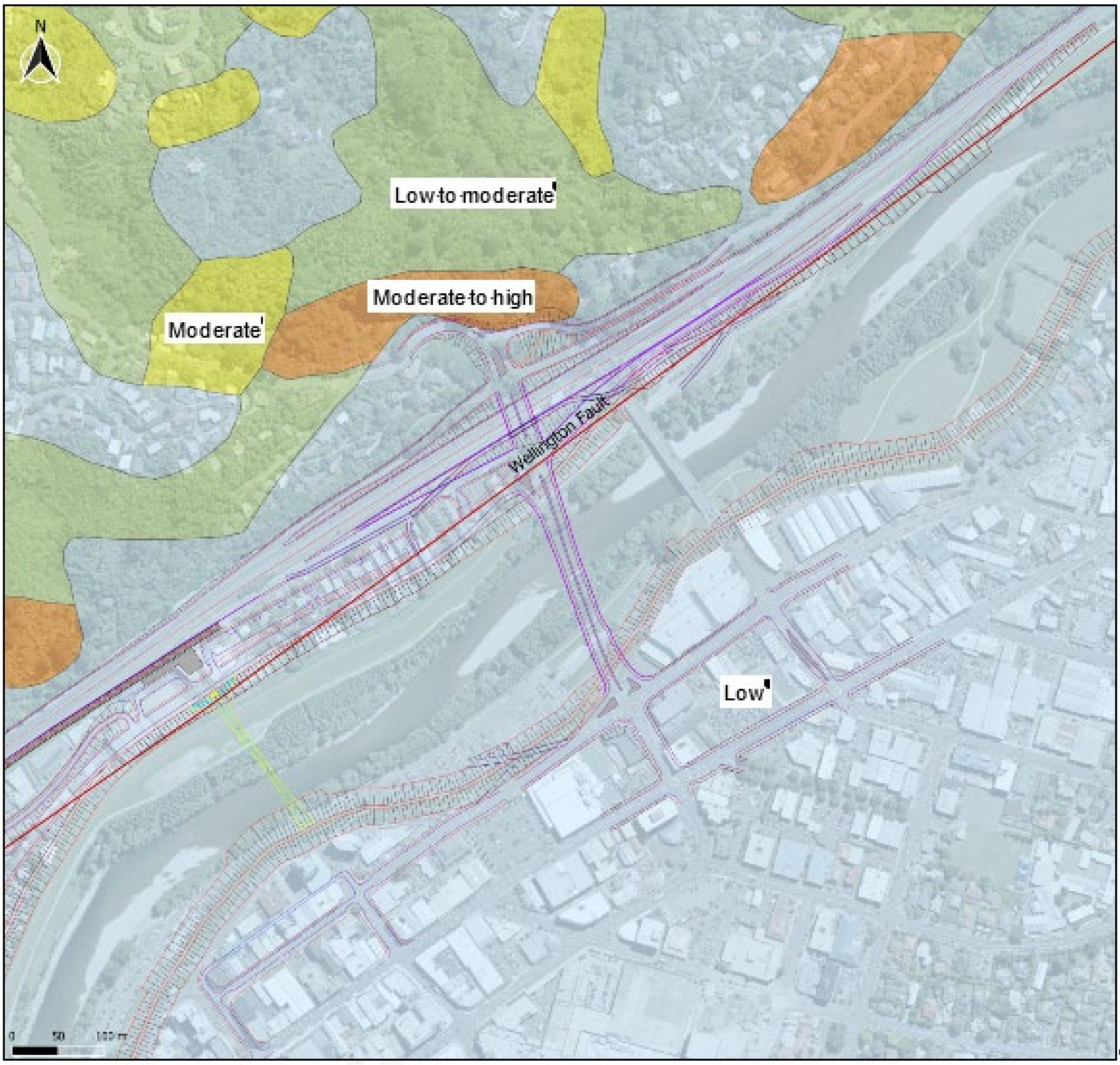


Figure 7 - GW earthquake induced slope failure hazard map

3.4 Water

Te Awa Kairangi flows through the Project area and is the link to the flood protection portion of the Project works. In addition, a key goal of HCC's CCTP is to reconnect the city centre with Te Awa Kairangi (Hutt City Council, 2019).

3.4.1 Catchment

Te Awa Kairangi has a total length of 56km and a catchment area of 655km^2. It flows from the slopes of the southern Tararua Ranges and surrounding hills, through Upper and Lower Hutt, before draining into Wellington Harbour at Petone. The geographic catchment of Te Awa Kairangi is detailed at Figure 8.

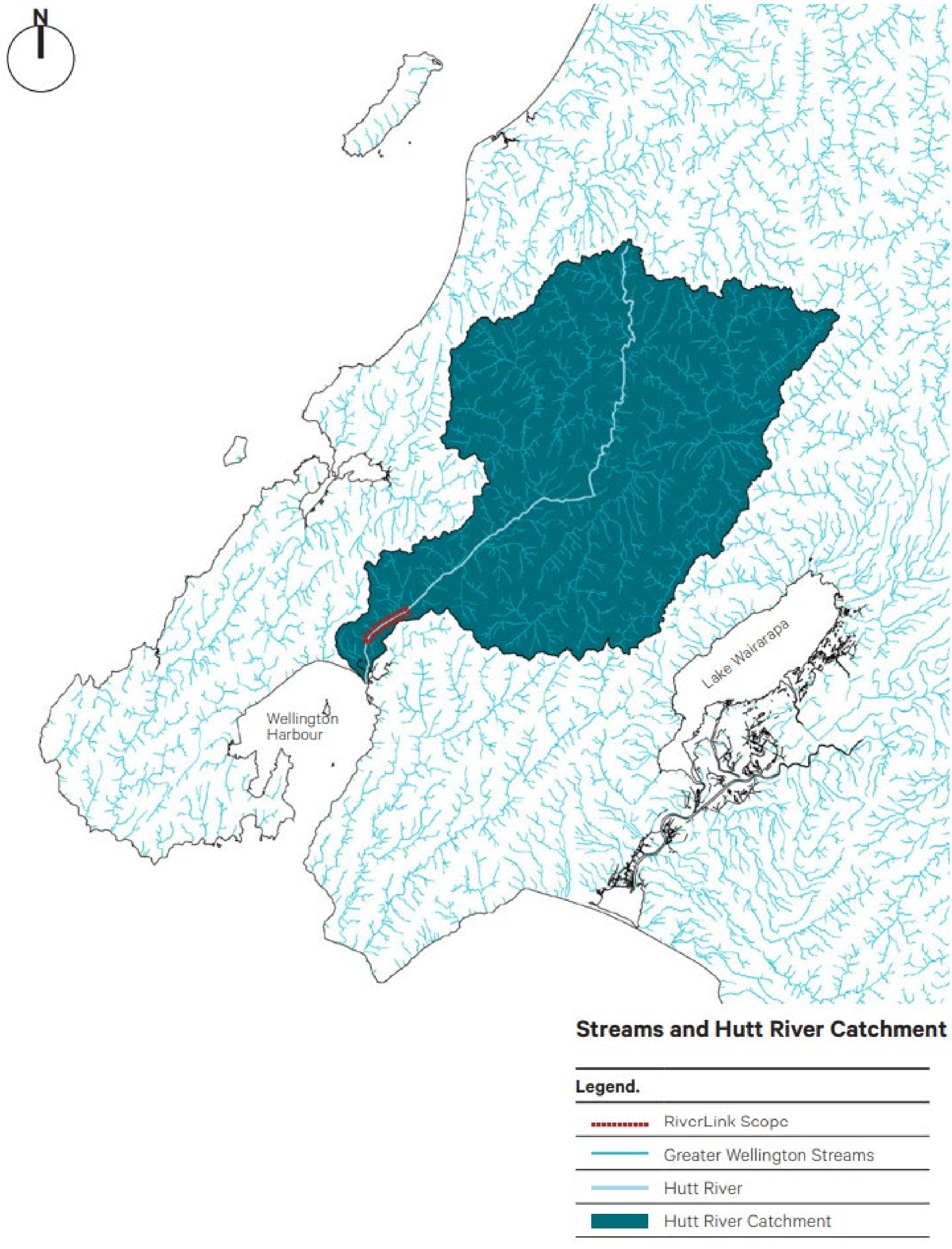


Figure 8 - Te Awa Kairangi catchment

3.4.2 Existing state of Te Awa Kairangi

Alignment

In the vicinity of the Project area, the river corridor alignment follows the Western Hills and SH2 up to the southern end of the Project site, where it moves eastward away from the hills heading towards the harbour at Petone.

Flooding

Flooding from Te Awa Kairangi is a natural process, that has been exacerbated by human development on the floodplain, both developing on the floodplain and constraining the river itself. The HRFMP estimates the risk of various flood events over the next 100 years as follows (Wellington Regional Council, 2001, p. 4):

- 100-year ARI flood (1,900 cumecs) – 63% chance, i.e. a chance of about two in three in the next 100 years
- 440-year ARI flood (2,300 cumecs) – 20% chance, i.e. a chance of one in five in the next 100 years, and
- Rare flood (2,800 cumecs) – 4% chance in the next 100 years.

It is noted that the HRFMP design standard sought to achieve a 2,800 cumec design standard through Lower Hutt city centre through the upgrading of major urban stopbanks, with remaining stopbanks to be upgraded to a 2,300 cumec design standard. The recurrence interval for the 2,300 cumec and 2,800 cumec has been reviewed by Tonkin + Taylor, with the findings provided at Appendix B of the River Hydraulics Assessment (Technical Report #1). This review has found that a 2,300 cumec event has an ARI (Average Recurrence Interval) of between 460 and 2,100 years under the current climate, and an ARI of between 60 and 140 years in a 2130 climate change scenario (depending on the climate change scenario assumptions made). A 2,800 cumec event has an ARI of between 3,100 and 67,000 years under the current climate, and an ARI of between 260 to 1,400 years in a 2130 climate change scenario.

The lower reaches of Te Awa Kairangi have been managed and modified within the Hutt Valley for over 100 years. The extensive bank protection works undertaken in the river over this time have resulted in a well-defined and contained river corridor which is deliberately constrained along a fixed alignment. The river is constrained by flood protection stopbanks and river edge engineering structures, including vegetative managed willow plantings and non-vegetative rock linings.

The HRFMP prepared in 2001 outlines public consultation and risk-based levels of protection that were considered by the participating local authorities in arriving at an acceptable level of risk from flooding. The HRFMP adopted a 'risk-based 2,300 cumec standard' as the design standard for stopbanks and other flood protection measures. This standard comprises a combination of structural measures that maximise community safety and cost-effectiveness. For major urban areas, including the Project area at the central Hutt City, it recommends flood protection to the 2,800 cumec standard. This involves the upgrade of major stopbanks (those protecting main urban areas) to the 2,800 cumec standard.

Morphology

Te Awa Kairangi is tidal as far upstream as the Melling Bridge, with few exposed gravel beaches. From Melling Bridge to the northern Project area extent the river is characterised by a meandering single channel with alternating gravel beaches. While beaches are relatively stable downstream of Melling Bridge, up-stream of Melling Bridge the river dynamics are more mobile, and beaches continue shifting and re-shaping. Channel widths range from 60m at Melling Bridge to 100m at Kennedy Good Bridge.

The estuary of Te Awa Kairangi is an approximately 3km long tidal river mouth estuary which drains into Wellington Harbour at Petone. Saltwater extends up to 3km from Wellington Harbour, nearly as far as Ewen Bridge.

Prior to the major earthquake which occurred in 1855, Te Awa Kairangi's primary path was on the north-west side of Gear Island in Petone. The significant uplift resulting from the 1855 earthquake altered the slope of the valley, causing Te Awa Kairangi to change course on the valley floor, and increasing its fall to the sea[18].

Originally far deeper, the Hutt Valley has been shallowed by the depositions of gravels and sands that have been carried into it by Te Awa Kairangi and its tributaries, as water rushed down from the vast catchment areas, across the plains to the sea. Material derived in this way has formed the flat area on which Lower Hutt has been built[19].

Te Awa Kairangi displays a pattern typical of most rivers: erosion and transport of sediment in the upper catchment, conveyance through the mid reaches, and deposition in the lower reaches and at the mouth.

Although numerous tributaries flow into Te Awa Kairangi, few of these are natural. Nearly 40 stormwater outfalls discharge into the river between Ewen and Kennedy Good Bridges.

There are five natural streams on the western side of SH2 within the Project area that are being impacted by the Project. These streams are natural tributaries that are culverted under SH2 and the existing stopbanks into Te Awa Kairangi, and are extensively piped within the western hills residential areas above. The locations of the tributary streams are shown in blue on Figure 9 below.

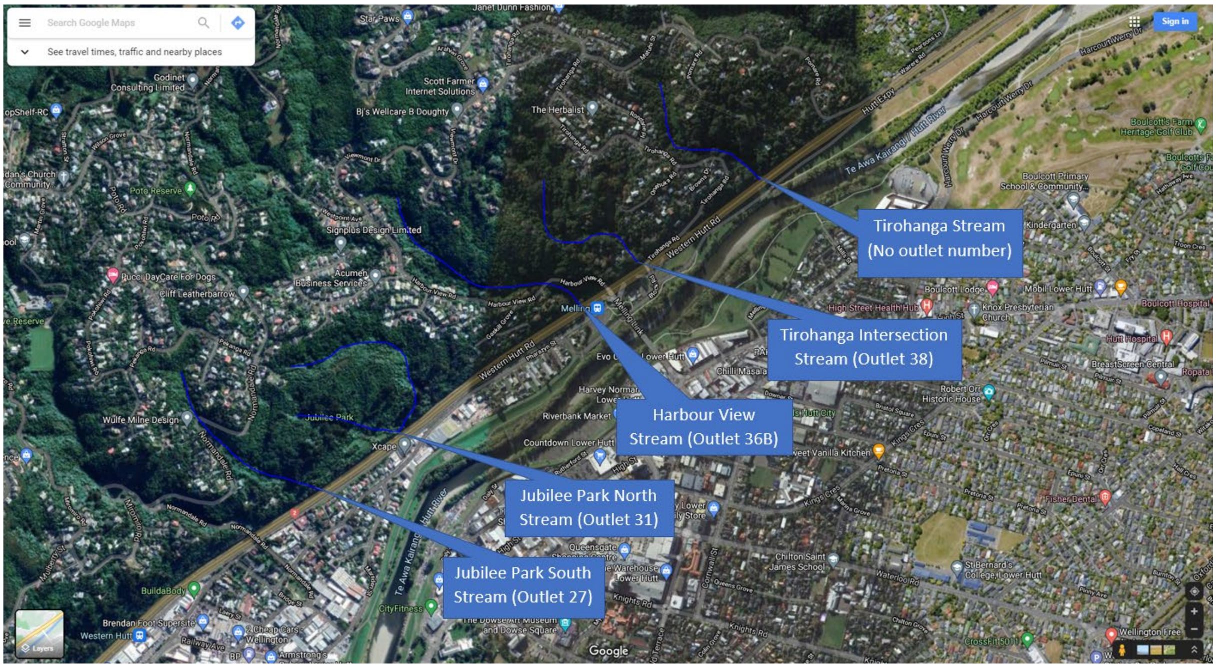


Figure 9 - Tributaries in the Melling area

Water quality

GW has established two relevant long term water quality monitoring sites on Te Awa Kairangi, one at Manor Park 6km upstream of the Project area, and one at Boulcott within the Project area. GW (Heath & Greenfield, 2016) and Aquanet (Stark & Maxted, 2007) have recently undertaken a comprehensive review of the current state and trends of water quality in Te Awa Kairangi; a subset of the relevant water quality data from these reports has been updated in the Freshwater Ecology Assessment (Technical Report #6) to incorporate available data through to May 2019.

The water quality data indicates that water quality upstream of and within the Project area is generally good, showing low to moderate nutrient concentrations and low contaminant levels, with many parameters analysed being below the level of detection. Observed median nutrient values were below relevant attribute and guideline levels; dissolved oxygen, temperature, and

[18] ULDF
[19] ibid

clarity were at a level that would not affect the ecological health of Te Awa Kairangi. Previous GW analysis concluded that both the Boulcott and Manor Park sites had excellent water quality; this is also true of the updated dataset.

The Freshwater Ecology Assessment (Technical Report #6) contains further detail on existing water quality relevant to the Project area.

3.4.3 Management of Te Awa Kairangi

Te Awa Kairangi has a long history of river management by GW (and its predecessors) to achieve flood protection and erosion control. These works are largely authorised by two consents; the GW existing river maintenance resource consent, reference number WGN130264 and consent number WGN110149 for the River mouth extraction. The main aim of the river management work programme is to:

- Establish and maintain Te Awa Kairangi within its design channel alignment as defined in the HRFMP;
- Maintain the flood capacity of the existing channel by removal of obstructions and gravel build-ups as necessary; and
- Maintain the integrity and security of the existing flood defences (including stopbanks and bank protection works).

In addition, the work programme also aims to maintain, or (where possible) improve, the in-river and adjacent riparian environment on a reach-by-reach basis.

These management activities occur from the coastal marine area for the extraction and the upstream side of the Estuary Bridge, Waione Street, Petone to the eastern end of Gillespies Road, Upper Hutt, a reach of approximately 28km, which includes the RiverLink reach.

The existing flood management activities upstream of the estuary are undertaken in accordance with a code of practice and conditions of the existing resource consents. The existing river maintenance resource consents do not authorise the extent of river modification proposed under RiverLink, but they will be relied on for maintenance activities once the RiverLink construction works are completed, in terms of any future channel maintenance requirements.

The existing flood management activities have influenced the existing river environment.

Maintenance of channel alignment

Structures

Channel alignment is maintained using a combination of ‘hard edge’ protection works (e.g. rock rip-rap linings or groynes), ‘soft edge’ protection works (e.g. planted, layered or tethered willows and debris fences), mechanical shaping of the beaches and channel by ‘ripping’ or recontouring, and channel diversion cuts.

Groynes are impermeable structures that project out from the bank edge to deflect the flow of water. Stockpiles of rock/concrete blocks are held adjacent to the river at a number of sites for urgent works during or after a major flood event.

Rock lining consists of rock boulders placed against a section of river bank to form a longitudinal wall that armours and protects the softer bank material behind it from scouring and erosion.

Permeable erosion protection includes the construction of debris fences, permeable groynes, and debris arresters. Debris fences extend from the bank into the river channel and are used to support the creation or re-establishment of a willow buffer zone along the edge of the river channel, to maintain channel alignment. These debris fences are interplanted with willows; once established, the fences and willows trap flood debris, and slow flows and gravel movement. Without debris fences, willows are more vulnerable to flood damage and are less likely to establish. Debris fences have been used in an 800m section near Kennedy Good Bridge.

Mechanical shaping

Beach ripping involves dragging a prong behind a bulldozer to loosen up the upper surface layer, or armour layer, of the beach. Beach ripping is undertaken on dry beaches to loosen the gravels and encourage mobility during future high flows or floods when the beach is inundated. Ripping helps prevent the formation of channel distortions and reduces lateral bank erosion.

Beach recontouring involves more extensive movement and redistribution of the gravels. It is also carried out on the dry bed and is used to streamline and shape a beach to avoid any future obstructions to flow.

Bed recontouring is the mechanical shaping or realignment of a section of the active bed. It is used to establish or maintain a design stream alignment and/or reduce erosion. It may involve moving material from a dry beach into the wet channel and/or moving the material from the wet channel onto a dry beach, to achieve a new channel form. It is used as an alternative to the construction of permanent structures such as groynes or rock lining in the first instance.

Maintenance of channel capacity

Various tools are used to maintain river channel capacity, including beach scalping, removal of vegetation and flood debris, and gravel extraction. Beach scalping involves the mechanical clearance of weeds and grasses from gravel beaches. This is done to reduce flood flow velocities which can encourage gravel aggradation and reduce channel capacity. Large machinery is used to remove the vegetation and loosen the armouring layer.

Removal of vegetation from beaches is done throughout the 28km reach every year on an ‘as required’ basis and usually in conjunction with beach ripping. Unwanted willows or other species including weeds are removed from the channel to minimise the potential for blockages during floods, or to prevent dislodged willows re-growing in the channel.

Removal of flood debris can include removing trees, slip debris, collapsed banks and remains of structures but does not include normal gravel build up. Flood debris blockages reduce channel capacity and can deflect flood flows into banks causing lateral erosion. Flood debris removal is normally undertaken after each significant flood event.

Regular gravel extraction is also undertaken to maintain channel capacity. Gravel bed material is extracted from Te Awa Kairangi to maintain bed levels to a design profile within an envelope of maximum and minimum levels, which corresponds to the approximate riverbed level present in 1998. The aim is to maintain a balance between flood capacity (reduced by higher bed levels) and the threat of undermining bank protection works (increased by lower bed levels). Material is excavated from the beaches where possible, and from the active channel. The existing gravel extraction activity is determined by regular bed level surveys and gravel volume assessments.

3.4.4 Hydrogeology

Te Awa Kairangi plays a significant role in the hydrogeology of the Lower Hutt groundwater basin as it is the main recharge source to the underlying aquifer system. Te Awa Kairangi is listed as a surface drinking water supply under the PNRP, and the northernmost extent of the Project area is subject to a groundwater community drinking water supply protection area, including land adjacent to Kennedy Good Bridge and the Boulcott Farm. The Project area also spans both the Lower Hutt Category A and Category B Groundwater Zones of the PNRP.

Three geological formations are relevant to the Project area: Taita Alluvium overlying Petone Marine Beds and Melling Peat. Underneath these formations are the Waiwhetu Artesian Gravels (aquifer), which is an extensive alluvial gravel layer that sustains a significant proportion (40%) of the annual municipal water supply for the Wellington Region.

The Taita Alluvium, Waiwhetu and Moera aquifers are recharged through Te Awa Kairangi in the upper catchment where the aquifer is unconfined (upstream of Boulcott). The river - groundwater interaction within the shallow Taita Alluvium aquifer is complex, but generally Te

Awa Kairangi loses water (recharges) to the underlined aquifers in the area between Taita Gorge and Boulcott/Kennedy Good Bridge. Between Boulcott and the coastline, the Waiwhetu aquifer is likely confined and the groundwater within the Taita alluvium discharges to the river.

The Hutt Valley – Wellington Harbour alluvial basin is the southernmost and largest of a series of basins that have developed along the south-eastern side of the active Wellington Fault. The Lower Hutt valley is a wedge-shaped, fault bound, sediment-filled basin adjacent to Wellington Harbour. Sediment fill thickness is approximately 350m near the Petone foreshore where the basin is 5km wide, and shallows to close to 0m at Taita Gorge, 12km to the northeast of Petone beyond the Project area where the basin is less than 1km wide.

As outlined above, the Waiwhetu Aquifer is an extensive alluvial gravel layer that provides a significant proportion of the water supply for the Wellington Region. The Taita Alluvium is more laterally extensive across the Hutt Valley and comprises coarse fluvial deposits with moderate to high permeability to form an unconfined aquifer. The Petone Marine deposits also extend across the width of the Hutt Valley but pinch out up-valley where the Taita Alluvium overlies the Waiwhetu Aquifer directly. A 3-dimensional conceptual model of the Lower Hutt groundwater zone is shown in Figure 10. The Taita Alluvium is not labelled, however comprises the uppermost light blue layer that overlies the orange shaded Petone Marine Beds.

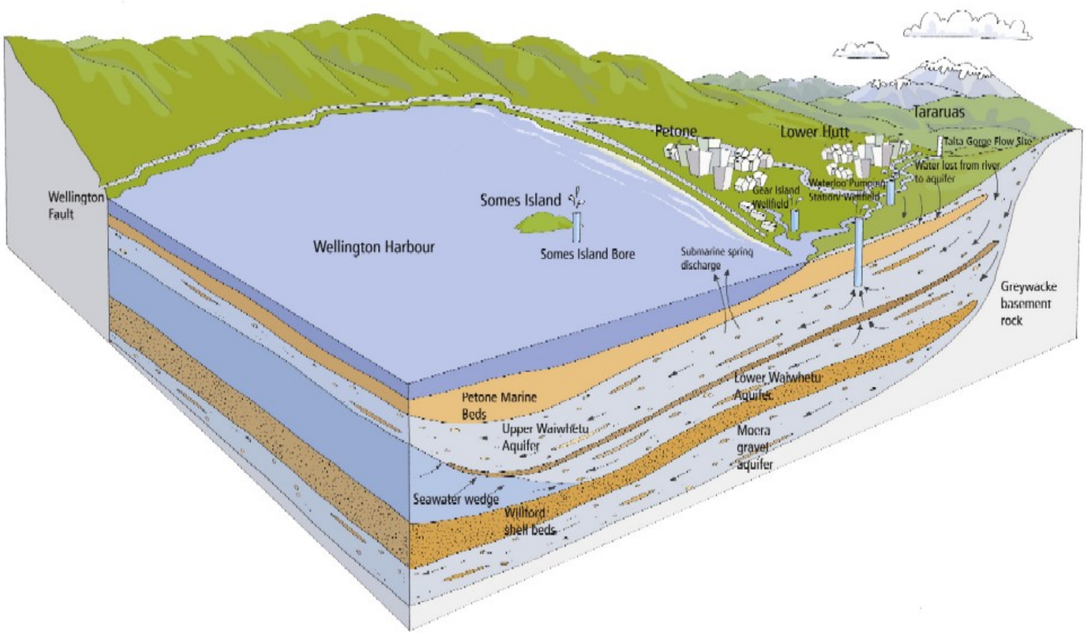


Figure 10 - Conceptual 3D model of the Lower Hutt groundwater zone (Greater Wellington Regional Council, 2021)

As detailed in the hydrogeology assessment, extensive Project specific subsurface investigations, including local in-situ testing and laboratory testing, and groundwater level monitoring have been carried out over a period of two years to gain an understanding local hydrogeology conditions in the Project area. Long and short-term monitoring records indicate that groundwater levels in the Taita Alluvium are influenced by rainfall and the water level of Te Awa Kairangi and fluctuate approximately 1-2m between summer low elevation and winter high elevation. At the Project area, groundwater is likely to be encountered within the Taita Alluvium at relatively shallow depths close to Te Awa Kairangi (i.e. approaching ground level towards the river), and ranging between 0.7m below ground level (bgl) to 2.7m bgl on the TLB, and 1.2m bgl to 2.5m bgl on the TRB. The Waiwhetu Aquifer is influenced by river recharge, groundwater abstraction and tidal pressure effects, therefore it is difficult to assess the natural groundwater level variability of this aquifer.

3.5 Ecology

3.5.1 Freshwater

Te Awa Kairangi

Despite a mixture of pastoral land uses, urban land use, water abstraction and river engineering works, Te Awa Kairangi continues to provide an important habitat for invertebrates and fish.

Freshwater habitats within the Project area of Te Awa Kairangi are generally of high-quality with macroinvertebrate communities indicative of fair to excellent quality. Similarly, the section of lower Te Awa Kairangi (downstream of the Project area) has moderate to high quality habitat although slightly reduced compared to the upstream sections likely due to increased homogenisation of the river habitat and the tidal influence which exists here.

As outlined in the Freshwater Ecology Assessment (Technical Report #6), in total 12 indigenous and one introduced fish species have been recorded within the wider Te Awa Kairangi catchment based on records available on the New Zealand Freshwater Fish Database (NZFFD) and survey results conducted in May 2020. Four 'at risk – declining' species (i.e. longfin eel, bluegill bully, giant bully, and kōaro) were identified as was lamprey a 'nationally – critical' species within the Project area. Likewise, further 'at risk' and threatened species have been identified within the wider catchment. Of these species, some are expected to utilise the Project area as a migratory pathway to upstream habitat. Potential inanga spawning habitat has been identified downstream of the Ewen Bridge. Freshwater habitats within the Project footprint of Te Awa Kairangi are generally of high-quality with macroinvertebrate community's indicative of fair to excellent quality. Similarly, the section of Te Awa Kairangi downstream of RiverLink has moderate to high quality habitat although slightly reduced compared to the upstream sections which is likely attributed to the further homogenisation of the river habitat and tidal influence.

Te Awa Kairangi is listed within Schedule F1 of the PNRP as having significant indigenous ecosystems, due to the following criteria:

- High macroinvertebrate community health (upstream of Te Marua and in specified tributaries)
- Habitat for indigenous threatened / at risk fish species
- Habitat for six or more migratory indigenous fish species, and
- Inanga spawning habitat.

In addition, Te Awa Kairangi is listed as an important trout fishery river and spawning waters in Schedule I of the PNRP.

Tributaries

Numerous tributaries are located on the true right bank of Te Awa Kairangi within the Project area, flowing from the Western Hills. These include streams in the northern portion of the Project area in Belmont, which are not impacted by Project works, and streams in the southern portion of the Project area around Melling, which are impacted by Project works. Streams in the Melling area which flow through the Project from the Western Hills in the west to Te Awa Kairangi in the east are, from north to south, Tirohanga Stream (which is not impacted by Project works), Tirohanga Intersection Stream, Harbour View Stream, Jubilee Park North Stream and Jubilee Park South Stream (which are impacted by Project works to varying degrees). Freshwater habitats within the tributaries are generally of a lower quality compared to the main Te Awa Kairangi channel. The tributaries in the Melling area are indicated at Figure 9. The outlet numbers in this figure correspond to the stormwater outlets identified in the Stormwater and Operational Water Quality Assessment (Technical Report #2). Harbour View Stream is a small hill fed tributary (approximate catchment size is 50 ha) joining Te Awa Kairangi on the true right bank. The stream drains a predominantly mixed secondary broadleaved forested catchment with residential dwellings and roads associated with the adjacent suburb in the immediate catchment. Harbour View Stream currently has two piped sections (120 m and 90 m long) that are limiting the connectivity of aquatic habitats within the stream and to Te Awa Kairangi. No fish were observed in the Harbour View Stream. The piped sections and a perched outlet to the upper culvert is likely impacting on fish movement.

Tirohanga Intersection Stream is a small hill fed intermittent tributary (approximate catchment size is 20 ha) on the true right-hand side of Te Awa Kairangi. The stream drains a predominantly mixed secondary broadleaved forested catchment with residential dwellings and roads associated with the adjacent suburb in the immediate catchment. Two 'not- threatened' indigenous fish (shortfin eel and banded Kōkopu) were identified within the stream. High flows coupled with a perched culvert outlet are likely restricting access for freshwater fauna in and out of the Tirohanga Intersection Stream catchment.

Tirohanga Stream is a small hill fed tributary (approximate catchment size is 20 ha) on the true right-hand side of Te Awa Kairangi. The stream drains a predominantly mixed secondary broadleaved forested catchment with residential dwellings and roads associated with the adjacent suburb in the immediate catchment. No field surveys were undertaken on the Tirohanga Stream, as it is located within privately owned land. However, a desktop assessment determined that it likely has similar values to the other tributaries.

Jubilee Park North Stream and Jubilee Park South Stream are both characterised as having steep upper reaches to the west of the motorway with a good vegetative cover of exotic trees and regenerating native vegetation. The lower reaches of the streams are piped from the motorway to Te Awa Kairangi.

3.5.2 Terrestrial

Vegetation

Vegetation that once covered the floodplain has been cleared over the last 150 years to facilitate the settlements of the Hutt Valley. Prior to clearance, species such as raupo, flax and toetoe dominated the wetlands, and kahikatea, matai, pukatea and rimu forest grew extensively on the valley floor. Only fragments of native vegetation remain within the floodplain. The eastern hill slopes above the river valley were dominated by hard beech forest while the western hills were once covered in tawa, kamahi, podocarp forest interspersed with kohekohe.

Terrestrial links between Te Awa Kairangi and surrounding hills of the lower reaches, and the few vegetated remnants remaining across the valley floor, are largely interrupted by the extent of urbanisation, and the culverting of streams to Te Awa Kairangi – which is strongly evident in the RiverLink Project area.

Eight vegetation/habitat types were identified within the Project Area. As outlined in the Terrestrial Ecology Assessment (Technical Report #7), mown grass is the primary vegetation type across the Project area, comprising the parkland in Te Awa Kairangi river corridor. Interspersed through the maintained grassy areas are patches of native amenity planting and unmaintained areas comprising rough grassland/weed fields. Immediately bordering Te Awa Kairangi are long strips of mature willows, poplars and alders that have been planted to aid flood management.

Outside of the parkland area, there is regenerating native forest and scrub, with some semi-mature nature trees, that occurs immediately adjacent to SH2. In many areas this thin strip is contiguous with larger areas of secondary native forest, however only a small area is included within the Project area itself. Given the proximity of this area to SH2 and residential housing, it is influenced by edge effects including incursions of various exotic plants.

The remainder of the Project area either comprises the largely bare gravel beaches in the bed of Te Awa Kairangi or built-up areas including roads and commercial and residential buildings. These residential areas include a number of garden plantings of limited floristic value, but which have the potential to provide habitat for native fauna such as lizards and common birds. Additionally, although the gravel beaches have limited floristic value, they are classified as high ecological value as they provide important roosting habitat for various coastal and riverine birds.

A constructed wetland exists in the Project footprint; it was built in 2019 by GW on behalf of the Project Partners as part of an initial phase of RiverLink, to test the feasibility of constructed wetlands within the modified river corridor to provide habitat for indigenous flora and fauna, improve stormwater quality and control, and to understand maintenance requirements over different time periods. It has a limited spatial extent, floral diversity and structural complexity. The purpose of the wetland construction is to maintain hydrological regimes by storing and slowly releasing water and filtering runoff a small catchment draining a valley in Belmont. It does not meet the definition of a wetland under the NPSFW, which applies only to a wetland that is not “constructed by artificial means”.

While vegetation along Te Awa Kairangi is predominantly exotic and dominated by willows planted for flood protection (now largely sterile hybrids), the river continues to provide a green corridor between its upper catchment areas and Wellington Harbour. Willows in the corridor provide perching space, as does the debris brought down with Te Awa Kairangi’s floods.

Over the last 15 years GW has planted a large number of native plants in the river corridor. Species such as karamu, flax and toetoe are now present, holding values for food and habitat, and planted areas provide “stepping stones” for some bird species such as tui. GW planting trials have indicated that active planting of indigenous species inside the river corridor is challenging, particularly on the front edge of the active river channel. Most successful establishment of indigenous species on the front edge of Te Awa Kairangi has to date been through natural regeneration, under other vegetation.

Three nationally threatened or at risk plant species have been identified in the Project area in the Terrestrial Ecology Assessment (Technical Report #7): kānuka, mānuka and Northern rātā. These species are listed due to the potential threat of myrtle rust. Two additional threatened species, pohutukawa and king fern are naturalised in the Wellington Region, meaning that they are growing outside of their natural range and are of little conservation concern.

Two areas of Significant Natural Resources (SNRs) have been identified in the District Plan, located directly adjacent to the works footprint of the Project. These areas are located on the lower western hills that border the TRB of Te Awa Kairangi and the Belmont Regional Park and they are identified as Jubilee Park Bush (SNR21) and Harbour View Bush (SNR14).

Notable trees

Ten notable trees are located within the Project area under the District Plan. The details of these notable trees, as noted in the District Plan, are provided at Table 5.

Table 5 - Notable trees within Project area

Notable tree no.	Address	Legal description	Location/description	Common name (Species)	Statement of significance
26	Fraser Street, Hutt Central	Road reserve	Western most and shortest tree. 1st tree from pedestrian crossing on High Street	Phoenix Palm (*Phoenix canariensis*)	80 - 100 years old. Group of palm trees creates a local landmark.
27	Fraser Street, Hutt Central	Road reserve	2nd tree from pedestrian crossing on High Street.	Phoenix Palm (*Phoenix canariensis*)	80 - 100 years old. Group of palm trees creates a local landmark.

Notable tree no.	Address	Legal description	Location/description	Common name (Species)	Statement of significance
28	Fraser Street, Hutt Central	Road reserve	3rd tree from pedestrian crossing on High Street.	Phoenix Palm (*Phoenix canariensis*)	80 - 100 years old. Group of palm trees creates a local landmark.
29	Fraser Street, Hutt Central	Road reserve	Eastern most tree. 4th tree from pedestrian crossing on High Street.	Phoenix Palm (*Phoenix canariensis*)	80 - 100 years old. Group of palm trees creates a local landmark.
31	14 Harbour View Road, Harbour View	Road reserve	Uphill specimen, closest to roadside.	Black Beech (*Fuscospora solandri*, formerly *Nothofagus solandri*)	Mature specimen in overall healthy condition.
32	14 Harbour View Road, Harbour View	Road reserve	Downhill specimen, furthest away from roadside.	Black Beech (*Fuscospora solandri*, formerly *Nothofagus solandri*)	More dominant specimen with good health and foliage cover.
33	Harbour View Road / SH2, Melling	Road reserve	Opposite Melling Railway Station, growing by the stream next to the large Pohutukawa tree.	Silver Fir (*Abies alba*)	Relatively rare specimen, healthy and reasonable form. Around 100 years old.
34	Harbour View Road / SH2, Melling	Road reserve	On the corner of Harbour View Road/ SH2 opposite Melling Railway Station.	Pohutukawa (*Metrosideros excelsa*)	Mature spreading specimen, dominant tree cover in the area. Around 100+ years old.
96	Raroa Road / 338 High Street, Hutt Central	Road reserve	On Council berm. In front of Raroa Road frontage of 338 High Street. Corner tree on High Street and Raroa Road on southern side.	Pohutukawa (*Metrosideros excelsa*)	Mature tree with good form. Around 80 years old.
110	73 Rutherford Street, Hutt Central	Road Reserve / LOT 2 DP 50907	Partly on Council berm / partly on private property.	English Elm (*Ulmus procera*)	Local landmark due to its height. Well over 100 years old.

The stand of four Phoenix Palms (notable trees #26, 27, 28 and 29) located on Fraser Street are shown in Figure 11.

Figure 11 - Notable trees #26, 27, 28 and 29 (source: Google Maps)

The two Black Beech trees (notable trees #31 and 32) located on Harbour View Road are shown in Figure 12.

Figure 12 - Notable trees #31 and 32 (source: Google Maps)

The Silver Fir and Pohutakawa trees (notable trees #33 and 34 respectively) located on SH2 opposite the existing Melling Station are shown in Figure 13.

Figure 13 - Notable trees #33 and 34 (source: Google Maps)

The four Pohutakawa trees (notable trees #91, 92, 96 and 97) located on Raroa Road are shown in Figure 14. Note that the other Pohutakawa trees on Raroa Road are also notable trees, however these are located outside the Project area.

Figure 14 - Notable tree #96 – foremost tree on the left (source: Google Maps)

The English Elm tree (notable tree #110) located on Rutherford Street is shown in Figure 15.

Figure 15 - Notable tree #110 (source: Google Maps)

Invertebrates

Eight species of native lizard are known to occur within approximately 5km of the Project area.

No native lizard species were recorded from a comprehensive survey throughout potential habitats within the River corridor. However, Northern grass skinks were located within the ‘mixed broadleaved forest and scrub’ adjacent to SH2. Survey work in these areas detected grass skinks in vegetation edges at Harbour View Road and along the south-eastern side of Tirohanga Road.

Other species such as Raukawa gecko, copper skink, ornate skink, ngahere gecko and barking gecko have been recorded in adjacent habitats and therefore it is likely that, despite not being detected during survey work, some of these species may be present within the Project area also.

In addition to lizards, one species of snail (*Wainuia urnula urnula*) was observed within the Project area, along the riparian margin of Te Awa Kairangi.

Birds

Riverine/coastal birds

Notable birds observed within the Project area during previously undertaken surveys were black shag, little shag, pied stilt and red-billed gull. Additional At Risk species identified during field surveys within the site were pied shag, New Zealand dabchick and New Zealand pipit.

A particular site of value for native birds identified from previous surveys is a roosting/nesting area for black shags located approximately 400m upstream of the current Melling Bridge. McArthur et al. (2015) also observed black shag nesting in the macrocarpa north of Melling Intersection in 2012 and 2015. Seven active nests were observed in October 2012 and two non-active nests in in January 2015.

Approximately 1 km downstream of the southern extent of the Project area (downstream of the Ava Railway Bridge), there is a large gravel island that is exposed at low tide. This island is a roost site for multiple Threatened or At Risk shorebirds including royal spoonbills, black shags, little black shags, pied shags, variable oystercatchers, pied stilts and Caspian terns. Further downstream, just over 2 km from the Project area, the estuary at the mouth of Te Awa Kairangi also supports Threatened and At Risk bird species including red-billed gull, variable oystercatcher, black shag and pied shag. All of these species have either been observed in the Project area, or are likely to roost, forage, and disperse through the Project area at least on occasion.

Forest birds

Studies undertaken on behalf of GW and Upper Hutt City Council have identified a number of threatened and at risk forest birds in the regenerating native forest patches in vicinity of the Project area, but not within the Project area itself. Whitehead (At Risk - Declining) are commonly observed in the forested areas of the Hutt Valley. New Zealand falcon (At Risk - Recovering) are also resident in the wider area. Less commonly observed species include kakariki (red-crowned parakeet), rifleman, long-tailed cuckoo and North Island kākā. The small, modified and degraded condition of the parkland surrounding the river corridor in the Project area suggests it is unlikely to be a core habitat for whitehead or any of the other aforementioned forest birds. These birds may however move across the Project area on occasion when moving between the forested hill slopes that bound the east and the west of the Hutt Valley.

3.6 Transport

Transport patterns through Lower Hutt are strongly influenced by landform and by Te Awa Kairangi. Today the main arterial routes connecting Lower Hutt to the north and south, SH2 and the Melling rail line, travel along the base of the Belmont hills – confined between the escarpment landform and Te Awa Kairangi.

Te Awa Kairangi provides a strong natural element separating these main transport routes from development on the Lower Hutt valley floor – being the city centre and its residential communities. Connections from SH2 across Te Awa Kairangi to Lower Hutt city are provided via the Melling and Kennedy Good Bridges (inside the Project area). The Melling Bridge gives access to the northern edge of the city centre; Kennedy Good Bridge provides access to residential areas north of the city, being Avalon and Boulcott. At the south end of the RiverLink area Ewen Bridge provides a third entrance over Te Awa Kairangi into Lower Hutt city centre, from Alicetown/Petone. Ewen Bridge is not directly connected to SH2.

3.6.1 Road

The roads within the Project area include a mix of state highway, primary arterials, secondary arterials, collector roads and local roads.

SH2 is the only direct road that links the Wellington region with Lower Hutt, and is the main road linking Lower Hutt with Upper Hutt and the Wairarapa region. SH2 is classified as a National Road. Within the Project area, SH2 has a posted speed limit of 100km/h and two lanes of traffic in each direction. At key intersections, such as Melling Link, SH2 provides additional lanes for turning to facilitate access to Lower Hutt city centre.

The SH2 intersection at Melling Bridge is at-grade, causing congestion, access and safety problems. At this intersection, Harbour View Road connects across SH2, providing access from the Western Hills into the Lower Hutt city centre.

The annual average daily traffic (AADT) volume of main roads within the Project area as of 2018 (collected 2013 to 2017) is outlined at Table 6.

Table 6 - AADT volume of main roads in Project area

Road	AADT
SH2 south of Melling	37,520
SH2 north of Melling	31,715
Melling Link	22,376
Ewen Bridge	32,180
Pharazyn Street	5,995
Marsden Street	7,745
Rutherford Street adjacent to #41	16,654
High Street adjacent to #339	12,660
Queens Drive adjacent to #134	12,680
Daly Street north	6,035
Daly Street south	6,940
Dudley Street	6,055

3.6.2 Public transport

The Melling rail line provides Lower Hutt communities with a public transport link into Wellington City. The line stops at the Melling Bridge – where 187 carparks provide a "park-and-ride" facility. Melling Bridge provides a pedestrian connection between the rail line and the Lower Hutt city centre. Further parking is provided at the Riverbank Car Park, on the east side of the river.

There are 13 scheduled bus services that travel to the Lower Hutt city centre. The bus routes utilise Queens Drive and Bunny Street as access routes to Queensgate Mall, which is a key destination within the local area. These services provide connectivity throughout the Hutt Valley and within the wider Wellington region.

3.6.3 Active transport

Within the city itself, walking is a primary mode for access to workplaces, shops, cafes and public amenities including various transport modes. Formal and informal paths for walking and cycling extend north-south along both banks of Te Awa Kairangi, including the Hutt River Trail, which runs approximately 29km between Petone in the south and Upper Hutt in the north.

Footpaths are provided on both sides of Melling and Ewen Bridges to facilitate pedestrian access across Te Awa Kairangi.

3.7 Built environment

3.7.1 Settlement patterns

In broad terms, the predominant existing settlement pattern around the Project area is one of dense urban development to the east and south of Te Awa Kairangi, and berm areas bounded by arterial transport routes to the west. This pattern is broken just north of Alicetown on the true right bank of Te Awa Kairangi, where urban development extends north of Ewen Bridge. In this area, development becomes increasingly confined between the river corridor and SH2/Melling line – until it reaches and stops at Melling Bridge.

The area of mixed residential/industrial/commercial development to the west between Ewen and Melling Bridges has been GW's focus for land acquisition, as a method of providing the levels of flood protection agreed with the community in the 2001 HRFMP. While 90 properties in this area have been purchased by GW for the Project, residential properties and industrial uses remain in this area, as properties are currently leased or tenanted.

To the east of Te Awa Kairangi, dense urban patterning extends up to the stopbank edge – comprising the Lower Hutt city centre; residential areas to the north of the city at Boulcott; and predominantly residential development south of Ewen Bridge (at Alicetown and Woburn). Despite Te Awa Kairangi providing a strong 'edge' to the city, development in Lower Hutt city consistently turns its back on the river.

3.7.2 Land use and built form

Lower Hutt city centre

Land use on the eastern side of Te Awa Kairangi within the Project area is characterised by activities expected of a central commercial area, including retail and commercial activities, office uses, bars and restaurants and medium density residential.

The uses and built form located along Daly Street closest to Te Awa Kairangi are described at Table 7, from south-west to north-east.

Table 7 - Built form and uses on Daly Street facing Te Awa Kairangi

Address	Built form (as viewed from Daly Street)	Use/tenant
69-99 High Street	Rear of a two-storey commercial building, including back of house servicing of tenants	Unichem Pharmacy Bottle-O Fix Federation (Bakery), Fish Market, The Mad Butcher, House of Spices
4 Daly Street	Two storey commercial building, including car parking facing Daly Street	Vibe (youth services) on ground floor and call centre on first floor
5 Daly Street	Two storey commercial building, with driveway/carpark to the east	"Millies House" nursery/pre school
21/23 Andrews Avenue	Five storey commercial building	Hot yoga, TBI Health among others
6 Daly Street	Part single, part two storey commercial building	Vacant, historically used as a bar
7 Daly Street	Two storey commercial building, including car parking	ProClima
10 Daly Street	Two storey commercial building	Ivy wedding and conference centre
12 Daly Street	Vacant lot – hardstand	Car parking
15 Daly Street	Six storey commercial building	Hutt Valley Chamber of Commerce, UDC among others

The uses and built form located in the vicinity of the intersection of Rutherford Street and Queens Drive are described at Table 8.

Table 8 - Built form and uses near the intersection of Rutherford Street and Queens Drive

Address	Built form	Use/tenant
46 Rutherford Street	Single storey commercial building and hardstand carpark	Dulux
49 Rutherford Street	Two storey commercial building	Brockelsby Roofing Products
144 Queens Drive	Single storey commercial building	Wishart Appliances
317 High Street	Two storey commercial building	Work and Income NZ
51 Rutherford Street	Single storey commercial building	Hot Spring Spa Pools
295 High Street	Mostly hardstand with a small office	Palmer car yard
53 Rutherford Street	Single storey commercial building	PetVet
28 Rutherford Street	Three storey commercial building including ground floor carparking	Harvey Norman

Marsden Street

The south-western extent of the Project area, adjacent to Ewen Bridge, is characterised by industrial activities, incorporating two storey commercial buildings with hardstand areas fronting onto Marsden Street. Further north, on the eastern side of Marsden Street there is a row of single storey residential dwellings.

Pharazyn Street

The northern section of Pharazyn Street is characterised by low density residential uses, incorporating single and two storey residential dwellings, as well as a number of two storey buildings housing residential units. Multiple childcare centres operate in this northern section of Pharazyn Street. Industrial uses are present in the southern section of Pharazyn Street, characterised by single and two storey commercial buildings with some areas of hardstand.

Melling

The existing Melling Station is a small single storey building housing a coffee shop and selling train tickets. A skate park is located on the eastern side of Melling Link.

Te Awa Kairangi

Areas of land within and adjacent to Te Awa Kairangi are zoned river recreation and are characterised by open space areas. Hard paved car park areas are present on the eastern side of the river between the Lower Hutt city centre and Te Awa Kairangi.

3.7.3 Contaminated land

A Contaminated Land Assessment (Technical Report No.13) has been prepared in support of the RiverLink Project. The assessment has identified the following 18 properties that present a moderate to high risk of existing contamination:

- 22A Mills (PT Lot 1 DP 65603)
- Portion of 0 Mill Street (Lot 3 DP 3286)
- 58 Mills Street (Lot 2 DP 87322 1/10 SH Lot 6 DP 3286 OUTSIDE STOP BANK)
- 5 Daly Street (LOT 6 DP 12645)
- 58 Pharazyn Street (Units 1-3 DP 71813 ON LOT 1 DP 5878431)
- 60-62 Pharazyn Street (LOT 2 DP 90483)
- 68 Pharazyn Street (PT Lot 1 DP 16593)
- 72 Pharazyn Street (Part Lot 1 DP 16593)
- 49 Rutherford Street (PT Lot 4 DP 20998)
- 69-95 High Street (PT Lot 1 DP 64789, Lots 1 and 2 DP 17049, Lots 1-3 DP 19893 and Section 1 SO 38172)
- 31 Marsden Street (Lot 3 DP 87282)
- 33 Marsden Street (PT Lot 3 Deeds Plan 270)
- 59 Marsden Street (LOT 2 DP 471637)
- Adjacent to 40 Marsden Street (PT SEC 24 Hutt DIST)
- Adjacent to 69-95 High Street (PT LOT Lot 1 DP 64789, Lots 1 and 2 DP 17049, Lots 1-3 DP 19893 and Section 1 SO 38172)
- At Daly Street and Andrews Avenue intersection
- 28 Bridge Street (Lot 2 DP 87282)
- 1-100 Hutt River (PT ASS 16081/999 SOUTH BLOCK)

In summary, there have been a number of historic and current Hazardous Activities Industries List (HAIL) activities undertaken across the Project area that have the potential to have resulted in soil and possibly groundwater contamination. Activities include horticulture, motor vehicle workshops, timber treatment and storage, concrete manufacturing sites, asphalt and bitumen plants and the storage, use and disposal of fuels and other associated substances. In addition, it is likely that lead-based paint and asbestos have been used in the construction of a number of buildings and structures across the Project area that may have resulted in soil contamination in land around the buildings and structures.

3.7.4 Infrastructure and utilities

A number of regionally and/or nationally significant utilities are located within and surrounding the Project area, including transmission and distribution networks for electricity, water supply, wastewater, road and rail.

Transpower assets

An existing Transpower substation and associated electricity distribution assets are located immediately east of the Project area near Connolly Street. Power lines from this substation cross Te Awa Kairangi in this location.

Stormwater infrastructure

As outlined in the Stormwater and Operational Water Quality Assessment (Technical Report #2), drainage from the hills west of SH2 is via a number of streams running down to culverts which transport flows under SH2, rail corridor and urban area to discharge to Te Awa Kairangi. These culverts vary in size up to 1800 mm and are gravity lines, with flows surcharging to allow discharge to Te Awa Kairangi during periods of high flows within the river. The catchment on the flat between the Western Hills and Te Awa Kairangi consists of highway and rail corridor along with urban and commercial areas. Stormwater flows from these areas discharge to Te Awa Kairangi either via gravity systems where levels permit this, or via pumped systems. The catchment east of Te Awa Kairangi is a mixture of urban and commercial areas that discharge stormwater to Te Awa Kairangi via gravity where levels permit this, or via pumped systems. No treatment of stormwater discharges from either side of the river is currently provided.

There is an existing stormwater pump station at the intersection of Bridge Street and Marsden Street.

Wastewater infrastructure

There are existing local wastewater services located at the end of Mills Street, at the southern end of High Street, and at the middle section of Marsden Street which are within the proposed stopbank footprint so require relocation.

The Western Hills Main Sewer is a 675-900 mm trunk wastewater main which runs through the Project area on the western side of Te Awa Kairangi. It drains wastewater from the Western Hills suburbs and Upper Hutt. At the northern end of the Project area, it runs along the western side of SH2. It crosses the highway upstream of the existing Melling Bridge and then runs along the western river berm, partially under the existing stopbank.

Water supply infrastructure

There are local water supply services at the end of Mills Street, in Daly Street between Margaret Street and Andrews Avenue, at the southern end of High Street, and at the middle section of Marsden Street that are within the area of the Project works.

There is a 450mm polyethylene run-to-waste pipe (associated with water supply bores) that runs under Queens Drive and discharges to Te Awa Kairangi near the proposed Melling Bridge.

An existing ring main (one of three major transmission ring mains in Lower Hutt) is located within the Project area. It is constructed of a combination of concrete-lined steel and cast iron. The ring main crosses Melling Bridge, runs down Pharazyn Street, crosses Ewen Bridge and runs up High Street.

Telecommunications lines

There are a number of telecommunications lines within the Project area, including at Pharazyn Street, Marsden Street, Melling Bridge and Daly Street, this includes a cabinet by the cemetery on Marsden Street.

Powerco gas infrastructure

Powerco operates a number of buried gas pipes in the Project area, including major mains that cross the river at Melling Bridge, mains on Marsden Street and Daly Street, and service outlets at Pharazyn Street.

Electricity lines

A number of key services run across Melling Bridge, including the strategic Melling to Petone 33kV cables. Four substations are located within the Project area: at the intersection of Daly Street and Andrews Avenue, at the intersection of Rutherford Street and Queens Drive, adjacent to Melling Station, and at the intersection of Marsden Street and Bridge Street.

Land Information New Zealand

There is one important survey mark (CP 5 SO 35431 (BDNN)) within the Project area, which is routinely surveyed as part of the Land Deformation Monitoring Network. There are also a number of other survey points and survey marks within the Project area.

3.7.5 River recreation use

The Project area includes the highly popular Hutt River Trail. This Trail runs alongside Te Awa Kairangi from Petone's Hikoikoi Reserve to the Te Marua entrance of Kaitoke Regional Park Upper Hutt. The Trail runs the entire length of the eastern riverbank (29km) and is popular for recreational use, for the easy, scenic walk and cycle path is provides, as well as for commuting by bicycle within the Hutt Valley. Within the Project area the Trail follows the top of the stopbanks, where it is sealed, as well as on berms as an un-sealed track. The Trail (shown in blue in Figure 16 below is connected to the wider network of Lower Hutt cycle paths.

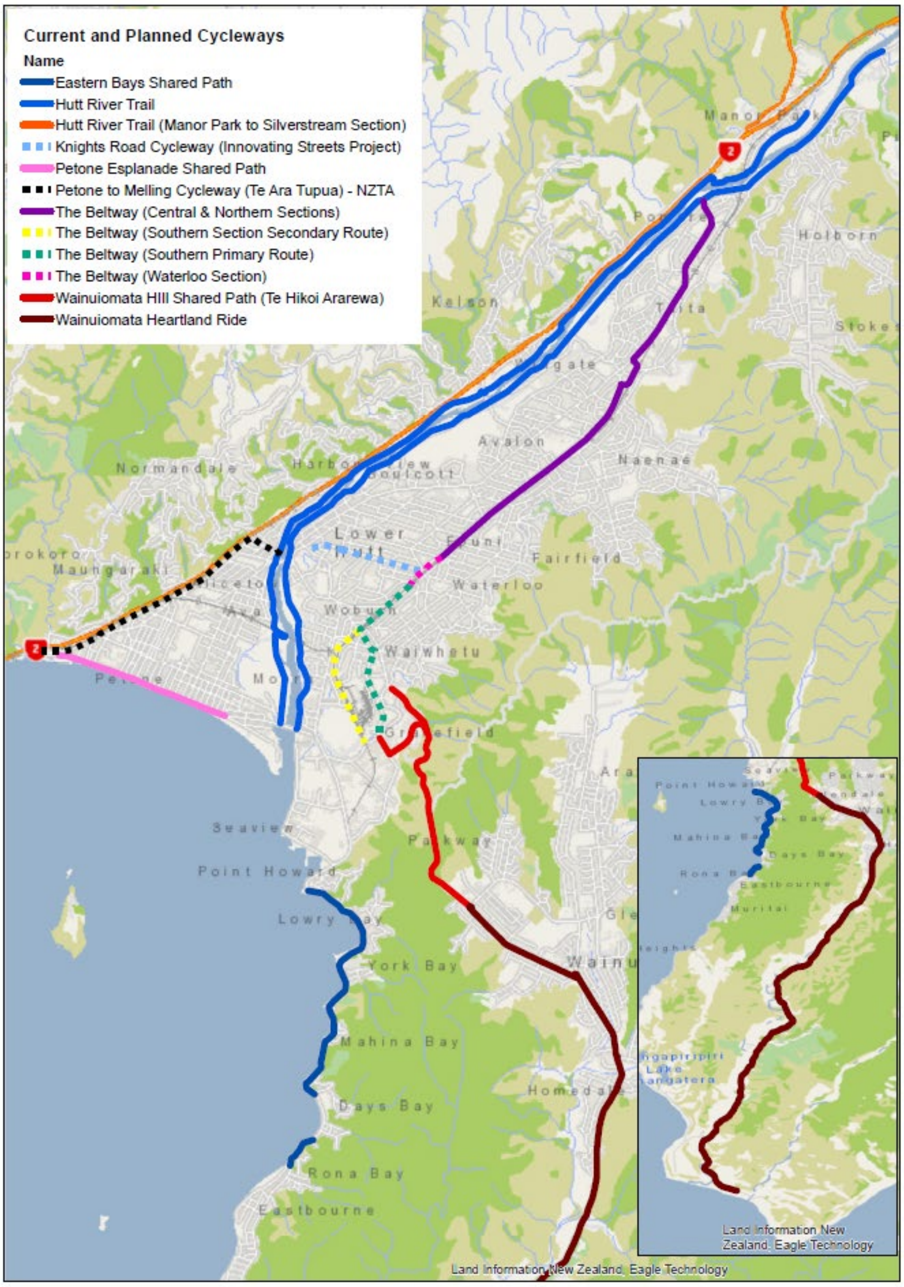


Figure 16 - Lower Hutt cycle path network

Te Awa Kairangi is also popular for its gravel beaches - which provide direct access to the water, and the recreational activities in the river such as swimming, fishing and kayaking. There are also recreational uses in parts of the existing sealed car parks on berms. For example, there are more formalised recreation facilities providing for activities like basketball. The riverside trails and car park is also used for organised leisure activities such as running and fitness groups including the Lower Hutt weekly 'Park Run'.

Te Awa Kairangi is listed in the following schedules of the PNRP:

- Schedule H1 as being a significant contact recreation freshwater body, and
- Schedule H2 as having a priority for the improvement of water quality for primary contact.

3.7.6 Social and economic

As outlined in the Economics Assessment (Technical Report No.18), Lower Hutt's population has had an average annual growth rate of 0.6% between 2006 and 2018, with a population increase of 6,831 people in this time. Lower Hutt was estimated to have a total population of 104,532 persons at the 2018 census. Population forecasts indicate continued growth. The high and medium growth population growth scenarios indicate the potential for the population to increase to 124,600 persons by 2043. Between 2000 and 2020 the total number of businesses has increased. However, the total number of workers fluctuated from a high of 10,600 workers in 2008 to a low of 9,000 workers in 2018.

Anecdotal observations indicate that residential area infill development has increased recently, following the residential and suburban mixed use plan change (Plan Change 43 to the District Plan) and the implementation of the National Policy Statement for Urban Development (NPSUD) requirement to remove minimum onsite car parking standards for residential development in certain urban locations, including for Lower Hutt.

The Economics Assessment (Technical Report #18) details that in 2018, the method of travel to work by people within and adjacent to the Project area was divided into 56.3% private vehicles, 26% public transport, 8.5% walked or jogged, and 8.6% worked from home. According to the 2018 census, which received 54,900 responses within the Hutt City area, 57.3% of residents worked and travelled within the Hutt City area, and 28.6% worked and travelled outside the Hutt City area.

With Lower Hutt forecast[20] to experience a decline in demand for traditional industrial land uses in the longer term, there is a need for a transition to other uses within the central city in particular to avoid a declining centre. The land uses where growth opportunity is forecasted includes residential and alternative employment and economic activities such as government, retail, health, education and training. Without this land use transition, the Lower Hutt central city is expected to decline.

There are currently very low levels of inner city living in Lower Hutt city centre. Day to day activities in Lower Hutt city centre are centred on work and commerce – with main areas of activity being on High Street, Queen Street, and around the central civic area – with the council buildings, the courthouse and the Dowse Art Museum forming a strong core to the central area, in association with the civic gardens. The river front is occupied at present by office and large format retail, and car-parking. On weekends the Riverbank carpark comes to life - transforming into the Riverbank Market.

3.7.7 Built heritage and archaeology

An Archaeology and Heritage Assessment has been undertaken for RiverLink (Technical Report #12). The existing heritage and archaeology values are summarised from this report below:

---

[20] Housing and Business Development Capacity Assessment, prepared by HCC, 2019

Kennedy Good Bridge to Boulcott

A number of heritage and archaeological sites are located in the vicinity of this area, including Motutawa Pā, Boulcott's Farm & Stockade, and Fry's Farm. However, none of these sites are within the Project area itself.

Boulcott Street area to Connolly Street

The former site of Maraenuku Pāwas in the vicinity of the present Connolly Street Transpower substation. This pā was constructed during the early 1840s in response to disputes over settler land acquisitions and burnt down in 1847. No physical evidence of the pā has been noted in the general vicinity, and it is likely that it has been largely if not completely destroyed by subsequent development of the river banks and bed, as well as the substation.

Melling Bridge to Daly Street area

There is no evidence of archaeological or heritage sites in the Melling Bridge to Daly Street area, since development appears to have occurred post 1900.

Daly Street area to Ewen Bridge

The following items of heritage significance are known to have been located in the area of Daly Street to Ewen Bridge, however, there only remains a low-moderate potential for in-ground evidence of these structures. There are no visible signs of these structures above ground.

- Foundations of former bridges across Te Awa Kairangi (bridges are known to have been constructed/upgraded in 1844, 1847, 1856, 1872, 1902 and 1929 before the current Ewen Bridge was constructed in 1996).
- Fort Richmond, which was constructed in 1845 in response to conflicts between would-be settlers and local Māori over disputed land purchases. An 1863 survey suggests this structure would have been situated mostly within what is now riverbed.
- Foundations of early settlement structures that grew up around the first Te Awa Kairangi bridges on the true left bank, including Whitewood's Hotel.

Roadways and lots from Railway Avenue to end of Marsden Street

This area includes the western approaches to the 1872 and 1902 Hutt River Bridges as well as part of the (former) Wesleyan Methodist Cemetery on Bridge Street. A number of early buildings (since demolished) are also noted in the area north-west of the stopbank along Marsden Street, including the former police station and Edward V Briscoe properties.

The Wesleyan Methodist Cemetery was established at least by 1850. Bridge Street was widened in 1908 and encroached on part of the cemetery. There is the potential for in-ground evidence remaining in the Bridge Street road reserve adjacent to the cemetery.

Existing Melling Station

The existing Melling Station building, while not formally identified as a heritage building in either the District Plan or by Heritage New Zealand Pouhere Taonga (HNZPT), has been assessed as having heritage significance as part of this AEE. It was constructed in 1953.

Lochaber House

The Project area includes the peripheral area of an historic property located above and opposite Melling Station, at 125 Western Hutt Road (SH2), known as Lochaber House. Lochaber House was constructed in 1899-1900.

Casa Loma

Casa Loma is a historic house located at 760 Western Hutt Road on the periphery of the Project area. It was constructed in 1911.

4. Project description

Overview

The Project encompasses flood protection works within and around Te Awa Kairangi, transport infrastructure reconfiguration and urban revitalisation works. The flood protection works will upgrade the stopbanks on either side of Te Awa Kairangi and re-align, deepen and widen the river channel. The transport infrastructure upgrades include the realignment of SH2 and a new grade-separated interchange at Melling, a new Melling Bridge, the creation of an active mode transport bridge and relocation of rail infrastructure. The urban revitalisation works will realign the Lower Hutt city centre with Te Awa Kairangi, with public spaces and upgrades to local roads.

This chapter provides an overview and detail about the works that will be undertaken as components of the RiverLink Project.

4.1 Introduction

The Project is the design, construction, operation and maintenance of RiverLink. Key components of the Project are as follows:

- Upgrade and raising of existing and construction of new stopbanks on both sides of Te Awa Kairangi between Ewen Bridge and Mills Street
- Instream works between the Kennedy Good and Ewen Bridges to re-align, deepen and widen the active river channel
- The replacement of the two signalised at-grade intersections of SH2/Harbour View Road/Melling Link and SH2/Tirohanga Road with a new grade separated interchange
- Construction of an approximately 215 m long and up to 7 span road bridge with a direct connection across Te Awa Kairangi from the new interchange to Queens Drive
- Removal of the existing Melling Bridge
- Changes to local roads
- Changes to the Melling Line rail network and supporting infrastructure, including relocation or reconstruction of the Melling Station
- Construction of an approximately 177 m long and 4 span pedestrian/cycle bridge over Te Awa Kairangi
- Construction of a promenade located along the stopbank connecting with future development, running between Margaret Street and High Street. This includes new steps and ramps to facilitate access between the city centre and the promenade.
- Integration of infrastructure works with existing or future mixed-use development
- Associated works including construction and installation of culverts, stormwater management systems, signage (including signage for health and safety, recognition of cultural sites, interpretation and wayfinding), lighting, network utility relocations, landscape and street furniture, pedestrian/cycle connections and landscaping within the Project area.

Project features and associated construction works are described in further detail below. The works are guided by the ULDF, which sets out the RiverLink vision and the urban and landscape design concepts that will guide the design development of the Project, so RiverLink can be integrated into the landscape and urban environment.

Any numbers, area or dimensions outlined in this section are approximate and may change because of detailed design. The final design of the Project (including the design and location of components such as stormwater pump stations or treatment devices) will be refined and confirmed at detailed design stage.

4.2 River works

The Project requires full reshaping of the riverbed and channel shape to establish a new natural meander pattern suitable for a widened channel. The re-shaping requires the removal of gravel and vegetation from the river channel and berms (between the two existing stopbanks) between Kennedy Good and Ewen Bridges. As described in more detail in the Geomorphology Report (Technical Report #5), the overall purpose of the river works is to:

a) Increase the standard of flood protection along the Project length between Kennedy-Good and Ewen Bridges; and

b) Achieve a better balance between the natural behaviour of the river and the measures used to manage the river to reduce the degree of maintenance interventions required to maintain Te Awa Kairangi. In particular, the Project aims to contain the amount of sediment deposition (which requires regular maintenance and removal) to the upper reach of the Project and minimise the sediment maintenance requirements in the lower reach. The reach locations are shown below in Figure 17.

The river-works are illustrated on the Stopbank Layout and River Works Plans A16-4831-SB151-158, River Cross Sections A16-4831-SB400-433 and the Schematic Landscape Plans A16-4831-L201-L208.

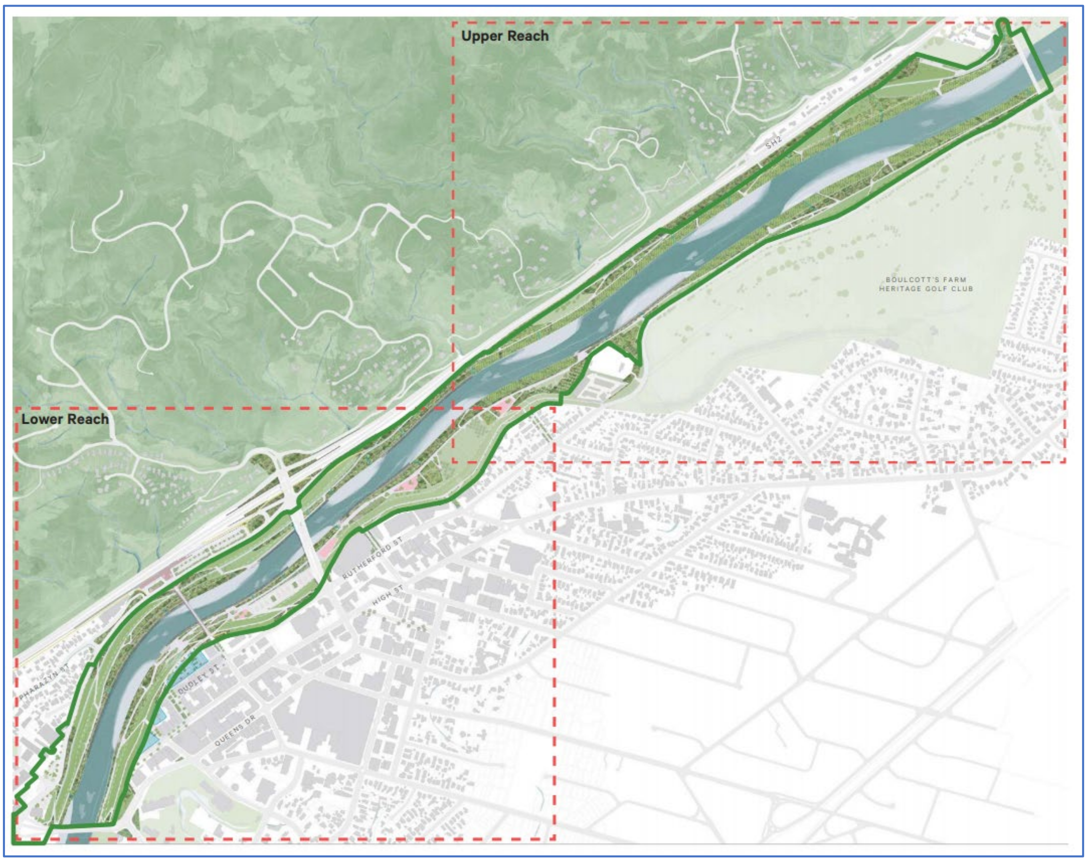


Figure 17 - Upper and lower reaches of the Project

The anticipated approximate bed and berm disturbance volumes for the stopbank and river channel works are provided in Table 9 below. Refer to the Stopbank Overall Layout Plan SB1410-141 for the cross section (xs) locations referenced in the table below.

Table 9 - Total cut and fill requirements across both the upper and lower reach for the stopbanks, berms, and channel work

	Cut (m^3)	Fill (m^3)
Stopbank - TLB	57,400	148,100
Stopbank - TRB	56,200	58,200
Left Berm - xs 320 to xs 500	36,000	35,000
Right Berm - xs 320 to xs 500	80,000	3,000
Left Berm – xs 500+	55,000	17,000
Right Berm – xs 500+	99,000	18,000
Main Channel Bed - xs 320 to xs 500	127,000	12,000
Main Channel Bed - xs 500+	126,000	31,000
TOTAL	636,600	322,300

Approximately 314,300 m^3 of bed and berm material will be surplus to the river and stopbank works (i.e. the difference between the above cut and fill total). An estimated 50,000 m^3 is considered to be unsuitable material and will be disposed of as part of landscape and site contouring, and/or disposed of offsite. Approximately 264,300 m^3 of material is estimated as being available for use in the Melling interchange, rail station and local road earthworks, as summarised in Table 11 below.

4.2.1 Lower reach

In the lower reach, the new river corridor between the stopbanks will consist of a 70 m wide active channel with a 10 m wide lower bench on each side, giving a channel width of 90 m, plus an upper berm of at least 25 m on each side. The minimum width of the river corridor will be approximately 120 m at Ewen Bridge and 140 m at the new Melling road bridge. The channel will be deepened to 1998 levels. Rock linings will be placed along the outer (deep pool) side of the bends of the meandering active channel, from below bed levels to the level of the lower bench. These will alternate with vegetated lower berms consistently throughout the lower reach to deliver increased flood protection. There will be five new areas of rock lining installed, ranging in length from approximately 180 m to 600 m.

Additional rock works will be added to the rock linings and at the edges of the inner side bars (gravel beaches) for aquatic habitat purposes. The lower bench will provide access to the channel edge and rock works for maintenance purposes. The lower berms will be widened and planted with either natives, willows or a combination of both, as shown in the Schematic Landscape Plans A16-4831-L201-208, the Stopbank Layout and River Works Plans A16-4831-SB151-158, and River Cross Sections A16-4831-SB400-433

Differences to the existing river channel environment

The overall area of the riverbed will increase from 100,000 m^2 to 138,000 m^2 in the lower reach as the river will be widened a small amount in some locations (typically by 5 – 10 m) to achieve a consistent 70 m wide river channel. Additional area will also be created through lateral shifting of the overall river channel location by up to 30m. This is to achieve adequate berm size on both sides of river channel to provide security from erosion for the new stopbanks. Five in-river pools will be retained but will be relocated to suit the new river meander pattern as shown on the Stopbank Plans and River Works drawing SB151-158.

4.2.2 Upper Reach

In the upper reach, the active channel will widen from 70 to 100 m in width, with a 30m berm width provided on each side of the river. The lower berm will be lowered, widened, and planted with a combination of willows and native plants to act as a buffer to river currents. Debris fences will be installed while the buffer vegetation is establishing (in place for approximately 5 years). These debris fences are proposed to be constructed of biodegradable materials, being untreated wooden poles and natural fibre rope, and are proposed to be placed as single 20m long fences across the berm, at 30m intervals. A rock lining will be installed on the true left bank in front of the existing Transpower substation, and where Harcourt Werry Drive comes close to the river. The total amount of rock to be placed across both the upper and lower reaches will be approximately 55,000 tonnes.

On both banks of the upper reach 'bioengineering' planting is proposed to address both the flood protection needs of this section of the river, and to satisfy an opportunity for cultural and ecological mitigation. There will be willows planted to extend 20 m from the bank edge with native tree species to be inter-planted in blocks of a minimum width of 5-15 m wide at 60-120 m intervals, all underplanted with native riparian shrub and groundcover species. Over time, a designed transition from willows to a mixture of native plants will occur through the removal of willows once native species have established.

Differences to the existing river channel environment

In the upper reach, the overall area of the riverbed will be increased from 123,000 m^2 to 163,000 m^2 as the channel will be widened by up to 25 m to allow a more natural channel movement. The number of in-river pools will reduce from six to five, but the depth and area of the pools will increase. Of importance to the future maintenance requirements of the river is the likely increase in sediment deposition that will occur in this upper reach because of the changes to the configuration of the river. With regular extraction undertaken, the changes to the upper reach will reduce the amount of sediment being transported into the lower reach and further downstream.

4.2.3 Stopbanks

The new stopbanks are shown on the Stopbank Overall Layout Plans SB140-141, Stopbank Layout Plans SB151-158, Retaining Wall Long Sections SB300-302, Retaining Wall Cross Sections and Stopbank Cross Sections TRB and TLB SB500-506 and SB600-602. An indicative example of the scale of the proposed stopbank adjacent to SH2, and its height in comparison to the existing stopbanks is shown below in Figure 18.

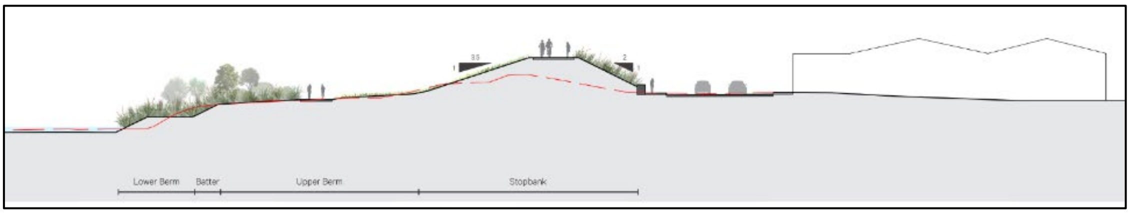


Figure 18 - Indicative stopbank height adjacent to 57 Marsden Street[21]

The upgrade or construction of new stopbanks on the TLB of Te Awa Kairangi between Ewen Bridge and Mills Street and along Marsden Street and Pharazyn Street on the TRB will result in stopbanks with a typical grade of 1V:3.5H, height in the order of 5.5 m and a crest width of approximately 4 m, other than where they are directly integrated into the surrounding landform (e.g. the true right bank upstream of the new Melling Bridge).

[21] The red dotted line indicates the existing stopbank heights and location

The grade of the stopbanks beneath the new Melling Bridge and pedestrian bridge, will be steeper – approximately 1V:2.5H – to accommodate the new landings.

The new stopbanks will be approximately 0.5 – 1.5 m higher than the existing stopbanks where they are increasing in height. Specific height increases are indicated as follows:

- TLB averages 1.3 m higher between CH 320 & CH 510 (0.56 m min @ CH 500 & 510 and 1.76 m max at CH 410)
- TRB averages 1.5 m higher between CH 320 and 410 – excluding impact of Melling interchange (min 1.09 m @ CH 410 and max 1.87 m @ CH 350)
    - Upstream of CH 510, the new and existing stopbank heights are the same or similar height.

Where the standard 3.5:1 stopbank profile cannot be achieved steeper stopbank batters, or a truncated stopbank section supported by a retaining wall, will be constructed. A combination of cantilevered reinforced concrete, MSE and stand-alone retaining walls have been adopted by the Project.

The approximate height, length and location of the stopbank retaining walls are as follows:

- Marsden Street– 150 m in length, up to 1.7 m in height
- Southern end of High Street, opposite to Fraser Street – 72 m in length, up to 1 m in height
- Alongside the existing Harvey Norman building On Rutherford Street – 169 m, up to 3 m in height

The stopbank design has been based on a 2D river hydraulics model built using available LIDAR survey and cross-sectional survey data. Following calibration and validation of the model with historical flood events, the model was used to check the proposed design potential flood impact. The hydraulic model was run for several design flow events including present day and future climate.

Based on the river hydraulics modelling, the stopbanks have been designed to cater for a 2,800 cumec peak design flow. The stopbanks have a proposed freeboard of 0.9m above the estimated peak water levels.

4.3 Melling interchange and bridge

The SH2, Melling interchange and bridge works are shown in the General Layout Plans A16-4831-C201-C205, and the bridge plans and drawings A16-4831-S101-RB, S202-RB, S201 -RB and S202-RB, and as shown in the high-level design provided in Figure 19 below.

Figure 19 - New diamond interchange at Melling

The upgrades extend along SH2 for approximately 1.55 km. The southern end of the work begins on SH2 adjacent to 51 Pharazyn Street in Melling, passes Harbour View, Tirohanga and Block Roads, and finishes roughly adjacent to 760 Western Hutt Road, where the works tie back into the existing SH2.

The road design principles and parameters of the main carriageway and ramps are as follows:

- The carriageway has been designed to motorway standards, with access to and from SH2 obtained via the grade-separated interchange
- The design speed adopted for SH2 through the interchange is 110km/h, and an 80km/h design speed has been adopted for the interchange ramps
- The carriageway will have two 3.5 m wide traffic lanes in each direction, and 3.0 m wide sealed shoulders with either rigid or wire rope barriers for shoulder protection
- Minimum of 10 m wide x 6.0 m high clearance envelope per carriageway to accommodate over dimension vehicles.
- A 4 m median between the carriageway edge lines which provides 2 m inside shoulders between the median rigid or wire rope barriers. The rigid or wire rope barriers will transition to concrete medians to the northern end of SH2 works to accommodate the existing split levels between the two carriageways

The works include:

1. Ground improvements to an approximate depth of RL -1m at the base of the new Melling interchange bridge and the new Melling Bridge (on both sides of Te Awa Kairangi)
2. Construction of a new Melling Bridge, approximately 215 m long and 28 m wide including construction of up to seven piers approximately 2.7 m in diameter, the piles of which will pierce the Waiwhetu Aquifer

3. Removal of the existing Melling Bridge, with existing piers cut off slightly below bed-level and the remainder of the piers remaining in-situ
4. Construction of a new approximately 39 m long by 30 m wide and 8m high single span bridge with a minimum clearance of 6 m over SH2
5. Closure of the Tirohanga Road and Block Road intersections with SH2. The SH2 upgrades also require the adjacent Melling skate park, Melling train station facilities and other buildings along Pharazyn Street to be relocated and/or demolished
6. Tirohanga Road will be connected to Harbour View Road via a new link adjacent to the northbound entrance ramp. The new Tirohanga Road alignment will provide 760 Western Hutt Road a with new property access, and direct access to SH2 from this property will be closed. A service bay for service vehicles, maintenance crews and police may be developed in this area if required by these entities
7. Re-configuration and realignment of Pharazyn Street, connecting to the new interchange at an intersection with the new southbound on and off ramp and connection to Marsden Street to the south
8. Establishment of separated cycleways through the new interchange and connecting roads, and
9. Retaining walls ranging between 0.7 m and approximately 10 m in height are required to support the SH2 improvements and other works, including:
   a) An approximately 405 m long retaining wall between approximately 1.5-5 m in height running between the bank of the Western Hills and SH2 underneath the new interchange

   b) Two retaining walls running along each side of the re-aligned section of Tirohanga Road, in the order of 192 m (the western-most wall) and 137 m in length respectively and up to 10 m in height.

   c) An approximately 181 m long retaining wall up to 5 m in height along the northern-most portion of the SH2 upgrade leading up to the south-bound exit ramp to the new Melling Bridge

   d) The connection to Pharazyn Street is supported by a retaining wall in the order of 26 m in length and approximately 3 m in height.
10. Along Pharazyn Street south of the pedestrian bridge – a retaining wall approximately 226 m in length and approximately 0.7 m in height is proposed.
11. Retaining walls and batters up to approximately 3 m in height along Queens Drive and Rutherford Street are also required to minimise the bridge landing impacts on private property. The approximate height, length and location of these property access retaining walls are as follows:
   a) A retaining wall approximately 164 m in length within and along the western (rear) property boundary of 28-46 Rutherford Street (Harvey Norman), ranging in height from existing ground level at both ends to a height of approximately 2.2 m in the middle.

   b) A retaining wall approximately 64 m in length starting at approximately 2.7 m high directly underneath the eastern abutment of the new Melling Bridge, increasing to a height of approximately 3.7 m at the northern corner of Rutherford Street and Queens Drive, and lowering to tie back into the existing ground level on the north-western side of Rutherford Street, south of Harvey Norman.

   c) A retaining wall approximately 134 m in length, starting at existing ground level on the eastern side of Rutherford Street adjacent to Brockelsby Roofing Products, increasing to an approximate height of 3.5 m at the eastern corner of Rutherford

Street and Queens Drive, and reducing back down to existing ground level adjacent to Work and Income NZ.

d) A retaining wall of approximately 33 m in length, tapering from an approximate height of 1.8 m north of PetVet to existing ground level just south of PetVet.

e) A batter slope (1 in 4) of approximately 87 m in length, with an approximate height of 3 m at the southern corner of Rutherford Street and Queens Drive, tapering to the south-west to an approximate height of 2 m along Rutherford Street (where the batter slope ties into the retaining wall adjacent to PetVet), and tapering to the south-east to tie into existing ground level at the western corner of Queens Drive and High Street.

4.4 Melling station and line

The Melling station works are shown in the Schematic Landscape Plans A16-4831-L201-208. The intent of the works is to create a multi-modal transport hub with a pedestrian focus which fits within the re-aligned SH2 and stopbanks. The new Melling Station works incorporate the following elements and changes:

a. The existing Melling railway line will be realigned and truncated by approximately 450 m to sit near the new intersection between Pharazyn St and Marsden St (shortening the existing line)[22]. The re-alignment and truncation of the rail line will not preclude a future extension to the Melling Line further north if required (this is part of a separate Notice of Requirement by Kiwirail Holdings Limited, which accompanies this application)

b. Re-locating the existing Melling train station (if feasible) or building a new train station approximately 500m south of the existing station

c. A new train platform with a minimum length of 120 m

d. A new bus hub with provision for at least 2 buses, accessible from Pharazyn Street

e. A drop-off bay located in proximity to the park-n-ride facilities and away from the public transport facilities

f. Cycle parking spaces located away from the park-n-ride carpark in the interests of safety; and

g. New park-n-ride facilities

4.5 Local roads

The changes to the local roads including new walking and cycling paths are shown in the General Layout Plans A61-4831-C201-C211 and involve:

a. Road stopping of parts of Melling Link, Daly Street, Marsden Street, Fraser Street, Block Road Margaret Street, and Pharazyn Street

b. Re-alignment of the road network including parts of Marsden Street, Pharazyn Street, Harbour View Road, Tirohanga Road, Queens Drive, Andrews Avenue and High St

c. Tama Street currently intersects with Victoria Street exit ramp and will continue to do so. Where it differs is that a new connection to Victoria Street proper will be constructed

---

[22] The Melling railway line changes are not subject to this Notice of Requirement. The railway line changes are subject to a separate Notice of Requirement, submitted concurrently with the RiverLink applications, on behalf of KiwiRail

d. Subject to detailed design, Dudley Street will likely become a two-way street

e. A new priority-controlled intersection between Harbour View Road and the re-aligned extended Tirohanga Road

f. Provision of a connected cycle and pedestrian network which seek to improve east-west connections across central Hutt City and connects with the wider walking and cycling network. This includes new paths and upgrades to the existing shared paths as follows:

- An on-road cycle path approximately 1.5 m in width along Pharazyn Street, beginning at the intersection between Marsden Street and Pharazyn Street and ending at Bridge Street; and / or
- A separated[23] cycle path approximately 3 m wide (with some departures if needed) beginning at the new Melling Station travelling south alongside the relocated and existing railway tracks to tie into the existing cycle path (the Pito-One to Bridge Street section of Te Ara Tupua) at Bridge Street
- A separated on-road cycle path approximately 3 m or 1.5 m in width which begins at the southbound off ramp and travels under the southbound on and off ramps and the proposed Melling Interchange Bridge and then either connects into Pharazyn Street or continues back onto SH2. The path can also continue up the southbound offramp, which is bi-directional, to gain access to the Western Hills suburbs via the grade separated intersection, or use the new Melling Bridge to access the Lower Hutt city centre. The separated southbound on road offramp also connects into the segregated path under the new Melling Bridge. This segregated path travels past the old Melling Bridge location, to connect into an upgraded shared[24] path travelling along the toe of the highway ramp embankment and connecting into the existing haul road. This path will utilise the existing haul road to the connection at the Kennedy Good Bridge
- A segregated approximately 4.5 m wide path along the TRB berm of the river and travelling north from Ewen Bridge to tie into the upgraded segregated path referred to in the point above
- A shared approximately 4.5 m wide path along Pharazyn Street north, past the pedestrian bridge to connect to southern shared path along the new Melling Bridge
- Shared approximately 4.5 m and 3 m wide paths along the sides of the new Melling Bridge and interchange. These shared paths will cross the interchange using signalised pedestrian crossings, and connect to the shared paths along the TRB
- Shared approximately 4.5 m wide paths connecting between Rutherford Street, the new Melling Bridge, and the stopbanks at the Melling Bridge landing on the TLB
- A segregated[25] approximately 3 m wide path over the new pedestrian bridge, connecting to the new shared path along Pharazyn Street; and
- A new shared approximately 4.5 m wide pathway atop the new TLB stopbanks between Ewen Bridge and Mills Street

g. Reconfiguration of local roads to better accommodate active transport modes (walking and cycling). The changes include:

- A portion of the former Daly Street becoming a 'shared space' / pedestrianised street in proximity to the new pedestrian and cyclist bridge
- A new pedestrian accessway and service lane extending from Laings Road to the stopbanks

[23] A cycling lane physically separated from the other road traffic
[24] A shared path is an off-road path which is wide enough to accommodate both walking and cycling
[25] A segregated path is a shared walking and cycling path, where there are pavement markings delineating the cyclist portion of the path

- Changes to Bridge Street, Dudley Street, Andrews Ave, High Street, Queens Drive, Marsden Street, Pharazyn Street Margaret Street, Rutherford Street, Woburn Road and Victoria Street to create better pedestrian and cycling facilities by way of broadened footpaths and advance on-road stop lines for cyclists
- A signalised crossing on Pharazyn Street connecting the new pedestrian bridge to the new railway station site

h. Changes to the configuration of the following intersections:
  - Queens Drive and Woburn Road – becoming signalised
  - Melling Link and Rutherford Street – becoming signalised
  - Melling Link and High Street – becoming signalised
  - Queens Drive and Rutherford Street (new Melling Bridge landing) – becoming signalised
  - Queens Drive and High Street (both ends) – becoming signalised
  - Daly Street & High Street – the existing roundabout will be closed as Daly Street will not exist
  - Margaret Street and Dudley Street – priority-controlled intersection
  - Andrews Avenue and Dudley Street – becoming a priority-controlled intersection
  - High Street and Fraser Street – High Street to be re-aligned along Fraser Street
  - Marsden Street and Pharazyn Street – the priority changes to Pharazyn Street
  - Marsden Street and Railway Avenue - becoming a split signal and signalised intersection
  - Tama Street - a new connection to Victoria Street will be constructed

i. Re-configuration of car parking through the Project area, as shown in the General Layout Plans C201- C211 and Schematic Landscape Plans L201-L208, with a reduction of 1,479 car parks, and a gain of 768 car parks, resulting in a net reduction of approximately of 598 public car parks and 113 privately leased car parks. A detailed breakdown of parking changes is provided at Table 10. Reinstatement of the existing informal car park area on the TLB at Harcourt Werry Drive is also proposed.

Table 10 - Changes to parking

Location	Spaces Removed	Spaces Replaced	Difference
Riverbank carpark	854	420	-434
Leased Harvey Norman riverbank carpark	103	0	-103
Daly Street	62	0	-62
Southern end of High Street/Fraser Street	8	0	-8
Dudley Street	18	0	-18
Pharazyn Street	130	34	-96
Marsden Street	38	83	45
Melling Station park-n-ride	187	201	14
Mills Street	12	0	-12
Block Road	21	0	-21
Rutherford Street	4	0	-4
Queens Drive	2	0	-2

Location	Spaces Removed	Spaces Replaced	Difference
Hutt City Church car park	40	30	-10

4.6 Pedestrian bridge, riverside promenade and integration of infrastructure works with existing or future mixed-use development

4.6.1 Pedestrian and cycle bridge

The new pedestrian and cycle bridge will span the stopbanks to provide a direct connection between the new Melling Station and Lower Hutt central area. This bridge is approximately 177 m long and up to 6 m wide to accommodate walking and cycling users. The bridge will be supported on three concrete piles extending into the riverbed and aquifer, creating a straight, four-span bridge, with abutments integrating into the new stopbank on both the TLB and the TRB. Ground improvements will be required for the bridge abutments. The pedestrian bridge detail is shown in the Pedestrian and Cycle Bridge Plans numbered L501-L503.

Specific facilities include a 3 m wide segregated cycling path along the bridge, and the provision of both steps and ramps at both ends, with gradients of no more than 1:20 to enable access and use of the bridge by a range of users including cyclists, pedestrian, and wheelchair users. A signalised pedestrian crossing across Pharazyn Street will connect the pedestrian bridge and the new Melling Station. The bridge will also be a key opportunity for cultural expression.

4.6.2 Integration of infrastructure with existing or future mixed-use development and proposed riverside promenade

RiverLink will also involve HCC working with relevant property owners and/or future developers to carry out urban renewal and revitalisation works to integrate the infrastructure works with existing or future mixed-use development. These works may include:

- the demolition and/or reconfiguration of the existing buildings
- temporary use of properties
- ground improvements for future development
- integration of future building sites with the proposed infrastructure work, and
- a promenade that will link to future buildings

The urban regeneration and integration works relate to the following properties:

- 4-5 Daly Street
- 69-95 High Street
- 6 - 13 Daly Street

A new promenade located between Margaret Street and High Street will be constructed to sit atop of the stopbank and connect to cantilevered first floor balconies of the future building development. Stairs and ramps will also be built concurrently for access between the city and the promenade. Some of this work will likely be done at the time of the infrastructure works, and some of the promenade and integration works may be done at a future time when existing buildings are altered or when new buildings are constructed.

4.7 Earthworks and vegetation removal

4.7.1 Earthworks

Earthworks including excavation and filling, reuse of onsite material, removal of waste material and importing material is proposed across the Project.

Earthworks are associated with removing the existing stopbanks, widening of the river corridor, establishment of berms and stopbanks, raising the land on the western side of the river to achieve design levels for the new interchange and supporting infrastructure and the realigned rail line, and for ground improvement works across the Project area. Excess or surplus cut material will be stockpiled (if needed) within the river corridor for re-use across the Project as required, it is estimated stockpiles will have a maximum height of 2.5 m.

The approximate total bulk earthworks (including both cut and fill) totals are summarised in Table 11 below. The maximum cut height is estimated to be 5 m and the maximum height of fill is estimated to be 5.5 m. The quantities relating to the river channel and the stopbanks portion of RiverLink were detailed above in section 4.2.3. These figures may change following detailed design so are indicative only.

Table 11 - Earthworks quantities for work outside of river corridor and stopbanks (Melling interchange, rail station and local roads)

Type	Quantity (m3)
Cut to fill (cut from outside river corridor)	23,000
Fill material taken straight from river corridor	154,300
Cut to waste	10,000
Imported fill from river works stockpile	110,000
Imported fill from offsite	43,500

4.7.2 Vegetation removal

Approximately 239,000 m^2 (24 ha) of vegetation will need to be removed to enable construction of the Project. The extent of the potential vegetation disturbance is shown in the Vegetation Disturbance and Building Removal Plans G012-13, with the quantities summarised in Table 12 below.

Table 12 - Vegetation removal

Vegetation type	Area (m^2)
Mixed broadleaved forest and scrub a mix of natives such as māhoe, kawakawa, matipo, tawa, karaka, pohutukawa, and large exotics including pine and sycamore. The ground layer is generally dominated by exotic weeds. This vegetation type is further broken down into five sub-types which are detailed in the Terrestrial Ecology Assessment (Technical Report #7).	16,500
Tall stature exotic planting (flood protection) Planted along the river specifically for flood protection - willow, poplar and alder dominate, but the understory has exotic plants interspersed with natives	158,900
Native amenity planting	8,900

Vegetation type	Area (m^2)
Occurs in isolated patches across the river corridor and commonly includes plants such as harakeke, cabbage tree, kowhai, and five finger	
Low stature amenity planting Planted along the river margin, and includes harakeke and oioi, but has been invaded by exotic weeds	1,500
Rough grassland / weed fields Unmown grass or waste areas	19,300
Dwellings with associated ornamental gardens Primarily residential dwellings and associated gardens that include areas of rank grass and various ornamental plantings.	34,000
TOTAL	239,000

4.8 Te Awa Kairangi / riverside works

River amenity will be improved with the provision of public open spaces and planted areas that integrate with the shared pathways and pedestrian/cycle bridge. Integrated with the new stopbanks and channel engineering, the enhanced river corridor environment will comprise some 80 ha and include improved amenity for people and nature. This includes landscaping and re-vegetation to provide a riparian landscape which integrates flood protection requirements, biodiversity, and habitat values.

Amenity features will include, but are not limited to pathways connecting to the wider walking and cycling network, planted areas, grassed areas, swale style landscape features, gravel beaches, play areas, a skate park, festival lawn / sports areas, car park / market hub, seating, kiosks, lighting, signage and markers, shelter structures and other ancillary structures that support the programmed activities and open space amenity including pedestrian paths, public art structures and installations, and appropriate lighting (of some paths and specific recreation features). Examples of how these works might look are illustrated in the Schematic Landscape Plans L200-L208 and Landscape Sections L400-L414,

Steps and ramps will be provided that facilitate access and strengthen connections between the city centre and the river corridor. In the lower reach, these facilities will be provided at access points off Ewen Bridge, the end of Laings Rd, Andrews Ave, alongside the new pedestrian bridge at Margaret St, Melling Link, Melling Rd and Mills St. On the TRB of the lower reach, the access points are at Bridge St and Pharazyn St, near the new Melling Station.

In the upper reach, the access points do not change from what currently exists. In comparison to the proposed lower reach access points, the upper reach accesses are smaller in scale, in keeping with the surrounding residential and open space land uses.

On the TLB, maintenance access will be provided to the upper and lower berms, with low key access points at Pharazyn Street, Laings Road, Mills Street, off Harcourt Werry, and also at Rutherford Street, via the public access to the relocated and reduced riverbank carpark. Apart from vehicle access to the riverside carpark, vehicle access will be restricted from the public. On the TRB, maintenance vehicle access will remain available near Belmont School, enabling the berms and river channel to be maintained but private vehicles will no longer be able to drive to the river edge.

Up to four ūranga (large concrete stepped terraces to provide access to the river and beaches) and up to three formed access points are also proposed,

These features are illustrated in the Schematic Landscape Plans L200-L216 and L400-L412 and General Layout Plans C201- C213

4.9 Culverts and stormwater

The stormwater design for the Project is outlined in Technical Report No. 2 Stormwater and Operational Water Quality and shown on the Proposed Drainage Service Works drawings (series C321-324).

All culverts and stormwater treatment structures in the RiverLink design have been designed with a 100-year design life (out to 2120) including consideration for climate change and surcharge from Te Awa Kairangi when it is in flood. Four pumping stations have also been included in the stormwater design to further manage potential impacts of stormwater flows. These design requirements will require the reconstruction (or replacement) of culverts, or the alteration of end sections (outlets) of culverts, through the footprint of the stopbank for all of the major stormwater and stream culverts. Where possible the location of existing culvert outlets will be pulled back from the river and will have naturalised channel 'outlets' between the culvert structure and Te Awa Kairangi. Culvert outlets will also be combined (rationalised) where possible to reduce the number of culverts required under the stopbank.

Where SH2 is being widened by more than 2 m and levels are changed by more than 300 mm, the drainage infrastructure (culverts) are assessed and the asset will be upgraded if it cannot meet the 100-year design life standard. Where the full length of any stream culvert needs to be reconstructed (replaced), provision for fish passage will be made, unless it is identified that fish passage is not practicable (including if there is no benefit to providing fish passage due to existing fish passage barriers). One of the state highway cross-culverts conveying flow from the catchment above Harbour View Road (Outlet 36b) will be reconstructed on a new alignment. As a result, 25 m of open stream cannot be retained and must be reclaimed (infilled). An offset for the loss of stream habitat here is proposed, with details for the stream offset plan to be provided pursuant to a condition of consent requiring the preparation of a Stream Offset Plan (as set out in Appendix A of this AEE). This condition requires that the Project result in no net loss of ecological function through the provision of an offset or offsets, for loss of stream ecological value and function.

Fish passage requirements will generally determine culvert sizing (i.e. the required culvert diameter could be somewhat larger than that required to convey design flow). Where provision for fish passage is included in culvert design, culvert diameter will be increased to allow for substrate to accumulate in the base and to meet minimum width criteria in accordance with the requirements of the NESFW[26]. Backflow prevention requirements, which require a round culvert base to effectively prevent the culverts from surcharging, mean this is not practicable in all culverts. In these culverts automated backflow prevention structures will be used so as not to preclude fish passage in the event fish passage becomes possible in future.

In relation to stormwater treatment, it is proposed to introduce treatment to the section of state highway affected by the new Melling Interchange construction, this includes the new Melling Bridge and the local road connections to the new interchange, in accordance with the relevant Waka Kotahi design standards. Treatment structures will be retrofitted into the existing stormwater network where local roads, and parking spaces (including the Melling Station, associated 'park n ride' and riverbank carparks) are altered and there is space and gradient available to achieve this. Treatment methods for the Project include installation of proprietary devices, rain gardens and vegetated swales.

[26] Regulation 70 of the NESFW

4.10 Network utilities

The closure and re-alignment of streets including Pharazyn Street, Marsden Street and Daly Street, and the re-location of the stopbanks, Melling interchange and the railway track re-alignment mean the relocation or upgrade of a number of network utility services is required as part of RiverLink.

The changes, rationalisation and relocation of network utilities include:

- Water supply and wastewater infrastructure including parts of the two trunk mains (the Western Hills Mains Sewer and a water transmission ring main), bulk water mains for the run-to waste pipe from nearby water supply bores, local three water services including stormwater outlets, wastewater, stormwater and water mains, and pipes, open channels and two stormwater pump stations (Tama Street and Marsden Street pump stations).
- In some locations, the increased earth loadings on the three waters infrastructure resulting from the increases to finished surface level will require the existing infrastructure to be replaced, even if it is not being relocated. This is particularly applicable to the bulk water mains.
- Electricity and gas distribution including the relocation of high and low voltage power cables and four sub-stations and gas mains
- Fibre optic communication cables and telephone lines
- Survey marks
- CCTV facilities

The service plans C101-111 indicate where network utilities are affected by RiverLink works, services to be protected, services to be relocated or demolished and indicative locations for the required relocations. The relocations and replacements of the affected network utility infrastructure will be undertaken in consultation with the appropriate network utility operators and in accordance with the network utility provider's required standards and specifications.

4.11 Operation and maintenance

The maintenance and operation activities relate to:

- Landscape furniture, accessways and stairs along the stopbank pathway and local streets
- Local roads, pedestrian and cycle facilities
- State highway road and cycle facilities
- Removal of flood debris from bridges
- Operational stormwater discharge, conveyance, detention and treatment (where provided) from the altered local roads and SH2
- Maintenance of the stormwater management treatment systems. This includes periodic (every 5-10 years) excavation and re-establishment of vegetative cover of stormwater swales, and regular contaminant removal from the proprietary systems
- Five-year maintenance period for flood protection works, after which flood protection, erosion control and public amenity activities in the river corridor are anticipated to be covered by the GW's existing river maintenance consents [32238], [34077], [34078] and [34486]. The consents permit:
  - Construction, maintenance, repair, replacement, extension, addition, alteration, demolition, and removal of structures,
  - Planting, maintenance and removal of vegetation, re-contouring and mechanical ripping of the riverbed,

- Construction of diversion channels, shaping, re-contouring and repair of bank edges, berms and stopbanks, clearance of flood debris
- Operation of machinery in the river bed, entry, and passage of the river bed,
- Maintenance of drains, dredging, construction of walkways, cycleways and associated structures including stormwater drainage, culverts, and footbridges
- Excavation, disturbance, and deposition of material
- The temporary and permanent diversion of the river flow for, during and because of river management activities
- Discharge of sediment and sediment laden stormwater within and outside the riverbed
- Extraction of gravel from the bed and banks of the river using a combination of wet and dry methodologies

While the existing river maintenance consents permit all forms of vegetation planting and maintenance, a new adaptive planting management approach is proposed in the upper reach. The aim of the adaptive planting is to transition from the initially required willows and debris fences along the lower berms to a flood protection bio-engineering regime which is predominantly comprised of indigenous plant species. This will be achieved through a series of stages over-time. It is envisaged that the first stage, where willows dominate, will last at least 5 years before the transition to more indigenous species begins.

While the willows will be initially used because they provide fast and efficient berm stabilisation and flood protection, the transition to indigenous species will better support and strengthen the mana and mouri of Te Awa Kairangi.

5. Construction methodology

Overview

This section describes the indicative construction methodology that has guided the assessment of construction effects for the Project. This construction methodology is indicative, as it aims to provide the Project Partners with flexibility for the final design and construction methods while providing sufficient information to assess the extent of adverse effects on the receiving environment. It has been informed by the Project Partners' experiences with similar state highway and flood protection projects.

The construction methodology has considered the location and extent of construction, the programme of works, guidelines and requirements to reduce adverse effects on the environment and construction techniques. This chapter outlines the six proposed construction stages for the Project and provides detail for concurrent works, main construction works and general construction aspects.

5.1 Introduction

This section describes the indicative construction methodology for RiverLink developed to inform this AEE and gives further detail of the main construction elements that are likely to be undertaken as part of the Project. The approach has been informed by the Project Partners' experience in developing and constructing projects of a similar scale locally and throughout New Zealand. An indicative construction programme for the Project is set out in section 5.3 below. Throughout this section there are cross-references to drawings where further information describing construction of the Project is available.

The information provided in this section is indicative only and is intended to provide sufficient detail of the proposed construction activities to confirm the Project can be constructed, to enable an assessment of the potential construction related effects on the environment and to identify any necessary measures to avoid, remedy or mitigate those effects.

Construction of the project will be influenced by a number of factors, including:

- The detailed design of the Project, which will occur at a future date once the designations have been confirmed and resource consents have been granted;
- The construction timing, staging, and duration;
- The procurement method adopted for construction of the Project; and
- Technological advances in construction techniques and methodologies.

The Project Partners seek flexibility in final design and construction methods to accommodate these factors, while ensuring that adverse effects on the environment are appropriately remedied or mitigated. Once the contract(s) for the Project have been awarded and a contractor (or contractors) are in place, the indicative construction methodology will be further refined and developed. This refinement will be undertaken in compliance with conditions of the designation and resource consents which will manage the effects of the construction activities.

5.2 Development of the construction methodology

The indicative construction methodology and activities outlined in this section were developed through an iterative process that involved several rounds of reviews with Project Partners and interaction with technical specialists. The intention was to consider the programme implications and potential adverse effects of various construction options to achieve a methodology that, as far as practicable, avoids, or otherwise minimises, potential adverse effects, while being operationally efficient. This included consideration of the following:

- The potential location and extent of construction compounds, bridge construction yards and construction haul and access roads, with the intent being to minimise disturbance and vegetation clearance in sensitive environmental areas, and as far as practicable avoid locating temporary construction activities near sensitive land uses and receptors;
- Construction programme and timing of particular activities, to take advantage of seasonal weather conditions;
- Waka Kotahi construction guidelines and consent authority standards, relevant to the avoidance and minimisation of adverse effects on the environment;
- Practical implementation, access requirements, safety and cost considerations, and potential for staging;
- The use of well-established construction techniques while not precluding methods to maximise the opportunity for contractor innovations;
- How open area limits will be set and managed through construction: and
- Disposal offsite of surplus earthworks/unsuitable materials

5.3 Indicative construction programme

It has been assumed that construction of the Project will start in late 2022 and the main project components would take approximately 4 years to complete. Enabling works may be undertaken ahead of this and the construction programme anticipates this. For example, removal/demolition of buildings and dwellings and some relocation of utilities may be done in advance of the main construction period. In addition to the main project elements, the implementation and establishment of smaller project components may be constructed over a longer period than four years, such as the total extent of planting.

5.3.1 Programme Critical Path

A Critical Path assessment through to project completion has been undertaken in the development of the indicative construction programme. The ability to construct the Melling Interchange works, primarily the SH2 underpass, is dependent on the removal of the existing Melling Station, which is in itself dependent on the diversion of Pharazyn Street parallel to, and on the rear of the Stopbank embankment.

The major critical path elements for the Project are therefore

- Works to enable construction of the Pharazyn Street stopbank
  - Environmental Controls, utilities relocations, building demolition etc
  - Pharazyn Street Stopbank and realigned Pharazyn Street, stormwater between the river and the existing Pharazyn Street, earthworks, pavement construction, including stormwater facilities installed beneath the stopbank and earthworks formations.
- Construct new Melling Station
  - New rail, station building and platform, station parking, etc
  - Complete railway connection and open new station
- Melling Interchange southbound works
  - Remove existing Railway Station building, construct SH2 southbound, southbound ramps and southbound underpass foundation and sub structure
- Melling Interchange northbound works

- Construction SH2 northbound, northbound underpass foundation and substructure
  - Construct underpass superstructure
  - Construction northbound ramps and western local road improvements
  - Open new interchange
- Complete closure of Melling Link/SH2 intersection and final carriageway works to SH2
- Removal of existing Melling Bridge

The final critical path from commencement to completion will be determined by the construction contractor and the Project Partners, however the need to open the new Melling Station and remove the existing station building to enable construction of the new Melling Interchange will dictate the construction critical path.

The indicative construction programme is based on the following typical sequence of works:

- Enabling works (vegetation clearance as necessary, removal/demolition of buildings and dwellings, removal of services, services relocation, site investigations);
- Early construction activities (site establishment, access and haul roads, trial embankments and the installation of erosion and sediment control devices);
- Main construction works including:
  - River channel works;
  - Access to specific sites (culverting and access bridges);
  - Ground improvements;
  - Earthworks;
  - Structures;
  - Pavements and surfacing; and
- Completion works (traffic services, landscaping).

These four steps are illustrated in Figure 20

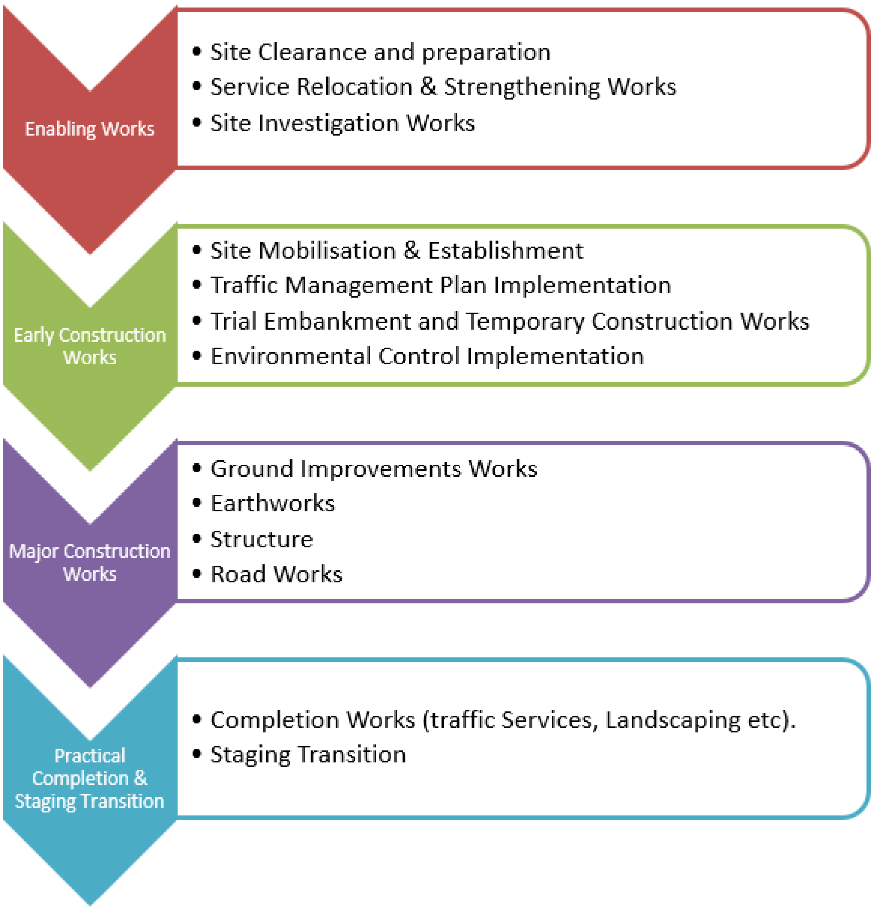


Figure 20 - Programme critical path

The specific staging and phasing of the work will be dependent on the method of procurement and contractor expertise, land acquisition, demolition/removing of existing buildings and dwellings, constraints to maintain rail services, minimum levels of service for traffic during construction, the availability of contractors and availability of other resources such as materials and construction equipment.

While some elements of the Project will be undertaken concurrently, it will be necessary to construct many elements sequentially to manage flood risk, optimise materials, minimise disruption, in particular to the Melling rail service, Hutt City traffic and SH2 commuter traffic.

5.4 Construction staging

For the purposes of assessing the potential effects related to construction of the Project, the Project has been divided into **six** indicative construction stages based on the assumed critical path described in section 5.3.1 above. These construction stages will occur sequentially, however there is some potential for elements of a stage to overlap with a prior or subsequent stage if of benefit to the overall programme, has no greater environmental effect, or failure to do so may result in the missing of an available seasonal window for a specific activity resulting in overall project delay.

Specific construction methodologies specific construction items are described in section 5.6.

5.4.1 Staging philosophy

The indicative staging described below has been developed to demonstrate the ability to construct the Project works with the following objectives:

- Maintain the operating level of service for the rail line
- Maintaining multi-modal accessibility and level of service, to the extent possible, for road users
- Maintain the operating level of service of SH2 and connectivity to Hutt City to current levels during the construction
- Manage the works such that the current levels of flood protection are maintained during storm events
- Avoiding or minimising adverse effects on the aquatic habitat and ecosystems
- Avoiding or minimising other effects on the environment wherever possible

5.4.2 Construction duration

The overall construction duration for the main components of RiverLink is approximately 4 years. The indicative timing for each of the stages is illustrated on the high-level indicative construction programme in Figure 21 below. Detailed design and enabling works (subject to consent approvals) are currently programmed to commence in 2022.

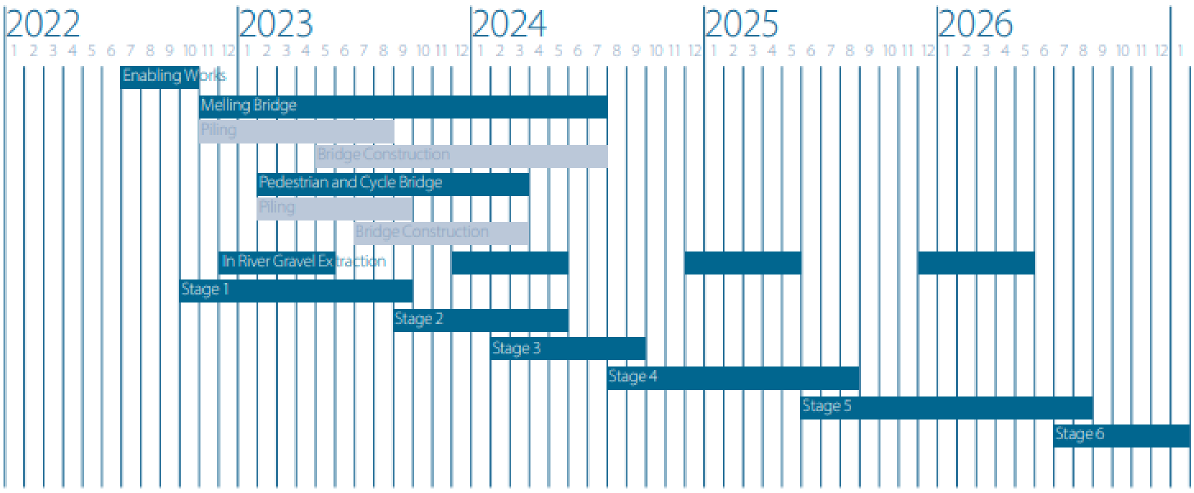


Figure 21 - Indicative construction programme

Detailed construction staging drawings are included in Volume 5 of the Application documents (the drawing set).

5.4.3 Enabling Works

Prior to the commencement of key construction activities for each stage (noting that Stage 1 is assumed to commence in October 2022), enabling works are likely to be required. These works include:

- Further detailed site investigations, including geotechnical, contaminated land and building assessments, groundwater monitoring, and investigations to confirm the location of existing services;
- Baseline environmental investigations or surveys;
- Building and structure demolition and removal;

- Site establishment activities, including site access points, temporary road sealing, access tracks, construction yards, temporary local road realignments and fencing;
- Establishment of the temporary public car park on Daly Street (required prior to the closure of the Riverside Carpark during Stage 2);
- Establishing environmental mitigation measures (e.g. erosion and sediment controls);
- Protecting and/or relocating of existing network utilities; and
- Vegetation clearance where seasonal restrictions (e.g. bird nesting and lizard survey) will potentially restrict or prohibit the commencement of subsequent critical path construction activities. E.g. remove trees and bush outside of the nesting season where otherwise planned removal would have occurred within that period.

5.4.4 Stage 1: Pharazyn Street stopbank and realignment

The Stage 1 critical path activity is to construct the stopbank adjacent to Pharazyn Street and the Pharazyn Street realignment to enable the subsequent closure of the existing Pharazyn Street and construction of the new Melling Station.

In parallel with these works it is anticipated that the stopbank and realignment works along Marsden Street will be completed where possible so as to minimise the period and number of times the TRB between the new Melling Bridge and Ewen Bridge is affected and closed for access.

The construction of the Melling Bridge and the Pedestrian Bridge works will commence, focusing on piling and abutment work, with the overall bridge construction spanning several subsequent stages.

Flood protection works upstream of the new Melling Bridge on the TLB are indicated as occurring within Stage 1, however these are able to occur within any stage to coincide with the demand for surplus material from the TLB for construction of the permanent works with a minimal of double handling of material.

The key works are illustrated on Figure 22 below.

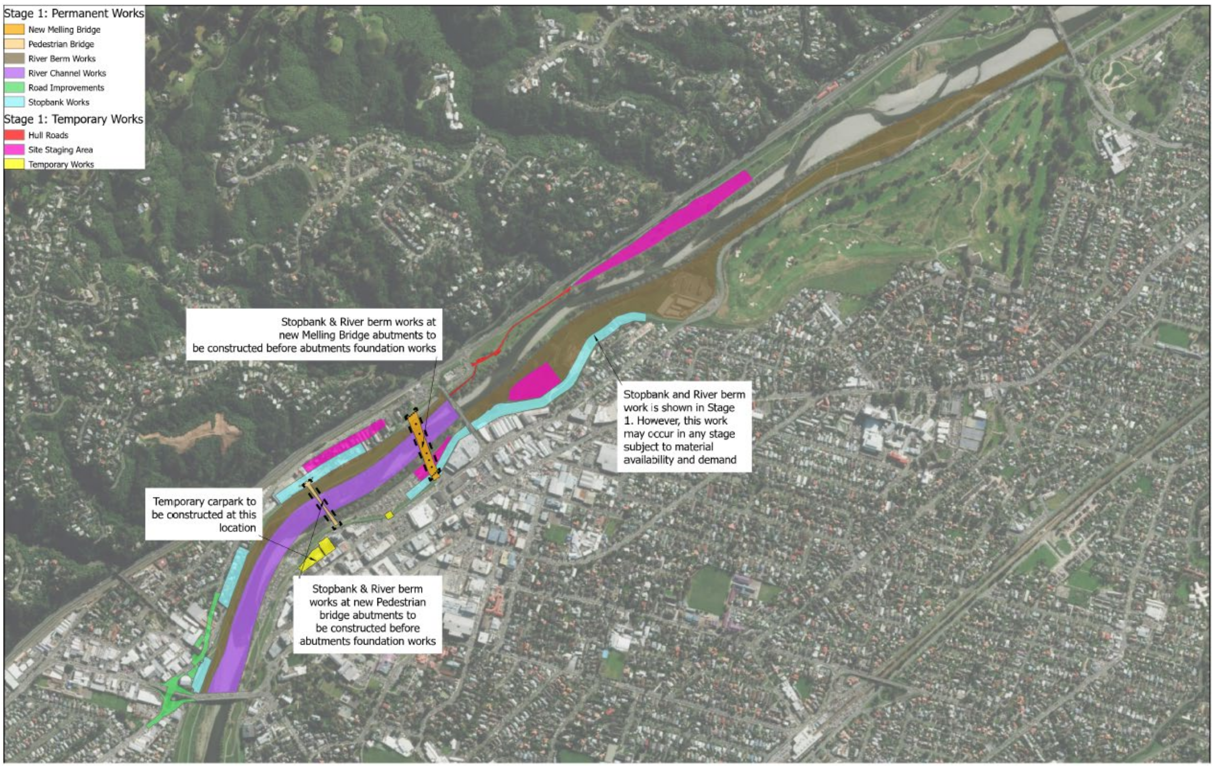


Figure 22 - Stage 1 construction works

The main disruption for the community arising from this stage will be:

- Public access to the TRB (western side) between Ewen Bridge and the new Melling Bridge will be closed.
- Public access to the TLB (eastern side) will be accommodated, albeit of a temporary standard past abutment and piling works for the Melling Bridge and pedestrian bridge.
- Public access to the TLB (eastern side) will be restricted/managed upstream of Melling Link. These works could occur in a subsequent stage(s)

Temporary traffic management will be required for Marsden and Pharazyn Streets and to manage safe access around the bridge abutment sites on Daly and Rutherford Streets. The works will include:

- Gravel extraction, channel widening, river protection works and bed reprofiling/disturbance from the Ewen Road Bridge to immediately beyond the location of the new Melling river bridge on the TRB of the river.
- Gravel extraction, channel widening, river protection works and bed reprofiling/disturbance from the new Melling Bridge on the TLB of the river to the eastern extent of the Project, noting the works east of the new Melling bridge may be completed within any stage of the Project.
- Property demolition and accommodation works (if not already completed as early enabling works) and utilities realignment and/or replacement (if not already completed as early enabling works). It has been assumed the realigned section of both Marsden Street and Pharazyn Street will include a utilities corridor(s) with shared trenches where possible.
- Remaining property demolition, accommodation works and utilities realignment and/or replacement required prior to the commencement of Stage 2.

- Establishment of primary stockpile and aggregate processing area and associated haul roads on the northwest area of the Project between the river and SH2, opposite the suburb of Belmont
- Marsden Street realignment – construction of the new section of Marsden Street, and associated new parking areas, where required to accommodate the new stopbanks. This will include traditional road construction, including stormwater, subgrade improvement, pavement construction and associated traffic services, paths, street lighting etc.
- Railway Ave/Marsden Street/Victoria Street intersection improvements – construction of the intersection modifications. This will include traditional road construction, including stormwater, subgrade improvement, pavement construction and associated traffic services, paths, street lighting etc.
- Marsden Street stormwater works – construction from the outlet end to Marden Street. New infrastructure will be trenched through the existing stopbank. This will be undertaken in stages with either temporary flood protection in place while a stopbank contains a trench, or trenched and reinstated to pre-existing levels where a sufficient construction window exists.
- Pharazyn Street stormwater works. - construction from the outlet end to adjacent to the existing Pharazyn Street. In order to maintain existing levels of service within the stormwater reticulation during construction, it is anticipated, where renewed or larger diameter infrastructure is required, that this will be laid adjacent to the existing reticulation until such time as the existing reticulation is no longer retained in service. This has been assumed as it will be difficult to construct entire lengths of new reticulation within a single stage, resulting in partially complete works being held between phases.
- New infrastructure will be trenched through the existing stopbank. This will be undertaken in stages with either temporary flood protection in place while a stopbank contains a trench, or trenched and reinstated to pre-existing levels where a sufficient construction window exists.
- Marsden Street river protection works – construction of the new stopbanks, where not impacting the existing Marsden Street, along with gravel extraction and river protection work.
- Pharazyn Street river protection works – construction of the new stopbank and the realigned Pharazyn Street - from a point east of 66 Pharazyn Street, where property is currently not available for occupancy and demolition until 1 May 2023, to immediately west of the intersection of Pharazyn Street and Block Road.
- Pharazyn Street earthworks formation – construction of the earthworks formation for the realigned Pharazyn Street, station and station carpark, except within the footprint of the existing Pharazyn Street. This will be constructed in parallel within the adjacent stopbank utilising the same construction plant. The earthwork formation at the existing Pharazyn Street will be constructed with a temporary batter that allows the existing Pharazyn Street to remain operational and unconstrained through to Block Road.
- New Pharazyn Street– construction of the new section of Pharazyn Street will include traditional road construction, including stormwater, subgrade improvement, pavement construction and associated traffic services, paths, street lighting etc.
- Melling Bridge and the Pedestrian Bridge construction will commence, focusing on piling and abutment work, with the overall bridge construction spanning several subsequent stages.

5.4.5 Stage 2: Daly Street stopbanks, Melling pedestrian bridge and Pharazyn Street realignment

The Stage 2 critical path activity is the construction of temporary road to provide connectivity to the realigned Pharazyn Street. This is achieved through the temporary reconfiguration of the Marsden Street/Pharazyn Street intersection, a temporary road from Marsden Street to the realigned Pharazyn Street and a temporary road from the realigned Pharazyn Street to Block Road.

Completion of these diversions will allow for the existing Pharazyn Street (section parallel to the rail line) to be closed and subsequent construction of the new Melling Station. Access to properties immediately east of the Marsden Street/Pharazyn Street intersection will need to be maintained.

In parallel with these works it is anticipated that the stopbank adjacent to the realigned section of Marsden Street will be completed (if not completed within Stage 1),

The construction of the new Melling Bridge and the Pedestrian Bridge will continue, with all piling expected to be complete with focus being on the sub and superstructure, with the overall bridge construction continuing over subsequent stages.

With the substantial completion of river protection works on the TRB between Ewen Bridge and Melling Bridge, it is anticipated the flood protection works along Daly Street from the new Melling Bridge to Andrews Ave will be completed. This will close access to the existing Riverbank Carpark throughout this length. Completion of this section will include construction of the replacement carpark. During the period where the Riverbank carpark is unavailable it is proposed some temporary parking is made available on sites along Daly Street earmarked for subsequent riverside development.

The intersections of High Street with Queens Drive and Pretoria Street will be upgraded from existing roundabouts to signalised intersections, enabling a more managed temporary traffic management regime to be in place for the subsequent raising of the Rutherford Street/Queens Drive intersection which will require a temporary closure.

Immediately preceding, or subsequent to, the High Street improvements, the local road improvements at the Queens Drive/Woburn Road intersection will be completed.

Flood protection works upstream of the new Melling Bridge on the TLB are indicated as occurring within Stage 1, however these may be undertaken at any stage to coincide with the demand for surplus material from the TLB from construction of the permanent works with a minimal of double handling of material.

The key works are illustrated on Figure 23 below.

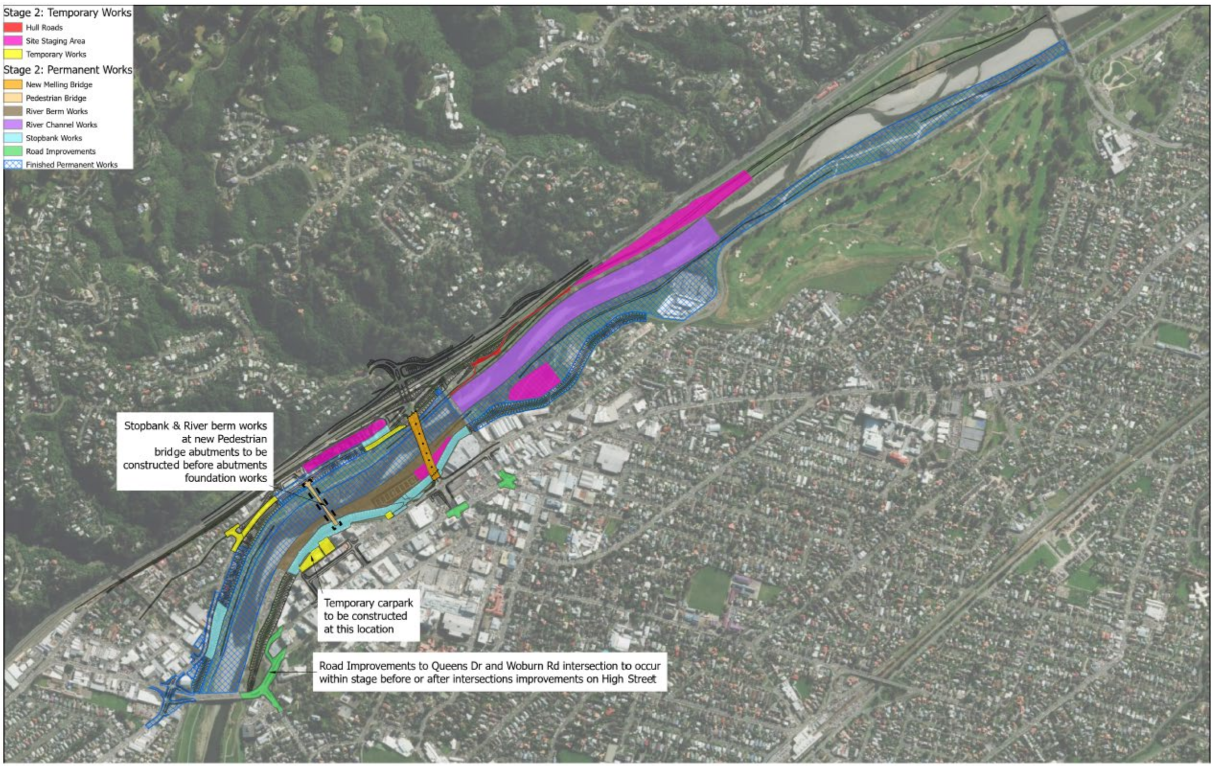


Figure 23 - Stage 2 construction works

The main disruption for the community arising from this stage will be:

- Public access to the section of riverbank adjacent to the realigned section of Marsden Street will be closed, with short diversions in place along the realigned Marsden Street. This is expected to be for a short duration.
- Public access to the TLB riverbank will be closed between Melling Link and Andrew Ave, including the Riverbank carpark. This will necessitate the temporary relocation of the Riverbank Market to an alternative site. The Riverbank Market is able to return to the Riverbank carpark on completion of Stage 2.
- Public access will be accommodated, albeit of a temporary standard past abutment and piling works for the new Melling Bridge and pedestrian bridge.
- Daly Street will be closed between Andrews Avenue and Margaret Street.
- Construction of temporary diversions at the intersection of Marsden/Pharazyn and Pharazyn/Block Road so Pharazyn Street can be realigned.
- Changes to the High Street intersections at Queens Drive and Melling Link/Pretoria Street.
- Changes to Railway Ave/Queens Drive and Woodburn Road.

The works will include:

- Gravel extraction, channel widening, river protection works and bed reprofiling/disturbance from the new Melling Bridge on the TLB to the eastern extent of the project, noting the works east of the new Melling Bridge may be completed at any stage of the project, albeit progressively in an upstream direction.
- Gravel extraction, channel widening, river protection works and bed reprofiling/disturbance on the TLB only from Andrews Ave to Melling Link.

- Remaining property demolition, accommodation works and utilities realignment and/or replacement required prior to the commencement of Stage 3.
- Operation of the primary stockpile and aggregate processing area and associated haul roads on the northwest area of the Project between the river and SH2, opposite the suburb of Belmont.
- Completion of the remaining section of stopbank on Marsden Street where Marsden Street has been realigned (noting this could be completed within the later stages of Stage 1 also).
- Construction of the stopbank along Daly Street between Andrews Ave and the new Melling Road Bridge.
- Construction of the new Riverbank carpark.
- Reconfiguring the intersection of Marsden Street and Pharazyn Street.
- Construction of a temporary road from the reconfigured Marsden Street intersection to the realigned Pharazyn Street, including, if necessary, modifications to the existing stopbank to ensure the existing stopbank level is maintained.
- Construction of a temporary road from the realigned Pharazyn Street to Block Road including, if necessary, modifications to the existing stopbank to ensure the existing stopbank level is maintained.
- Reconfiguring of the High Street intersections with Queens Drive and Melling Link/Pretoria Street to enable more efficient traffic management when Queens Drive and Rutherford Street are affected in subsequent stages and in line with the long-term traffic management arrangements. Replacement of the existing roundabouts with signalised intersection using proven construction materials and techniques. The complexity for these intersections arises from the need for careful traffic management, with it anticipated that kerb and path improvements will be constructed during the day, with pavement works undertaken overnight when detours will have the least effect on road users. All works here will need to be completed prior to any significant works on Rutherford Street.
- Reconfiguration of the High Street intersection with Daly Street and the Andrews Ave intersection with Rutherford Street to enable more efficient traffic management when the stopbank adjacent to and over Daly Street in constructed and in line with the long-term traffic management arrangements. Reconfiguration of the Railway Ave/Queens Drive/Woodburn Road intersection and approaches.
- Continued construction of Melling bridge and pedestrian bridge.

5.4.6 Stage 3: New Melling Station and Carpark

The Stage 3 critical path activity is the construction the new Melling Station, platform, track and carpark. Completion of these works allows for the closure and removal of the existing station and rail facilities freeing up the site for construction of the new SH2 southbound carriageway, ramps, bridge abutment and connections to Pharazyn Street.

The construction of the new pedestrian bridge will be completed within this phase, if not completed prior, enabling it's opening prior to or in conjunction with the new Melling Station.

The construction of the Melling Bridge will continue, with outstanding works expected to be the approaches from the new Queens Road /Rutherford Street Intersection and the yet to be constructed Melling Interchange approaches.

There are minimal in river works or river protection works anticipated during Stage 3 downstream of Melling Link. Subject to demand for fill there is potential for gravel extraction to commence upstream of Melling Link progressing in an upstream direction.

The intersection of Queens Drive and Rutherford Street will be closed, including a short length either side, to facilitate the importation of engineer fill to lift Rutherford Street and the Queens Drive approach to the level required for the Melling Bridge. This closure is to be as short a duration as practicable to minimise disruption. It is possible, to best accommodate existing land use/access and/or property purchase timing, that these works could be constructed later in programme subject to their completion prior to the opening of the new Melling Bridge and not occurring concurrently with improvements on High Street.

Flood protection works upstream of the new Melling Bridge on the TLB are indicated as occurring within Stage 1, however these may be undertaken at any stage to coincide with the demand for surplus material from the TLB from construction of the permanent works with minimal double handling of material.

The key works are illustrated on Figure 24.

The main disruption for the community arising from this stage will be:

- Public access to the riverbank will be restricted at discrete locations associated with bridge construction.
- Temporary closure of Queens Drive and the adjacent sections of Rutherford Street.
- Traffic diversions via High Street through new intersections.

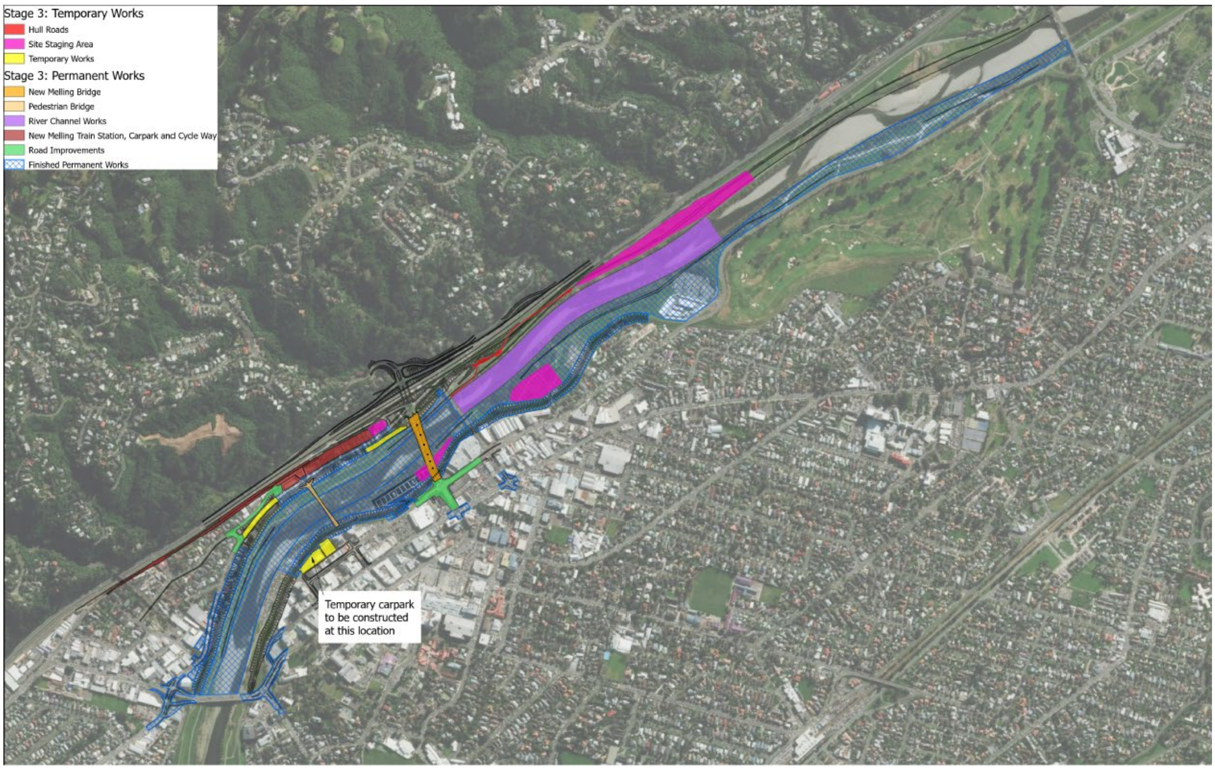


Figure 24 - Stage 3 construction works

Stage 3 works comprise:

- Completion of earthworks formation between the realigned Pharazyn Street and the new rail track and SH2 on ramp.
- Construction of the new Melling Station, new section of rail track and station parking

- Completion of the new Melling pedestrian bridge.
- Continued construction of the new Melling Bridge.
- Completion of the Marsden Street/Pharazyn Street intersection on permanent alignment, including provision for access to the remaining commercial properties and station access
- Construction of the new Melling Bridge approaches on Rutherford Street and Queens Drive, including potential temporary closure of Queens Drive and the length of Rutherford Street being raised. Traffic to be diverted via High Street through the new intersections.
- Pharazyn Street stormwater works – collecting runoff from SH2 and from the west of SH2 will be extended from where they were constructed to in Stage 1 to adjacent to the existing rail line (or under if using trenchless technologies).
- Cut-over and final connection of the new rail track to the new Melling Station in a KiwiRail planned shut period. E.g. an Easter or Christmas shutdown.
- Opening of the Melling pedestrian bridge and new Melling Station.
- Remaining property demolition, accommodation works and utilities realignment and/or replacement required prior to the commencement of Stage 3.

5.4.7 Stage 4: Melling interchange commencement and Pharazyn Street stopbank completion

The Stage 4 critical path activity is the removal of the existing Melling Station and construction of the southbound SH2 carriageway and southbound Melling Interchange works.

The construction of the new Melling Bridge will be completed within this phase, if not completed prior.

The remaining local road improvements on the Lower Hutt side of the river will be completed, if not already completed sooner. This is expected to be the improvements to Andrews Ave, Dudley Street and Margaret Street.

All flood protection works on the TRB downstream of the new Melling Bridge will be completed by the end of this phase, with the short section of stopbank adjacent to the intersection of Marsden Street and Pharazyn street completed. It is expected the majority of the stopbank fill material will come from berm construction with minimal sourced from the adjacent river.

Flood protection works upstream of Melling Bridge on the TLB are indicated as occurring within Stage 1, however may be undertaken at any stage to coincide with the demand for surplus material from the TLB from construction of the permanent works with minimal double handling of material.

The key works are illustrated on Figure 25

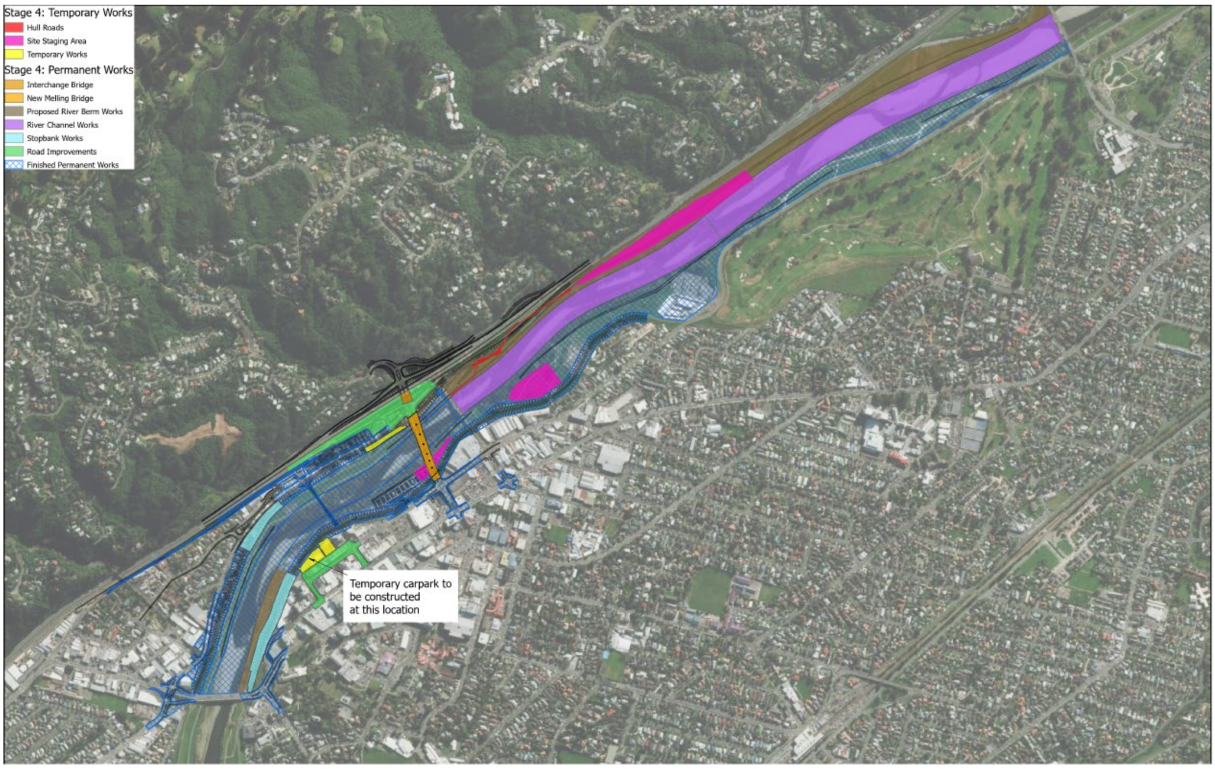


Figure 25 - Stage 4 construction works

The main community impacts during arising during this stage are:

- Public access to the riverbank will continue to be restricted at discrete locations.
- Public access will be closed on the true left (eastern) side of the river between Ewen Bridge and Andrews Avenue.
- Temporary traffic management on SH2 south of Melling Link will be required.
- Temporary traffic management on High Street, Andrews Ave, Dudley Street, Margaret Street and Daly Street

The works comprise:

- Demolition or removal from site of the existing Melling Station
- The stage will include utilities realignment and/or replacement (if not already completed as early enabling works) where existing utilities would sit beneath the new embankments or conflict with other element of the works.
- The gravel extraction, channel widening, river protection works and bed reprofiling/disturbance from east of Block Road to the eastern most extent of the north bank flood protection works, noting the works are able to be completed at any stage, subject to suitable access to and from the materials staging area being maintained. Where in channel works have been progressed in an earlier phase, these will be continued in an upstream direction from the end point from the previous stage.
- Construction of the new stormwater reticulation between the existing SH2 and the river parallel, and immediately south of the alignment of the new Melling interchange underpass. This will include any ground improvements or other allowance to accommodate any settlement arising from the Melling interchange embankments. Note this is an offline upgrade of the existing culverts under the state highway which will not be livened until the upstream extents are livened in subsequent stages.

- Construction of upgraded stormwater reticulation that crosses SH2 north of the existing Melling bridge between their outfalls and the edge of the existing SH2.
- Offline construction of the new SH2 southbound lanes including the completion of the SH2 southbound on-ramp and link from Pharazyn Street, and the approach to the new Melling Bridge.
- Completion of the remaining section of stopbank on Pharazyn Street that has been realigned at its intersection with Marsden Street (noting this could be completed within the later stages of Stage 3 also).
- Completion of the remaining section of stopbank along Daly Street between Ewen Bridge and Andrews Ave.
- Completion of the new Melling Bridge.
- Commencement of the Melling interchange highway underpass southern abutment.

5.4.8 Stage 5: Northbound Melling interchange and bridge

The Stage 5 critical path activity is the temporary reconfiguration of the Melling Link/SH2 intersection to allow southbound traffic to be shifted to the new southbound lanes, reconfiguration of the existing southbound lanes to be the new northbound lanes, and subsequent construction of the northbound Melling Interchange and underpass superstructure.

The northbound Melling interchange works will include the local road improvements to the west of SH2.

All remining flood protection works will be completed, including any remaining in channel works in the upper reaches of the Project area.

All remaining stormwater reticulation between the river and SH2 will be completed and commissioned, with any abandoned pipelines decommissioned either by removal, or infilling.

The main impacts arising during this stage are:

- Public access to the riverbank will continue to be restricted at discrete locations on the true right bank.
- Temporary traffic management will be required on SH2, Harbour View Road and Tirohanga Road, along with construction of temporary intersection upgrades at Melling Link.
- Closure of Block Road.

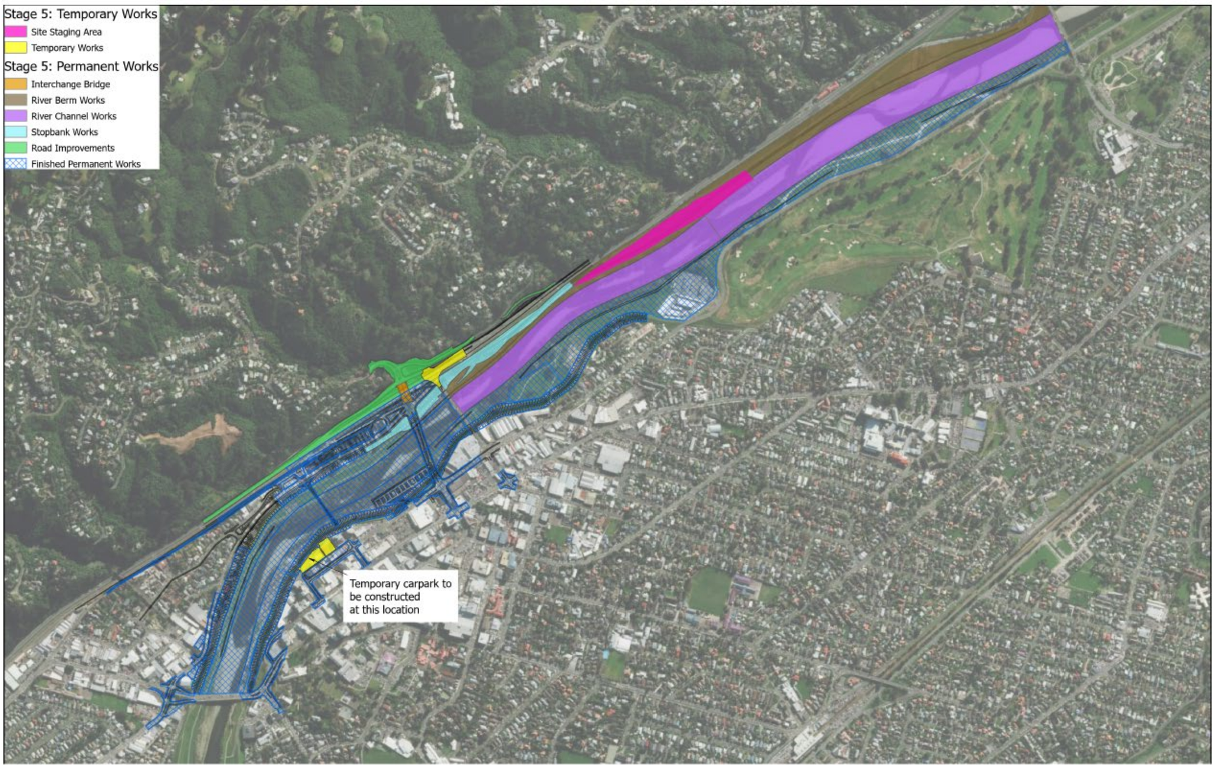


Figure 26 - Stage 5 construction works

Stage 5 works comprise:

- The closure of Block Road
- Gravel extraction, channel widening, river protection works and bed reprofiling/disturbance from the temporary connection of Pharazyn Street to Block Road to the eastern most extent of the north bank flood protection works, noting the works east of Block Road are able to be completed at any stage, subject to suitable access to and from the materials staging area being maintained
- The stage will include utilities realignment and/or replacement (if not already completed as early enabling works) where existing utilities would sit beneath the new embankments or conflict with other element of the works
- Temporary reconfiguration of the SH2/Melling Link intersection, maintaining all current movements, but with southbound traffic now diverted on to the new southbound lanes.
- Extension of upgraded stream and stormwater reticulation that crosses SH2 north of Melling Link under the existing southbound lanes
- Reconfiguration and upgrade of the existing southbound lanes to be the new northbound lanes.
- Once traffic relocated from the existing northbound lanes
- Completion of the new stormwater reticulation parallel, and immediately south of the alignment of the new Melling interchange underpass to connect to the existing reticulation to enable abandonment (grouting) of the existing reticulation.
- Construct the northbound off-ramp earthworks and pavements
- Completion of the Melling interchange bridge
- Reconfiguration of Harbour View Road and Tirohanga Road, maintaining connectivity to the temporary Melling Link intersection

5.4.9 Stage 6: Melling Interchange on ramp and SH2 northbound

The Stage 6 critical path activity is the completion of the northbound Melling Interchange ramps and local road improvements, removal of the SH2 Melling Link intersection, deconstruction of the existing Melling Bridge and reconfiguration of the Melling Link/High Street intersection.

All remaining stormwater reticulation between the river and SH2 will be completed and commissioned, with any abandoned pipelines decommissions either by removal, or infilling.

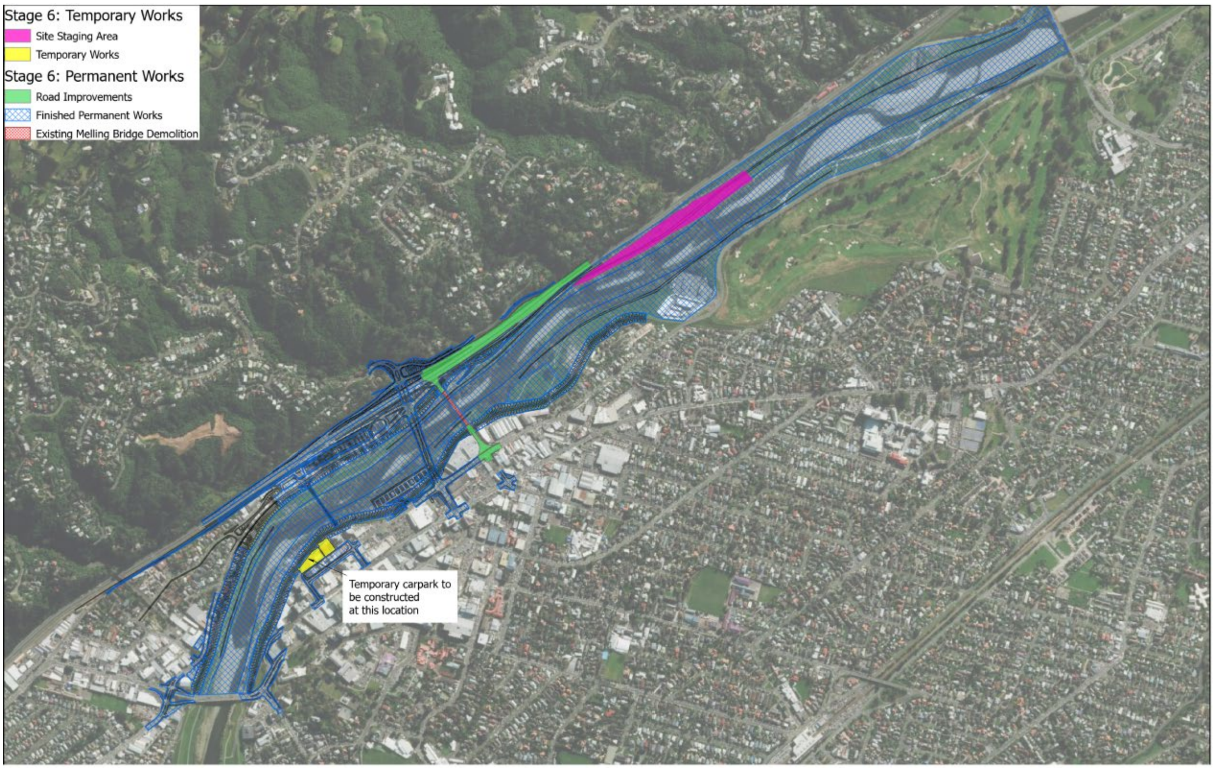


Figure 27 - Stage 6 construction works

Stage 6 works comprise:

- The stage will include utilities realignment and/or replacement (if not already completed as early enabling works) where existing utilities would sit beneath the new embankments or conflict with other element of the works.
- Construction of a temporary northbound on-ramp from Tirohanga Road to SH2 northbound to enable construction of the interchange northbound on ramp.
- Opening of the new Melling Interchange.
- Completion of upgraded stream and stormwater reticulation that crosses SH2 north of Melling Link under the existing southbound lanes.
- Construction of the interchange's northbound on-ramp.
- Construction of SH2 north of the Melling Interchange bridge, including closure of the Melling Link intersection.
- Reconfiguration of the intersection of Rutherford Street and Melling Link, including the works on Melling Link between the intersection and the stopbank.
- Opening of the SH2 northbound on-ramp and completion of Tirohanga Road works.
- Deconstruction (to bed level) of the existing Melling river bridge.
- Final riverbed profiling, erosion protection and stopbank works at the location of the removed Melling bridge.

- Removal and reinstatement of the final staging and processing areas.
- Disestablishment.

5.5 Concurrent works

With each stage of construction there are several elements that will occur concurrently. These are predominantly associated with the river and flood management works and include:

- Gravel extraction, stock piling and processing
- Channel widening, bank edge protection works including riprap construction, upper and lower berm construction
- Stopbank construction
- Development of recreational areas between the river and new stopbanks
- River crossing construction, working in the river
- Similarly, utilities protection, relocation and replacement will also occur throughout the Project duration to enable early and/or uninterrupted construction of each stage.

5.6 Main construction works

5.6.1 Public access to parking and riverside recreational areas

During construction of the river protection works it is probable, for the safety of the public, that the recreational areas and tracks within the river corridor will be closed to public access. The extent of this restricted access will be equivalent to the length of river works or stopbank constructed in each stage (described in section 1.4) plus any restrictions associated with haul roads and site access.

Where possible, typically in areas with wider river terraces, temporary access tracks may be provided past the works, however this will depend largely on the contractors' final construction methodology and the ability to safely access these temporary tracks.

Prior to the construction of the stop bank works within a stage, it is expected the carparking adjacent to that stage will remain fully available. During the construction of a stage the carparking within a stage footprint will be unavailable to avoid interaction between the public and heavy construction plant. By completion of each stage, the carparking affected within that stage will be completed to final capacity and made available.

The following table indicates the cumulative carpark reduction at the end of each stage.

Table 13 - Cumulative carpark reduction at end of each stage

Stage	Parks removed	Parks re-instated	Cumulative Difference at stage end
Enabling	84	104	+18
1	185	113	-54
2	747	251	-550
3	146	251	-445
4	266	0	-711
5	0	0	-711
6	10	10	-711

Note: These carpark numbers make no allowance for the provision of temporary parking potentially made available as described below.

5.6.2 Temporary relocation of Riverbank Market / temporary public car park area

A potential option to mitigate the effects of the Riverbank car park being unavailable at times during construction, is to develop a temporary public car park on Daly Street which can be used by the public during construction and for the Riverbank Market on Saturdays. Alternatively, part of Andrews Ave and Dudley Street may be intermittently closed on Saturdays and the road reserve area used as a temporary market location.

A temporary car park can be achieved by removing the existing HCC owned buildings on Daly Street, as part of the early enabling works, so that an at grade car park can be developed. This would mitigate car park loss until completion of the main infrastructure works. The location for this possible temporary car park is illustrated on the Stage 1 construction drawing (Figure 22 above). A temporary car park on the Daly Street land is expected to accommodate approximately 150 spaces.

5.6.3 Gravel extraction works

Gravel extraction from the channel and excavation and fill in the upper and lower berms are to occur throughout the Project length. This includes removal of any existing rock lines. Where possible these will coincide with adjacent fill activities however this may be difficult to achieve in many locations arising from seasonal constraints (for extraction), access and the overall construction sequence for the balance of the Project such that disruption is minimised.

The gravel extraction works are a combination of lowering the river bed and widening the channel with protected banks, either riprap or planting. The channel reprofiling, detailed in the example cross-section below shows the new profile lowering the river bed, and widening the channel as well as the creation of berms above each river bank before returning to existing ground levels prior to the stop banks. The dotted red line denotes the existing ground profile.

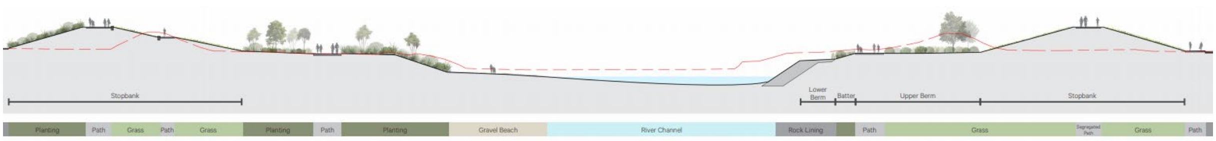


Figure 28 - Channel reprofiling cross section

The widening of the channel, being the construction of the berms and widened channel, will likely be undertaken using traditional heavy earthmoving equipment, predominantly excavators and dumpers. This excavation will be completed as dry works just above river level with excavated material being either cut to fill, cut to waste (unsuitable material), or cut to stockpile for processing to be used in the overall Project works.

Works will typically be undertaken from the downstream end, progressively in an up-stream direction. This minimises the likelihood of excavations being infilled during high flow events and allows the excavated face to be essentially in standing water if a high flow event arises, minimising downstream discolouring and deposition of silts.

Works within the riverbed will also involve wet work, with measures in place to minimise the extent of excavation or works within flowing water, noting that it will not be possible to avoid this entirely. It is not anticipated, nor likely feasible, that there will be any dewatering associated with gravel extraction or re-profiling.

Where excavation is occurring within the riverbed, vehicles (dumpers) will traverse along the river at low speed to minimise disturbance, primarily in areas of low depth and flow velocity and on beaches where they exist. Access tracks will be constructed into the river, with it anticipated these will be ramps within material to be excavated for later terrace construction to leave to the extent possible materials that will remain undisturbed. These ramps will be constructed at varying separation along the river that minimises bank disturbance. An average spacing of 200m has been assumed, however the precise spacing will depend on the constructor's final method and plant selection as well as the need to avoid specific features and areas. In planning works, an important consideration will be to minimise the number of river crossings. With riverbed works progressing in an upstream direction, commencing at the Ewen Bridge, river bed that is traversed will only be bed that is to be excavated in future.

Excavation works will avoid flowing water as far as practicable, through adoption of the following methods:

- Riverbed widening
  - Where the channel is widened, excavation to new bed level will be undertaken by an excavator operating from the riverbank, including the terrace just above river level during the excavation discussed above, leaving in place a bund between the existing channel and the new channel.
  - The excavation footprint will contain water to river level, however this will be substantially standing water with flows being predominantly groundwater through the sides of the excavation.
  - On completion of main widening excavation, the bund is removed. Where the widening at bed level is substantial, say 10m+, there is potential this bund may be 3m to 4m wide to allow an excavator and dumper to reach the cut face and excavate it back along the river alignment without significant traversing within flowing water.
  - Where the excavation cannot be completed behind a bund, extraction will likely be undertaken with a combination of
    - either directly from the river channel by large excavator (30t plus) and dumpers (50t plus) traversing the river bed to access tracks cut in the banks (typically within and as part of the widening works) and on to haul roads to permanent works or stock pile sites; or
    - bladed up on to dry beach by a bulldozer (D9 or larger) and loaded out by an excavator into dumpers.
- Riverbed reprofiling (lowering and filling)
  - All riverbed reprofiling (lowering and filling) will be wet work, with the amount undertaken in flowing water able to be minimised as well as the introduction of control measures.
  - Where possible bunds may be formed, assumed to be 1.5 to 2m high, between the main channel (deeper flows) and shallower areas by the 'pushing up' of bed material. This would typically be achieved with an excavator or bulldozer operating within the bed, creating an area isolated from main flows allowing for bulk excavation with minimal mobilisation of silts into the main flow and downstream.
  - Extraction will likely be undertaken with a combination of a large excavator (30t plus) and dumpers (50t plus) or by a bulldozer (D9 or larger) blading the gravel up on a dry beach for removal by an excavator and dump truck operation traversing the river bed to access tracks cut in the banks (typically within and as part of the widening works) and on to haul roads to permanent works or stock pile sites.
  - Without construction of significant in channel river diversion works able to accommodate the daily flow of the river, it will not be possible to construct all reprofiling without working in flowing water. It is anticipated the main channel excavation will be completed after the widening and/or the balance of the riverbed

reprofiling (described above) has been completed, which will have the combined effect of lowering the main channel water level and marginally reducing its flow velocity.

  – Extraction will be undertaken in the flowing water, where not easily diverted or isolated using the same plant as the balance of the bed reprofiling.

    It is probable the riverbed, particularly shallow or beach areas within the disturbed reach will be utilised as haul roads where doing so generates a minimal disturbance. This will in some cases include full river crossings with the formation of a firm crossing of the river, with coarse gravel or rock on a riffle area. Off-road dumpers can easily cross the river in this way, with a minimum of disturbance and generation of fine suspension material.

- Riverbed beaches
  - Where new beaches are being formed through a filling operation, these will be constructed via a cut to fill operation from the adjacent river channel. Where proposed beaches are within the footprint of existing banks, these will be constructed with the cutting of the berms.

5.6.4 Riverbank protection works – erosion control

The river edge protection works are achieved through vegetative planting or rock riprap facing constructed from imported angular material. The erosion control measures will be installed progressively throughout the Project as exposed faces are constructed and completed to provide either immediate protection (riprap) or to facilitate vegetative protection as early as possible, with there being potential exposure to erosion until the vegetation is established.

This methodology focuses primarily on the riprap construction, as it requires excavation below the proposed new riverbed level.

It has been assumed for this methodology that the riprap protection comprises a layer of geofabric placed on profiled in situ material, upon which is placed a bedding layer (nominally 150mm well graded aggregate) to protect the fabric, upon which is placed the riprap rocks.

- Riprap construction – within widening footprint.
  - The riprap construction will be constructed from the riverbank, either existing where not widened or from the engineered berm where widening is occurring.
  - Where widening is being constructed and the final location of the riprap is beyond the extent of the existing river channel, the riprap construction can be undertaken in no flow to low flow conditions by installing the riprap toe and an initial height of facing within a trench, after which the bank facing is constructed up the exposed face.
  - With there being minimal flow, this work can be undertaken in either an up or downstream direction.
  - Placement of the bedding layer and riprap will be by large excavator (30t plus), potentially with a long reach boom and/or a grapple attachment for the careful interlocking placement of individual rocks.
  - Bedding and rock material will be transported to the workface on road trucks with rock decks or dumpers, predominantly along the haul roads used for gravel extraction activities.
- Riprap construction – within existing channel footprint
  - The riprap construction will be constructed from the existing profiled riverbank.
  - Where construction is within the existing river channel and there is no adjacent gravel beach, installation will occur within flowing water. This is best undertaken from the upstream end in a downstream direction to enable the immediately adjacent

constructed riprap (within 10m) to act as a partial screen against flow for the placement of fabric and bedding materials.

– Constructed lengths below water level are typically constructed from beginning to completion within a single shift in order to minimise the duration of exposed bank. This length varies depending on the daily productivity, but is typically between 20m and 50m per day.
– Excavation of the toe, below bed level, has the potential for the largest bed disturbance with adjacent material 'washing' into the open excavation with the associated migration of fine-grained materials and discolouration. Avoidance is difficult, although the temporary construction of temporary bunds immediately upstream of, and parallel to, the excavation can minimise the disturbance. A common method is to create a bund in front of (in the river channel) the excavation to isolate the excavation from the main flow. This results in the excavation being in proximity to standing water. This bund is created and removed progressively as the works progress along the river.
– Placement of the bedding layer and riprap will be by large excavator (30t plus), potentially with a long reach boom and/or a grapple attachment for the careful interlocking placement of individual rocks.
– Discolouration of water during placement of bedding can be minimised with the use of clean river gravels.
– Bedding and rock will be transported to the workface on road trucks with rock decks or dumpers, predominantly along the haul roads used for gravel extraction activities.

5.6.5 In river construction sequence

The in-river gravel extraction, rip rap construction and beach creation is anticipated to occur in a phased approach, with the disturbed reach (of works within the pre-existing river channel) being limited to 500m at any one time to minimise sedimentation effects and effects on aquatic habitat values. This staging has been informed and developed with input from the specialist advisors on these topics. The following represents the anticipated phases within a 500m reach:

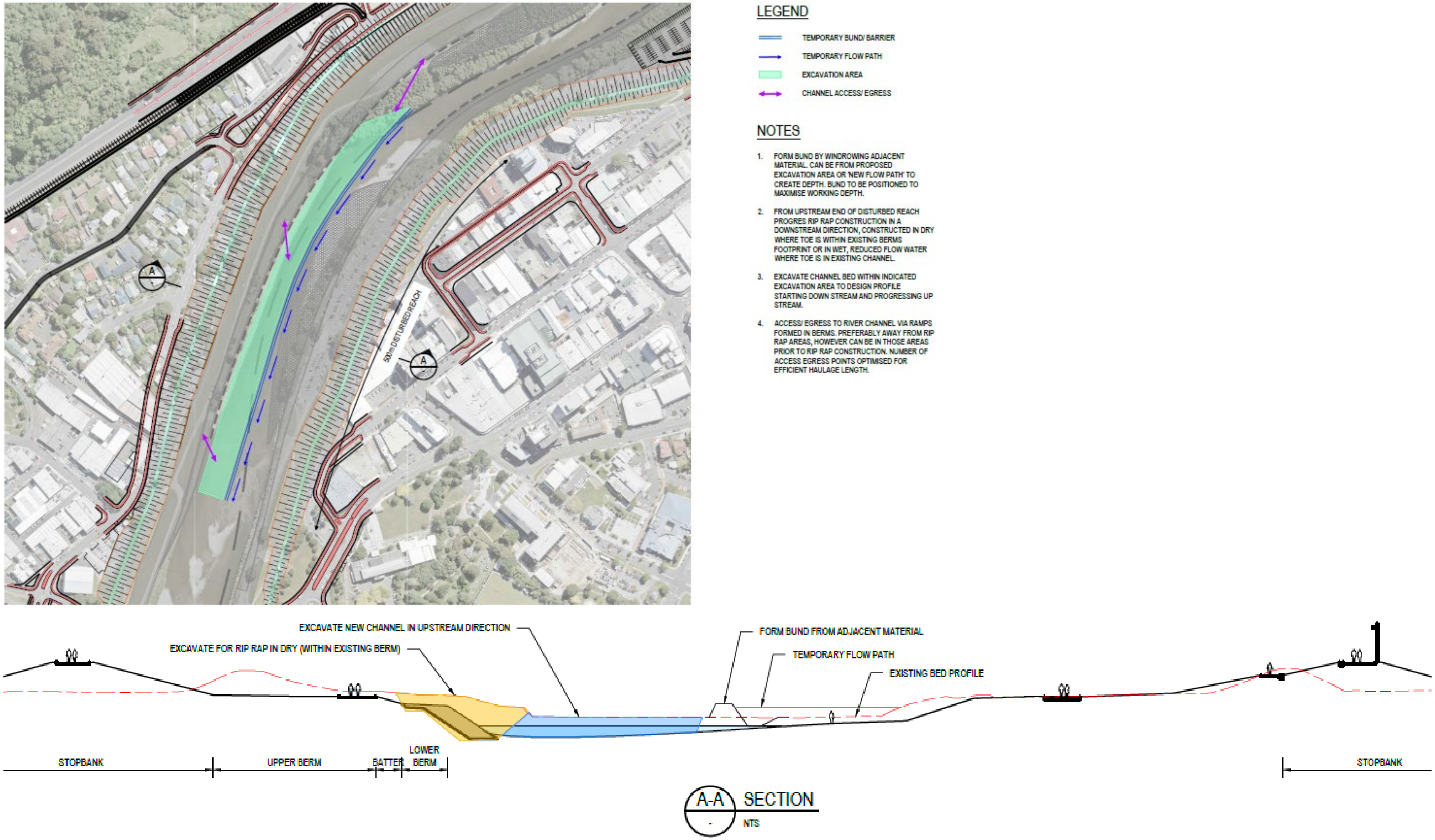


Figure 29 - Phase 1 Bund establishment and gravel extraction

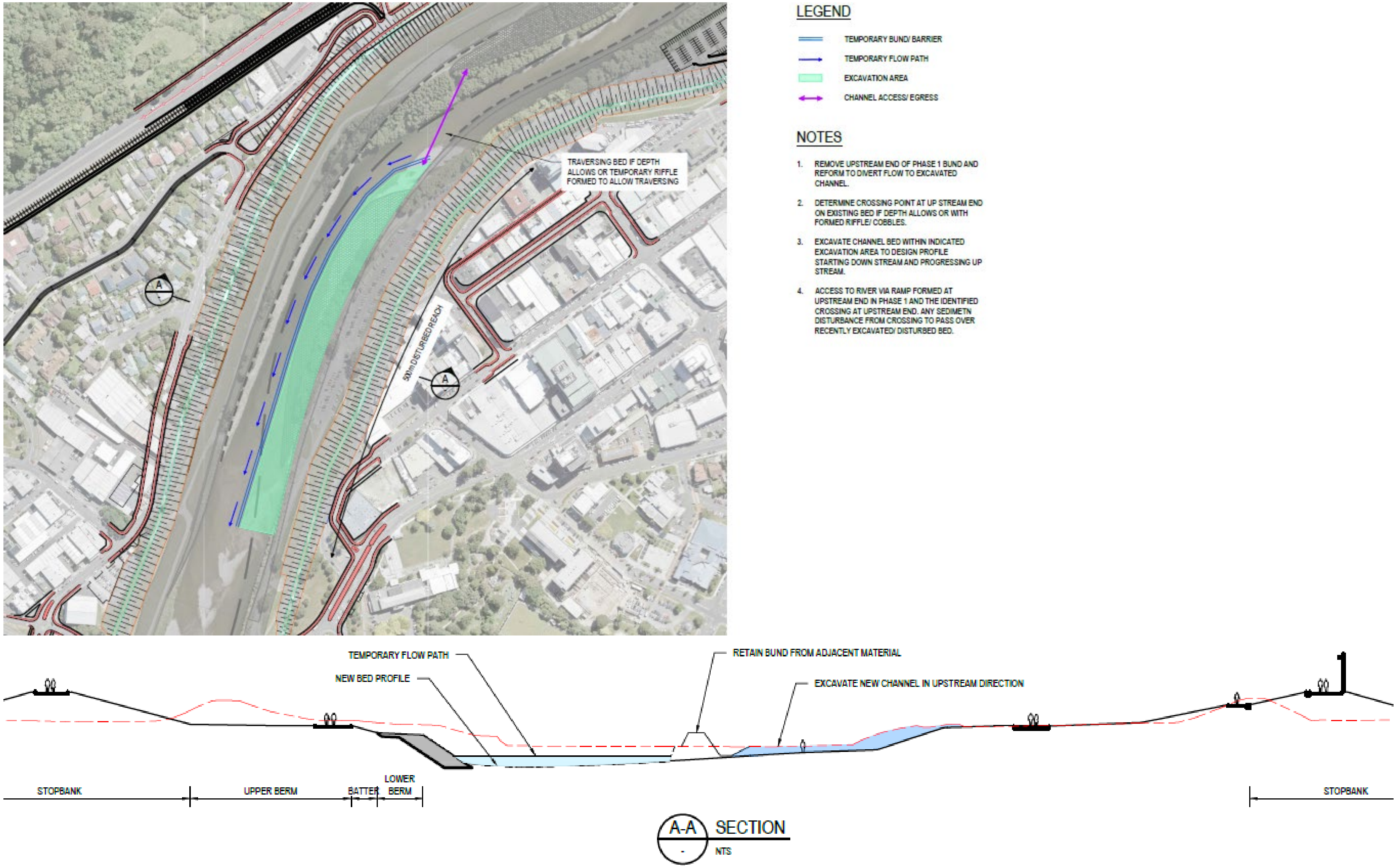


Figure 30 - Phase 2 – Shift channel and extract remaining gravel

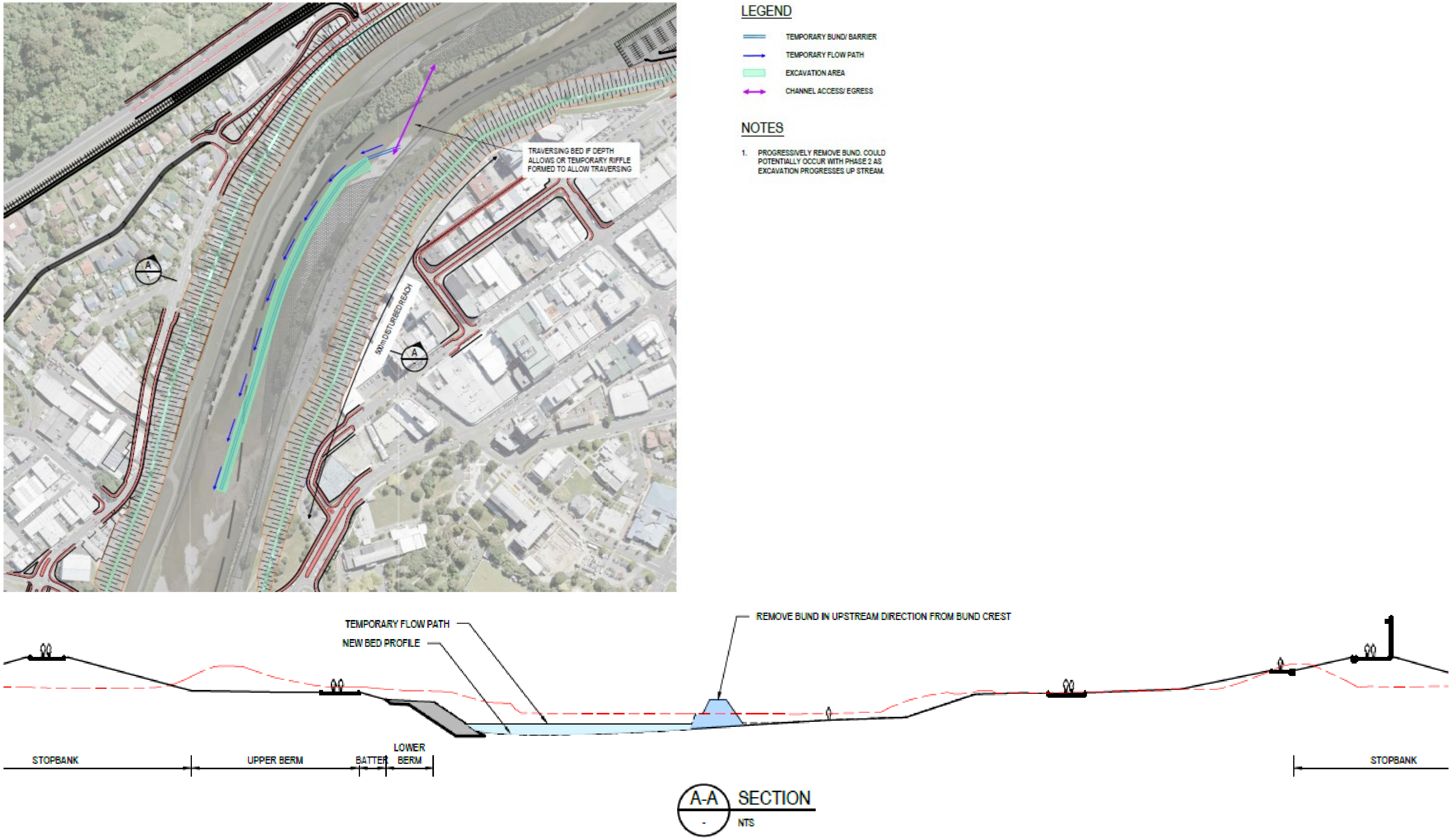


Figure 31 - Phase 3 Bund removal

5.6.6 Stopbank construction

Stopbank material

The stopbanks are constructed of three main zones, defined by three material types being the bulk/general fill, drainage layer and low permeability facing to the river side of the stopbanks. These are all overlain by topsoil and/or suitable path surfacing as appropriate.

The new stopbanks may be constructed in, on or outside the existing stopbanks. Generally the new stopbanks have been designed to have their river side embankment face aligned or within the proposed stopbank, with the existing stopbank encapsulated within the bulk fill element of the new stopbanks meaning there is no reduction in the existing level of flood protection during construction and there may be no requirement for the construction of temporary measures. In isolated locations only, where the new stopbanks are on the same alignment as the existing stopbank, the existing stopbank may be fully reconstructed and construction may require a temporary cofferbank. This does not preclude the ability to rebuild the stopbanks in their entirety.

The material for the stopbank construction will be sourced as follows:

- General fill – This material can be from any of following:
  - Site won river gravel material. This is expected to be predominantly sandy/silty gravels and cobbles. This material has been observed to be rounded and poorly graded. There is minimal processing anticipated however any large cobbles will need to be removed, either picked out during placement, or more likely, screened at a stockpile prior to placement.
  - Existing stopbank material. These materials vary along the length of stopbanks and consist of either imported quarry stripping's or reworked river deposits. This will either be in situ/existing stopbank material left undisturbed, or stopbank material cut to fill where stopbanks are to be relocated.
  - Stopbank undercut material – Material undercut from beneath the proposed stopbank. This material will be likely soft compressible silt and is likely to require conditioning (drying) to allow placement and compaction.
  - Imported granular fill (e.g. quarry overburden material or similar). This is only expected where there is a shortfall of gravel sourced material or to progress the works while river gravel extraction is not maintaining supply. E.g. during any periods where extraction is not permitted, if applicable.
- Graded filter material:
  - This will be a manufactured material designed as a transition from the low permeability facing to the more open bulk fill and drainage layers. It will be either imported or manufactured onsite from crushed and screened material river gravels.
- Low permeability material - This needs to be a cohesive fill material with a hydraulic conductivity of less than 1 x 10-7m/s, which may be sourced from:
  - Imported residual soils and highly weathered greywacke rock (off site quarry overburden material)
  - Site won silt – material undercut from beneath the stopbank footprint. This material is likely to require conditioning (drying) to allow placement and compaction.
- Topsoil:

- Topsoil for stopbank will be a combination of site won topsoil and imported topsoil, with its primary purpose being a growing medium suitable for establishing grass cover laid to a thickness of 50mm to 100mm to minimise erosion potential
- Site won topsoil is anticipated to provide less than 50% of the required site wide volume, all of which will be incorporated in the works
- Imported topsoil to make up the balance of the required volume.

Construction sequencing

The stopbanks will be constructed utilising traditional industry standard construction plant and techniques in the following sequence:

- Topsoil strip
  - Excavation of toe drain, cut off trench and undercut (if any) to:
  - fill if material is suitable for an area with placement available
  - processing area (if processing required e.g. for low permeability fill)
  - stockpile (if suitable for reuse, but no open area available)
  - waste (material is unsuitable or surplus)
- Construction of toe drain
  - installation of subsoil reticulation to the local stormwater network
  - placement of graded filter material
- Construction of stopbank
  - placement of general fill
  - placement of graded filter material to river side face, tying in to the cut off trench
  - placement of low permeability fill to river side face, tying in to the cut off trench
- Construction of cut off trench
  - placement of graded filter material
  - placement of low permeability fill
- Finishing
  - topsoiling
  - landscaping
  - paths (if any)

Where existing stopbanks are within the footprint of the new stopbanks, these may remain in situ within the general fill zone, with only the existing topsoil stripped. Where existing stopbanks occupy any of the other zones (toe drain, cut off trench, filter or low permeability material) it is expected the existing stopbank will be removed to the profile of the general fill, with any cut material being cut to areas of general fill, such that the key stopbank features (lining and toes) are of consistent and uniform construction.

Where removal of any stopbank (partial or in whole) is required, the new stopbank will be constructed to at least the same elevation, or a temporary stopbank constructed to ensure the current levels of flood protection are maintained. It is likely there will be short periods where a stopbank has a cut through, or tie-in construction to existing which will reduce the flood protection levels if left. The contractor will be required to demonstrate a method, including an assessment of risks associated with the approach, including contingency, for rapid reinstatement or replacement of the affected stopbank in the event of a forecast event or on-set of inclement weather.

- Transportation of stopbank materials
  - General fill material sourced from the gravel extraction will be transported directly from the river (if sufficiently drained), from a temporary stockpile site adjacent to the stopbank, or from a stockpile site/processing area along the alignment. Where material is uplifted from a stockpile to the stopbank site, it is anticipated this will either be in road trucks or dumpers utilising the haul roads established for the gravel extraction. In isolated locations it is likely road trucks will utilise the local road network with the intention being this is minimised.
  - Imported materials (low permeability fill, graded filter material not manufactured on site and topsoil) will be imported to site in truck and trailer units directly to where required in the permanent works, or if needed to create a buffer of supply to stockpile and then uplifted as above.
- Plant used for stopbank construction
  - Plant used for the stopbank construction will be traditional earthworks plant. Material will be bought to site in the dumpers used for the gravel extraction, or small plant such as Moxys or road trucks where manoeuvrability is required. Material placement will occur with a combination of excavator (20t plus), predominantly where placement includes shaping, or spread using a bulldozer, or blade on a compactor (up to 19t with either a padfoot roller or smooth vibrating roller). It is expected each stopbank construction site will have a minimum of 1 excavator, 1 bulldozer, and 2 compactors, supported by 3 to 5 vehicles importing material.
- River crossing construction

Pedestrian bridge and new Melling Bridge

Both the pedestrian bridge and the new Melling Bridge are expected to be relatively traditional in the design with multiple spans and piled foundations. It is anticipated that each bridge will have piers both on the riverbanks and within the river channel with abutments positioned immediately behind, and independent of the stopbanks at either end.

Bridge spans will be confirmed during detailed design, however it is anticipated spans of the main channel will be optimised to minimise the number of piers within the main river channel. Where spans are up to approximately 35 m in length, they will most likely comprise of traditional precast beams. Precast beams may be lifted into place by either cranes or launching girders (used when access for lifting cranes is difficult, such as over wide waterways or where it is desirable to limit the construction footprint). Long span bridges, having spans of more than 35 m in length, are likely to be constructed with structural steel beams or box girders with similar installation techniques.

Piled foundations and columns will require access for a piling rig, cranes and other equipment required to construct the substructure (i.e. piers). It is anticipated this activity will be able to be constructed from installed low temporary causeways (effectively an armoured section of the bed) within part of the river along with some channel control associated with the staged gravel extraction activities in order to effectively undertake piling works out of the flowing river. Temporary causeways will be formed from mounded river gravels and will later be removed as part of bed reprofiling. Temporary causeways will follow the proposed bridge alignments (i.e. generally perpendicular to river flow) and will be trapezoid in form, with a base up to approximately 16-20 m wide (dependent on river depth at the location), with a flat top of approximately 10 m width. Should causeways not prove practical it is likely the bridge piling and substructure would be constructed using a temporary trestle bridge to access pile locations.

Alternative construction methods will be investigated further through detailed design and once a contractor is appointed. On site concrete batching is considered unlikely considering the proximity of local concrete batching plants.

5.6.7 Culvert outlets

There are a number of culvert outlets conveying stream flow and stormwater from the landward side of the stopbanks into the river channel requiring reconstruction or alteration, as summarised in Table 14. This includes an indicative construction duration for each. Further detail of the culvert works is contained in the Stormwater and Operational Water Quality Assessment (Technical Report #2) and are shown on the Proposed Drainage Service Works C321-324 drawings.

Table 14 - Culvert works

Outlet no	Stormwater or stream and description	Affected length[27]	Construction duration (approx.)	On-line/offline[28]	Stage
23	Stormwater: New PS and 1500 diameter culvert plus rising main	84 m	1 month	Online	1
24	Stormwater: New PS and 1200 diameter culvert plus rising main	77 m	3 months	Offline	4
27	Jubilee Park South Stream: Gravity 1500 diameter culvert (no fish passage possible[29])	114 m	2 months	Offline	1
31	Jubilee Park North Stream and stormwater (existing outlet 29 which captures runoff from Pharazyn Street is combined into outlet 31 which is stream from Jubilee Park catchment): New PS and 1350 diameter culvert plus rising main plus additional	450 m (made up of multiple pipelines replaced or abandoned)	6 months across multiple stages	Offline	Multiple 1, 2, 3, 4, 5

[27] The affected length of existing pipe is the section being altered (replaced)
[28] Construction online or offline is based on the preliminary design approach. This may alter in some instances at detailed design
[29] Detail around fish passage can be found in Technical Report No. 2 Stormwater and Operational Water Quality Assessment

Outlet no	Stormwater or stream and description	Affected length27	Construction duration (approx.)	On-line/offline28	Stage
	upgrades upstream (no fish passage possible)				
35	Stormwater: New PS and 1500 diameter culvert plus rising main	244 m	6 months	Online	Multiple 1, 2
36B (Harbour View Road culvert)	Harbour View Stream: New 2100 diameter culvert or equivalent box (no fish passage possible)	175 m	4 months	Offline	Multiple 4, 5
37	Stormwater: diameter pipe	95 m	2 months	Online	5
37C	Stormwater: 750 diameter pipe	90 m	1 month	Online	1 (but could be any associated with adjacent stopbank works)
38 (Tirohanga Road)	Tirohanga Intersection Stream: 1800 diameter culvert with fish passage	102 m	2 months	offline	Multiple 5, 6
40	Stormwater: New PS and 1800 diameter pipe plus rising main	200 m	4 months	offline	1 (but could be any associated with adjacent stopbank works)
33	Stormwater: 750 diameter	142 m	4 months	online	Multiple 1,2 3
39a	Stormwater: 600 diameter pipe (Shown on plans but may be excluded as at upstream limit of stopbank upgrade)	63 m	2 months	online	5

5.7 General construction aspects

5.7.1 Construction compounds

Indicative locations for construction compounds, construction staging areas and aggregate processing areas have been identified and are shown on the construction staging drawings in Volume 5 of the Application documents. The proposed designations accommodate these areas. Final locations and areas required for the construction compounds and bridge construction yards will be confirmed at detailed design stage and once a contractor has been appointed.

Site office compounds

The Project will have one or more site office compounds from which the construction works will be managed for the long-term duration of the Project. These compounds will include project offices, meeting rooms, ablution facilities, workshops for repairs and maintenance of plant and equipment, lay down and storage areas for materials delivery and parking.

At this stage, it is envisaged that site office compounds could be established in the following locations:

- Pharazyn Street - servicing all works to the north of the river. It is anticipated this would be the primary location
- Queens Drive – adjacent to the new bridge abutment and servicing the works on the TLB. It is anticipated this would be a secondary compound
- Western Hutt Road close to Belmont School and Kennedy Good Bridge may be used for as a contractor site compound, specifically for contractor parking and briefings, as this location has good road access to both sides of the river, away from the critical Melling link/SH2 intersection.

There is potential that one of the properties owned by one of the Project Partners, but not occupied may be made available for offices and meeting rooms.

Bridge construction yards

Smaller construction yards will be established at each bridge site to accommodate the bridge teams, materials, plant and equipment. The construction yards are contained within the site staging areas shown on the construction staging plans and will be established as required for the construction of each bridge and will be decommissioned at the completion of the associated bridge. These construction yards are likely to consist of 2 to 4 containers within a fenced compound.

Station construction yards

A smaller construction yard may be established at the new Melling Station site to accommodate the building contractor, materials, plant and equipment. The construction yard will be established as required for the construction of the station and will be decommissioned at its completion. This construction yard is likely to consist of 2 to 4 containers within a fenced compound and may be combined with the Pharazyn Street site office compound.

5.7.2 Protection and relocation of existing network utilities

Existing network utilities affected by the construction of the Project will need to be maintained, protected or relocated.

The Project Partners individually have a number of existing memorandums of understanding with network utility providers for similar works. Initial discussions have been undertaken with network utility operators regarding the management of their assets during construction. Network utilities will be protected or relocated in collaboration with the utility providers and in accordance with the relevant provider's standards. Protection or relocation of existing utilities will generally occur prior to or in conjunction with the main construction phase of the Project. The scope and timing of the necessary utility relocation and protection works will be developed and agreed between the Project Partners and network utility operators to enable continued operation, to mitigate any safety hazards and provide cost efficiency for the required works.

During the subsequent detailed design phase, construction methodologies will be developed in consultation with each network utility operator to manage effects of construction on specific network utilities.

5.7.3 Earthworks quantities and distribution

Earthworks will predominantly involve cut to fill operations within the footprint of a stage plus cut to stockpile for processing for specific materials (e.g. low permeability fill) plus stockpiling of material for use in later stages. Ideally this stockpiling will occur adjacent to, or within, the vicinity of the future stages, subject to available access and space to minimise losing the integrity of the material through repeated handling/disturbance.

Table 15 - Earthworks by stage

	Cut to Fill(i) m^3	Cut to Stockpile(ii) m^3	Cut to Waste(iii) m^3	Cut from Stockpile to Fill(iv) m^3	Import fill from offsite(v) m^3
Stage 1	210,600	60,000	28,000	12,000	5,000
Stage 2	56,000	7,000	10,000	52,000	8,000
Stage 3					5,000
Stage 4	19,000	63,000	5,000	2,000	1,000
Stage 5 & 6	138,000	58,000	15,000	122,000	24,500
Total	423,600	188,000	58,000	188,000	43,500

I. Cut to Fill – Cut from adjacent excavation areas (Channel and Berm) direct to stop banks or road formation
II. Cut to Stockpile – Cut to stockpile for processing or for use in later stages
III. Cut to Waste – Removal from site unsuitable/surplus material to clean fill
IV. Re-use of material stockpiled from processing areas or stockpiled during earlier stages
V. Import of bulk fill and Rock RipRap from off site.

The figures in the above table are intended to illustrate the bulk earthworks and river materials handled in each construction stage. An estimated total cut of 669,600 m^3 is required (comprising 636,600 m^3 from the river and berms (Table 9) and a further 33,000 m^3 of cut (Table 11) for the Melling interchange works). Table 15 above also shows that an estimated 188,000 m^3 of cut material will transition via stockpiles as fill for both stopbank construction and the Melling interchange works.

5.7.4 Stockpile locations

Where-ever possible stockpiling of material will be minimised to avoid the costs associated with double handling and the maintenance of stockpile site and to minimise potential effects on sensitive receivers (ESC and dust etc). With a significant quantity of material being excavated to form the river berms, it is likely that rather than excavate this to stockpile, this easily accessible material will be left in-situ until needed within the permanent works, with other material (e/g river channel extraction), being excavated direct to bulk fill areas. This will minimise the potential for material stockpiling.

Where stockpiling is required, this will be within the stage being excavated in the following locations in order or priority/likelihood:

- Adjacent, or near as practicable to the material's final placement within the stage
- Within a staging or aggregate processing area for either use un-processed in a subsequent stage or processed for use within the current or a subsequent stage.
- Stockpiled on berm areas within a stage (which may be leaving material in-situ until required) subject to any stockpiling not reducing available waterway/flood storage from current levels.
- Stockpiled on berm areas (or future stopbank footprint) of future stages where space is available without creating nuisance within that subsequent phase. It is expected this would be an unlikely scenario.

5.7.5 Processing/drying of silt materials

A reasonable quantity of cut material is expected to be silts that if dry enough will be suitable for either bulk fill or low permeability fill. Bulk excavated silts may require processing and or drying to be used, or alternatively cut to waste and replaced with imported fill. The determination of actual quantities of any silts cut to waste and replaced or processed will be determined during subsequent phases of the Project based on factors such as:

- Available space
- Processing cost versus cost of cut to waste and replace
- Ability to control dust during drying (e.g. wetting), while still drying.

Should the constructor elect to dry silt materials it is likely any one, or more, of the following methods may be utilised:

- Spreading in stockpile location (thin lift), drying, uplifting and placing in permanent location. This can require large areas and robust sediment control measures to be in place. As it requires a large area, it is likely this would not be used, however if it is needed, then it would potentially take place at a staging or the aggregate processing site.
- Treating with additive (typically lime or cement, depending on material composition). This can either be treated in a processing area or blended in-situ at its final location. Where the material is to be constructed in a thin layer, on steeper gradients, and difficult to mix in-situ, treatment will most likely be undertaken in a processing area.
- Blending with more competent materials, e.g. free draining gravels. This will be undertaken mostly in-situ within bulk fill locations and is considered the most likely method.

5.7.6 Haul routes and access routes

Earthworks operations can be contained within the proposed designation boundaries, including internal hauling of material, disposal of excess soil and gravel extraction sites. Given the likely requirement for importation of specific fill materials (low permeability fill, topsoil, pavement aggregates etc.), there will be material movement on public roads outside the proposed designation boundaries. The indicative construction access routes along the existing SH2 and the local road network and indicative internal haul routes within the proposed designation boundaries for earthworks, plant and materials are shown on the construction staging drawings in Volume 5 of the Application documents. Additional but shorter access tracks will be constructed from these internal haul roads to specific locations, such as bridge sites, riverbed access and sites for ground improvement works.

5.7.7 Material Processing

The materials being excavated from the river channel and berms are expected to contain high quality gravels suitable for processing into engineered materials. Processing is expected to include:

- Drying of saturated materials (as per section 5.7.5 above).
- Screening (without crushing) throughout the disturbance areas – controlling grading for quality control of bulk fill, bedding layers, subgrades etc. Plant used in the site-wide screening process is expected to include:
  - static grizzly screens (Figure 32) and vibrating grizzly screens and machine (loader or excavator) mounted screens or screening buckets (Figure 33). These are also referred to as scalping screens as they ‘scalp’ out any material over the aperture size.
- Crushing and screening plants (Figure 35) located at the Aggregate Processing Site shown on the Construction Staging drawings for the manufacture of engineered aggregates, e.g. filter materials, basecourses. This site is on an existing river terrace on the TRB beside SH2 opposite Wairere Road and will include:
  - Mobile screening plant (Figure 34) to manufacture a higher level of quality control than a grizzly. Screening plant is able to screen efficiently to various sizes to manufacture specific materials/gradings.
  - Aggregate crushing.

Figure 32 - Static grizzly screen

Figure 33 - Screening bucket

Figure 34 - Mobile screening plant

Figure 35 - Mobile crushing and screening

Because there is a net shortfall of cut material to satisfy the fill demands for the stopbanks and the Melling Interchange it is expected that manufactured aggregates will need to be sourced and imported from local quarries, rather than manufactured from site won materials. Through detailed design the actual quantity of material required to be imported may be optimised (reduced) potentially making the establishment and operation of a mobile crushing plant economically viable.

5.7.8 Imported aggregates

Imported aggregates will include:

- Bulk fill – where cut volumes are exhausted
- Low permeability fill – to line stopbanks where site won material is not able to be economically or feasibly treated to a compliant or constructable material (see section 5.7.5 Processing/drying of silt materials)
- Crushed materials – basecourse, subbases, filter material, bedding materials etc where site won material is not able to be economically or feasibly treated to a compliant or constructable material or where the net shortfall of site won source material makes supply of this manufactured material more practical and efficient to be supplied from off-site

For the purposes of this assessment it has been assumed imported material will be sourced from north of the Project area along the SH2 corridor, either from the Quarry at Belmont or further afield. Material will be bought to site down SH2 and into the site at the intersection of SH2 and Melling Link.

5.7.9 Erosion and sediment control

The scale of the Project will require the disturbance of a large area of land within the proposed designations. An overriding principle for the Project has been to balance the land disturbance required against efficiencies in construction programme to minimise the amount of construction-related sediment in the river and associated downstream catchment.

A key erosion and sediment control principle will be to minimise the area and length of time that particular areas of ground or riverbed are open through staging and sequencing of works and progressively stabilising open earthworks and riverbed disturbance areas to reduce the potential for erosion and sediment generation to occur. This best practice approach will be used in conjunction with proven structural and non-structural control devices and methods for the land-based earthworks, and where possible for the in river works.

Best practice erosion and sediment control measures will be implemented for the Project. The erosion and sediment control measures to be implemented are described in detail in the Construction Water Quality technical report and the draft ESCP attached as an appendix to that report.

5.7.10 Water use requirements for construction

Water will be required for construction activities, such as dust suppression. No resource consents for water takes are sought at this time. The contractor will be required to obtain sufficient water supply for construction of the Project. The potential source or sources are not yet known, but may involve reuse of water collected on site or reticulated drinking water, as Te Awa Kairangi's catchment is fully allocated. If the contractor's chosen source requires resource consent authorisation (for example, a partial transfer from an existing authorised take), they will be required to obtain this consent separately prior to the commencement of works.

5.7.11 River Bridge/Pile Construction

A suggested bridge construction methodology, prepared by Alta Consulting Ltd based on the preliminary bridge designs, is provided below. The methodology has a particular emphasis on the piling method noting particular concerns being raised associated with the potential impact of the temporary and permanent piling works on the Waiwhetu artesian aquifer noting Wellington Water Ltd draws up to 70% of its daily water take from the Waiwhetu aquifer at the Waterloo well field, near the bridge construction site.

Methodology – General Bridge Construction

The following are indicative construction steps typical for construction of a bridge of this nature.

1. Contractor mobilisation and site establishment

   This would entail site mobilisation and establishment, including setting up a site compound with facilities for workers. The yard would need to accommodate plant, piling and bridge building materials, temporary works materials, environmental controls including water treatment, and parking.

2. Construct temporary accessway, piling platform, and temporary staging including finger access causeways for piling works.

   The design of the temporary works would need to be mindful of the aquifer and be designed in such a way as to not impact the water supply. This could include shallow piles with bracing or a temporary causeway.

3. Commence piling construction.

   Details of the piling sequence are included in more detail below. This work will include the bridge piers.

4. Construct abutment structure and earthworks.

   The abutment structures will require ground improvements as well as bulk earthworks. Suitable earthworks and ground improvements will be required for this work. Piling of the abutments will follow the same methodology as the main bridge piles outlined below.

5. Construct pier headstock

   The pier headstocks are likely to be constructed in-situ. The works will require the installation of a shoring system (such as scaffolding or similar platform) or custom temporary works. These could be constructed from the temporary works braced against the piers, or using shoring built up from the riverbed.

6. Remove finger staging platforms.

   Once the pier headstocks are complete, the finger staging platforms can be removed. If using causeway, this can be left in place until most of the bridge construction is completed.

7. Install girders using crane(s) from the staging platform.

   Precast bridge girders will be installed from the temporary staging platforms or causeway. The configuration of cranage required for the lift will be dependent on the detailed bridge design and the contractor’s preferred method. Both single and double crane lifts are expected to be feasible.

8. Cast the in-situ deck topping slab and footpath.

   Temporary edge protection will be required for works on the bridge deck. Typical concrete construction methods will likely be utilised for this work.

9. Cast abutment backwall, settlement slab and backfill behind abutment.

   Typical concrete construction methods will likely be utilised for this work.

10. Install barriers and top rail.

    Precast barriers and top rails are likely to be utilised. In addition, lighting and other traffic services will be installed onto the bridge. There may be additional utilities that are required to be attached to the bridge structure.

11. Remove temporary staging, demobilise site compound, and reinstate the site.

Methodology – Piling Construction

Piling activity, once temporary access has been formed, is anticipated to be 4 to 6 weeks per pile, subject to achievable piling speeds and any difficulties that may be encountered. With there being 2 piles within the active river bed for the Melling Bridge and 1 for the pedestrian/cycle bridge, it is expected the in-river piling activity will be between 3 and 6 months in duration, with the remaining piles being constructed in the dry on the river berms (existing or new). The piles will take a similar construction duration each with the total piling taking between 9 and 12 months. It is not anticipated multiple piles will be installed concurrently, on a single bridge, however there is potential for piling to occur on the pedestrian/cycle bridge and the Melling Bridge concurrently.

1. Geotech investigations

   Prior to the commencement of works on site, further geotechnical investigations will be completed. These will provide further details on the level of the aquifer and aquiclude, along with other ground conditions impacting the final design at each pile location. The location of the aquitard/aquiclude and underlying aquifers are critical in determining the length of casing required and the necessary temporary works to construct the pile safely.

2. Piling contractor mobilisation

   Once temporary works are installed, piling plant can be mobilised and environmental controls installed. These will likely include water treatment facilities, ground water monitoring and any other controls required for the works.

3. Install the nominal 4m diameter temporary casing.

   A temporary casing will be driven into the aquiclude. The top of the casing is to extend above the static water level in Waiwhetu gravels. The intent of this is to provide a confined working environment for the subsequent piling works. In the event of a leak around the pile, the quantity of leakage can be contained and remediated without significant volumes of water escaping or entering the aquifer.

   This temporary casing will be grouted between the outside of the casing and the surrounding ground at the aquiclude level. Methods for this grouting include jet grouting (grout injection) from the surface or using pre-installed grout pipes externally or grout pipes inside the casing with injection nipples through the steel casing.

   Once this is completed, the material inside the pile can be excavated out to a level that maintains a seal at the base of the excavation.

   The temporary casing can then be tested to ensure that it holds water. This can be done in both positive and negative pressures.

4. Drill and drive the 2.7m structural pile casing.

The permanent works pile casing will then be installed. This will likely be driven using a pile hammer until refusal, likely to the top of the Waiwhetu gravel layer, where it may require drilling or coring to achieve the required depth. The casing will likely require a piling shoe with some slight overcut to overcome ground friction to be able to achieve the required pile depth which includes some additional depth for the concrete plug to be cast at the base.

While this pile is driven, the water level inside the temporary works can be balanced with the aquifer pressure, to minimise any potential leakage.

Once the casing has been installed to the required depth, the material can be excavated from inside the casing and concrete placed onto the base of the pile to create a plug. Following this, the anulus between the ground and the 2.7m casing can be grouted. This can be done using jet grouting or preinstalled grout lines, similar to step c above. At the completion of the grouting, the seal can be tested by raising or lowering the water in the temporary casing.

5. Concrete works

Once any leakage path has been sealed and grouted off, the annulus between the 4m diameter temporary casing and the 2.7m structural casing can be filled with concrete. This will provide ballast so the structural pile can be dewatered, and the remaining pile works can be completed as a dry pile.

The temporary 4m pile casing can be trimmed to an agreed level at the completion of the piling works.

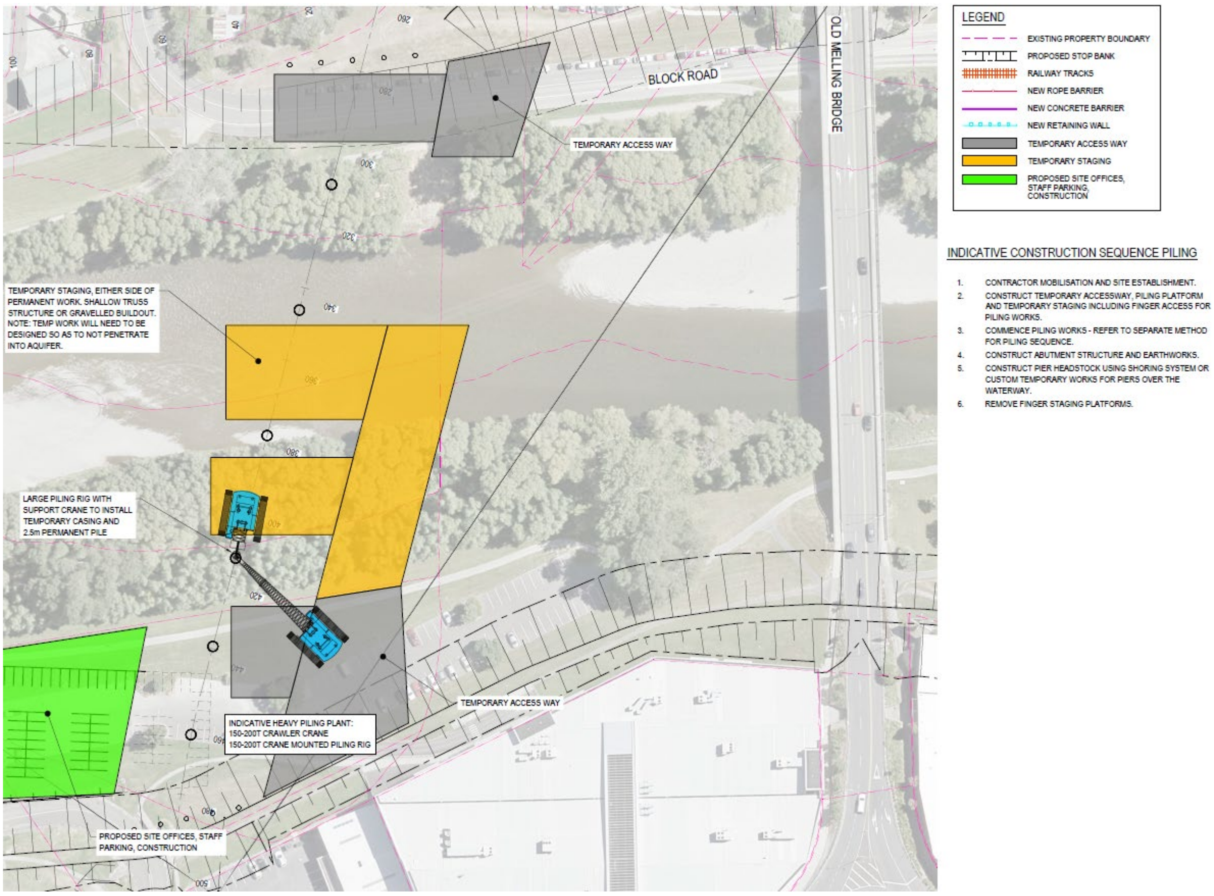


Figure 36 – Piling method

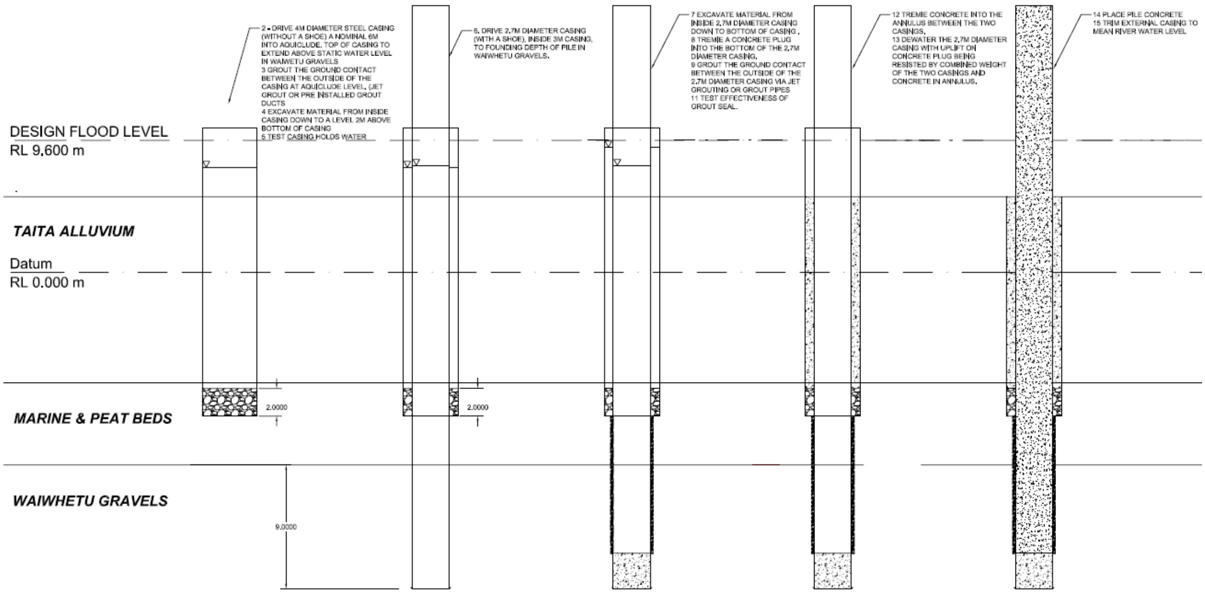


Figure 37 - Piling sequence

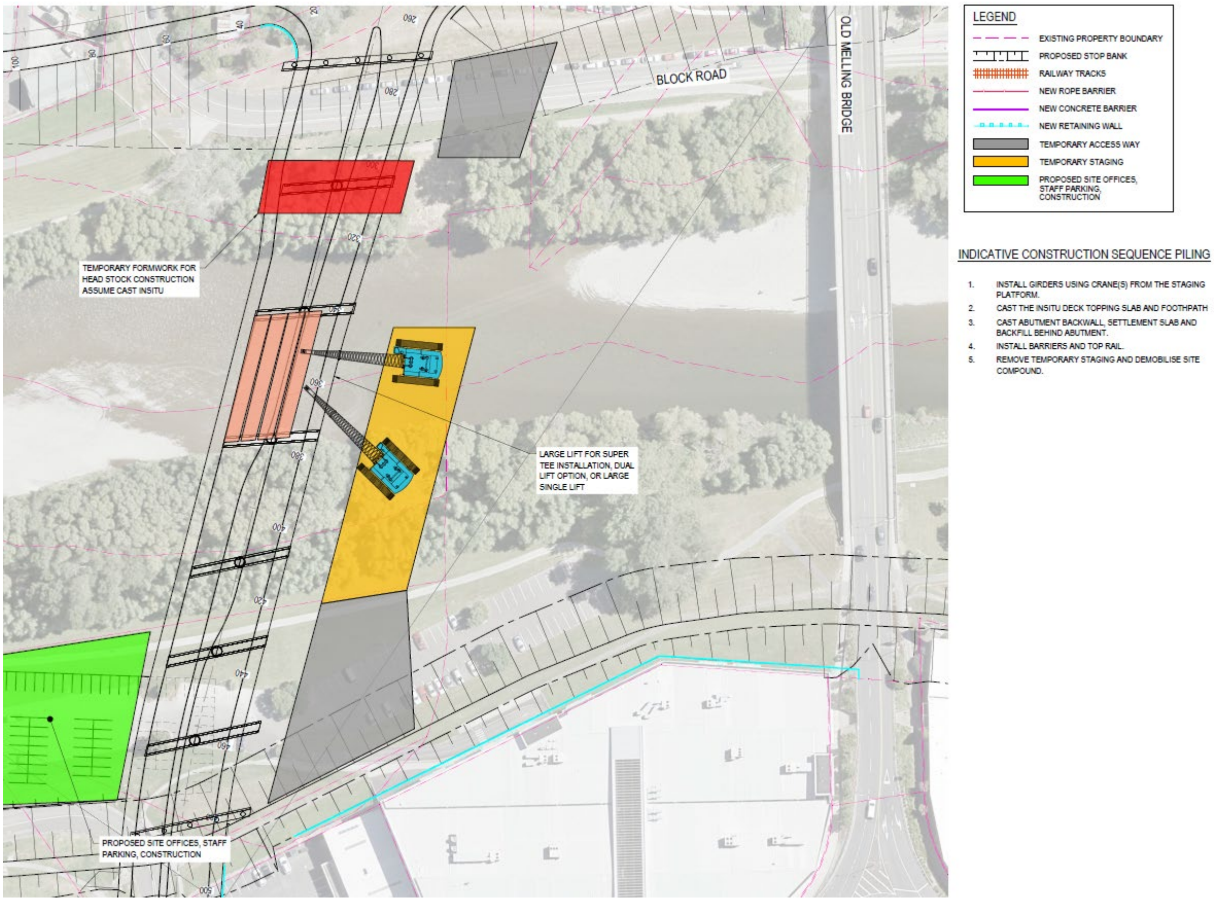


Figure 38 - Deck construction

5.7.12 Construction plant equipment

Light vehicle/ plant requirements

Light vehicles used during construction will be predominantly crew cabs (utility vehicles or light trucks), light trucks (up to 3.5T), maintenance plant, project management and construction observations vehicles (car or utility vehicle)

Light vehicle/plant movements

Assuming five vehicles covering Project/Contract Management and Site Engineers, each undertaking 10 trips per day on average will equate to 100 trips per day, with approximately twice that number expected for crew movements, maintenance, miscellaneous trips across the project site.

Table 16 below outlines the number and type of heavy construction plant/vehicles that will be on site during construction.

Table 16 - Heavy vehicle/plant requirements

Activity	Construction equipment	Quantity
Gravel extraction works - riverbed widening and reprofiling	Excavator (12T – 20T)	1
	Excavator (30T plus)	2
	Dump truck (50T plus)	3
	Dozer (28T)	1
	Watercart	1
Riverbank protection works	Excavator (12T – 20T)	1
	Excavator (30T plus)	1
	Dump truck (40T plus)	1
	Truck and Trailer	2
Stopbank construction	Watercart	1
	Dump trucks (40T)	3 (Note: Same dump trucks as gravel extraction)
	Truck and Trailer	2-6 (Note: 2 if low perm fill only, more if bulk fill required)
	Excavator (12T – 20T)	2
	Dozer (28T)	1
	Compactor (20T plus) with/without padfoot	2
	Vibrating Roller (12T plus)	1
	Watercart	1
River crossing construction (bridges construction)	Tracked mobile crane (105T plus)	2
	Crane mounted auger (rotatory bored piling)	1
	Truck mounted concrete pump + boom arm	1
	Concrete mixer truck	3
	Poker vibrator	2
	Transporter (material deliveries including beams)	1
	Excavator (12T – 20T)	2-4

Activity	Construction equipment	Quantity
Road works (including local roads realignment)	Dump trucks (40T)	3 (Note: Same dump trucks as gravel extraction for import of river sourced bulk fill for Pharazyn Street only)
	Truck and Trailer	2-6 (Note: Potentially truck only on local roads, with higher numbers when importing from off-site bulk fill to Rutherford Street/Queens Street)
	Grader	1
	Concrete mixer truck	1
	Wheeled loader (2m3 plus)	2
	Dozer (14T)	1
	Vibratory roller (5-7T)	3
	Vibrating Roller (7-9T plus)	2
	Asphalt paver (12T) (+tipper lorry)	1
	Mini piling rig (5T) (bored piling for retaining wall)	1
	Watercart	1
Road works (SH2, new Melling interchange)	Excavator (12T – 20T)	
	Dump trucks (40T)	3 (Note: Same dump trucks as gravel extraction for import of river sourced bulk fill for Melling Interchange and SH2 southbound only)
	Truck and Trailer	4-12 (Note: Lower number when import of roading aggregates, with higher numbers when importing from off-site bulk fill to Melling Interchange and SH2)
	Grader	1-3
	Wheeled loader (2m3 plus)	2
	Dozer (14T)	1
	Vibratory roller (9T)	3
	Vibrating Roller (12T plus)	2

Activity	Construction equipment	Quantity
	Watercart	2
	Asphalt paver (12T) (+tipper lorry)	1
	Mini piling rig (5T) (bored piling for retaining wall)	1
	Crane mounted auger (rotatory bored piling)	1
	Truck mounted concrete pump + boom arm	1
	Concrete mixer truck	3
	Poker vibrator	2
	Transporter (material deliveries including beams)	1
Melling Station and station parking	Excavator (12T – 20T)	2
	Truck and trailer	2-4 (Note: May be truck only delivering building materials and occasional materials for civil works)
	Concrete mixer truck	2
	Wheeled loader (1m3 plus)	1
	Grader	1
	Vibratory roller (9T)	2
	Watercart	1
	Asphalt paver (12T) (+tipper lorry)	1
	Truck mounted crane (20T plus)	1
Melling Line rail track realignment	Excavator (12T – 20T)	
	Wheeled loader (1m3 plus)	1
	Truck and trailer	2-4 (Note: May be truck only delivering building materials and occasional materials for civil works)
	Grader	1
	Vibratory roller (9T)	2
	Watercart	1
	Concrete mixer truck	1
	Rail tamper / regulator	1

Activity	Construction equipment	Quantity
Deconstruction of the existing Melling river bridge	Pulveriser mounted on excavator (30T)	
	Truck and trailer	2-4 (Note: May be truck removing material to waste off-site)
	Excavator (30T plus)	
	Tracked mobile crane (105T plus)	2
Aggregate Processing Area	Excavator (30T plus)	
	Dump truck (40T plus)	3 (Note: Same dump trucks as gravel extraction)
	Truck and trailer	2-4 (Note: May be truck only)
	Wheeled loader (2m3 plus)	2
	Static or mobile screen	1-2
	Tracked semi-mobile crusher	1
	Watercart	1
Site Staging Areas	Excavator (12T – 20T)	Varies
	Dump truck (40T plus)	Varies
	Truck and trailer	Varies
	Water	Shared with adjacent construction
	Tracked mobile crane (105T)	Storage only away from adjacent site
Traffic Management	Traffic Signs Truck (Attenuator)	2-4
	Traffic Signs Truck (no attenuator)	1-4

Heavy vehicle/plant movements

The majority of listed plant will be confined to off-road activities or within constructions sites. Predominant heavy vehicle movements will be importation of aggregate and fill materials to site via SH2 from the north, plus importation of structures and building materials.

The highest daily movement for heavy plant will be truck only and truck and trailer movements with peak daily movements expected to be approximately 80 trips per day and 120 trips per day respectively. Exact numbers will be dependent on the speed at which the constructor is able to place material. For example, if able to increase production by 50%, the number of trips would be 120 and 180 trips per day, with there being a corresponding reduction in the number of days trips would be occurring.

It is expected that over dimension and overweight loads will occur overnight or off-peak via SH2. This would be for the establishment of heavy equipment (such as dumpers, large excavators and cranes) and large loads (e.g. bridge beams).

5.7.13 Site access points

It is anticipated that the contractor will seek access to site using most of the local roads that connect to the Project works site.

5.7.14 Traffic management

Construction of the Project will require temporary traffic management (TTM) on both the existing state highway and local roads. This may include:

- Shoulder and lane closures;
- Temporary deviations;
- Road closures/detours;
- Site access arrangements including acceleration and deceleration lanes; and
- Temporary speed limits.

In many instances construction activities can be undertaken offline, with temporary traffic management only needed where construction of tie-ins is required under live traffic, or to manage traffic arrangements between stages. Some road realignments or bridge works will require the construction of temporary diversions to maintain through traffic. Temporary traffic management controls will be implemented in accordance with the standards in the Code of Practice for Temporary Traffic Management (CoPTTM) to ensure that the TTM measures are put in place safely and that the impacts on traffic are minimised to the extent practicable.

5.7.15 Hazardous substances and materials

Construction activities and site works will include a wide range of machinery and construction plant. The majority of this plant will be motorised and require a regular supply of fuels and oils. The machinery will require refuelling on- site, meaning fuel, oils and other lubricants will be stored within the proposed designations.

The management of hazardous substances, including storage, handling, transport and disposal, will be subject to specific management practice and industry guidelines and full site management details will be provided in the Construction and Environmental Management Plan for the Project. This management will minimise potential effects on health and safety from exposure to hazardous substances and minimise potential for adverse effects on the environment.

6. Statutory context

Overview

This chapter sets out the key statutory matters under the Resource Management Act 1991 relevant to the Project, namely:

- The relevant provisions of the RMA
- Relevant national, regional and local plans and policy documents
- The Notices of Requirement and outline plans required
- A summary of the regional resource consents sought under the applicable regional plans
- Resource consents sought under National Environmental Standards
- Statutory acknowledgements
- Other legislative matters and approvals relevant to the Project

6.1 Introduction

The purpose of this section is to set out the statutory framework against which the Project must be assessed. Relevant statutory matters are set out, including the applicable RMA planning documents as well as matters under other relevant legislation. It focuses particularly on those provisions of the RMA that are relevant to the application, including:

- purpose and principles of the RMA (Part 2);
- duties and restrictions (Part 3);
- NoRs for designations (Part 8); and
- applications for resource consent (Part 6).

An assessment of the Project against the statutory framework is provided in Chapter 11 of this AEE. In addition, this section identifies the statutory authorisations sought under the RMA for the Project. In summary, GW, Waka Kotahi and HCC are proposing to seek designations, construction resource consents, and operation and maintenance resource consents as set out below.

Designations

GW, Waka Kotahi and HCC are individually seeking bespoke designations to individually authorise their RiverLink land use activities. These are detailed in section 6.8.2 below.

Construction resource consents

GW, Waka Kotahi and HCC are collectively seeking individual resource consent approvals to jointly authorise all GW, Waka Kotahi and HCC activities associated with RiverLink that will commence during construction of the Project, including:

- land use consent to disturb the soil of contaminated land pursuant to the NES Soil under section 9(1) of the RMA;
- land disturbance activities under section 9(2) of the RMA;
- activities in, on, under or over the bed of rivers and streams under section 13 of the RMA and the NESFW;

- diversion of water in rivers, streams and groundwater under section 14 of the RMA; and
- discharge of contaminants from contaminated land to either land or water under section 15 of the RMA.
- discharge of contaminants to air under section 15 of the RMA, sought by GW, Waka Kotahi and HCC,

Operation and maintenance resource consents

Resource consents are sought to authorise the following operations and maintenance activities for specific Project Partners:

- diversion and discharge of stormwater from new state highway infrastructure to land and water under sections 14 and 15 of the RMA, sought by Waka Kotahi; and
- diversion and discharges of stormwater from new permanent impervious surfaces to land and water under sections 14 and 15 of the RMA, sought by HCC.

6.2 Resource Management Act

6.2.1 Purpose and principles (Part 2)

Consideration of the NoR and the applications for resource consent are subject to Part 2 of the RMA. Part 2 of the RMA is comprised of sections 5 to 8 and outlines the purpose and principles of the RMA.

Section 5 sets out the purpose of the RMA, being to promote the sustainable management of natural and physical resources, and states:

> *(2) In this Act, **sustainable management** means 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 —*
>
> *(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
>
> *(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

Section 6 sets out the matters of national importance that all persons exercising functions and powers under the RMA shall recognise and provide for. Subsections (a), (b), (c), (d), (e), (f), and (h) and are relevant for the Project. In summary, these matters relate to:

> *(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:*
>
> *(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:*
>
> *(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:*
>
> *(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:*
>
> *(e) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:*
>
> *(f) the protection of historic heritage from inappropriate subdivision, use, and development:*

(h) the management of significant risks from natural hazards.

Section 7 sets out other matters to which particular regard shall be had. Of relevance to the Project are subsections (a), (aa), (b), (c), (d), (f), (g), (h) and (i) as set out below.

(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon[30]:

(i) the effects of climate change.

Section 8 requires all persons exercising functions and powers under the RMA to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

6.2.2 Duties and restrictions (Part 3)

Part 3 of the RMA sets out a number of restrictions on the use of resources (including land and water), and on activities that affect resources (such as the discharge of contaminants).

Section 9 of the RMA imposes restrictions on the use of land. The Project will involve a number of land disturbance activities controlled under section 9(1) related to the NES Soil and section 9(2) of the RMA related to earthworks which contravene regional rules. The proposed activities that would otherwise be permitted or require consent under district plan rules (section 9(3) of the RMA) will be authorised by the proposed designations for the Project.

Section 13 of the RMA imposes restrictions on activities in, on, under and over the beds of lakes and rivers. Te Awa Kairangi traverses the Project area and it, as well as tributaries to it, will be affected by structures as part of the Project, through the installation of the new Melling Bridge, the pedestrian and cycle bridge and through the replacement and modification and alteration of existing culverts. The Project also requires gravel extraction to provide the material to construct the stopbanks and reshaping of the riverbed to establish a new channel and a natural meander pattern for the widened river channel.

Section 14 of the RMA relates to any take, use, damming or diversion of water. The Project will require temporary and permanent diversion of Te Awa Kairangi in association with stopbank construction, river channel widening and reshaping the river channel. There will be temporary and permanent diversion of water associated with culvert works on tributaries within the Project area that feed into Te Awa Kairangi. There will be ground water diversion associated with construction of the Project as a result of dewatering activities.

Section 15 of the RMA restricts discharges of contaminants into air, or into or onto land or water. The Project will involve discharges to air, land and water during construction and discharges to land and water during operation.

The specific resource consents and the relevant plan rules requiring consent are set out in section 6.6 below.

[30] Salmon and the habitat of salmon are not relevant to the Project

6.2.3 Designations

As outlined in Chapter 1 of this AEE, GW, Waka Kotahi, and HCC are requiring authorities and they have given notice of their requirements for new designations, and in the case of Waka Kotahi and HCC, alterations to existing designations in the District Plan.

The process for considering a NoR for a new or altered designation is set out in Part 8 (sections 166 - 186) of the RMA. In accordance with sections 168(1) and 168(2), a local authority or requiring authority respectively may, at any time, give notice in the prescribed form to a territorial authority of its requirement for a designation for a public work, or for a project or work.

6.2.4 Resource consents

As the consent authority for the regional consent applications, the GW Environmental Regulation department must consider applications for resource consents under sections 104 to 107 of the RMA and may impose conditions under sections 108 and 108AA if it chooses to grant consent.

As the consent authority for the district consent applications required under the NES Soil, the HCC as consent authority must consider applications for resource consents under sections 104 to 106 of the RMA and may impose conditions under sections 108 and 108AA if it chooses to grant consent.

6.2.5 Matters for consideration

As required by section 104, consent authorities considering applications for resource consent must, subject to Part 2, have regard to the following matters as assessed in this AEE.

Table 17 - Section 104 requirements

Section 104 requirement	AEE reference
(1)(a) Actual and potential effects on the environment of allowing the activity	Chapter 9: Assessment of effects on the environment and the technical assessment reports in Volume 4 of this Application
(1)(ab) Measures proposed for the purpose of ensuring positive effects on the environment to offset or compensate for any potential adverse effects	Chapter 9: Assessment of effects on the environment Chapter 10: Management of effects on the environment
(1)(b) Relevant provisions of national and/or regional policy statements, national environmental standards, plans and other regulations	Chapter 11: Statutory assessment
(1)(c) Other matters that are considered to be relevant and reasonably necessary to determine the application	Chapter 11: Statutory assessment

As required by section 171, territorial authorities considering NoRs must, subject to Part 2, consider the effects on the environment of allowing the requirement, having particular regard to the following matters as assessed in this AEE.

Table 18 - Section 171 requirements

Section 171 requirement	AEE reference
(1) Part 2 of the RMA	Section 11: Statutory assessment
(1) Effects on the environment	Chapter 9: Assessment of effects on the environment and the technical assessment reports in Volume 4 of this Application
(1)(a) Relevant provisions of national and/or regional policy statements and plans	Chapter 11: Statutory assessment
(1)(b) Adequate consideration of alternatives	Chapter 7: Consideration of alternatives
(1)(c) Reasonable necessity for achieving Requiring Authority objectives	Chapter 11: Statutory assessment
(1)(d) Other matters that are considered to be reasonably necessary to consider	Chapter 11: Statutory assessment

Section 105 of the RMA sets out further matters that the consent authority must have regard to in relation to the consents sought for the discharge of water and contaminants (stormwater and sediment), dust from earthworks and gravel extraction activities during construction and discharges of stormwater during the ongoing operation of the Project. The matters identified in section 105 of the RMA are assessed in Chapters 9 and 11 of this AEE, which demonstrate how the requirements of section 105 are met.

Relevant policy statements and plans are identified in section 6.3 below. An assessment against these provisions is provided in Chapter 11 of this AEE.

In addition, there is a range of 'other matters' that must be considered, which can include matters outside the RMA, including non-statutory policy documents. A brief description of other matters relevant and/or reasonably necessary to consider are outlined in sections 6.3 to 6.5 below. An assessment against 'other matters' is provided in Chapter 11 of this AEE.

Restrictions on the power to grant consent

Section 107(1) of the RMA restricts the power to grant resource consent to discharge a contaminant or water where that discharge is likely, after reasonable mixing, to give rise to any of a number of specified types of adverse effects. This restriction is subject to the exceptions listed at section 107(2), including where there are exceptional circumstances, or where the discharge is of a temporary nature.

A detailed assessment against section 107(1) is contained in Chapter 11 of this AEE.

6.3 Plans and policy documents

The national, regional and district planning and policy documents relevant to the Project (prepared in accordance with the RMA) are listed below.

6.3.1 National Policy Statements

New Zealand Coastal Policy Statement 2010 (NZCPS)

The NZCPS contains objectives and policies relating to New Zealand's coastal environment. While the Project is located outside of the coastal environment and is unlikely to impact on the coastal environment through its construction-related sediment discharges, the NZCPS has been considered, since the Project has the potential to affect the downstream coastal environment.

There are seven overarching objectives of the NZCPS which set out the high-level direction for managing the coastal environment, and 29 policies that follow this direction. The objectives of the NZCPS include, in summary:

- Safeguard the form, functioning and resilience of the coastal environment and sustain ecosystems by maintaining biological and physical processes, protecting significant natural ecosystems and maintaining or enhancing coastal water quality;
- Preserve the natural character of the coastal environment and protect natural features and landscape values;
- Take into account the principles of the Treaty of Waitangi;
- Maintain and enhance public access and open space opportunities in the coastal environment;
- Ensure coastal hazard risks taking account of climate change are managed;
- Enable people and communities to provide for their social, economic and cultural wellbeing;
- Ensure management of the coastal environment recognises and provides for New Zealand's international obligations.

An assessment of the Project in relation to the NZCPS is provided in Chapter 11 of this AEE.

National Policy Statement for Freshwater Management 2020 (NPSFM)

The revised NPSFM came into effect on 3 September 2020. It contains one overall objective and 15 policies. The policies relevant to the Project are summarised below:

- Te Mana o te Wai and involving tangata whenua in freshwater management (Policies 1 and 2);
- Integrated whole-of catchment management (Policy 3);
- Integration with New Zealand’s response to climate change (Policy 4);
- Implementation of a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and for all others is either maintained or improved (Policy 5);
- Protection of wetlands and their values (Policy 6);
- Avoidance of the loss of river extent and values to the extent practicable (Policy 7);
- Protection of significant values of outstanding water bodies (Policy 8);
- Protection of the habitats of indigenous freshwater species (Policy 9);
- Protection of the habitat of trout and salmon (Policy 10);
- Efficient use and allocation of freshwater (Policy 11);
- Achievement of the national target (as set out in Appendix 3) for primary contact (Policy 12);
- Monitoring and reporting (Policies 13 and 14); and
- Enabling communities to provide for their social, economic, and cultural well-being (Policy 15).

The relevance of the NPSFM to the Project will be primarily through consideration of consents required under the PNRP (noting the PNRP was prepared prior to the NPSFM 2020) and an assessment of the Project in relation to the NPSFM provisions is provided in Chapter 11 of this AEE.

National Policy Statement for Urban Development 2020 (NPSUD)

The NPSUD took effect on 20 August 2020 and replaced the National Policy Statement on Urban Development Capacity 2016.

The NPSUD 2020 requires councils to plan for growth and ensure a well-functioning urban environment for all people, communities and future generations. The NPS-UD provides direction to make sure capacity is provided in accessible places, helping New Zealanders build homes in the places they want – close to jobs, community services, public transport, and other amenities communities enjoy.

An assessment of the Project in relation to the relevant provisions of the NPSUD is provided in Chapter 11 of this AEE.

6.3.2 National Environmental Standards

Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011

The NES Soil establishes a nationally consistent set of planning controls and soil contaminant values for 12 priority contaminants, across five standard land use scenarios (rural residential, residential, high density residential, recreational and commercial/industrial).

The NES Soil applies to sampling and disturbing the soil on any piece of land identified as meeting one of the following criteria:

a. an activity or industry described in the Hazardous Activities and Industries List (HAIL) is being undertaken on it;

b. an activity or industry described in the HAIL has been undertaken on it; or

c. it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken on it.

The regulations in the NES Soil have the equivalent status of rules in a district plan.

As assessment of the Project in relation to the NES Soil is provided in Chapter 11 of this AEE. The potential effects of land contamination are addressed in Chapter 9 of AEE, which concludes that there is land within the Project footprint where it is known that HAIL activities are likely to be currently being, or are likely to have been, undertaken. As a result, the NES Soil applies to the Project and district resource consents are sought to disturb the soil of contaminated land during construction as a discretionary activity under clause 11(2) of the NES Soil. This consent is pursuant to section 9(1) of the RMA, for an activity that is not allowed by a national environmental standard without a resource consent.

A detailed assessment of the proposal against the requirements of the NES Soil is provided in Appendix B of this AEE.

Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007

This NES requires regional councils to ensure that effects on drinking water sources are considered in decisions on water permits or discharge permits and rules in regional plans. No consents relating to this standard are required. However, the potential effects of the Project on the quality of drinking water sources (including Wellington Water Limited's potable wells at the

Waterloo bore field which is located to the south / south-east of the Project) are addressed in section 9.4.1 of this AEE.

Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NESFW)

The NESFW came into effect on 3 September 2020. The regulations in the NESFW have the equivalent status of rules in a regional plan and they cover a variety of activities, including works within and adjacent to natural wetlands, and construction and alteration to structures such as culverts, weirs and flap-gates within the bed of a river[31]. There are no natural wetlands within or adjacent to the Project area. The Project activities which fall under the NESFW include reclamation, placement, use, alteration, extension, or reconstruction of a culvert and the installation of flap gates.

The NESFW does not apply to alterations or extensions to existing structures in, on, over or under the bed a river[32], but it does apply where a structure is reconstructed (i.e. replaced).

Reclamation

As described in section 4.9 above, and 9.3 and 9.7 below, a 25 m section of existing open channel stream, referred to as Harbour View Stream, will be filled in with hardfill and structural fill material as part of the new Melling Interchange and associated slip way construction. The infilling of this stream meets the definition of reclamation in the NESFW which reflects the definition of reclamation prescribed in the National Planning Standards[33].

While the definition of reclamation also includes the construction of any causeway, it applies when in the context of the formation of permanent dry land. Consequently, the temporary causeways (or embankments/construction tracks) in Te Awa Kairangi required for construction of the new bridges are not regarded as reclamation under the NESFW, as they do not create permanent dry land.

Consent is therefore sought under Regulation 57 of the NESFW. This is a regional land use consent pursuant to section 13 of the RMA, for an activity that is not allowed by a national environmental standard without a resource consent.

Culverts

In relation to culverts, a number of existing culverts are affected by the Project, these culverts and the relevant information pertaining to them in relation to the NESFW are outlined in Table 19 below.

---

[31] Means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)

[32] Regulation 60 Resource Management (National Environmental Standards for Freshwater) Regulations 2020. This subpart does not apply to any of the following structures in, on, over, or under the bed of any river or connected area:an existing structure, meaning a structure that was in the river or connected area at the close of 2 September 2020, and including any later alterations or extensions of that structure:

[33] means the manmade formation of permanent dry land by the positioning of material into or onto any part of a waterbody, bed of a lake or river or the coastal marine area, and includes the construction of any causeway;

Table 19 - Summary of Project culverts

Outlet	23	24	27	29	31	33	35	36b	37	37c	38	40
Stream/stormwater	Stormwater	Stormwater	Jubilee Park South Stream	Stormwater	Jubilee Park North Stream	Stormwater	Stormwater	Harbour View Stream	Stormwater	Stormwater	Tirohanga Intersection Stream	Stormwater
Natural connection upstream	No	No	Yes	No	Yes	No	No	Yes	No	No	Yes	No
Natural connection downstream	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Upstream connection location	Existing stormwater network	Existing stormwater network	Existing stormwater network	Existing stormwater network	Existing stormwater network	Existing stormwater network	Existing stormwater network	Stream	Existing stormwater network	Existing stormwater network	Stream	Existing stormwater network
Outlet location	River	Stopbank toe with channel to river	Stopbank toe with channel to river	Outlet 31	Stopbank toe with channel to river	Stopbank toe with channel to river	River	River	Stopbank toe with channel to river	Treatment swale with outlet to river	Stopbank toe with channel to river	Amenity wetland with channel to river
NESFW fish passage requirements	-	-	Will not comply	-	Will not comply	-	-	Will not comply	-	-	Will comply	-
Backflow prevention	Automated and pump station	Automated and pump station	Automated	Automated and pump station	Automated	Automated	Automated and pump station	Not required	Automated and pump station	Not required	Not required	Automated and pump station

As identified in Table 19 above, the Project includes works on four culverts that convey flow from natural streams, either directly or indirectly through existing piped stormwater infrastructure. These are outlets 27, 31, 36b and 38. All four of these culverts require a substantial length of the culvert to be replaced and therefore the activity is considered reconstruction. Although in some instances the reconstruction connects to existing pipe infrastructure, on a conservative basis the Project has assessed the reconstruction of these culverts requires consideration under the NESFW because these culverts convey flow from a river.

Regulation 70 of the NESFW sets standards for culvert design and Regulations 62 and 63 require that prescribed information on the culverts be supplied to the regional council once they are installed. One of the Project culverts (Outlet 38) has been designed to meet the permitted activity conditions in Regulation 70 and will result in an improvement in fish passage at this culvert. The other reconstructed culverts are not able to satisfy Regulation 70. The full assessment of relevant culverts against the permitted activity conditions of Regulation 70 is set out in Appendix B of this AEE.

There are a number of other culverts on both sides of Te Awa Kairangi which are regarded as urban stormwater culverts. While in some instances they may connect to a river at the outlet end, these culverts are not connected to a river at both ends[34]. Therefore, the NESFW requirements do not apply to these purely urban stormwater culverts.

Due to site and topographical constraints preventing fish passage at Outlet 36b and the inability to design culverts 27 and 31 to mimic a natural stream bed substrate due to backflow prevention requirements, the reconstruction of culverts 27, 31 and 36b are unable to meet Regulation 70 of the NESFW. Consent is therefore sought as a Discretionary Activity for this work pursuant to Regulation 71 of the NESFW. This is a regional land use consent pursuant to section 13 of the RMA, for an activity that is not allowed by a national environmental standard without a resource consent.

Flap gates

In relation to flap gates, Regulation 74 of the NESFW prescribes that the placement, use, alteration, extension, or reconstruction of a passive flap gate in, on, over, or under the bed of any river is a non-complying activity. The Project design has made provision for automated flap gates (penstocks) where backflow prevention structures are required. This design is considered effective in reducing the impact to fish passage as the design of the flap is to only operate when water levels reach a critical height. This reduces the impact on fish movements and upstream physical habitat. Consequently, consent for use of flap gates is not required under the NESFW as these structures will not be ‘passive’. Information related to flap gate design prescribed by Regulation 65 will be provided once the structures have been installed.

6.4 Regional Policy Statement for the Wellington Region

The Regional Policy Statement for the Wellington region (RPS) was made operative on 24 April 2013. Relevant resource management issues are:

- 3.3 Energy, infrastructure and waste;
- 3.4 Freshwater (including public access);
- 3.5 Historic heritage;
- 3.6 Indigenous ecosystems;
- 3.7 Landscape;

[34] Some outlets are located within Te Awa Kairangi but there is no upstream habitat or connectivity to a river upstream at these locations

- 3.8 Natural hazards; and
- 3.10 Resource management with tāngata whenua.

An assessment of the Project in relation to the relevant sections of the RPS is provided in Chapter 11 of this Application.

6.5 Proposed Natural Resources Plan

The Proposed Natural Resources Plan (PNRP) was notified in July 2015. Hearings were held between 2015 and 2018 and decisions issued in July 2019. The plan is currently in the appeals stage – provisions that were not appealed or where the appeals have been resolved are operative. Provisions with unresolved appeals are yet to be made operative and hence the operative provisions in the relevant regional plan remain relevant. The Appeals version of the PNRP, as at 1 July 2021, has been referenced throughout this AEE.

A summary of specific consent triggers with respect to the PNRP rules is provided below in Table 23 and Table 27 and a full assessment of the applicable rules is set out in Appendix C.

A summary assessment of the Project in relation to the relevant objectives and policies of the PRNP is provided in Chapter 11 of this AEE.

6.6 Operative Regional Plans

6.6.1 Operative Regional Freshwater Plan for the Wellington Region

As the PNRP is yet to be made fully operative, parts of the Regional Freshwater Plan (RFP) remain relevant to the Application. An assessment of the Project in relation to the relevant objectives and policies of the RFP is provided in Chapter 11 of this AEE.

The RFP was made operative on 17 December 1999 and was updated through six plan changes, the most recent of which took effect from 1 August 2014. A summary of specific consent triggers with respect to the RFP rules is provided below in Table 24 and a full assessment of the applicable rules is set out in Appendix C.

6.6.2 Operative Regional Soil Plan for the Wellington Region

As the PNRP is yet to be made fully operative, parts of the Regional Soil Plan remain relevant to the Application. An assessment of the Project in relation to the relevant sections of the Regional Soil Plan is provided in Chapter 11 of this AEE.

The Regional Soil Plan was made operative on 9 October 2002 and a plan change affecting the definition of "soil" was made operative on 1 September 2003. A summary of specific consent triggers with respect to the rules is provided below in Table 25 and a full assessment of the applicable rules in the Regional Soil Plan is set out in Appendix C.

6.6.3 Operational Regional Plan for Discharges to Land for the Wellington Region

As the PNRP is yet to be made fully operative, parts of the Regional Plan for Discharges to Land remain relevant to the Application. An assessment of the Project in relation to the relevant objectives and policies of this plan is provided in Chapter 11 of this AEE.

The Regional Plan for Discharges to Land was made operative on 17 December 1999. There have subsequently been a number of plan changes to give effect to the original and 2014 versions of the NPSFW. The most recent plan change took effect from 1 August 2014.

A summary of specific consent triggers with respect to the rules is provided below in Table 26 and a full assessment of the applicable rules in the Regional Plan for Discharges to Land is set out in Appendix C.

6.7 City of Lower Hutt District Plan

The City of Lower Hutt District Plan (District Plan) was made fully operative on 18 March 2004. The plan has been subject to a rolling review and HCC embarked on a comprehensive review of the District Plan in mid-2020. Council's current timeline suggests draft provisions will be released from mid-2021 with the plan not finalised and notified until mid-2022.

Objectives and policies relating to the following activities covered by the District Plan are relevant to the Project:

- bulk earthworks and land disturbance works
- construction of retaining walls, including mechanically stabilised earth (MSE) walls
- general construction works that may not comply with permitted noise standards
- establishment of the pedestrian and cycling bridge across Te Awa Kairangi
- establishment of the promenade atop the GW stopbanks
- ground improvement works
- establishment of structures to facilitate access to the promenade
- upgraded and new connections to local roads
- new over bridge, interchange and new bridge over Te Awa Kairangi
- new cycleways / lanes
- relocation of the Melling Station
- realignment of the existing Melling Railway line to accommodate the new Melling Interchange
- establishment of new carpark(s) and access for the relocated Melling Station
- earthworks.

An assessment of the Project in relation to the relevant sections of the District Plan is provided in Chapter 11 of this AEE.

6.8 Designations

6.8.1 Existing designations

There are no existing designations for the Project.

The designations set out in Table 20 below are included in the District Plan within and/or immediately adjoining the Project area for RiverLink. The first three designations belong to GW, Waka Kotahi and HCC. The second three designations are held by other requiring authorities. In order to undertake work in accordance with a designation on land where there is an earlier designation in place, the written consent of the requiring authority for the earlier designation is required under section 177(1)(a). Prior to construction commencing on land subject to existing designations, approval under section 177(1)(a) will be required from KiwiRail.

Table 20 - Existing designations

Requiring authority	Designation reference	Designation purpose
GW	WRC 11	Flood Protection Purposes: To enable the construction, upgrading and maintenance of

Requiring authority	Designation reference	Designation purpose
		stopbanks and associated works necessary to support stopbanks (Boulcott) - not within the Project area, but immediately adjoining
Waka Kotahi	TNZ 1	Motorway purposes
HCC	HCC 4	Riverbank Carpark
New Zealand Railways Corporation (now KiwiRail)	NZR 1	Railway Purposes – Melling Branch
Minister of Education	EDUC 5	Primary School (Belmont School) – – not within the Project area, but immediately adjoining
Transpower NZ	TPNZ 2	Electricity substation (Melling) – not within the Project area, but immediately adjoining

6.8.2 Proposed designations

GW, Waka Kotahi and HCC have given notice of their requirements for the designation of land required for the Project as described in Volume 1 of the Application.

Designation plans showing the land to which each NoR relates are provided in Volume 5 of the Application documents, and a schedule of land directly affected by the NoRs is included in Volume 1 (Forms).

Table 21 - Proposed designations

Requiring authority	Proposed designation
Wellington Regional Council	A new designation for "flood protection purposes”. This includes construction, upgrading and maintenance of flood protection works and associated works necessary to support flood protection purposes.
	A new designation for “public transport purposes” to operate and maintain the new Melling Station and associated infrastructure.
Waka Kotahi NZ Transport Agency	A new designation and an alteration to designation TNZ 1 (Motorway Purposes) to construct, operate and maintain a new state highway connection at Melling, a cycleway/shared path and associated infrastructure, and demolition of the existing Melling Bridge.
Hutt City Council	An alteration to Designation HCC 4 for the Riverbank Carpark. A new designation to support and promote the urban renewal and revitalisation of Lower Hutt city centre, including local road changes[35].

The proposed designations directly affect the following types of land ownership:

[35] HCC may seek to acquire land/properties within its designated area for urban renewal as part of the Project

Table 22 - Summary of land directly affected by the designations

Owner type	Area affected (ha) (approximate)
Private	6.00
Council / Crown	83.60
Road	22.40
Other (riverbed)	61.55

6.8.3 Relationship between designations

There are three requiring authorities involved in RiverLink – GW, Waka Kotahi and HCC. Each is issuing a NoR for their respective project components, which are described in detail in Chapter 4. As shown on the proposed designation drawings in Volume 5 of the Application (AD16-4381-D201-203), there is a degree of overlap between the designations, which reflects the overlapping responsibilities between the requiring authorities. There is also an alteration required to KiwiRail's designation, which is included in a separate NoR[36]. Where they overlap, the requiring authorities have agreed to the following designation priority:

- Primary (first) designation
  - Altered KiwiRail NZR 1*
  - Altered Waka Kotahi TNZ 1*
  - Altered HCC 4*
- Secondary designation
  - New GW designation
- Tertiary designation
  - New Waka Kotahi designation, and
- Quaternary designation
  - New HCC designation.

* The three primary designations do not overlap each other, so have equal primacy.

6.8.4 Effect of the designations

In accordance with section 178 of the RMA, a NoR has an interim effect from the day on which either the requiring authority gives notice of the requirement to a territory authority[37] or, where a territorial authority decides to issue a NoR, the day on which the receiving territorial authority decides whether to notify the NoR.[38] The interim effect period ends when the notice is either withdrawn, cancelled or included in the district plan.

The implications of an interim designation are the same as that of a confirmed designation, i.e. no person may do anything that would prevent or hinder the public work, project, or work to which the designation relates unless they have written consent from the requiring authority.[39] In the case of the interim effect this does not, however, apply to a requiring authority with an existing designation in the same location.

[36] The KiwiRail NoR has been lodged concurrently to this application, but is a separate application not subject to this AEE
[37] Section 178(3)(b) of the RMA
[38] Section 178(3)(c) of the RMA
[39] Section 178(2) of the RMA; see also section 176(1)(b) of the RMA

For RiverLink this means that the owners and/or occupiers of properties within one or more of the designation boundaries, which are not currently owned by either GW, Waka Kotahi or HCC, must seek the relevant requiring authority approval before undertaking any activity that would hinder RiverLink.

6.8.5 Designation lapse period

Section 184 of the RMA provides that a designation lapses, unless given effect to, on the expiry of five years after the date on which it is included in the district plan unless the designation specifies a different period, or an extension has been sought for a longer period prior to expiry. GW, Waka Kotahi and HCC are not seeking a longer lapse period and rely on the default 5-year lapse period for their respective designations.

6.8.6 Outline Plans

Section 176A of the RMA requires that an outline plan must be submitted to a territorial authority before commencing construction of a project or work under a designation, unless sufficient detail is included in the designation such that an outline plan is not required.[40]. The Application (i.e. this AEE, the associated drawings, technical reports and management plans) contains sufficient information that no subsequent outline plan will be required, other than for certain specific elements as identified in the proposed designation conditions or where an alternative design or work is proposed (refer to Appendix A for the proposed conditions).

6.9 Activities requiring resource consent

All activities that required consent under either the GW PRNP or the operative Regional Plans are set out below.

All key resource consents for the Project are being sought as part of this Application. If, after detailed design is complete, further or different consents are required these will be sought at the time.

GW is relying on its previously granted river management consent (i.e. the existing river maintenance consent, number WGN130264) that relates to works in the bed and on the banks, berms and stopbanks of Te Awa Kairangi to enable ongoing maintenance of the RiverLink river channel works once constructed. This is outlined further in section 6.9.4 of this AEE.

6.9.1 Consents sought in this application

The regional consents sought for construction of the Project are identified in section 6.9.2 and the consents sought for operation and maintenance of the Project are identified in section 6.9.3 below.

As noted above, regional consent is also sought for reclamation as a Discretionary Activity under Regulation 57 and for reconstruction of culverts as a Discretionary Activity under Regulation 71 of the NESFW. This assessment is provided in Appendix B.

District consent is sought to disturb the soil of contaminated land during construction as a discretionary activity under clause 11(2) of the NES Soil. This assessment is provided in Appendix B.

6.9.2 Consents sought for construction activities

Table 23, Table 24, Table 25 and Table 26 describe the resource consents sought for construction activities under the PRNP and the relevant GW regional plans.

---

[40] Section 176A(2)(b) of the RMA

Table 23 - PNRP consents sought - construction

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Land use				
Land use (s.9(2)) – earthworks and vegetation clearance Land use (s.9(2)) – roading and tracking earthworks	Large scale earthworks undertaken across the Project, including stopbank construction, interchange construction, construction yards, access and haul roads which are greater than 3,000 m^2 per property in any 12-month period. Vegetation clearance on erosion prone land within 5m of a surface water body	R101: Earthworks and vegetation clearance	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.9(2)) – geotechnical investigations	The use of land and the associated diversion and discharge of water or contaminants for drilling and construction of a bore, where: • The depth of some bores will exceed 5 m BGL within a Community Drinking Water Supply Protection Area	R147: Drilling, construction or alteration of any bore	Controlled Activity	Waka Kotahi HCC GW
Land use (s.9(2)) – earthworks extending deeper than 5m BGL	Construction and excavation activities relating to the state highway interchange and Melling Bridge deeper than 5 m BGL in Community Drinking Water Supply Protection Area.	R146A: Construction and excavation activities greater deeper than 5 m bgl in community drinking water supply protection areas and the Hutt Valley Aquifer Protection Zone	Discretionary Activity	Waka Kotahi HCC GW
Works in watercourses (land use and disturbance)				
Land use (s.13) – new and altered stream culverts	Reconstruction, construction, alteration and replacement of stream culverts where:	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• The general conditions cannot be complied with • The culvert is longer than 20 m in length and greater than 1.2 m in diameter • The maximum fill height above the top of the culvert (cover) exceeds 2 m • The disturbance of bed material exceeds 20 m^3 • the culverts will alter the natural course of a river			GW
Land use (s.13) – new river crossing structures in, on, under or over the bed of rivers and streams	New Melling Bridge and new pedestrian/cycle bridge across Te Awa Kairangi with piers constructed within the river bed, including temporary causeway(s) required for construction, where: • The general conditions cannot be complied with • The catchment area above the bridges and causeway(s) exceeds 50 ha • The area of the bridges and causeway(s) within the bed of the river exceeds 20 m^2	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) new structures	New structures (e.g. habitat features and erosion protection structures including rock rip rap, concrete aprons, ramps, treatment swales and river access structures) in the bed of a river where:	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• The general conditions cannot be complied with • The structure is located within a Schedule C site • The footprint of the erosion protection structure exceeds 10 m^2			
Land use (s.13) - maintenance, repair, replacement, upgrade, or use of existing structures	Maintenance, repair, replacement, upgrade, or use of existing structures (e.g. erosion protection structures) where: • The relevant general conditions cannot be complied with • The resulting structure adds more than the lesser of 5% of the plan or cross-sectional area of the structure in the river or lake bed, or 1 m in horizontal or vertical projection	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – demolition and removal of structures in, on, under or over the bed of rivers	Demolition and removal of temporary structures required for construction activities (i.e. causeway(s) and existing structures (including Melling Bridge) where: • The general conditions cannot be complied with • the activity disturbs greater than 10 m^2 of bed	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – beach recontouring	Beach recontouring where: • general conditions cannot be complied with	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• works will occur within areas of the bed covered by water • excavation will exceed a depth of 1 m • recontouring will be required in a Schedule C site.			GW
Land use (s.13) – gravel extraction outside of sites of significance	Gravel extraction of Te Awa Kairangi outside the PNRP Schedule C sites of significance where: • The general conditions cannot be complied with • Greater than 1 m^3 of material is removed by mechanical means • Extraction is in areas covered by water • Extraction exceeds 0.5 m in depth • Extraction is within 50 m of an established weir, ford, culvert, bridge, dam, surface water intake structure or network utility structure	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – gravel extraction within sites of significance	Gravel extraction from Te Awa Kairangi within sites of significance identified in Schedule C (Maraenuku and Motutawa pās)	R129A: Gravel extraction for flood protection purposes or erosion mitigation inside sites of significance	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – bed recontouring and excavation of the river bed	Bed recontouring and excavation and disturbance of the river bed not otherwise provided for by any rule in the PNRP.	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Land use (s.13) – trimming or removal of vegetation from the bed of any river or lake	Removal of vegetation from the bed of Te Awa Kairangi where the general conditions cannot be complied with, and removal is associated with river deepening or widening.	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – planting in the bed of a river or lake	Planting of vegetation in the bed of Te Awa Kairangi where: • planting in Schedule C sites will not be exclusively native	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – tracking across Te Awa Kairangi	Construction vehicle tracking across and through Te Awa Kairangi not otherwise provided for.	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – reclamation	Reclamation (infilling) of a river not otherwise provided for by any rule in the PNRP.	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Diversion of water				
Water permit (s.14) – take and diversion of groundwater	Excavation and associated take and diversion (including discharge) of groundwater for the purpose of dewatering a site where: • The take and diversion and discharge is from, onto or into contaminated and or potentially contaminated land, and	R146A: Construction and excavation activities in the Community Drinking Water Supply Protection Areas and the Hutt Valley aquifer system	Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• Excavations and associated structures relating to dewatering will extend beyond 5 m BGL.			
Water permit (s.14) – diverting water within or from a river	Diversion of water within or from Te Awa Kairangi due to construction of the stopbanks and structures in the floodplain that will obstruct the flow of water from Te Awa Kairangi during flood.	R135: General rule for damming and diverting water	Discretionary Activity	Waka Kotahi HCC GW
Water permit (s.14) – placing structures that obstruct the flow of water	Activities that cannot meet activity specific rules in the PNRP require separate consents for temporary and permanent diversion of water. All structures (both temporary and permanent) which require consent under Rule R129 that will obstruct the flow of water in Te Awa Kairangi require consent under this rule. This also includes: • Temporary diversion of water within Te Awa Kairangi and tributaries associated with construction works. • Permanent diversion of water within or from the tributaries of Te Awa Kairangi through replacement culverts.	R131: Damming or diverting water within or from rivers	Discretionary Activity	Waka Kotahi HCC GW
Discharges				
Discharge permit (s.15) – stormwater discharge of sediment and contaminants	The discharge of sediment into water or onto land where it may enter water from earthworks or vegetation clearance on land within 5 m of a waterbody	R101: Earthworks and vegetation clearance	Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
from earthworks and vegetation clearance	The discharge of sediment laden water from an area of bulk earthworks greater than 3,000 m^2			
Discharge permit (s.15) to discharge sediment and during and as a result of works in watercourses (i.e. structures, gravel extraction, etc described above)	The discharge of sediment associated with works in watercourses not otherwise provided for by the specific activity rules.	R129: All other activities in river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Discharge permit (s.15) – discharge of contaminated land to land and water	Construction discharges from contaminated land to land and water where a DSI has not been undertaken.	R56: Investigation of, or discharges from contaminated land	Discretionary Activity	Waka Kotahi HCC GW
Discharge permit (s.15) – discharge of contaminants to air	Discharge of contaminants to air associated with extraction, crushing, screening, processing and stockpiling of river gravels where the discharge may cause noxious, dangerous, offensive or objectionable odour, dust, particulate, smoke, vapours, droplets or ash beyond the boundary of the property	R41: The discharge of contaminants into air that are not permitted, controlled, discretionary, non-complying or prohibited	Discretionary Activity	Waka Kotahi HCC GW

Table 24 - RFP consents sought - construction

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Works in watercourses (land use and disturbance)				
Land use (s.13) - new and altered stream culverts	Reconstruction, construction, alteration and replacement of stream culverts where: • The stream is not intermittently flowing • The disturbance of bed material exceeds 20 m^3 • The culvert does not meet fish passage requirements	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – new river crossing structures in, on, under or over the bed of rivers and streams	New Melling Bridge and new pedestrian/cycle bridge across Te Awa Kairangi, including temporary causeway(s) required for construction of these crossings, where: • The length exceeds 6 m • Structures are required in the river bed • The disturbance of bed material exceeds 20 m^3	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC
Land use (s.13) new structures	New structures (e.g. habitat features, river access structures and treatment swales) in the bed of a river not provided for by any other rule in the RFP.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) Maintenance, repair, replacement,	Maintenance, repair, replacement, extensions, additions and alterations to structures where:	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
extensions, additions and alterations to structures	• The resulting structure is not contained within the form of the existing structure • The resulting structure adds more than the lesser of 5% of the plan or cross-sectional area of the structure in the river or lake bed, or 2 m in horizontal or 1 m in vertical projection • The activity disturbs greater than 4 m^2 of bed per lineal metre of structure (with a maximum disturbance of 200 m^2 for any structure) • Work is undertaken in flowing water during trout spawning (31 May – 31 August)			GW
Land use (s.13) – extension of linear rock protection	Extension of existing rock rip rap where the resultant rock rip rap: • extends more than 1 m from the existing river bank • adds more than whichever is the lesser of 25% of the length of the existing rock rip-rap or 30 m measured from the existing structure • disturbs more than 2 m^2 of bed material per lineal metre of structure • Extends into the river bed from the bank more than whichever is the lesser of 10% of the width of the water body or 10 m;	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• Work is undertaken in flowing water during trout spawning (31 May – 31 August)			
Land use (s.13) – demolition and removal of structures in, on, under or over the bed of rivers and streams	Demolition and removal of temporary structures required for construction activities (i.e. causeway(s)) and existing structures (including Melling Bridge) where: • the activity disturbs greater than 20 m^3 of bed material; • Work is undertaken in flowing water during trout spawning (31 May – 31 August)	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi GW HCC
Land use (s.13) – gravel extraction	Extraction of gravel from Te Awa Kairangi where: • Extraction is in areas covered by water • Vegetation is disturbed or damaged • Greater than 50 m^3 of material will be extracted • Extraction exceeds 0.5 m in depth	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – bed recontouring and excavation of the river bed	Bed recontouring and excavation of the river bed not otherwise provided for by any rule in the RFP.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – trimming or removal of vegetation from the bed of any river or lake	Removal of vegetation from the bed of Te Awa Kairangi where the removal is not for flooding or erosion protection purposes or removal is	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	undertaken in flowing water during trout spawning (31 May – 31 August)			GW
Land use (s.13) – Planting for erosion protection and bank stabilisation	Planting of vegetation in the bed of Te Awa Kairangi where planting may extend more than 10% of the width of Te Awa Kairangi or 5 metres into the river bed	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – tracking across Te Awa Kairangi	Construction vehicle tracking across and through Te Awa Kairangi not otherwise provided for.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – new erosion protection structures	New erosion protection structures which extend into the available river bed width from the bank no more than whichever is the lesser of: • 10% of the width of the water body; or • 10 metres.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) - reclamation	Reclamation (infilling) of a river not otherwise provided for by any rule in the PNRP.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW
Land use (s.13) – structures and use of land in the floodway	The excavation and construction of structures and associated use of land within the Hutt River Floodway not used for flood protection purposes where: • Greater than 20 m^3 of material is required to be deposited	Rule 48A: Uses of land within the Waiohine Floodway, the Lower Ruamahanga River Floodway, and the Hutt River Floodway	Restricted Discretionary Activity	Waka Kotahi HCC GW

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
	• The structure obstructs the flow of water			
Discharges				
Discharge permit (s.15) – stormwater discharge of sediment and contaminants from earthworks and vegetation clearance	The discharge of sediment laden water from an area of bulk earthworks greater than 3,000 m^2 The discharge of contaminants that may enter water not otherwise provided for in the RFP (contaminated land)	Rule 5: All remaining discharges to fresh water	Discretionary Activity	Waka Kotahi HCC GW
Discharge permit (s.15) to discharge sediment and during and as a result of works in watercourses (i.e. structures, gravel extraction, etc described above)	The discharge of sediment associated with works in watercourses not otherwise provided for by the specific activity rules.	Rule 49: All remaining uses of river and lake beds	Discretionary Activity	Waka Kotahi HCC GW

Table 25 - RSP consents sought - construction

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Land use (s.9(2)) – roading and tracking earthworks	Roading and tracking for the highway interchange that will result in a road or track having a continuous length of new upslope batter extending for than 200 m, with a height of greater than 2 m measured vertically.	Rule 1: Roading and tracking	Restricted Discretionary Activity	Waka Kotahi HCC GW

Table 26 - RPDL consents sought - construction

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Discharge permit (s.15) – discharge of contaminated land to land and water	Construction discharges from contaminated land to land	Rule 22: Contaminated sites (off-site discharges)	Controlled Activity	Waka Kotahi HCC GW

6.9.3 Operation and maintenance

Table 27 describes the consents sought for operation and maintenance under the PRNP.

Table 27 - PNRP consents sought - operation and maintenance

RMA consent	Activity/scope of application	Rule reference	Activity Status	Consent for
Discharges				
Discharge permit (s.15) – stormwater discharge from State Highway network	Operational stormwater discharges from the new Melling interchange and state highway.	R52: Stormwater from a port, airport or state highway	Restricted Discretionary Activity	Waka Kotahi
Discharge permit (s.15) – stormwater discharge from local roads and impermeable surfaces	Operational stormwater discharges from local roads and impermeable surfaces where the footprint exceeds 3,000 m^2 and a *Stormwater Strategy* does not apply.	R52A: Stormwater from new subdivision and development	Restricted Discretionary Activity	HCC

6.9.4 Existing river maintenance consent

The existing river maintenance consent WGN130264 is comprehensive in terms of the activities that it provides for. These are summarised as follows:

- Land use consent [32238]: River management activities in the bed and on the banks, berms and stopbanks of Te Awa Kairangi/Hutt River for flood protection, erosion control and public amenity purposes including:
  - construction, maintenance, repair, replacement, extension, addition, alteration, demolition and removal of structures;
  - planting, maintenance and removal of vegetation;
  - Re-contouring and mechanical ripping of the river bed;
  - constructing diversion channels;
  - shaping, re-contouring and repair of bank edges, berms and stopbanks;
  - clearance of flood debris;
  - operation of machinery in the river bed, entry and passage of the river bed;
  - maintenance of drains;
  - dredging;
  - construction of walkways, cycleways and associated structures including stormwater drainage, culverts, and footbridges; and
  - excavation, disturbance and deposition of material.
- Water permit [34077]: To temporarily and permanently divert the flow of Te Awa Kairangi/Hutt River during and as a result of river management activities for flood protection, erosion control and public amenity purposes.
- Discharge permit [34034]: To discharge sediment and sediment laden stormwater into Te Awa Kairangi/Hutt River during, and as a result of, river management activities within and outside the river bed for flood protection, erosion control and public amenity purposes,
- Land use consent [34486]: To extract gravel from the bed and banks of Te Awa Kairangi/Hutt River using a combination of wet and dry methodologies.

The existing river maintenance consent contains a very comprehensive description of river management activities which is consistent with all future GW operation and maintenance requirements for the RiverLink section of the Te Awa Kairangi. Activities include:

> *(f) development of vegetative bank protection, including tree planting, willow layering, cabling and tethering; and*
>
> *(g) maintenance of vegetative works, including:*
>
> *(i) additional planting;*
>
> *(ii) new layering of trees;*
>
> *(iii) re-cabling of tethered willows;*
>
> *(iv) removal of old trees; and*
>
> *(v) trimming and mulching of trees;*

Sitting behind this existing river maintenance consent is the “Code of Practice” and “Environmental Monitoring Plan for River Management Activities” which together co-ordinate consistent implementation of all river management activities undertaken by GW.

Section 10 of the Code describes all river management methods that make up GW's river management 'toolbox' including the measures to be taken to avoid or mitigate the potential adverse effects of the activity.

The Code can be amended (as per condition 11.1 of the existing river maintenance consent). The existing river maintenance consent also requires the following management plans to be prepared:

- Operational Management Plan – in relation to each reach of the river (consistent with the relevant HRFMP);
- Annual Work Plans (must be consistent with Operational Management Plan and sections 6, 10 and Appendix 7 of the Code); and
- Site specific effects management plans and monitoring (SSEMP) - required for activities listed in Condition 4.3 and 4.4 (high potential impact activities).

Other conditions also set key bottom lines for the following matters:

- managing bed levels
- minimisation of disturbance of noise and amenity
- fish passage
- riparian vegetation (addresses high value riparian vegetation –means riparian vegetation within the consent area that is identified in the Operational Management Plan, the PNRP, by GW's Key Native Ecosystems and Wetland Programmes, or by flood protection surveys as having significant indigenous biodiversity values)
- sediment release; and
- lizards and geckos.

Conditions also set out requirements for baseline monitoring and management, Kaitiaki monitoring, Ropu Kaitiaki (knowledge sharing) and annual reporting, amongst other matters.

Following construction, construction monitoring and any required modifications to the RiverLink works will be implemented under the construction consents for a period of 5 years. Following this 5-year period, the existing river maintenance consent will provide for the operation and maintenance of the GW component of the Project, with respect to the maintenance of the modified river channel, berms, structures in the river channel (excluding bridges) and stopbanks. This includes any required gravel extraction to keep the bed levels maintained at any appropriate level defined by the HRFMP or Operational Management Plans.

6.9.5 Bundling of activities

Where there are a group of activities where the effects overlap, or where the activities are intrinsically linked (such that one activity could not occur without the others), it is appropriate for them to be considered holistically as a single bundle according to the most stringent activity status.

The activities are also grouped according to the relevant application, as GW, Waka Kotahi and HCC will each hold a suite of relevant resource consents for their part of RiverLink.

The resource consents for the Project are appropriately bundled together. The most restrictive activity status applies and therefore the Project is considered as a discretionary activity.

6.9.6 Resource consent lapse period

Sections 125(1)(a) and (1A)(a) of the RMA provide that a resource consent lapses, unless given effect to, five years after the date of commencement of the consent unless a date is specified in the consent. GW, Waka Kotahi and HCC are not seeking a longer lapse period and rely on the default 5-year lapse period for their respective resource consents.

6.9.7 Consent duration

GW, Waka Kotahi and HCC seek resource consents with the following durations:

- unlimited duration in respect of land use consents under section 9(2);
- ten (10) years from the date of commencement under sections 13, 14 and 15 of the RMA, in respect of consents required for construction activities; and
- thirty-five (35) years from the date of commencement under sections 13, 14 and 15 of the RMA in respect of consents required for the long-term operation and management of the Project.

6.10 Statutory acknowledgements

A statutory acknowledgement is a formal recognition by the Crown of a particular cultural, spiritual, historic and traditional association that an Iwi has with a specific area, as set out in the 'statements of association' contained in the relevant Treaty of Waitangi Deed of Settlement. Treaty Settlement legislation relevant to the Project is set out as follows:

- Port Nicholson Block (Taranaki Whānui ki Te Upoko o Te Ika) Claims Settlement Act 2009; and
- Ngāti Toa Rangatira Claims Settlement Act 2014.

The two statutory acknowledgements apply to a number of statutory areas. Of direct relevance to the Project area, the statutory acknowledgements apply to Te Awa Kairangi under both the Taranaki Whānui ki Te Upoko o Te Ika and Ngāti Toa Rangatira Claims Settlement Acts.

These statutory acknowledgements, and the statements of association (including in respect of Te Awa Kairangi) are set out in the PNRP – Chapter 12 – Schedule D.

6.11 Other legislative matters

This section provides a brief introduction to the other legislation that will be relevant in the delivery of the Project to provide context for other authorisations that are expected to be necessary for the Project. Any authorisations required under other legislation are not applied for as part of the current application package and the requirement for additional authorisations is stated for information only. The additional authorisations will be applied for at the appropriate phase of the Project.

6.11.1 Heritage New Zealand Pouhere Taonga Act 2014

The District Plan does not identify any Significant Archaeological Resource Sites within the Project area. A single Significant Cultural Resource Site is located within the project area - the Maraenuku Pā site on Connolly Street.

The Archaeology and Historic Heritage assessment summarised in section 9.13 of this AEE confirms that there are no listed and/or protected sites within the Project area (either in the District Plan or by Heritage New Zealand Pouhere Taonga (HNZPT). However, two heritage listed buildings, Casa Loma and Lochaber House, border the Project area and may be indirectly affected by construction activities. The existing Melling Station building, while more modern and not listed, has heritage value and will be affected. There is also the potential for pre-1900's artefacts to be encountered during construction of the Project. As a result, RiverLink will be applying for a project-wide general archaeological authority for the Project, which would include an On-Call Procedure (OCP) for areas where archaeological values have not yet been identified.

6.11.2 Wildlife Act 1953

The Wildlife Act 1953 addresses the protection and control of wild animals and birds and the management of game. The potential effects of the Project on protected species are discussed in Section 9.8 of this AEE. An application will be made under the Wildlife Act for an authority to relocate protected species, including lizards, prior to commencing construction of the Project.

6.11.3 Road stopping - Local Government Act 1974 / Public Works Act 1981

Part of the Project includes partial road stopping of Daly Street and Mills Street. The appropriate road stopping approval will be sought in parallel to the RMA approval process.

6.11.4 Public Works Act 1981

The Public Works Act 1981 (PWA) enables land to be acquired, either by agreement or by the compulsory processes set out in the PWA, for public works. It contains provisions for compensation for owners of land required for public works, and a process for the disposal of land no longer required for a public work.

A NoR for the designation of land and confirmed designations allow the owners of land subject to the NoR or designation to apply for the Environment Court for an order obliging the requiring authority to acquire all or part of the land (s185 of the RMA).

A number of the private properties subject to the proposed designations for RiverLink have already been acquired for the Project.

6.11.5 Fisheries Act 1996

The Fisheries Act 1996 provides for the utilisation of fisheries resources while ensuring sustainability. Prior to commencing construction of the Project, if required, an application will be made to the Ministry of Primary Industries under section 97(1) of the Fisheries Act for a special permit to collect exotic or native fish from a relocation site.

6.11.6 Conservation Act 1987

The Conservation Act 1987 promotes the conservation of New Zealand's natural and historical resources, including the establishment of the Department of Conservation. Prior to commencing construction of the Project, an application will be made to the Minister of Conservation, as appropriate, under section 26ZM of the Conservation Act for approval to move or transfer native fish and other aquatic life.

7. Consideration of alternatives

Overview

The three separate components of RiverLink, being flood protection, state highway upgrades and urban revitalisation, were developed separately before coalescing into a combined project in the past decade. This chapter outlines the processes that have developed the components of the RiverLink Project, and discusses the alternatives considered in reaching the proposed consent design. This chapter presents a brief summary of the key studies that have shaped RiverLink. Further detail can be found in Appendix E.

The concept of a river promenade, a key component of RiverLink, was first raised by Hutt City Council in the 1987 CBD Structure Plan, and further refined in subsequent Hutt CBD master plans in 1999 and the 2000's. These plans emphasised turning the Lower Hutt city centre towards the river as a catalyst for the revitalisation of the city centre. Concurrently, the HRFMP was adopted by GW and HCC (among others) in 2001, setting a blueprint for the upgrade of flood defences on Te Awa Kairangi. Importantly for RiverLink, the HRFMP undertook to upgrade stopbanks protecting major urban areas (including the Lower Hutt city centre) to contain floodwaters to a capacity of 2800 cumecs. In addition, all new bridges were to be upgraded to the 2800 cumec standard.

The Melling Gateway Strategic Case, a joint document approved by GW, Waka Kotahi and HCC in 2014, outlined the problems and strategic responses to the Melling Gateway project, and confirmed that GW, Waka Kotahi and HCC agreed that future investment activities need to be coordinated due to the interdependence across the strategic responses. Interest in the Project for Waka Kotahi arose due to safety and capacity concerns at the Melling intersection. Upgrading this intersection provided the opportunity to upgrade the flood capacity of the Melling Bridge concurrently. Upgrading Melling Bridge was in GW's interest, since the existing bridge is a flood constraint. RiverLink thus emerged as an integrated Project combining state highway upgrades, flood protection upgrades and urban redevelopment.

In 2015, the Hutt River City Centre Upgrade Project, prepared for GW, Waka Kotahi and HCC, undertook an options assessment combining flood protection and promenade components, thus integrating the flood protection and urban redevelopment Project components. A longlist of ten options was reduced down to two options which were put forward to public consultation. Option A for public consultation involved immediate implementation of significantly improved flood protection measures, while Option B involved immediate implementation of moderately improved flood protection measures, with more significant flood protection measures following later in 2035. Community support strongly favoured Option A.

The Melling Gateway Programme Business Case (2015), again a joint document by GW, Waka Kotahi and HCC, confirmed the strategic case for state highway and Melling Bridge upgrades, and identified the recommended path to resolve problems and achieve outcomes. This path was not to provide any interim transport network improvements, and instead deliver all major Melling transport elements ASAP.

In 2017, HCC prepared the 'Riverside Promenade Business Case – Building the Future'. This document further refined the promenade concept, which included integrating new buildings into the stopbank promenade in order for development to "face" the river. It identified that the best option to stimulate development and investment in the city centre was to construct and deliver a contiguous promenade extending from Margaret Street towards Ewen Bridge.

The preliminary design of the river channel was completed in 2018 in the 'DamWatch RiverLink Riverworks Preliminary Design Report', which summarised inputs from a number of other technical specialist reports. It was agreed in a multi-criteria analysis (MCA) process that the river channel should be based on a variable channel width option, with a 70m wide channel up to Melling Bridge, and then a long transition to a 100m channel between Transpower and Kennedy-Good Bridge. This report was prepared for GW but acknowledged the integrated nature of RiverLink and that GW, Waka Kotahi and HCC were working together with an integrated design approach.

From 2017 to 2019, three MCAs were undertaken to select a preferred option for the state highway interchange design, new Melling Bridge and integration between the state highway and Hutt city centre. GW, Waka Kotahi and HCC were all involved throughout this process.

The Melling Intersection Improvements Indicative Business Case (IBC), completed in 2017, reduced a longlist of 43 options to a shortlist of four options. The Melling Link – Further Options Report (2018) investigated the feasibility of these four options, and subsequently evaluated a number of key project components (e.g. interchange form, and location of bridge landing in Hutt city centre).

Subsequent to this, three options incorporating variations on the agreed key Project components (including a diamond interchange) were developed. Public consultation undertaken from May to June 2018 found that a design incorporating a direct connection to Queens Drive was supported by 46% of those who identified a preferred option. The Melling Intersection Improvements MCA Workshop (Jun 2018) Report confirmed that the Queens Direct option performed best of the three options considering the wide range of criteria though the MCA process. The Melling Transport Improvements Single Stage Business Case (2019) confirmed the Queens Direct option and was endorsed by the Transport Agency Board at its December 2019 meeting. The adoption of this option also confirmed the removal of the existing Melling Railway Station; a new Melling Station is proposed as a replacement approximately 500m to the south-west. The new station location will be in line with the new pedestrian and cycle bridge across Te Awa Kairangi.

With the concept river design (flood protection) and concept state highway upgrade designs confirmed, the final component to be confirmed was the promenade and related landscape, development and urban design components. The RiverLink City Edge Multi Criteria Analysis Report (2020), prepared for GW, Waka Kotahi and HCC, undertook an MCA considering six options for the integration of stopbanks and future urban development on the eastern side of the river (i.e. a promenade). Following this process, a new option was developed that incorporated the strengths of the preferred options. The City Edge MCA Analysis Addendum (2020) commenced MCA assessment of this new option, however the completion of flood modelling in July 2020 resulted in adjustments to stopbank heights with consequential effects on Project design.

In the scope resolution phase that followed, 8 out of 14 design changes were resolved by GW, Waka Kotahi and HCC, while six sites were resolved through an MCA assessment of alternatives. The Assessment of Alternatives 1-6 Assessment Report (2020) prepared for GW, Waka Kotahi and HCC undertook this MCA for each of the six locations affected by stopbank changes and confirmed recommended options for each location for consent design.

Thus, the concept design for the promenade and urban redevelopment component of RiverLink was finalised in late 2020, following the concept flood protection design in 2018 and the concept state highway interchange and Melling Bridge design in 2019.

7.1.1 Purpose of this chapter

This chapter outlines the process followed by GW, Waka Kotahi and HCC in assessing alternatives for the development of the Project (and its individual core components), in accordance with the RMA provisions relating to the consideration of alternatives for NoRs and resource consent applications, respectively.

When considering the NoRs, in accordance with section 171(1)(b), the decision-maker must have particular regard to:

"whether adequate consideration has been given to alternative sites, routes, or methods of undertaking the work if

(i) the requiring authority does not have an interest in the land sufficient for undertaking the work; or

(ii) it is likely that the work will have a significant adverse effect on the environment."

The words 'have particular regard to' in section 171 mean that the decision-maker must consider the matters to which the subsection refers specifically and separately from the relevant considerations. The words do not mean 'give effect to'. Accordingly, section 171(1)(b) does not set a 'pass' or 'fail' benchmark, but instead provides one (important) factor to be considered under section 171.

Under section 171(1)(b), the decision-maker evaluates the process followed by the requiring authority in considering alternatives. Importantly, the choice of site, route, or method of the work remains the requiring authority's to make.

While GW, Waka Kotahi and HCC need to consider alternatives in deciding the site or route of the Project, they are not obliged to choose the 'best' option. The policy function of deciding the most suitable option is up to the relevant Project Partner / requiring authority. The focus is on the process not the outcome.

As a starting-point for an alternatives process, a requiring authority must establish an appropriate range of alternatives for consideration. What will constitute an appropriate range of alternatives is a question of fact that will depend on the circumstances of each case. Key principles outlined by the Courts include that a requiring authority does not need to demonstrate that it has considered all possible alternatives, and in particular, it is not required to eliminate alternatives that are clearly speculative or suppositious.

In addition to the requirement to consider alternatives in respect of NoRs under section 171(1)(b), Clause 4 of Schedule 6 of the RMA applies to resource consent applications. It requires a description of any possible alternative locations or methods for undertaking the activity if it is likely that the activity will result in any significant adverse effect on the environment[41].

7.1.2 Introduction

The RiverLink Project components are all related and interlinked, the tables below summarise the timeline and key findings of alternatives studies undertaken leading up to and during the Project development and the design of RiverLink. There are a number of processes that considered more than one of the key Project components, but for ease of reference each study is categorised by reference to its primary Project component.

Table 28 outlines studies for the flood protection (GW) component, Table 29 outlines studies for the state highway upgrades (Waka Kotahi) component, and Table 30 outlines studies for the promenade/city centre redevelopment (HCC) component. Studies that focused on a particular aspect of design, and were not significantly consequential for a broader Project component, are listed in Table 31.

All the processes listed in the tables are then discussed in the text that follows (references are provided in the chapter).

[41] Assessments of the Project against sections 105 and 107 of the RMA, including their alternatives components, are provided at section 11.5 and 11.6 of the AEE respectively.

Table 28 - Flood protection studies

Report Name	Year	Section in AEE	Key findings	Agencies involved
Hutt River Floodplain Management Plan	2001	7.3.2	Set a *risk-based 2300 cumec standard* requiring the upgrade of all major stopbanks (i.e. those protecting the main urban areas of Lower Hutt & Upper Hutt cities) to a 2800 cumec capacity with all remaining stopbanks to a 2300 cumec capacity, and all new bridges and their floodways to pass a 2800 cumec flood.	GW HCC
Hutt River City Centre Upgrade Project - Options Evaluation Report	2015	7.4.1	Reduced a longlist of 10 options to a recommendation to proceed to consult the community on two options, being 2C (providing significantly improved flood protection) and 4A (improved flood protection at moderate cost, but likely requiring further upgrades from 2035 on).	GW HCC Waka Kotahi
Hutt River City Centre Upgrade Project Report to Greater Wellington Regional Council	2015	7.4.2	Immediate implementation of Option 2C was named Option A, and the implementation of Option 4A followed by implementation of Option 2C in 2035 was named Option B. Recommended to consult with the community on this basis.	GW
Community feedback on Integrated Concept Design Options	2015	7.4.5	Community clearly preferred Option A (74%) over Option B (16%).	GW
DamWatch RiverLink Riverworks Preliminary Design Report River Channel Design Assessment of Options and Preliminary Design Report RiverLink River Channel Design Channel Alignment: Options 1 and 2 Selection Process	2018 2018 2018	7.5.6 7.5.7 7.5.8	Preliminary design of the river channel should be based on the variable channel width option (Option 2), with a 70 m active channel up to Melling Bridge and then a long transition to a 100 m channel between Transpower and Kennedy-Good Bridge.	GW

Table 29 - State Highway upgrade studies

Report Name	Year	Section in AEE	Key findings	Agencies involved
Melling Gateway Strategic Case	2014	7.4.3	Outlined the problems and benefits of, and strategic responses for, the Melling Gateway project, and confirmed that GW, Waka Kotahi and HCC agreed that future investment activities need to be coordinated due to the interdependence across the strategic responses.	Waka Kotahi GW HCC
Melling Gateway Programme Business Case	2015	7.4.4	Confirmed the strategic case for change and identified the recommended path to resolve problems and achieve outcomes, being scenario E; to provide no interim transport network improvements and deliver all major Project elements ASAP.	Waka Kotahi GW HCC
Melling Intersection Improvements Indicative Business Case (IBC)	2017	7.5.9	Reduced a longlist of 43 options to an initial shortlist of 13 options, and a final shortlist of four options (6, 7, 9 and 11).	Waka Kotahi GW HCC
Melling Link – Further Options Report	2018	7.5.10	Describes investigations undertaken to assess the feasibility of the four options identified in the IBC. Following these investigations, a number of key project components were evaluated, before three options (9, 9A and 9B) incorporating variations on the agreed key project components were developed.	Waka Kotahi GW HCC
Public Consultation – May-June 2018	2018	7.5.11	Direct connection to Queens Drive (Option 9) was supported by 46% of those who identified a preferred option.	Waka Kotahi GW HCC

Report Name	Year	Section in AEE	Key findings	Agencies involved
Melling Intersection Improvements MCA Workshop (June 2018) Report	2018	7.5.12	Concluded that the Queens Direct option (Option 9) performed the best considering the wide range of criteria through the MCA process.	Waka Kotahi GW HCC
Melling Transport Improvements Single Stage Business Case	2019	7.5.13	Summarised the state highway interchange upgrade alternatives optioneering process between 2016 and 2018 and confirmed the recommended option of Queens Direct (Option 9) which was endorsed by the Transport Agency Board at its December 2018 meeting.	Waka Kotahi GW HCC

Table 30 - Urban redevelopment studies

Report Name	Year	Section in AEE	Key findings	Agencies involved
CBD Structure Plan CBD Master Plan Hutt CBD Heart CBD Vision 2030 CBD Making Places	1987 1999 2005 2008 2009	7.3.1	Promoted the concept of a river promenade, the importance of turning the city centre to face the river, and the potential for mixed use development.	HCC
Riverside Promenade Business Case – Building the Future	2017	7.5.1	Concluded that construction of a contiguous promenade from Margaret Street towards Ewen Bridge (Stages 1 and 2) would have the highest positive impact on investments.	HCC
RiverLink City Edge Multi Criteria Analysis Report	2020	7.6.2	Undertook an MCA considering six options for the integration of stopbanks and future urban development on the eastern side of the river, and proposed that a new option should be developed incorporating the strengths of preferred options.	HCC Waka Kotahi GW

Report Name	Year	Section in AEE	Key findings	Agencies involved
City Edge MCA Analysis Addendum	2020	7.6.3	Commenced MCA assessment of newly developed option, however was put on hold due to stopbank changes.	HCC Waka Kotahi GW
Scope resolution phase	2020	7.6.4	Completion of flood modelling in July 2020 resulted in adjustments to stopbank heights with consequential effects on design. Workshops attended by representatives from GW, Waka Kotahi and HCC resolved 8 out of 14 design changes, with six sites to be resolved through assessments of alternatives.	HCC Waka Kotahi GW
Assessment of Alternatives 1-6 Assessment Report	2020	7.6.5	Undertook MCAs for six locations affected by stopbank changes, confirming recommended options for each location for consent design, including for the city edge location.	HCC Waka Kotahi GW

Table 31 - Discrete studies

Report Name	Year	Section in AEE	Key findings	Agencies involved
RiverLink Daly Street Interface Structures Design Statement	2017	7.5.2	Option 1 (MSE retaining wall supporting a precast slab over the service road and supported by a beam and piled column arrangement adjacent to development) was the preferred option due to its structural performance and minimal impact on the proposed adjacent development on Daly Street.	HCC Waka Kotahi GW
Riverlink Preliminary Design Landscape Architecture, Urban Design and Ecological Design Technical Report	2018	7.5.3	Did not make recommendations on connection options and development of residual land on Pharazyn Street. Recommended a three or four span bridge of variable or constant depth with two piers located outside the main river	GW Waka Kotahi HCC

Report Name	Year	Section in AEE	Key findings	Agencies involved
			channel and one within it (Option 3) for the pedestrian/cycle bridge.	
Preliminary Concept Design Technical Report RiverLink Transport Assessment	2018	7.5.4	Outlined the effects on traffic redistribution resulting from various road closure options.	GW
RiverLink Preliminary Design Report for Stopbanks	2018	7.5.5	No preferred stopbank retaining wall selected, appropriate wall type to be determined at detailed design stage.	GW
RiverLink Te Awa Kairangi – Pedestrian and Cycle Bridge, Concept Design Report	2019	7.6.1	Concluded that a trunk bridge (Option 1) was the preferred solution for the pedestrian/cycle bridge	HCC Waka Kotahi GW
SH2 Pedestrian Overbridge Memo	2019	7.6.6	Confirmed that a pedestrian overbridge connecting the new Melling Station to Harbour View is not considered feasible.	HCC Waka Kotahi GW

The next sections describe in further detail the consideration of alternatives process carried out for the Project. In summary, in selecting the design now proposed for the Project, GW, Waka Kotahi and HCC have carried out a structured, transparent, and systematic process, which has taken into account a wide range of potential alternatives. In doing so, GW, Waka Kotahi and HCC have – both as individual requiring authorities for the Project designations, and together in progressing the overall Riverlink Project – met their obligations for consideration of alternatives under the RMA.

7.1.3 Background and problem identification

Following the promenade concept articulated in 1987 and the HRFMP in 2001, strategic investigations, scoping, scheme assessments, and business case processes were undertaken between 2013 to 2020 which identified the following key problems:

- The existing level of service for flood protection causing flood protection issues within Hutt City
- Existing transport infrastructure having a lack of resilience; and accessibility, efficiency and safety issues at the Melling Intersection on SH2, and
- Difficulty encouraging investment in the Lower Hutt city centre due in part to the above problems resulting in a lack of renewal and revitalisation of Lower Hutt's city centre.

7.1.4 Process summary

Formal identification of the preferred development and design options for all Project components (flood protection, urban renewal/revitalisation and the Melling Intersection Improvements) has been carried out over a number of years (since 2013) including through numerous studies. This section collates and summarises these background studies that led to the identification of the need for the Project and its progression through the iterative design process.

7.2 Evaluation framework and process

MCA is a commonly used tool to guide the assessment of options for infrastructure and other projects. It is a tool used to compare and assess alternative proposals or options where there are multiple considerations, and where there are a range of diverse effects which can range from beneficial to potentially adverse.

MCA has been a key tool used to provide information and analysis about options considered throughout the development of the RiverLink Project.

The MCA processes used for the Project provided the information gathered through the options processes to the relevant decision-maker: in this case, GW, Waka Kotahi and HCC as requiring authorities (and consent applicants). That in turn enabled the requiring authorities to make decisions as to the form of their component of the RiverLink Project, in a 'joined up' manner to provide for a cohesive overall project.

The assessment methodology for the Project has incorporated:

- MCAs to assist in assessing different project components and options (including the development of Project specific criteria)
- Value for money (construction and operational cost) consideration42
- Consultation with stakeholders, affected landowners and the public at various stages of assessment

[42] Cost is a matter that can appropriately be considered by the requiring authority, taking into account the analysis and information on effects and outcomes provided through MCA processes.

- Iterative changes to the design as more detail and information was obtained from consultation and technical assessment, with those changes subject to further alternatives analysis as appropriate, and
- Monitoring of the effect of changes to the design against the Project objectives.

Overall, the methodology for all MCA processes used across key phases of the Project involved determining evaluation categories, confirming a rating system and then applying project specific evaluation criteria and rating each option.

7.3 Pre-project phase (1987-2013)

The concept of a river promenade, a key component of RiverLink, was first raised in the Hutt City Council 1987 CBD Structure Plan, and further refined in the 1999 CBD Master Plan, 2005 Hutt CBD Heart, the 2008 CBD Vision 2030 and the first CBD Making Places long term development strategy in 2009 (all prepared by Hutt City Council). During this early pre-Project phase, the flood management planning (another key component of RiverLink) was also kicked off and culminated in the completion of the HRFMP in 2001, focused on flood protection.

This period is referred to as the pre-Project phase because various Project elements were envisaged in broad terms, but there was no specific project under detailed consideration to enable consenting and construction processes. Importantly, the HRFMP set key 'baseline' expectations for flood protection, which then guided later Project development.

7.3.1 CBD Plans

The string of CBD master plans listed above (all prepared by Hutt City Council) carried a number of key themes forward, including the development of a river promenade, the importance of turning the city centre to face the river, potential for mixed use development and a river plain as a high amenity landscape.

7.3.2 Hutt River Floodplain Management Plan – 2001

The HRFMP (Greater Wellington Regional Council, 2001) was developed over the course of 10 years in conjunction with community groups and organisations in the Hutt Valley and was supported by extensive technical studies to improve the community's resilience to flooding. Importantly for RiverLink, the findings of the HRFMP were adopted by both GW and HCC.

The development and implementation of the HRFMP occurred in five phases. Phase one, completed in November 1996, defined the flood problem, including physical, social, economic and environmental issues. Phase two involved analysing options using an MCA process. Phase three, which concluded June 2000, involved refining and finalising preferred options. Phase four involved the development, refinement following public consultation and finalising of the draft plan. GW, HCC and Upper Hutt City Council adopted the final HRFMP in August 2001. Phase five, from August 2001 onwards, involves the full implementation of the HRFMP.

The HRFMP is a foundation for implementing structural and non-structural measures and an environmental strategy for enhancing the river environment. It has provided a basis for flood improvement works, river management activities, the management of uses in the river corridor, and land use planning policy for RiverLink and the wider Hutt Valley.

The HRFMP provided a detailed assessment of the costs and risks of flooding of Te Awa Kairangi. It established that the level of protection provided by existing stopbanks was mixed; reaches downstream of Kennedy-Good Bridge (including the RiverLink Project area) had a much lower capacity and security than reaches upstream, with some sections of stopbank that could be breached during an event as small as a 50-year flood.

To achieve the flood protection standards of the HRFMP, a programme of physical works was planned to upgrade the stop banks, river channel and berms within defined sections of Te Awa

Kairangi. The floodplain management planning process undertaken in the HRFMP is summarised below.

Nature of options considered

Options considered in the development of the HRFMP included structural flood protection options (stopbanks, bank edge protection and river realignment, house raising and bridge replacement/upgrading), non-structural measures to improve community resilience, including land use measures and emergency management preparedness, and an environmental strategy to enhance Te Awa Kairangi's environment.

The HRFMP established an accepted level of protection (or design standard) from floods, which was a risk-based standard with varying protection standards to different areas in the floodplain, depending on how flood-prone they were. The agreed risk-based standard was called the *risk-based 2300 cumec standard* and included, amongst other things:

- A requirement to upgrade all major stopbanks (i.e. those protecting the main urban areas of Lower Hutt & Upper Hutt cities) to a 2800 cumec capacity with all remaining stopbanks to a 2300 cumec capacity
- A requirement for bank-edge and berm protection to a 2300 cumec capacity in main urban areas, with a 1900 cumec capacity for isolated and small urban areas, and
- A requirement for all new bridges and their floodways to pass a 2800 cumec flood.

Multi criteria analysis

As outlined above, phases two and three of the development of the HRFMP involved analysing flood protection options, including:

- Developing and evaluating design standard options
- Evaluating a broad range of flood management approaches, being environmental strategy, non-structural measures and structural measures, and
- Using social, economic and environmental criteria to evaluate them.

The preferred design standard and implementation measures were selected following public consultation.

Evaluation included initial selection of some (or a combination of) options and used technical, social and environmental databases established in the preceding phase. Factors considered included physical flood conditions, land requirements, costs, benefits and economic efficiency, visual impact, development pressure, and social / community values regarding perceived risk and level of protection.

Further evaluation and findings

The preferred options were then refined and finalised. Refining the chosen options took into consideration impacts of works on the environment, engineering considerations and social, economic and environmental benefits.

GW approved the final design standard, being the risk-based 2300 cumec standard, and the following implementation measures:

- Structural measures including:
  - Upgrades to stopbanks protecting major urban areas to the 2800 cumec standard, and protecting smaller urban areas to the 2300 standard.
  - Bank-edge protection works and major river realignment in the Ava to Ewen Bridge reach.

- An option to raise houses above the 1900 cumec flood level for residents of Bridge Road-Gemstone Drive (Upper Hutt) and Belmont (Lower Hutt).
- When bridges reach the end of their useful life, upgrade of the new bridge to the 2800 cumec standard.

- Non-structural measures including:
  - Land use: through policies and rules in district plans or voluntary actions that deal with constructing buildings and structures, doing earthworks and using land in a wise manner.
  - Emergency management: by preparing the community to cope with flooding.
- An Environmental Strategy that identifies opportunities to enhance Te Awa Kairangi's environment.

The HRFMP identifies a number of reports and publications and sets out what the anticipated results of the plan are in conjunction with the monitoring requirements. The HRFMP is intended to remain a living document.

The process used to reach the above approved flood protection measures was deliberative, robust and detailed. The conclusions and design standards reached in the HRFMP have informed and been incorporated into the design of the RiverLink Project.

7.3.3 RiverLink emerges

Around 2012 was when RiverLink started to evolve to be a joint project between GW, Waka Kotahi and HCC. It included achieving flood protection, connecting the city centre to the River through urban development, and a fully integrated multi-modal transport system (that streamlines SH2 movements with good quality public transport and high-quality cycling and walking networks).

7.4 Options considered during RiverLink project development (2013-2016)

This section discusses the options considered within background studies undertaken during the RiverLink Project development phase, which commenced in 2013. It was at this time that GW, Waka Kotahi and HCC developed the integrated Project concept (i.e. started to work together to develop and deliver the three interrelated projects as one combined Project). The project development phase concluded in 2016, since after this time options developed changed from conceptual optioneering to more detailed design options.

7.4.1 Hutt River City Centre Upgrade Project Options Evaluation Report

The Hutt River City Centre Upgrade Project - Options Evaluation Report (Boffa Miskell, 2015) recorded the findings of an options evaluation process for the river section between the Melling and Ewen Bridges known as the Integrated Concept Design process. This report was prepared for GW, Waka Kotahi and HCC and provided the basis for recommendations to the Hutt Valley Flood Management Subcommittee.

Nature of options considered

The report examined ten physical works options, made up of combinations of base flood protection options and "making places" options. Base flood protection options considered flood resilience improvements to river channel width, berm width and stopbank height, while "making places" options considered options for the development of a river promenade, park and connections, and transport design options for the SH2 intersection and Melling Bridge. Options for achieving the Making Places and local road transport objectives were then integrated with the flood resilience 'base' options to create a set of six sub-set options.

The main purpose of this study was to identify recommended options that GW, Waka Kotahi and HCC could take to the community for formal consultation and feedback.

Evaluation undertaken

The following methods were used to evaluate the options combining base flood protection, making places, policy and staging options:

- The MCA method (more qualitative than quantitative) was used to allow the relative merits of the Project options to be evaluated
- Cost evaluation through the “value for money” method was used (quantitative) in addition to the MCA process to determine the relative costs of the options as well as the investment versus timing issues, and
- Adaptive pathways being an assessment of the ‘use by dates’ for the flood protection options when compared to providing the design standard set in the HRFMP.

Findings

The Hutt River City Centre Upgrade Project - Options Evaluation Report recommended that the Hutt Valley Flood Management Subcommittee proceed to consult the community on options 2C and 4A.

- Option 4A provided an improved level of flood protection for a relatively moderate cost, did not require private property acquisition, enabled investment in the city side commercial properties by providing certainty as to the edge of the river corridor, and encouraged development by physical works including roading changes. However, Option 4A did not provide flexibility to address the need for managing the influences of climate change on flood frequency and magnitude. It was likely that by about 2035 the planning process would need to begin again to upgrade further.
- Option 2C provided a significantly improved level of flood protection which would provide a longer period of benefits in terms of resilience and long-term planning. The option also enabled investment in the city side commercial properties by providing certainty as to the edge of the river corridor. The options required the acquisition of private property on the west bank of the river which has a greater acquisition cost than Option 4A and also generates a higher level of social disruption.

7.4.2 Hutt River City Centre Upgrade Project Report to Greater Wellington Regional Council

The purpose of the Hutt River City Centre Upgrade Project Report (Atapattu, 2015a) was to advise GW Councillors about the integrated concept design options for the Hutt River City Centre Project and to seek Council approval to two options (4A and 2C outlined at section 7.4.1 above) for community consultation.

In the report, the immediate implementation of Option 2C was named Option A, and the implementation of Option 4A followed by implementation of Option 2C in 2035 was named Option B.

The outcomes at section 7.4.1 above were presented to the workshops of the Hutt Valley Flood Management Subcommittee, HCC and GW’s Strategy and Policy Committee in May/June 2015 (Atapattu, 2015a). The report author recommended that GW:

- Note that the Melling Bridge needs replacement to provide the HRFMP recommended standard of protection to the Lower Hutt city centre and the central residential areas, and
- Approve Option ‘2C’ to be called Option A and ‘combined 4A progressing to 2C in 2035’, called Option B, for community consultation.

7.4.3 Melling Gateway Strategic Case

The next project development workstream to kick off related specifically to the Waka Kotahi component of RiverLink (state highway upgrades), so that this could feed into integrated project development and decision making which was evolving by around 2014.

The Melling Gateway Strategic Case, prepared for GW, Waka Kotahi and HCC, outlined the problems and benefits of, and strategic responses to, the Melling Gateway project, but it did not provide separate options or alternatives. Part of the process involved defining the problem(s) through a facilitated problems workshop held with key stakeholders in July 2014.

The Melling Gateway Strategic Case documented four strategic responses to address the consequences of the problems confirmed through the strategic case work, in order to deliver the desired benefits. These were:

- Implement flood protection measures aligned with the HRFMP
- Optimise transport network operations with minor infrastructure improvements
- Integrate urban design plans with flood protection and transport network plans, and
- Progressively enhance the transport network with major infrastructure improvements.

In terms of funding, the Melling Gateway Strategic Case identified that each agency needed to develop separate investment activities to progress the strategic responses identified above. Significantly, the Melling Gateway Strategic Case confirmed that the agencies involved (i.e. GW, Waka Kotahi and HCC) agreed that future investment activities need to be coordinated due to the interdependence across the strategic responses.

7.4.4 Melling Gateway Programme Business Case

The Melling Gateway Programme Case (PBC) (GHD Limited, 2015) was a document jointly prepared for GW, Waka Kotahi and HCC. The purpose of the PBC was to confirm the strategic case for change, to identify a range of options available to GW, Waka Kotahi and HCC to resolve problems, and achieve project benefits and to outline a recommended path to achieve these outcomes.

The PBC reports that GW, Waka Kotahi and HCC had been developing their respective project elements for a number of years, either in collaboration or consultation with the other agencies. In doing so each of the agencies had been through or were in the process of planning for their respective projects and going through option development and assessment stages.

Nature of options considered

The three primary transport concepts considered were:

1. Short-term intersection and network improvements retaining the existing Melling Bridge: Redirecting Melling Link right turn traffic via Block Road with capacity improvements on Block Road
2. At-grade connection to SH2 from a new bridge incorporating the redirected Melling Link right turn via Block Road (modified short-term improvements option for a new bridge), and
3. Grade separated interchange with a new bridge: Melling Link on an elevated structure over SH2 with the northbound SH2 entry via a loop from Harbour View Road.

Eight programme options were developed and evaluated in two workshops attended by representatives of GW, Waka Kotahi, HCC and technical experts. The scenarios were refined during the workshops, and assessed against the key success/assessment criteria identified at the Strategic Case phase being:

a. A connected, resilient and secure floodplain

b. An integrated, resilient, safe and efficient transport network

c. A more liveable Hutt City

d. Enhanced economic growth

The PBC report emphasised that there were three key requirements that needed to be considered in addition to the assessment criteria:

a. The option must achieve 1:440-year flood protection

b. Traffic and transport requirements would be met in the short, medium and long-term, and

c. HCC's Making Places objectives would be achieved in an acceptable timeframe.

Evaluation undertaken

Due to the various project elements, there were a large number of potential options relating to staging and different packages of project elements. A long-list of eight options was reduced to a short-list of three options (indicated in bold):

- Scenario A: Do Minimum - minimal flood protection and staged network operation improvements – not shortlisted.
- Scenario B: Partial flood protection and staged network operation improvements – not shortlisted.
- Scenario C: Delayed full flood protection and delayed transport network improvements – not shortlisted.
- **Scenario D: Interim transport network improvements and all major elements in the medium term – shortlisted.**
- **Scenario E: No interim transport network improvements and all major elements ASAP – shortlisted.**
- Scenario F: Interim transport network improvements, all flood mitigation works in the medium term and delayed Grade Separated Interchange – not shortlisted.
- Scenario G: Interim transport network improvements and staged (east then west) flood protection elements and delayed Grade Separated Interchange – not shortlisted.
- **Scenario H: Interim transport network improvements, delayed flood protection elements and delayed Grade Separated Interchange – shortlisted.**

Following evaluation of the shortlist, Scenario E was recommended as the preferred option, since it achieved the programme assessment criteria (and by extension the three key problems outlined in the PBC) as follows:

- A connected, resilient and secure floodplain: Achieved full flood protection over the medium term (10-15 years).
- An integrated, resilient, safe and efficient transport network: Achieved long term transport objectives, meeting required levels of integration, resilience, safety and efficiency.
- A more liveable Hutt City: Provided long term infrastructure to protect the community from major flood events.
- Enhanced economic growth: Provided enabling infrastructure for the city centre redevelopment.

Findings

The PBC concluded that Scenario E provided significant benefits above the existing situation and against many of the other options considered. This was because the programme was achievable for GW, Waka Kotahi and HCC and reflected a collaborative approach to the planning and delivery of the various programme improvements.

7.4.5 Community feedback on Integrated Concept Design Options September 2015

The Community Feedback on Integrated Concept Design Options is a report prepared by GW to provide an overview on the community feedback received on the Integrated Concept Design options for the Hutt River City Centre Upgrade Project for consideration by the Hutt Valley Flood Management Subcommittee (Atapattu, 2015b).

Options A and B (refer to description at section 7.4.2) were released for public consultation in July 2015. A total of 279 written responses were received, compiled and analysed. Option A was supported by 74% of respondents compared to 16% for Option B. The feedback results also indicated clear support for the promenade concept, parking spaces and the proposed pedestrian/cycleway bridge, components common to both options.

Option A was the option endorsed by the (GW and HCC) Hutt Valley Flood Management Subcommittee.

7.5 Options assessed during preliminary design phase (2017-2019)

This section discusses the options and background reports which were used to develop the preliminary design for the RiverLink Project, based on Option A and Scenario E above, during the preliminary design phase. It was in this stage that the broad conceptual Project components established above were developed in further detail to prepare preliminary designs for each component (i.e. broadly confirm river channel and stopbank design, state highway interchange design and new Melling Bridge alignment, and urban development interface with the river). This stage concluded once preliminary designs were established for each project component and before consent design commenced.

7.5.1 Riverside Promenade Business Case – Building the Future

The Riverside Promenade Business Case – Building the Future (Hutt City Council, 2020) aimed to provide a better understanding of the economic impacts of developing the promenade to support decision making regarding the preferred option for the design and development of the promenade to achieve desired outcomes.

The nature of the options considered related to the integration of future development with the stopbank, thus resulting in a promenade. Various staging options were considered relating to length and quality of integration provided, as well as broader connections from the city centre to the river, and a new pedestrian and cycle bridge. Evaluation of options included qualitative methods (a workshop and survey open to the public) and quantitative methods (an economic impact assessment).

The findings of the business case centred on the Stage 1 and Stage 2 options. Stage 1 involved the construction of the promenade and associated service tunnel between the stopbank and development from Margaret Street to Andrews Avenue. Stage 2 involved the same promenade being extended south of Stage 1 towards Ewen Bridge.

The business case report concluded that, if Stages 1 and 2 were completed at the same time, impacts on investment could be more pronounced as it would be unlikely that the small area in

Stage 1 would (on its own) attract a significant number of visitors or investors because of the inconvenience that potential construction in the future Stage 2 would create. In conclusion, the report summarised that given the budget limitations of HCC for the promenade project, HCC should focus on concentrating efforts on construction of Stages 1, 2 and the pedestrian and cycling bridge. This conclusion was supported by the results of the economic impact assessment and the survey results.

7.5.2 RiverLink Daly Street Interface Structures Design Statement

The RiverLink Daly St Interface Structures Design Statement (Beca Limited, 2017), prepared for GW, Waka Kotahi and HCC, described the four options considered for construction of the structures that would interface with Daly Street and the river corridor, between the junctions of Daly Street with High Street and Margaret Street. The report estimated that the interface would comprise a new 390m long wall structure to support the eastern edge of the stopbank to allow a service lane to be accommodated between the stopbank and adjacent development. It was assumed that a promenade would be provided along the top of the stopbank.

Design concepts considered for the interface structures included Mechanically Stabilised Earth (MSE) retaining walls and piled box culverts/walls on the stopbank side, and beam and column arrangements on the development side. The selection of an option took account of structural performance (including seismic resilience), indicative cost, effect on adjacent development and buildability in relation to the stopbanks.

Assessment of the factors identified indicated that Option 1 (MSE retaining wall supporting a precast slab over the service road and supported by a beam and piled column arrangement adjacent to development) was the preferred option due to its structural performance and minimal impact on the proposed adjacent development on Daly Street.

7.5.3 Riverlink Preliminary Design Landscape Architecture, Urban Design and Ecological Design Technical Report

The Riverlink Preliminary Design Landscape Architecture, Urban Design and Ecological Design Technical Report (Boffa Miskell Limited, 2018), prepared for GW, Waka Kotahi and HCC, presented the preliminary design for the landscape works as part of RiverLink. It built on the agreed river channel design and focused on the interface between the river corridor and the urban environment of Lower Hutt city centre. The report addressed three key design elements:

- Landscape design: Vegetation, river corridor access, recreation, paths, river edge, landform, art, furniture, signage + lighting
- Ecology: Wetlands, terrestrial habitat, and aquatic habitat
- Urban design: City Edge promenade + park, street spaces, pedestrian/cycle bridge, interfaces and westside.

The technical report presented an indicative design for landscape architecture, urban design and ecology for the flood protection and Making Places elements of the RiverLink Project. It considered options for discrete project elements, being connection options between the river and city centre, pedestrian bridge options, and options for development of residual land on Pharazyn Street.

- While no recommendations were made in respect of connection options or development of residual land on Pharazyn Street, a recommendation in respect of the pedestrian bridge was made: Bridge options considered in the technical report included various bridge spans, and bridge types including suspension, truss and arch bridges.
- Using a simple MCA process, the design team assessed the bridge options against flood capacity, cost, ability to connect to the promenade with minimal additional ramping and

cost, and the user experience of the pedestrian bridge – the visual and experiential quality and appropriateness of the bridge to the river context.

- Following evaluation, the design team found Option 3 to be the most appropriate pedestrian bridge option for this environment. Option 3 was a three or four span bridge of variable or constant depth with two piers located outside the main river channel and one within it.

7.5.4 Preliminary Concept Design Technical Report RiverLink Transport Assessment

The RiverLink Preliminary Concept Design Transport Assessment (GHD Limited, 2018), prepared for GW, summarised the transport implications as a result of RiverLink stopbank improvements. The assessment considered options in relation to the Lower Hutt city centre transport network on the eastern side of the river and the local road network on the western side of the river. The assessment was informed by multiple stages of traffic modelling.

Lower Hutt city centre network – eastern side of river

The implications of either partially or completely closing Daly Street as a western access route were assessed, with a number of configurations and concept mitigation options considered.

Local road network – western side of river

Due to the requirement of a larger stopbank footprint on the western side of the river, various options for the closure or realignment of Marsden Street were considered.

Further evaluation

The report stated that the complete closure of Daly Street was the most likely outcome of the increased stopbank footprint on the eastern side of the river, given the stopbank footprint would need to extend into the road corridor. The implications of closing Daly Street as a "western access route" were assessed, and it was determined there would be redistribution of traffic to High Street and to the western side of Te Awa Kairangi (Pharazyn and Marsden Streets).

Supported by high-level redistribution modelling and consideration of alternative Marsden Street options, the report recommended that Marsden Street be maintained as a two-way road with similar configuration. A closure of Daly Street and Marsden Street would result in significant traffic redistribution to Pharazyn Street and High Street. With the local road network implications in the city centre, retention of Marsden Street was considered critical to retain a functional "western ring route". This recommendation has been followed through to consent design, which proposes a reconfigured two-way Marsden Street.

Findings

The report concluded that modelling of the different scenarios or options demonstrated:

- If Marsden Street was closed to accommodate the new stopbank footprint (in absence of a realigned road), traffic would redistribute to the eastern side of the river through the city centre
- If Daly Street was fully or partially closed (and Marsden Street retained), traffic would transfer to the western side of the river
- If both Marsden and Daly Street were closed, then overall there was predicted to be an increase in traffic on the eastern side of the river through the city centre
- If Daly Street was fully closed, making Dudley Street two way would partially mitigate the effects, however the flow on southern High Street would increase to a level that would require the street layout to be amended.

- Altering the intersection control on the “eastern access route” would not mitigate the effects of a Daly Street closure alone

7.5.5 RiverLink Preliminary Design Report for Stopbanks

The Riverlink Preliminary Design Technical Report for Stopbanks (Opus Limited, 2018), prepared for GW, records indicative earthworks quantities and sources, and the design parameters considered when designing the stopbanks. The report also includes preliminary design of retaining walls (excluding the proposed MSE retaining wall and service tunnel at Daly Street described in section 7.5.2 above), at locations where there would be space constraints, and ramps that provide access over the stopbanks between the city and the river.

Although four retaining wall options were considered, no preferred wall design was selected at this time, rather the report noted that site investigations and geotechnical assessment should be carried out at each wall site during the detailed design stage and the most appropriate type of wall could be determined at this time. The RiverLink Preliminary Design Technical Report for stopbanks concluded that locating all the services into a single trench has the potential to reduce the costs by 50%.

7.5.6 DamWatch RiverLink Riverworks Preliminary Design Report

The Riverlink Riverworks Preliminary Design Report (Damwatch Engineering Limited, 2018), prepared for GW, pulled together the evaluation of a number of different technical assessments and reports to present a preliminary design for the river works and river channel design elements of RiverLink. The report included consideration of river channel design, sediment transport modelling, hydraulic modelling and channel alignment selection drawn from various specialist reports.

The most relevant reports discussed in the RiverLink Riverworks Preliminary Design Report are the RiverLink Project, River Channel Design Assessment of Options and Preliminary Design Report, discussed further in section 7.5.7 of this AEE, and the RiverLink, River Channel Design, Channel Alignment, Options 1 and 2: MCA Selection Process report, discussed in section 7.5.8 of this AEE.

7.5.7 River Channel Design Assessment of Options and Preliminary Design Report

The River Channel Design Assessment of Options and Preliminary Design Report (G & E Williams Consultants and Christensen Consulting Limited, 2018) included an evaluation of the preferred Option A channel design (see section 7.4.5) and an analysis of potential options for the channel configuration within the preferred 90 m design channel.

Nature of options considered

Option 1, called the “Consistent” river channel, had a channel width of 90m from Ewen Bridge upstream to Kennedy Good Bridge. Option 2, called the “Variable” river channel, comprised a 70m wide active channel from Ewen Bridge to above Melling Bridge, an 800m transition channel above Melling to the Transpower site, and a 100m design channel from Transpower to the Kennedy Good Bridge. Within these two options, there were two sub-options; keeping the bed level at the current level (2014) and restoring the bed level to the modelled 1998 bed level.

Evaluation undertaken

The report analysed the options from a technical perspective and used this to inform a separate evaluation process (the MCA described next in the RiverLink River Channel Design Channel Alignment Options 1 and 2: MCA Selection Process (Polvere, 2018) in section 7.5.8 below).

Findings

The technical analysis found the following:

- There was very little space for any variations in alignment or meander pattern within a “Consistent” channel width (Option 1). While there were more possibilities with the 70m “Variable” channel (Option 2), any pattern that retained an appropriate curvature and wavelength required substantial alterations to the existing channel.
- Keeping the bed level at its current level was recommended because it provided lower, more resilient river channel banks with the additional capacity provided by slightly higher stopbanks considered to be a better solution.
- The “Variable” channel (Option 2) would be easier to manage through small to medium flood events, and likely have better pre-flood conditions before a major event.
- The “Variable” option (Option 2) would have shorter rock works of less height than the Consistent option, but they would be thicker meaning the residual risks of failure (of the flood defences) would be lower.

The report determined that a variable channel width, with a 70 m active channel up to Melling Bridge and then a long transition to a 100 m channel between Transpower and Kennedy-Good Bridge was preferable to a constant 90 m active channel throughout. This was because a narrower 70 m active channel up to Melling Bridge provided higher sediment transport capacity, and it would be more likely that gravel would be transferred through to below Ewen Bridge rather than depositing through the City Centre reach.

The report recommended that preliminary design of the river channel should be based on the “Variable” option (Option 2) with the existing (2014) bed levels and that channel design would need to be further refined, taking into account the inter-connections that arise from the various elements of the Project.

7.5.8 RiverLink River Channel Design Channel Alignment: Options 1 and 2 Selection Process

The Riverworks Preliminary Design Channel Alignment: Options 1 and 2 Selection Process (Polvere, 2018) records the broader evaluation of the options for the river corridor, being the Variable (Option 2) or Consistent (Option 1) design channel described in the report described in section 7.5.7 above.

Evaluation undertaken

The objectives used to evaluate each option were based on the themes of flood resilience, Mana Whenua, environment and sustainability. Three MCA workshops were undertaken as follows:

1. 1 September 2016: Technical experts considered project objectives and developed associated criteria and sub-criteria.
2. An initial evaluation of the river alignment options by the technical experts and GW Flood Protection operations team.
3. Review of completed Workshop 2 evaluation by GW Flood Protection with input from technical experts.

Findings

The appraisal of the two river alignment options identified that the “Variable” river channel option was the highest and most favourable option for meeting the objectives and attributes identified. Sensitivity testing confirmed that the “Variable” channel alignment preference was not dependent on the importance of any objective. The report concluded the Variable channel alignment was selected and subsequently progressed.

Melling Intersection Improvements Indicative Business Case (IBC)

The Melling Intersection Improvements Indicative Business Case (IBC) (NZ Transport Agency, 2017) outlines the optioneering process undertaken from October to December 2016. Following completion of the draft IBC, the Transport Agency's Value Assurance Committee directed the team to progress and develop a Single Stage Detailed Business Case (SSBC) for approval. The work carried out in the IBC was carried forward into the further alternatives assessment process outlined below.

Nature of options considered

Options to solve the transport issues were identified in a long list workshop with GW, Waka Kotahi and HCC, resulting in a long list of 43 options.

The following key principles were developed as part of the IBC to assist in understanding the scope of the options and serving as part of the sifting of options:

- Traffic to connect into edge of Lower Hutt City Centre - not the core or further away
- All routes for all modes should be legible and all existing connectivity should be retained
- There should be full pedestrian and cycle connectivity, taking desire lines into account
- Retain the ability to extend the Melling rail line further north should the need arise in the future
- Proposal should allow for the flood protection works which were being designed for a 440-year ARI event, and
- Maintain Melling as the Gateway to the Lower Hutt City Centre with the bridge to connect into road network adjacent to Te Awa Kairangi.

Of the 43 options developed, 13 were shortlisted and 30 were discarded because of their inability to contribute to the investment objectives, or misalignment with the key principles outlined above. The following summarises the discarded options at a high level:

- At-grade intersection options for SH2/Melling where they are the "final" options: These options provided no meaningful contribution to safety, accessible travel choices or reliability.
- Grade separated options from previous studies: Multiple grade-separated options were retained, however many did not appropriately consider pedestrians and cyclists.
- Options with SH2 going over local roads: Discarded due to geometry and constructability.
- Options with bridge location north of Melling Link and South of Queens Drive: Bridge locations to the north did not provide for HCC's desire for the interchange to be a gateway into Hutt City Centre, while Bridge locations to the south would direct too much traffic into the city centre.
- Options retaining the current Melling Bridge: The height above Te Awa Kairangi of the current Melling Bridge is a significant capacity constraint on the floodway, therefore these options were discarded.

Evaluation undertaken

Three MCA workshops were held to further evaluate the initial shortlist of 13 options and identify a preferred option. The first of these MCAs was held as part of the IBC (the other two MCA processes were carried out as part of the Further Options Report and the Melling Intersection

Improvements MCA Workshop Report, described at section 7.5.9 and 7.5.11 respectively below).

The criteria adopted to evaluate the options varied slightly between each workshop, but included the below:

- Transport benefits
- Fit with local road system
- Utility for non-motorised travel modes
- Railway/bus system utility
- Impacts on tangata whenua values
- Visual and landscape impacts
- Natural hazards management fit
- Impact on adjacent land uses
- Urban design opportunities
- Consentability
- Engineering degree of difficulty
- Ability to be staged
- Additional safety benefits
- Recreational impacts
- Cost

The IBC MCA (MCA 1) was held in December 2016, whittling down a long list of 13 options to a shortlist of 4 options.

Options discarded at this stage included complex interchange designs involving safety or geometry/constructability concerns, and various interchange designs that did not provide transport and flood benefits. Options taken forward at this stage were generally of a more conventional design, involving either a diamond or roundabout interchange, and proposing either a direct or indirect connection to Melling Link. Four options (6, 7, 9 and 11) were taken forward from the IBC to the next stage.

7.5.9 Melling Link – Further Options Report

The Melling Link – Further Options Report (Options Report) (Stantec, 2018) describes the investigations undertaken to assess the feasibility of the four options identified through the IBC process described above. A safety audit, traffic modelling and topography survey were undertaken to assess the feasibility of the four options. This resulted in a number of sub-options being developed. Rather than assessing options and sub-options, the Project team decided to evaluate a number of key project components (described below) before deciding on a shortlist.

The Options Report summarises this shortlisting process and presents the shortlist of options recommended for public consultation.

Evaluation undertaken

The Options Report assessed various options for project components including interchange form, Tirohanga Link, bridge linkage to Lower Hutt City Centre and the connection between Lower Hutt City Centre and the interchange. GW, Waka Kotahi and HCC reviewed these key project components at an option assessment workshop in February 2018 against the criteria outlined above at section 7.5.9.

Findings

Tirohanga Link

Two options were considered to link Tirohanga Road; first to construct a new link parallel to SH2 connecting to Harbour View Road, and second to construct a new bridge over SH2 to connect Tirohanga Road into the interchange opposite Pharazyn Street.

A connection from Tirohanga Road to Harbour View Road was the preferred option, since it was superior in efficiency, and provides excellent safety and visibility. A link to Pharazyn Street would require undesirable construction in the floodplain.

Linkage to Lower Hutt City Centre

Options considered were to link the interchange across the river to Melling Link or Queens Drive. Queens Drive scored similar or better against all considerations, however Waka Kotahi wanted to consider options connecting to the existing Melling Link, hence both options were carried forward for further investigation.

Connection between Lower Hutt City Centre and Interchange

To connect the interchange to the river bridge, a direct connection and a dog leg connection were considered. Both options were carried forward for further investigation, since there were strong contrasting pros and cons for each option.

Assessment of Interchange Form

Five interchange form options were considered; signalised and non-signalised roundabouts, diamond, diverging diamond and large gyratory. A diamond interchange was selected as the preferred interchange form, since it generally scored well and is a well-known and understood interchange layout in New Zealand. The signalised roundabout and large gyratory options were excluded from further consideration since they performed poorly under the majority of considerations, while a diverging diamond interchange was not supported by the Waka Kotahi safety team.

Recommended Options

Based on the investigations described above, three options were recommended for further development during the SSBC phase:

- Option 9: Diamond Interchange with direct connection to Queens Drive;
- Option 9A: Diamond Interchange with dog leg connection to Queens Drive; and
- Option 9B: Diamond Interchange with direct connection to Melling Link.

Importantly, all options provide a link from Tirohanga Road to Harbour View Road, Options 9 and 9A connect to Queens Drive while 9B connects to Melling Link, Option 9A provides a dog leg while Options 9 and 9B provide a direct link, and all options incorporate a diamond interchange form. These options are therefore consistent with and carry forward the recommendations of the above findings.

The Melling Link – Further Options report recommended progressing the concept design of Options 9, 9A and 9B for assessment and consideration through public consultation.

7.5.10 Public Consultation – May-June 2018

The three shortlisted options as identified in the Melling Link – Further Options Report (9, 9A and 9B) were presented to the community for feedback during May-June 2018. Of the 382 responses received, 189 identified a preferred option. A direct connection to Queens Drive (Option 9) was supported by 46% of those who identified a preferred option. Respondents preferred a direct connection to Queens Drive since it had fewer traffic lights, was easy to navigate, had better access to the city centre and minimised disruption during construction.

7.5.11 Melling Intersection Improvements MCA Workshop (June 2018) Report

A third MCA workshop was held in June 2018 to consider the final three options (9, 9A and 9B), with the intent of confirming a recommended option (Stantec, 2019a). Technical specialists undertook preliminary investigations and led discussions on each criterion at the workshop.

Evaluation undertaken

The third MCA assessed the final three options against the criteria indicated for MCA. Six weighting systems were applied to the MCA scores to compare different themes of emphasis, i.e. environment, economic etc.

Findings

Regardless of the weighting system used to calculate scores, a clear order of preference emerged, with Queens Direct (Option 9) the most favoured, followed by Queens Indirect (Option 9A) and Melling Link (Option 9B). Queens Direct (Option 9) was preferred for the following reasons:

- It provides for better connectivity to HCC's Eastern Access Route, and provides a more direct public transport connection to the city centre than Melling Link (Option 9B). Queens Indirect (Option 9A) also provided this benefit.
- In terms of natural hazards, it provides additional future flood protection compared to Melling Link, which would lock in flood constraints for the next 100 years. Queens Indirect (Option 9A) was also less desirable since it would fix in place an undesirable berm fill obstruction.
- From an urban design perspective, it creates a gateway effect not provided by the Melling Link (Option 9B) and Queens Indirect (Option 9A) options.
- In terms of engineering degree of difficulty, it has the least impact on stopbanks, involves a lower lift of Rutherford Street (2-3m), and predominantly avoids existing traffic. Melling Link (Option 9B) would require a segment of the existing bridge to be removed to enable completion of construction of the new bridge, while Queens Indirect (Option 9A) is also challenging as it has significant interaction with stopbanks, and requires a 5m lift to Rutherford Street.
- All options provide significant travel time improvements and improve safety on SH2.

This MCA workshop report concluded that the Queens Direct option (Option 9) performed the best considering the wide range of criteria through the MCA process, and recommended that this option be presented to Waka Kotahi for their consideration alongside other aspects when deciding on a recommended option to present to their Board.

7.5.12 Melling Transport Improvements Single Stage Business Case

The Melling Transport Improvements Single Stage Business Case (SSBC) (Stantec, 2019b) revisited the case for change, and explained the process used to progress from an options long list to a recommended option, including the results of technical assessment and consultation activities. The SSBC summarises the optioneering and MCAs outlined above in sections 7.5.9 and 7.5.11 of this AEE.

The SSBC identifies that the recommended option of Queens Direct (Option 9) was endorsed by the Transport Agency Board at its December 2018 meeting.

Figure 39 below demonstrates the progression of Queens Direct (Option 9) development of the Melling transport improvements as the preferred option.

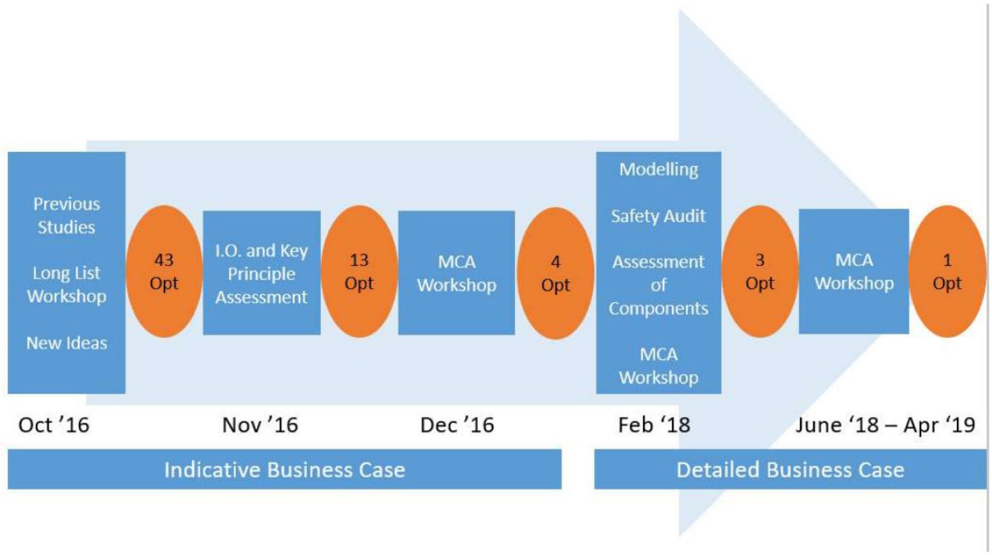


Figure 39 - Queens Direct Option 9 development through the Business Case process (sourced from the SSBC)

The key finding of the SSBC was that Queens Direct (Option 9) outperformed both other short-listed options in the MCA process, was preferred by the community during consultation, and is the most compliant geometric design solution given the general layout of the adjoining road network.

New Melling Station Location Options Assessment

Appendix J of the SSBC specifically undertook a new Melling Station Location Options Assessment. This assessment considered two possible station locations, indicated in Figure 40.

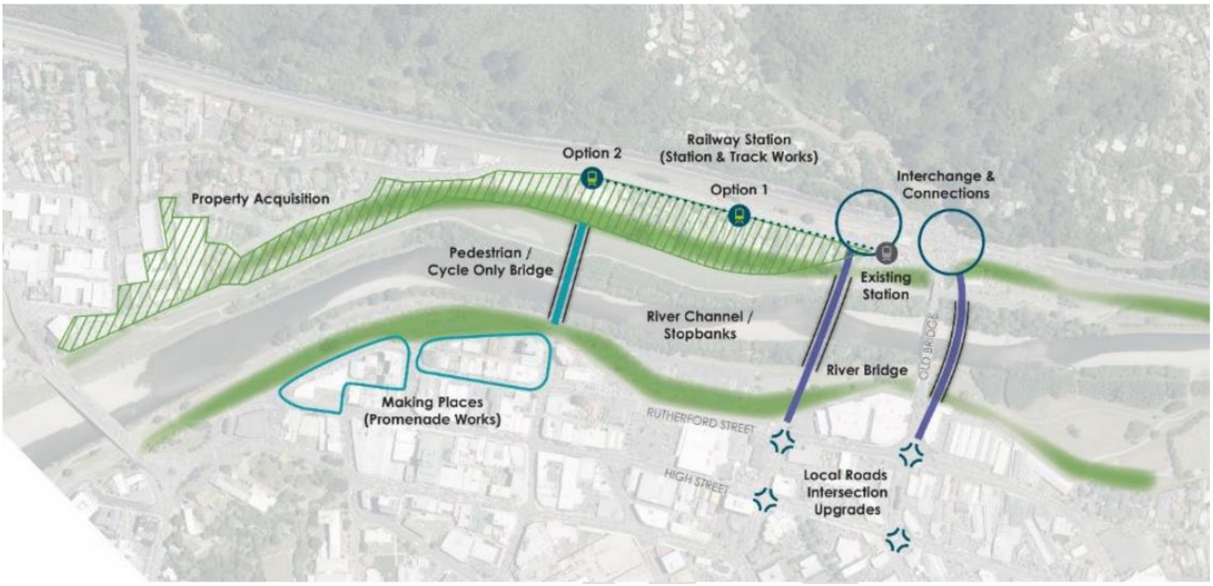


Figure 40 - New Melling Station location options (source: Appendix J of SSBC)

Option 1 would locate the station 250m south of the existing station. This is the minimum amount by which the station location could be adjusted to accommodate the interchange footprint. Option 2 would locate the station 500m south of the existing station, directly opposite the proposed pedestrian bridge into the Lower Hutt city centre.

The assessment of the options found that both options increase the walking distance from Western Hills and Boulcott to the station, both facilitate park and ride spaces, both show negligible difference for existing bus users accessing Melling Station from Belmont (the only current service), and minimal changes to rail patronage were expected from both options.

Public consultation in June 2017 indicated that 48% of respondents (the largest cohort) preferred the railway station to be located opposite the city centre/Margaret Street.

The Station Location Options Assessment concluded that on balance, the differences between the two options were minimal, with both having beneficial aspects.

7.6 Options assessed during consent design (late 2019-2021)

This section discusses the further refinement of the preliminary design options outlined above that were taken through to the design development for the NoR and resource consent applications.

7.6.1 RiverLink Te Awa Kairangi – Pedestrian and Cycle Bridge, Concept Design Report

The RiverLink Te Awa Kairangi - Pedestrian and Cycle Bridge Concept Design Report (Isthmus Limited, 2019), prepared for GW, Waka Kotahi and HCC, builds on the work undertaken by Boffa Miskell on the pedestrian bridge structure design described in section 7.5.3 where Option 3, a four span bridge, was determined to be the preferred option.

Nature of options considered

The options considered for the design of the pedestrian and cycle bridge focused on physical form and appearance. The three options considered were a trunk bridge, bow bridge or branch bridge.

The bridge concept options were evaluated by the design team against resilience, consentability, cost, constructability, Awa (iwi values) and human experience criteria. The report concluded that Option 1, the Trunk Bridge was the preferred design solution, since it performed best against the assessment criteria, outperforming the other options in terms of cost and resilience.

7.6.2 RiverLink City Edge Multi Criteria Analysis Report

The RiverLink City Edge Multi Criteria Analysis report (GHD Limited, 2021a) prepared for GW, Waka Kotahi and HCC summarised the outputs from multiple MCA's undertaken on six options for the 'City Edge' future urban development design concept for the eastern side of the river, in the vicinity of the Lower Hutt city centre. The report considered the need for underlying infrastructure (including building platforms), services, and the connection of future buildings with the stopbank (and integration into the Lower Hutt city centre). At that time, the possibility of including some building development within the current applications was considered. However, as such developments are unlikely to be constructed by HCC, and as the District Plan is now under a full replacement review, it was considered more appropriate for such developments to be provided for through a combination of the integration works now sought in the application along with the new planning framework to be provided in the new District Plan.

Nature of options considered

The City Edge MCAs considered six options for the integration of stopbanks and future urban development for the eastern side of the river. These options ranged from no property acquisition with retaining walls maintaining Daly Street and existing development, to major property acquisition with the closing of Daly Street, development of a promenade and new areas of public space. Various permutations considered compromise scenarios in the continuum between these two extremes.

Evaluation undertaken

The six options were evaluated in the City Edge MCAs against urban design, Te Mana o te Wai[43], development feasibility and economics, cost and implementation, flood resilience, transport and environmental and social criteria.

Findings

Options proposing retaining walls and limited access paths (Options 1 and 2) were not recommended for further consideration since they reduced connections between the city and river. Options 3, 4, 5 and 6 each had strengths and weaknesses, therefore it was recommended that none of the options be progressed in their entirety, and that a new option should be developed having regard to and incorporating the strengths of Option 3 (Southbank park urban renewal and revitalisation), Option 4 (Integrated development), Option 5 (New development with wider stopbanks) and Option 6 (Preliminary Design 2018). Key themes to take forward were recorded as being:

- The inclusion of both areas of public open space and buildings in the City Edge area, with the provision of more river – city connection;
- Low level buildings (not exceeding 3 storeys) to achieve a financially feasible development, in recognition of the findings arising that buildings over 3-4 stories require significantly greater ground improvement works due to the ground conditions;
- Not structurally integrating buildings with flood protection structures to provide for easy staging of investment and development, and to avoid compromising flood resilience and increased construction and maintenance risk. The integration of some form of a promenade would provide positive outcomes for pedestrians;
- Avoidance of structures like the tunnel for Daly Street due to increased costs, personal safety concerns, and the lack of flood and seismic resilience associated with this feature; and
- Minimising MSE retaining walls where possible.

7.6.3 City Edge MCA Analysis Addendum

The City Edge MCA Analysis Addendum (GHD Limited, 2021b) was prepared for GW, Waka Kotahi and HCC following completion of the previous MCA. Its purpose was the assessment of a new City Edge option (Option 7) that was developed to create an option that integrated the preferred/key themes or design elements identified in the City Edge MCA. Option 7 required medium property acquisition, proposed a promenade boardwalk connecting a new 4-storey development in northern Daly Street to the top of the stopbank, a 4-5m high retaining wall near the pedestrian bridge, with otherwise low or no retaining walls along Daly Street, new access points between the river and city centre, and new development in place of existing buildings and explicit provision made for under building carparking.

Option 7 was to be assessed against the full suite of MCA criteria used for the original MCA described in section 7.6.2. However, when the assessment was partially complete, it was put on

[43] As defined in the NPSFM 2020, Te Mana o te Wai *"is a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community."*

hold due to broader RiverLink scope issues relating to the position and height of the stopbanks, which impacted on City Edge.

The broader RiverLink scope issues were resolved through the Scope Resolution Phase described in section 7.6.4, which then resulted in the alternatives assessment process at six specific locations as summarised in section 7.6.5. It was determined that the assessment of alternatives for the six locations sufficiently incorporated the key issues from the City Edge MCA process (including the elements previously incorporated into Option 7) so the City Edge options were consequently determined through the assessment process described in section 7.6.5.

7.6.4 Scope resolution phase

The completion of flood modelling in July 2020 resulted in adjustments to the stopbank heights which had consequential effects on a number of Project assumptions and requirements. As a result, workshops were held to define the issues and GW, Waka Kotahi and HCC requirements at 14 locations within the Project area affected by the stopbank changes. The result of this work was unanimous agreement by GW, Waka Kotahi and HCC on Project design at 8 of the 14 locations, and the identification of six sites/areas where an assessment of alternatives was necessary to identify the “best for RiverLink” design for that location. This assessment is set out in section 7.6.5.

7.6.5 Assessment of Alternatives 1-6 Assessment Report

Resulting from the scope resolution phase, six specific project locations were identified as requiring specific testing through an assessment of alternatives process. For each of the six project locations, the design team created several potential design solutions and then assessed the performance of the options developed. These were referred to as Assessment of Alternatives 1-6 (AoA 1-6).

The AoA 1-6 Assessment Report (GHD Limited, 2020a), prepared for GW, Waka Kotahi and HCC, documents the assessment of alternatives at six locations within the Project area as a result of the scope resolution phase. The preferred alternatives were carried through to the Draft Indicative Design for Design Freeze 1. The concept of design freezes is explained at section 7.6.7.

The locations of the six AoA’s are Marsden Street (AoA 1), South Daly Street (AoA 2), North Daly Street City Edge (AoA 3), Chamber of Commerce & Auto Point House (AoA 4), Melling Bridge/Rutherford Street (AoA 5) and River Design Upstream of Melling (AoA 6).

Each option for each of the six AoA’s was evaluated against flood protection, transport, urban renewal and revitalisation, Te Mana o te Wai, environmental, property and implementability criteria, unless a criterion was identified as irrelevant for a particular AoA. The options were considered against the environment as it is today, i.e. the ‘base case’ or ‘do nothing’ option was the continued reliance on the existing environment for each option, rather than a comparison between the options.

AoA 1 – Location and alignment of Marsden Street

This assessment considered three different alignment options for Marsden Street to allow sufficient space for the new stopbank location, the impacts on the wider transport network, the scale of property acquisitions and integration into the wider urban environment.

The preferred option for AoA 1 was Option A, which proposed a realignment of Marsden Street adjacent to the stopbank, incorporated a 1m high retaining all for approximately 150m, and required no additional property acquisition beyond that already identified as required for the Project before the AoA process. Option A was recommended since, although all options achieved the RiverLink Project objectives, Option A was identified as having the fewest adverse effects (other options required additional property purchases) and lowest cost while still contributing to the desired Project outcomes.

AoA 2 – Southern configuration of Daly Street

This assessment considered five options relating to how the stopbank can be accommodated into south Daly Street, which includes consideration of the stopbank / city interface, the need for retaining walls, road layout, the scale of property acquisition required, and the potential for development.

The preferred options for AoA 2 were Options D and E, which both required the removal of Daly Street, acquisition and removal of buildings to build the stopbank and enable future urban development, retaining walls at the southern end of High Street and at the end of Andrews Avenue, and changes to adjacent road layouts and intersections. Other options were discarded since they required even greater retaining wall lengths and heights, which did not promote the desired connection between the river and city centre. Both Options D and E were recommended to be taken forward and developed further in the next stage of design because the respective option's impacts on the transport network would be more clearly understood at this stage, allowing the better performing option to be identified and chosen.

AoA 3 - Central Daly Street configuration

This assessment considered three options to integrate the stopbank with future urban development in central Daly Street, which included consideration the stopbank / city interface, the need for retaining walls, stopbank resilience, and the potential for development.

The preferred option for AoA 3 was Option C, which proposed a 4m wide stopbank crest, with sloped land to provide maintenance access and a low 2m retaining wall to enable some development within the toe of the natural stopbank, and regular bridging to provide points of access between future development and the stopbank, rather than a continuous promenade. Other options were discarded since they proposed 5m retaining walls along the eastern side of the stopbank to facilitate a continuous promenade, which posed seismic, flood resilience and stopbank maintenance issues. Option C was recommended to be taken forward as it most effectively balanced the competing desired outcomes of resilience and urban renewal / amenity, while not foreclosing any future development opportunities.

AoA 4 - Northern Daly Street configuration

This assessment considered four options to address how to fit the stopbank, the existing and future urban development, the pedestrian bridge and the access to the pedestrian within a constrained space, and considered the property acquisition requirements.

The preferred option for AoA 4 was Option B, which proposed stair and ramped pedestrian access off the pedestrian bridge down the stopbank, a cycle ramp providing direct access to the city centre from the pedestrian bridge, partial property purchase of 20 Daly Street to achieve a natural stopbank toe and 5m buffer for the cycle ramp, and low localised retaining walls. As Option B achieved the desired transport and amenity outcomes, was more efficient than other options in terms of cost and land (because it was cheaper and required less private land), and did not preclude future private and/or public redevelopment of adjacent sites, it was the recommended option for AoA 4.

AoA 5 - Melling Bridge landing into Rutherford Street

This assessment considered seven options to connect the new Melling interchange and bridge into Rutherford Street / Queens Drive while also considering road geometry, stopbank design requirements, property impacts and landscape / urban renewal.

The preferred option for AoA 5 was Option B1.5, which proposed an alignment of the Queens Drive centreline slightly to the north (but close) to the existing alignment, removal of the Wishart and Work and Income buildings, a batter slope to the southern side of Queens Drive affecting property, and a retaining wall to the northern side of Queens Drive such that the Brockelsby Roofing building could be retained. In respect of the treatment to the southern and northern sides of Queens Drive, Option B1.5 was a hybrid of Options B1 and B2. Other options were discarded since they had greater property impacts, and some resulted in skewed intersection layouts and poor legibility. Option 1.5 was the recommended option since it provided a compromise between Options B1 and B2, it provided for a less adverse urban renewal outcome than Option B1, and avoided the significant complexity and risk associated with the acquisition of the Brockelsby Roofing site required by Option B2.

AoA 6 - Active River Channel Design between Harcourt Werry Drive and Kennedy Good Bridge

This assessment considered four options for the design and management of the active river channel between Harcourt Werry Drive and Kennedy Good Bridge to manage in-channel erosion/food resilience, including consideration of ecological outcomes, buffer types, river and berm channel widths, maintenance and construction requirements.

The preferred option for AoA 6 was Option A, which proposed a managed willow (interspersed with blocks of natives) and native bio-engineered, ‘flexible’ edge, 100m active river channel width, flexible channel and edge conditions, no groynes and a natural river meander. Other options were discarded since they fixed the river channel and did not provide for natural river processes. Subject to the adoption of an adaptive management approach, Option A was the recommended option because it achieves flood resilience outcomes and allows for natural river processes, and does not foreclose the pursuit of any alternative options in future if required.

All of the preferred or recommended options for each of the six AoA’s were carried through into the consent design.

7.6.6 SH2 Pedestrian Overbridge Memo

As part of the consent design work, a possible pedestrian bridge over SH2 connecting to the proposed pedestrian/cycle bridge was considered. The option of a pedestrian bridge over SH2 was addressed within the SSBC (Stantec, 2019b), specifically Appendix I. Appendix I found that due to the steep topography of the western hill suburbs, fewer people walked, and more people drove to Melling Station than from the valley floor. Various options were considered in the SSBC for a new potential pedestrian overbridge over SH2, connecting the new Melling Station to the Western Hill suburbs of Harbour View.

Further investigations were undertaken during the consent design phase, which built on the investigations contained within Appendix I to the SSBC. These further investigations and findings are documented in a document titled SH2 Pedestrian Overbridge Memo, prepared by GHD, dated 24 July 2020 (GHD Limited, 2020b) for GW, Waka Kotahi and HCC.

Various options incorporating pedestrian bridge connections to Gaskill Grove and City View Grove were considered in the SSBC. These were tested and further developed in the SH2 Pedestrian Overbridge Memo

Evaluation undertaken

All of the options considered in the SSBC required stairs to achieve the proposed grades; a separate accessible ramp was not considered. As the SSBC options precluded disabled access, these options were discarded and not assessed further. As part of further evaluation undertaken, GHD prepared a further detailed option during consent phase to further understand the gradient required to achieve an overbridge connecting Gaskill Grove to the new Melling Station. An option incorporating stairs in addition to an accessible ramp was also considered.

Findings

The investigations and further evaluation found that approximately 20 households are brought within an 800m catchment (i.e. walking distance) of the new Melling Station as a result of an SH2 overbridge and therefore the overbridge only provides a very small benefit. Given the small catchment and steep gradient necessary for the bridge, compared to the otherwise significant benefits to cycle and pedestrian links at the Melling interchange as a result of the RiverLink Project, a pedestrian overbridge connecting the new Melling Station to Harbour View is not considered to be warranted so was not included in the consent design for RiverLink.

7.6.7 Further consent design refinements

As part of design work undertaken to complete the consent design for the Project, further refinements were made to the design that involved a consideration of alternatives. These further refinements and the alternatives considered are outlined below.

Cycleway / Shared Path Design

During preliminary consent design, three broad options for cycling infrastructure provision were developed and assessed. There were elements within these options that had crossover. The options included shared paths of varying widths along the stopbank and riverbank, a shared path on Pharazyn Street to Bridge Street, a separated cycleway on the new Melling Bridge and shoulders on SH2 northbound and southbound.

These options were discussed with cycle advocacy and interest groups from across Wellington and the Hutt valley as well as HCC walking and cycling representatives. Through these discussions a hybrid version was selected as the preferred option to develop for the consent design. The elements of this preferred option are as follows:

- Separated bi-directional cycleway along the railway corridor from Parliament Street to the new train station
- Shared path of minimum 4.5m and 3m widths along the stopbank and riverbank respectively on the TLB.
- Shared path of minimum 4.5m along the riverbank transitioning to the stopbank on the TRB.
- Shared path pedestrian and cycle bridge across the river.
- Separated bi-directional cycleway on southern side of new Melling Bridge
- Shoulder on SH2 northbound up to the existing interchange – utilising exit ramps to connect to bridges over SH2 and the river
- Shoulder on SH2 southbound with underpasses to remove conflict at exit and entry ramp gore areas.

The initial amendment to earlier phase option (referred to as Option 2) was a shift in the location of the Pharazyn St path to the eastern side of the road and the connection to the stopbank. As this design was further developed and the effects of it were understood, the impact of parking on Pharazyn Street and safety of the path with the number of residential accessways across it caused further exploration to extend the current Pito-one to Melling cycleway that runs adjacent to the rail line. The preferred solution was to extend the Pito-one to Melling separated bi-directional cycleway along the railway corridor from Parliament Street to the new train station.

New Melling Station and carpark design

Due to the spatial requirements for the state highway, entry and exit ramp geometry, flood protection works in the river, and minimum rail corridor requirements, there are limited options for locating the new rail station. The remaining space in this (Melling) area has been fully utilised for the station, bus and car connections, car park layout and stormwater treatment. The proposed location of the new Melling Station is a natural fit with the overall RiverLink Project, and in terms of providing improved connectivity to Lower Hutt city centre.

Pedestrian and cycling bridge western abutment

At the western abutment of the pedestrian and cycle bridge, the interface with the realigned Pharazyn Street was considered. Two options were considered; the bridge landing at the top of the stopbank level, and the continuation of the pedestrian bridge to incorporate an overbridge over Pharazyn Street.

The Pharazyn Street overbridge option was discounted due to geometry, i.e. the height required to cross over Pharazyn Street resulted in a very high bridge structure with long ramps connecting to the stopbank and the rail station. The visual impact and undesirability from a user perspective were further reasons to discount this option. Therefore, the preferred option was to land the western end of the bridge at the top of the stopbank, which is at the same level as the new Pharazyn Street.

SH2 over bridge culvert impacts

The new SH2 interchange overbridge and associated on and off ramps will require the relocation (reconstruction) of the existing culvert under Harbour View Road. This will result in the loss of a 25m section of natural waterway between the highway and the existing Harbour View Road culvert. This 25m section of waterway cannot be retained as part of the new works as it is the location of the new SH2 overbridge abutments and off ramp for the new interchange. Relocation of the abutment to retain the section of stream was not practically achievable due to roading geometry requirements without a major increase in earthworks and associated loss of vegetation and possible impact on adjacent flowpaths. A number of alternative solutions were considered for management of the tributary flows. These alternatives and the reason that they were not considered feasible are identified below:

- Installing a culvert along the alignment of the current channel and culvert beneath the abutment: This option was discounted as the abutment works require major ground improvement which prevent a culvert being installed in this location.
- Installing a culvert and outlet on the northern side of the abutment: This option would have required the culvert to go through the abutment and the associated ground improvement similar to the option above and was therefore not considered further.
- Installing channel on the south side of the interchange: The adjacent topography is very steep and would have required additional land acquisition, significant additional excavation and clearance of established bush. A channel in this location would be significantly steeper than the current channel and likely to require engineered energy dissipation or bed reinforcement and the downstream section of culvert between the channel and the River would be steeper preventing fish passage.
- Installing a culvert on the south side of the interchange but daylighting a section/ providing a new section of channel between SH2 and the river: There are no suitable locations where this could be achieved in the vicinity of the current alignment.

The waterway cannot be reinstated within the immediate vicinity, due to the topographical and spatial constraints. While reinstating the waterway under the over bridge abutment may be technically possible, such an undertaking would result in a very significant structure at significant expense, therefore this is considered to be unfeasible.

None of the alternative options identified allowed retaining or re-establishment of a channel similar in nature to the existing and the option to culvert the flow and daylight an alternative section of culvert in the Tirohanga Stream to re-establish an open channel similar in nature and of similar or greater length (i.e. an offset) was adopted.

Design Freezes

The development of consent design plans adopted a methodology of design freezes to allow for specialist input into the design. There were three design stages: Design Freeze 1 (DF1), Design Freeze 2 (DF2) and Final Consent Design. The DF1 plans were prepared based on the outcomes of the various alternatives and optioneering processes outlined above. These DF1 plans were provided to the specialist technical assessors to prepare their draft technical assessments. DF2 plans were then prepared, incorporating amendments to the DF1 plans based on comments and mitigation recommendations provided by the technical specialists and further detail as project design detail was developed and tested. Following final reviews, the DF2 plans were updated to reflect the final consent design.

7.7 Conclusion

Given the RiverLink Project development has spanned a number of years there have been a number of assessments undertaken to the assess alternative options, for the overall Project and its individual components. The Project has adapted over time to the different objectives of the three requiring authorities and in response to feedback from environmental specialists, the public and key stakeholders.

The alternatives assessment has been robust and thorough in terms of the requirements of section 171(1) and Clause 4 of Schedule 6 of the RMA. Robust evaluation frameworks have been followed throughout the development of the alternative design options, with MCA being a key tool employed to carry out analysis and provide information in respect of alternatives considered to GW, Waka Kotahi and HCC.

Following that detailed consideration of alternatives, it is clear that the consent design will provide a large number of benefits and deliver three long awaited projects under the umbrella of a single integrated design solution. The alternatives process (and outcomes) has been cognisant of environmental, social and cultural constraints; such that an overall positive outcome will be achieved.

8. Consultation

Overview

Consultation has been undertaken for the Project for the purposes of informing stakeholders, consulting and gaining feedback to inform the proposed design and mitigation. It has been undertaken in accordance with best practice guidelines and principles.

Consultation for the Project has been ongoing since 2014, with consultation during initial Project development, preliminary design, and consent design and pre-lodgement. Consultation has occurred with local, regional and national stakeholders including the community, directly affected landowners and residents, government organisations, local businesses, advocacy groups and local service providers. This has involved a number of methods, including one-on-one meetings, group meetings, public open days, newsletters and online material.

Consultation with Mana Whenua has primarily occurred at governance/Board level, as Mana Whenua were identified as partners for the Project, but also at marae and hapū level through the preparation of the Cultural Impact Assessment. The Te Awa Kairangi group is representative of Taranaki Whānui and Ngāti Toa. Consultation resulted in the development of the Kaitiaki Strategy to provide overarching principles for the Project, and informed Project design and this AEE. More recently, a Mana Whenua Steering Group has been established to work with GW, Waka Kotahi and HCC through the consenting process and the post-construction phase.

Ongoing consultation and communication with the relevant regulatory agencies has also been undertaken as part of the preparation of consenting documentation. This chapter provides detail regarding consultation methods, feedback received and its integration into the Project.

8.1 Introduction

Consultation and building relationships with people who are interested in, or affected by the Project, is an important part of RiverLink.

There is a long history of consultation that has influenced this Project, with separate consultation and projects originally undertaken by GW, Waka Kotahi and HCC. HCC began consulting in 1987 to support the development of plans for the central city, while in 1996, GW began developing a new flood management strategy for Lower Hutt. In 2014 it was identified that the Melling intersection on SH2 was becoming congested. This work has been built on, and further consultation has informed the Project development as GW, Waka Kotahi and HCC have come together to develop and deliver the combined RiverLink concept.

This section provides an overview of the stakeholder, iwi and public consultation that has been undertaken for the Project. It summarises the consultation undertaken in the different phases of the Project, including the activities undertaken, the parties consulted and the consultation outcomes. GW, Waka Kotahi and HCC will continue to consult with iwi, the community, and neighbours through the RMA consent process and prior to and throughout the construction of the Project.

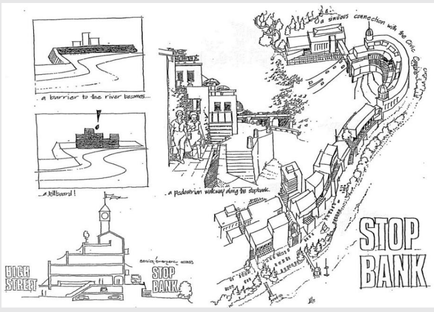
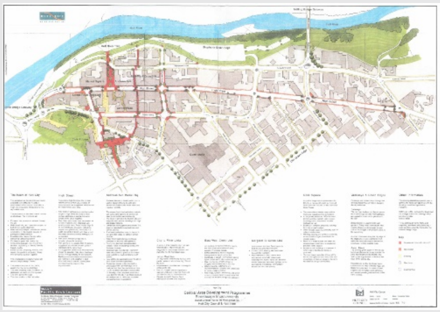
Consultation for RiverLink has been guided by the principles and core values of the International Association for Public Participation (IAP2) and GW, Waka Kotahi and HCC's respective guidelines for best practice consultation under the RMA, the LTMA and the HNZPTA (Greater Wellington Regional Council, 2019; NZ Transport Agency, 2016; NZ Transport Agency, 2016; NZ Transport Agency, 2016; Hutt City Council, 2018; Hutt City Council, 2020)..

The purpose of the consultation across all stages is to inform, consult, and gain feedback, which in turn has fed into the design and mitigation of environmental effects for the RiverLink Project. This process has informed the options chosen, and the design refinements made as design progressed. The objectives of the consultation varied depending on the Project consultation phase, and the desired outcomes of consultation during that phase.

8.2 Historic consultation in the pre-Project phase (pre-2014)

As RiverLink is a combination of three projects which were each previously separate projects being delivered by GW, Waka Kotahi and HCC, there have been historic consultation activities undertaken to support each of the respective projects. A timeline of this pre-RiverLink consultation is summarised in Table 32, Table 33 and Table 34.

Table 32 - History of HCC consultation between 1987 and 2014, informing central city urban revitalisation and development plans

Year	Document		Consultation	Outcome
1987	CBD Structure Plan		Consultation with public and meetings with interest groups to inform the urban form set out in the Structure Plan	Established the concept of a river esplanade and connecting the River to the CBD
1999	CBD Master Plan		Leaflet drop and public meetings to obtain public views of plans proposed under the master plan	Identification of street upgrades to ease traffic and increase / improve access to the River
2009	CBD Vision 2030		Community consultation workshops and community meetings to understand the community's long-term aspirations for the CBD	Confirmed community vision for the CBD and establishment of six broad themes to guide future development within the CBD

Year	Document		Consultation	Outcome
2009	CBD Making Places		Focus groups, design workshops attended by community and stakeholders, and review of previous consultation relating to the CBD Vision 2030	Developed or further developed ideas for public works to transform the CBD

Table 33 - History of GW consultation informing Lower Hutt flood protection and resilience plans

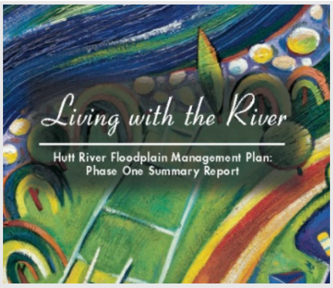
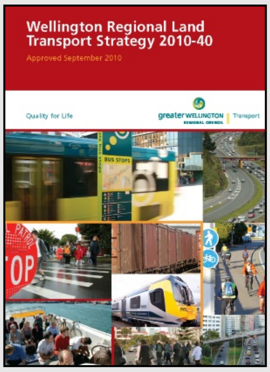
Year	Document		Consultation	Outcome
199 6	Living with the River		Representative survey of residents' opinions to inform the proposed management of the Hutt River corridor.	First phase in development of a management plan for Hutt River floodplain
200 1	Hutt River Floodplain Management Plan			A Plan to identify and manage flood hazard effects of the Hutt River
200 1	Hutt River Environmental Strategy			A strategy specific to Hutt River's corridor and relationship to the Lower Hutt CBD-
201 6	Hutt River Environment Strategy Action Plan		Household and business surveys, and interviews consulting the public about views of the river corridor and how they would like it to be managed.	Development of an Action Plan to support the Hutt River Environmental Strategy

Table 34 - History of consultation between 2010 and 2014 informing Waka Kotahi plans for Melling transport improvements

Year	Document		Consultation	Outcome
2010	Regional Land Transport Strategy 2010-2040		Public notification and comments requested, and also relied on consultation from - 2007-16 RLTS, - Western Corridor plan, - Ngauranga to Wellington Airport Corridor Plan	Identified transport issues and pressures in Greater Wellington. This identified that Melling was an important east-west connection, and that better connection was required
2014	Regional Land Transport Management Plan		Brochure prepared and sent to key stakeholders inviting feedback and public notification requesting comment	Identified the ongoing transport issues within Wellington Region including the existing Melling interchange being a network capacity constraint.

8.3 Integrated project development and preliminary design consultation (2014 – 2018)

In 2013, GW, Waka Kotahi and HCC developed the integrated Project concept. In 2014 they began to undertake consultation with each other, as a partnership, and with external stakeholders, landowners, iwi and the community. GW, Waka Kotahi and HCC began developing the Project and consultation with those parties informed this work. Consultation has been on-going throughout integrated Project development and will continue. Consultation to date has been undertaken in the following phases, which are described in more detail below.

- Project development (2014-2016): Integrated consultation begins, consulting on the Project footprint and associated property acquisition.
- Preliminary design (2016-2018): Consultation to inform preliminary designs.
- Consent design (pre-lodgement consultation (2019-2021): For input into the NoR and resource consent applications.

8.3.1 Project development (2014-2016)

Consultation to support business case development

In 2014, GW, Waka Kotahi and HCC undertook stakeholder consultation in relation to the Melling Gateway Strategic and Programme Business Cases. The purpose of the consultation was to confirm the need to take an integrated approach to addressing and investing in the three issues of flood risk, transport, and the city. The consultation assisted in the identification of key stakeholders to be targeted for further consultation including:

- Landowners in the Lower Hutt city area
- Businesses in the Lower Hutt city area
- Road users and commuters
- Mana Whenua
- Network utility providers including Transpower and Wellington Water Ltd
- KiwiRail

Integrated consultation

In 2015, GW, Waka Kotahi and HCC undertook public consultation and targeted consultation to explain the flood protection issue and work completed to that point in time. The purpose of this phase of the consultation was to introduce the public to and gain their feedback on the options developed to address flood protection that would also provide for improvements to be made to urban amenity and transport. This is also outlined more generally in the consideration of alternatives at section 7.4.5. The options at that stage, were:

- **Option A** – provision of a 1:440-year return period flood hazard protection that included an allowance for climate change (by enlarging and moving stop banks further west into Pharazyn and Marsden Streets, which would require removal of property on these streets); or
- **Option B** – taking a staged approach, whereby:
  - In stage 1 flood protection works would be undertaken within the existing corridor to a slightly lower standard, which would initially require no property purchases; then
  - In stage 2 (in approximately 20 years), there would be a move to the higher Option A flood protection standards, with completion aimed to be achieved in around 30 years to allow for increased river floods caused by climate change.

In addition to feedback on the options, the public was asked about the best use of the river corridor spaces and the features the community would like to see within the corridor.

- To elicit this feedback, the following consultation was undertaken:
- Consultation by way of letters, meetings, or phone calls with landowners whose properties were identified as potentially needing to be fully or partially acquired;
- Targeted consultation with landowners along Daly Street, stakeholders and specific interest and community groups; and
- Public consultation with the community in the form of open days and information sessions between 20-29 August 2015, brochures and feedback forms, advertised by a range of media including postcard drops, radio advertisements, media releases and newspaper articles.

Key feedback included:

- There was a strong preference for Option A;
- There was good support for the city centre and river edge enhancements;
- There was good support for a cycling/pedestrian bridge connecting the CBD to the western side of the river;
- Design needs to reflect the importance of the river corridor for leisure and recreation and the need for access linkages for a range of users;
- A 'gateway' or iconic bridge was preferred but cost needed to be closely monitored;
- There was a need for careful consideration during further design to reduce the impacts on public and private parking areas; and
- There was a good level of support for developing design and planning provisions for incorporating new Daly Street development with the stopbank and promenade.

The outcome of the consultation was a better understanding of what components of RiverLink were particularly supported, or potentially an issue. The consultation process fed into the identification of the preferred option to provide flood protection – Option A.

8.3.2 Preliminary design (2016-2018)

Between January 2016 and February 2018, building on the identification of a preferred option that was achieved in the previous project development phase, the next phase of consultation began for the Project now known as RiverLink. That phase focused on developing Option A further and sought information and feedback on the needs and options for the Melling transport improvements. Table 35 summarises the consultation activities that were undertaken during this phase.

Table 35 - Preliminary design consultation activities

Date	Consultation type
2016	Three Community design workshops to inform the design of RiverLink and learn more about the features people wanted to see within RiverLink
	Transport user experience interviews to understand issues and opportunities for the Melling transport system
	Stakeholder workshops to inform the development of options for the Melling intersection
	Online surveys to gauge community support and inform the economic assessment underway for the central city development strategy being developed (Making Places) including a riverside promenade
	Consultation with property owners on Daly Street, Marsden Street and Pharazyn Street about the potential for development along the stopbank and impacts / need for their property, and continued conversations with property owners affected by the anticipated flood protection works to support a voluntary property acquisition process
	Riverbank Market stall to advertise RiverLink and gain feedback on the Melling intersection issues and opportunities
2017	'Pop up' container with wall displays and information and take away material at the edge of Te Awa Kairangi opposite Andrews Avenue and at the popular 'Festival of Lights' to provide regular forums for communication with the public about RiverLink

Date	Consultation type
	Public open days to check in with the community about the design work to date and to seek input on where the Melling Bridge and a new Melling Station might be located
	Online surveys asking public to rank importance of railway station amenities and to understand travel patterns within the central Lower Hutt
	Continued consultation with property owners on Daly Street about the potential for development and impacts / need for their property, and continued conversations with property owners affected by the anticipated flood protection works to support a voluntary property acquisition process
	Consultation with rail commuters about issues and opportunities associated with Melling Station and to seek opinions on the location of a new railway station
	Online feedback forms available on the RiverLink website to provide a channel for general feedback
2018	Pop-up container continues to be used for communication, often located within the Riverbank carpark on Saturdays, near to the Riverbank Market
	Targeted community stakeholder workshops to raise awareness for the CCTP (which was developed off the ‘Making Places’ strategy consulted on during the Project development phase) and the importance of RiverLink to its success
	Melling transport improvements consultation where open days and information displays were held at Dowse Art Gallery, Riverbank Market and Queensgate mall. The intent was to seek feedback on options for Melling intersection and update the public on flood protection design work
	Letters and some subsequent meetings with 50 potentially affected property owners (affected by either transport or flood protection works) as well on-going conversations with property owners affected by the anticipated flood protection works to support a voluntary property acquisition process
	Emails and meetings with key transport and business stakeholders including the AA and Hutt Valley Chamber of Commerce seeking their feedback
	Use of Social Pinpoint (an online GIS based consultation tool) as a channel for feedback
All the consultation recorded in this table was supported by regular (approximately quarterly) newsletters and updates on the RiverLink Project website following key milestones and/or steps in the design and consultation process, and publicity via media releases and newspaper adverts.	

The objective of this phase of consultation was to give the public an opportunity to inform the design, seek the public’s views on different elements of the design as they were produced and to update the public as the Project progressed.

A summary of the key themes coming out of feedback received during the preliminary design stage include:

Central City

- Strong support for revitalising the CBD and more residential activity in the CBD.
- Very important to connect the city to the river and to create safe amenities which support social interaction.
- Relocation or suspension of the Riverbank Market for the duration of construction is undesirable.
- Support for the integration of residential and business activities along the river.

Transport

- Use and accessibility of Melling Station needs improvement, and an extension of the Melling Line would be supported so there needs to be an ability to accommodate extension of the Melling railway line in the future.
- Mixed use spaces and changes to the local road network need to be carefully designed to minimise congestion.
- The parking available at the proposed new Melling Station is not adequate.
- Support for relocation of Melling Bridge if it would improve congestion.
- Overall support for a promenade and walking/cycling bridge due to limited number of connections over the river. Participants were interested in ensuring the width of the bridge would provide for multiple users.
- Improvements to the cycling and pedestrian network were supported, but changes to the design of new facilities were noted as needing improvement. Increased pedestrian access to the city and the river with safer crossings was a key theme arising.
- Preference for a diamond interchange connecting directly to Queens Drive.
- Support for minimising congestion and local traffic volumes.

River

- Easy and frequent access to river and activities which enhance interaction with the river (fishing, water sports, kayaking) were strongly supported.
- Important to retain natural character of river corridor and to enhance amenity values within river corridor.
- Improving the river corridor for recreational activities.
- Improving the visual and landscape quality of the river corridor.
- Improving the water quality of the river.
- Compulsory acquisition is considered to impact social housing tenants and immigrants, and there is a current lack of affordable housing for those displaced to move to.
- Reducing the risk of flooding houses and businesses was considered the top priority when asked to rank preferences for improvements to the river corridor.

Cultural

- Cultural impacts need to be communicated and addressed at the marae and hapū level not with the trusts or boards.

The community had a positive perception of the flood protection upgrades that are proposed. The feedback from this phase supported GW, Waka Kotahi and HCC to develop and assess options and develop the preliminary design for the Project. Specific project elements that were confirmed through the public consultation included the development of the pedestrian and cycling bridge, further confirmation of public support for the relocation of the Melling road bridge and proceeding with a more expensive option of river and stopbank works to reduce the risk of flooding. The consultation also signalled the importance of the river corridor for recreation purposes, which supported the continued development of the riverside area as the design proceeded.

8.4 Consent design and pre-lodgement consultation (2019-2021)

Consultation for this phase began in 2019 as GW, Waka Kotahi and HCC consolidated their integrated approach to RiverLink, and technical AEE investigations and analysis were undertaken to develop the Project so that it was ready for the required RMA approvals process. This consultation continued into 2021, as documentation was prepared to support the resource consent applications and notices of requirement. This consultation has been undertaken by representatives from GW, Waka Kotahi and HCC, and by the team preparing this AEE.

The remainder of this chapter identifies the Project Partners and key stakeholders, summarises the consultation undertaken, and feedback received through the consent design phase, and explains how this feedback has been responded to or considered in the AEE and the mitigation recommendations and conditions.

8.4.1 Mana Whenua consultation between 2019-2021

Mana Whenua are identified as partners for the RiverLink Project, and have been involved in the RiverLink Project since 2019. Accordingly, consultation has occurred at governance /Board level and through the Project development, largely through the Te Awa Kairangi group. Local hapū and iwi have also been consulted through the development of the Cultural Impact Assessment, discussed below. The Te Awa Kairangi group is widely representative of the iwi Taranaki Whānui ki te Upoko o te Ika a Maui and Ngāti Toa Rangitirawho are Mana Whenua. The group provided a platform to work collaboratively to identify and mitigate any potential issues as they arose. During this phase, the consultation of iwi representatives has included attendance and input into key Project development workshops along with specialist workshops, and regular hui, identifying and looking at issues of importance to Mana Whenua. A summary of the specific consultation undertaken in specialist workshop and focused meetings is summarised below in Table 36.

As a result of this partnership and collaboration, the Kaitiaki Strategy was completed by Mana Whenua for the Project in February 2020. The Kaitiaki Strategy sets out Te Ao Māori (Māori worldview) principles, corresponding responsibilities and actions for Mana Whenua and other Project Partners to remain cognisant of as the Project is developed and its impacts on the wider environment are considered.

In November 2019, a Cultural Impact Assessment was commissioned on behalf of Taranaki Whānui and Ngāti Toa, and developed by a representative from the Te Awa Kairangi group, and was also informed by consultation with local hapū and iwi. The resulting assessment is summarised in section 9.17 of this AEE and the full Cultural Impact Assessment (Technical Report #16) is in Volume 4 of the Application documents.

Regular hui were used to work through the integration of the Kaitiaki Strategy into the ULDF (for example, an open day and hui was held with local hapū and the Te Awa Kairangi group at Te Tatau o Te Po Marae on 25 March 2021).

The hui also included cultural mapping of the Project area so this could be included and considered in the ULDF document and design. The Korowai design providing the design core/theme behind the urban and landscape design of the Project was developed by a local Māori graphic designer, and refined through the ULDF hui.

In June-July 2021, the Project Partners collectively identified a group of Mana Whenua representatives to perform the role of a Mana Whenua Steering Group (MWSG) to support the consent process, through to detailed design and construction of RiverLink. This established group of Mana Whenua representatives already advise on a nearby Waka Kotahi project (Te Ara Tupua, the new walking and cycling link between Wellington and Lower Hutt). This MWSG has agreed to assist with the provision of Mana Whenua oversight and input on the RiverLink project also.

The group's purpose is to identify opportunities, connect people, realise outcomes and fulfil consent condition requirements prior to lodgement of the RMA applications, continuing until completion of construction. The MWSG comprises representatives of Taranaki Whānui, Ngāti Toa and the applicants.

At the time of writing, consultation with the MWSG on the RiverLink project had recently commenced and was building on the earlier engagement activities described above. Mana Whenua Steering Group

The Project Partners also engaged Wikaira Consulting in June 2021 to provide advice to the MWSG and to review the draft application material on behalf of Mana Whenua. The application lodged reflects the recommendations of Wikaira Consulting within the draft conditions, with specific additions arising through the consultant and MWSG involvement in the Project.

Table 36 - Summary of hui and workshops targeted to AEE and ULDF development

Date	Consultation
June 2020 -May 2021	**Hui** were undertaken every four – six weeks with a particular focus on the development of the ULDF and the in-river and riverside design. Feedback on other elements such as what input Mana Whenua wanted to provide into multi-criteria assessment processes and the RMA consent conditions was also sought through these hui.
March 2021	**Open day and hui at Te Tatau o te Po Marae**. The hui included presentations from the Project Team to a wider Mana Whenua audience including kaitiaki from the marae, representatives of Taranaki Whānui, Te Atiawa, Te Ara Tupua Mana Whenua Steering Group members, and a Te Whanganui a Tara Whaitua representative.
Jan to May 2021	**Multiple hui** were held between the technical specialists / the planning lead for the AEE and Mana Whenua representatives (Morrie Love and Jenny Ngarimu) as the AEE drafting and specialist reports were being developed and finalised. The purpose of the hui was to understand the environmental effects of the Project, identify, any areas of potential concern, support the development of the cultural impact assessment and to develop the draft conditions with regard to Mana Whenua involvement post-consent approval and cultural impact mitigation.
June to July 2021	**Hui** commenced with a group of Mana Whenua representatives that have been established to function as a MWSG for the Project.

Feedback

Project components including the new pedestrian / cycle bridge, Melling bridge and the promenade between Daly Street and the stopbanks were identified as key opportunities for cultural expression, such as naming of bridge and other structures, artistic design, and design themes.

With regard to the design of the river channel and berm design (and planting), a consistent theme of the feedback received from Mana Whenua was the desire for native species to replace the willow planting on the riverbanks, and for the design of the river channel and edge to retain and provide a variety of habitats for birds, lizards and other native species. The key matters identified in the cultural impact assessment were the importance of the ecological health and cultural significance of the river, and the need to protect indigenous fish species and cultural heritage sites. The specific feedback received at the Marae Open Day included:

- A discussion on how the Korowai theme of the Project is to be given effect to;
- A desire for the new infrastructure to be given new names e.g., the pedestrian bridge, new road bridge etc. Bringing back traditional and 'forgotten' names for the Project elements and the natural elements (such as streams) around the Project area is supported;
- An interest in the native planting along the river – Mana Whenua were seeking to have it include a range of heights, and tall trees such as kahikatea to attract birds to the area;
- Mana Whenua see the need for a tikanga plan to be provided. The river has been an important historic transportation route, and is a feature of significance, integral to how Mana Whenua identify themselves. The tikanga and significance of this needs to be tied in;
- Cultural indicators such as long finned eels could be used to measure the health of the river;
- The potential for the equivalent of the Te Ara Tupua / Ngauranga to Pito-One Shared Path Mana Whenua Steering Group to guide this Project was raised as the mechanism for Mana Whenua input into the next stage of the Project.

Response to Mana Whenua feedback

These key matters have been incorporated into the Project's design and proposed conditions as follows

- The Kaitiaki Strategy has been embedded into the ULDF as part of its overall vision and guiding principles;
- The ULDF has been developed to incorporate the Korowai theme within all elements of the Project, as part of the design framework drawing elements and patterns together, for example within the way finding and signage design, the artwork along the pedestrian bridge and the balustrades of the new road bridge;
- Revegetation plans for the Project have been amended to include a wider range of indigenous vegetation. Further, the 7.7ha of willows trees in the upper river reach which will be planted to stabilise the river berms post-construction will be required to transition to a native riparian vegetation planting over the mid to long-term;
- Conditions are proposed to invite Mana Whenua to establish a Mana Whenua Steering Group (MWSG) for the Project. The purpose of the MWSG is to:
    - facilitate ongoing consultation with Mana Whenua in respect of the activities authorised by the designations and resource consents;

- provide an opportunity for Mana Whenua to provide kaitiaki inputs into the Project; and
- ensure appropriate tikanga and kawa (customary practices and protocols) are being applied throughout the development and implementation of the Project.

- Conditions are proposed to provide for a MWSG, which is a forum to share information during about the construction of RiverLink and provide an avenue for group members to raise concerns or identify opportunities. A Mana Whenua Values Plan is also allowed for, to inform relevant management plans for the Project.
- Conditions are proposed requiring that Project updates are provided to the local Marae and Te Rūnanga o Toa Rangitira communications officer to keep local Mana Whenua updated on the Project during construction and provide an avenue for queries and any issues;
- A condition has been included which requires fish monitoring before, during and following construction which includes monitoring for the presence of fish including cultural indicator species such as the long-finned eel. The MWSG also has the opportunity arrange for Mana Whenua representatives to observe the fish recovery activity.

8.4.2 Stakeholder consultation between 2020 and 2021

Pre-lodgement stakeholder consultation took place between June 2020 and May 2021.

The stakeholders to be consulted were identified and grouped for targeted consultation as shown in Table 37.

The regulatory teams within HCC and GW are identified as separate stakeholders because they are consulted separately to any internal Project Partner work to assess the RMA applications and provide recommendations to a hearings panel, during the formal RMA approvals process.

Political representatives were identified separately in the consultation planning processes, to recognise that there are specific communication processes within the Project Partner agencies with respect to these parties.

Table 37 - Stakeholders

Stakeholders	
Landowners and neighbours	Affected residential and business landowners and immediate neighbours and the Riverbank Market operator
Local Government and statutory agencies	Hutt City Council (regulatory) Greater Wellington Regional Council (regulatory), Department of Conservation (DOC), KiwiRail, and Heritage NZ Pouhere Taonga,
Local schools	Belmont School
Business interest groups	Hutt Valley Chamber of Commerce, Hutt Valley NZ (tourism organisation), Southend business Group, road user groups including the AA, Road Transport Association and the Heavy Haulage Association
Environmental interest groups	Forest and Bird, Friends of Hutt River, Fish and Game, Whaitua Te Whanganui-a-Tara Working Group, and Pareharu Forest Group
Not for profit groups	Rotary Club, E Tu Awakairangi Hutt Public Art Trust and Generation Zero
Cycling and walking advocacy groups	Hutt Cycle Network, Cycle Wellington, Doctors for Active Safe Transport, Great Harbour Way Trust and Port Nicholson Poneke and Living Streets Aotearoa

Stakeholders	
Utility providers	Wellington Water Ltd, Transpower, Powerco, Wellington Electricity, Spark, Chorus, Vodafone and FirstGas
Emergency Service Providers	NZ Police, Fire and Emergency Services and Wellington Free Ambulance
Lower Hutt community	River and river path users, train commuters, local residents, local schools

8.5 Consultation with key stakeholders during the consent design and pre-lodgement phase (2019 onwards)

This section provides the detail of the consultation undertaken during the consent design and pre-lodgement phase from 2019 onwards with key stakeholders.

8.5.1 Directly affected landowners and neighbours

Consultation

Directly affected landowners have been identified as those whose properties are fully or partly within the proposed designations. **Project neighbours** are those whose properties border the proposed designations.

In November 2020, 331 of the directly affected landowners and Project neighbours were contacted by letter informing them of the Project consent preparation phase and extending an invitation to attend an up-coming public open day on 28 November 2020 to learn more about the Project, and/or to meet directly with the Project Team to understand more about the Project.

A further 179 directly affected landowners and Project neighbours were directly contacted by a Project Partner representative due to existing relationships held between the Project Partner and the property owner, or the need for land to be acquired from these properties. These landowners were either contacted by way of a letter, phone-call, or a face-to-face meeting to inform them of consent phase consultation for the Project and invite them to the open day held on 28 November 2020. At a number of the face-to-face meetings (in particular where the indicative design indicated that land was likely to be required from that property), the draft Project design plans were shown and the design concepts specifically relevant to their property were discussed.

In late May 2021, with the pre-lodgement design further refined, a second letter was provided to the directly affected and adjoining landowners using similar methods of contact. The letter provided an update on the Project and its progress, as well as an invitation to directly consult with the Project Team to understand how the Project interacts with their property. Meetings and consultation resulting from this invitation are anticipated to be undertaken throughout June 2021.

In late May / early June 2021, an additional letter was sent to the relevant property owners from whom land is required for the Project, advising of the indicative design and how the design is anticipated to affect their properties by way of Land Requirement Plans. Information about the Public Works Act was also provided alongside a request to meet and discuss the requirements as soon as possible. These meetings were underway at the time of writing.

Feedback and response

The feedback and response resulting from this consultation is summarised in section 8.6 below, as it was generally received at the open days, or online via Social Pinpoint.

8.5.2 Local government

A **Statutory Approvals Group** (SAG) was set up to consult with both the Regional and City Council regulatory teams, acknowledging the role that they will have in the statutory process and subsequent monitoring of conditions of the designations and resource consents, if approved.

Between May 2020 and May 2021, the SAG met every 1-2 months, and more frequently closer to the application lodgement date to:

- work through potential statutory approval issues and information expectations for the Project;
- identify risks; and
- test adequacy of the information being compiled by the consultant team for the AEE.

While the SAG was the main forum for consultation with the Councils' regulatory teams, separate meetings were also held with the separate approvals teams to discuss specific matters of interest to each regulatory authority.

Pre-lodgement discussions were also undertaken with specialist technical peer reviewer representatives of the GW and HCC regulatory teams during the development of the AEE for the Project. These specialist meetings included introductions to the Project, presentation of the relevant Project components, and discussions regarding the assessment and effects of the Project relevant to the specialist fields. Potential mitigation and management measures were also discussed.

As the SAG met regularly through the application development, feedback was provided on different matters as issues arose.

8.5.3 KiwiRail

Consultation

Beginning in July 2020, meetings and site visits have been held with KiwiRail with both representatives from their operation and planning teams to understand KiwiRail’s design requirements for the relocated rail infrastructure and how to manage the planning approvals / amendments resulting from the relocation. As the design progressed, the potential for a new cycleway alongside the railway line in the Project Area also became a regular agenda item.

Feedback and response

The preliminary designs for the railway infrastructure have been reviewed by KiwiRail regularly as they have been developed, and KiwiRail has shared design standards and requirements to ensure that the preliminary design of the relocated infrastructure will meet KiwiRail requirements. It was noted that more input will be required during the Detailed Design stage with regard to ancillary drainage, stormwater, overhead line equipment and clearances, and the potential for a cycleway and other network utilities to run adjacent to the Melling Line. A Railway Management Plan has been agreed to be developed by KiwiRail in partnership with the Project team to set out the approach to manage and re-locate KiwiRail assets and network utilities. Initial feedback on the potential cycleway has emphasised the need to use the appropriate

KiwiRail application process[44] to construct a cycleway alongside their infrastructure, and accordingly, an application is being made.

Following discussions to ensure the Project and KiwiRail requirements are aligned, KiwiRail is lodging its own Notice of Requirement to alter its existing Melling Line designation in the District Plan. The importance of 'futureproofing' the rail-line, so it can be extended further north in the future was emphasised by KiwiRail. As a result, the geometric design of the bridge was developed to not preclude a future rail line operating under the new Melling interchange. To support this, the Notice of Requirement prepared to alter the designation has not reduced the length of the designation to the north, despite the new Melling Station being relocated further south as part of the Project.

KiwiRail was also concerned to ensure that any operational noise and vibration effects resulting from the new Melling Station and relocation of the railway line were managed. The likely effects of the new Melling Station were accordingly assessed as set out in section 9.11 of this AEE, which indicates that the District Plan permitted activity standards can be met. Consultation will continue to take place by way of regular meetings to continue KiwiRail's involvement in the development of any rail, network utility or cycleway mitigation or opportunities.

8.5.4 Department of Conservation

Consultation

Detailed consultation with DoC began by introducing the Project in December 2020, followed up by a workshop in April 2021 and further information provided in May 2021. The consultation has focused on Te Awa Kairangi, including the river channel changes, berms and vegetation removal, where there is the greatest potential for change. To date, the consultation with DoC has focused on explaining the identified effects on the ecology of the area and discussing some of the mitigation options being considered to address these effects.

Feedback and response

DoC sought to clarify the relationship between the RiverLink consents being sought, and the existing GW river maintenance consent, The Project Team confirmed that a decision was made early in the application development process to assess and consent the extent of the RiverLink Project separately, although the on-going maintenance of the river post-construction would be undertaken as authorised by the existing river maintenance consent.

DoC supported ecological benefits created by the Project – including the proposed approach to transition from willows to natives along the river berms in the upper reach of the Project but sought to understand how fish spawning habitats and fish migration are being protected, as well flagging that if environmental offsetting is that the preference is that the offset occurs within the area of effects. DoC suggested that including threatened indigenous species into revegetation plans could contribute to habitat creation and help native species to thrive. To respond to DoC feedback, a work stand down period from September to November (inclusive) is proposed to protect fish spawning and migration in this period. In terms of offsetting the proposed Stream Offset Plan will set out the quantum, design and location of the stream offset required.

Consultation with DoC staff will continue, particularly with regard to further development of ecological mitigation and offset measures.

[44] A non-statutory application process KiwiRail has developed to obtain KiwiRail's approval for assets to be built on its land

8.5.5 Heritage New Zealand Pouhere Taonga

Consultation

A meeting was held with Heritage NZ Pouhere Taonga (Heritage NZ) in May 2021, to introduce the Project, and discuss in detail the assessment of effects underway on the identified historic and archaeological sites and features within and adjoining the Project Area. The consultation focused on the identified archaeological effects, the potential for effects on heritage, and some of the mitigation options being considered. Of particular focus were the historic values of the existing Melling Railway Station and the Wesleyan Cemetery on Marsden Street.

Feedback and response

Feedback included advocating for the relocation of the existing Melling Station building with as much of the history of the existing Melling Station building being incorporated into the new Melling Station, including keeping elements and orientation as similar as possible. If it is proven unfeasible to relocate the station, Heritage NZ indicated they may accept the option to construct a new station which incorporates elements of the existing station building. Heritage NZ indicated they can offer advice and support when considering the detail of retrofitting, relocation, or designing a new station building that integrates the character of the existing station building. They requested that the Project team consult with them throughout the process of undertaking the feasibility assessment, and in detailed design and planning stages for the new Melling Station. To respond to Heritage NZ concerns around the new Melling Station building, a condition has been developed requiring an assessment of whether relocating and/or refurbishing the existing Melling Station as part of the new Melling Station is reasonably practicable. This assessment must be undertaken by a Suitably Qualified Person in consultation with Heritage NZ.

There was also some concern about how the values and history (including former location) of the Wesleyan Cemetery will be treated – Heritage NZ consider it more appropriate that green-space / park area (rather than a proposed carpark) is developed over the previous location of the cemetery. In response to this feedback, an earlier car park proposed for this area has bene removed from the Project design drawings.

Consultation will continue with Heritage NZ, particularly with regard to future development of heritage mitigation measures and the additional approvals required for the Project under the HNZPT Act.

8.5.6 Belmont School

Consultation and feedback

In April 2021, contact was made with Belmont School to explain the Project and understand and address any concerns or questions raised. The immediate feedback was a desire to understand how the construction traffic will impact and interact with the school traffic at pick-up and drop-off times. The school noted that there is a public carpark alongside the Melling Reserve Access Road, which parents use for as parking for pick-ups and drop-offs, and the school was concerned that it may not be available during construction.

Response to feedback

The Project will not be using Fairway Drive (the main road access to school grounds) as a construction vehicle access point, so there will be no impact or conflict with school access. The Project requires no changes to the carpark off the Melling Reserve Access Road, meaning parents will be able to continue using this through the construction period. The Project team has offered to visit the school to present and explain the Project including providing more detail about the access routes and indicative construction methodology. This presentation is anticipated in July 2021.

8.5.7 Business interest groups including road user groups

Consultation and feedback

In February, March and April 2021, presentations about the Project were made to both the Hutt Valley Chamber of Commerce, and the Southend Business Group[45]. A further opportunity for comment was provided to the Chamber of Commerce when the HCC Chief Executive presented the proposed Long-Term Plan to the group in April 2021. The presentations were followed up with one-to-one meetings with representatives of local businesses and organisations. Other meetings have been held from February 2021 onwards with businesses directly impacted by Project including the shopping facility owned and operated by Harvey Norman and the Riverbank Market operator to understand and work through how to manage or mitigate impacts of the Project on these businesses.

Both the Chamber of Commerce and the Southend Business Group were concerned about the car parking changes both during construction, and as a result of the Project. The importance of receiving local business input into any measures to address parking shortfall was emphasised. The provision for a connected cycleway (both locally and wider) was also raised. Otherwise, the Chamber of Commerce signalled strong support for the Project including the commercial opportunities the Project would bring. This was evidenced in a letter sent to the Minister of Transport signalling the Chamber of Commerce's support for the entire RiverLink Project. The letter was written in response to media articles which signalled that the government funding of the Melling interchange was potentially at risk.

Meetings were also held with road user groups including the **AA, Road Transport Association, and the Heavy Haulage Association** during April and May 2021. The Project was explained, and design drawings were provided, so specific feedback could be provided on the design.

The road user groups supported the Melling transport improvements, and also supported the replacement of the local road roundabouts with signalised intersections. On the local road network, the use of painted traffic calming devices (rather than mid-block speed humps / tables) were advocated for, and it was requested that road design across the entire Project carefully consider road dimensions and grades in light the variety of vehicles using the network.

Response to feedback

During the meetings with the road user groups, the Project team was able to confirm that accommodation for over-sized vehicles etc has been included in the design and that painted traffic calming devices were planned for the local road network.

Conditions are proposed which include on-going communication and consultation with residents and businesses affected by the construction activities, alongside conditions which require a parking review and a Transitional Parking Plan to:

a. manage the loss of public parking during construction; and

b. support a transition to multi-modal transport options to enable access.

In the interim, The Project team will continue to work with the organisations and businesses impacted by the Project to understand their business requirements and develop any further

---

[45] a group of businesses and organisations created to promote and revitalise their area of interest - the southern end of High Street, Queens Drive and the adjoining streets

mitigation measures. Another presentation is to be scheduled with the Chamber of Commerce in June/July 2021.

8.5.8 Environmental interest groups

Consultation

Meetings were held with the **Whaitua-te-Whanganui-a-Tara Committee**, and **Fish & Game** in March and May 2021. Contact has also been made with representatives of **Forest & Bird, Friends of Hutt River** and the **Pararehau Forest Trust** offering to consult on the Project and receive their feedback. The latter two organisations have responded that they feel adequately informed about the Project through other means such as the open days and general publicity described in section 8.6 below. Forest & Bird have been provided information about the Project but are yet to advise how they would like to engage.

Feedback and response

The feedback from the Whaitua Committee was generally positive, with particular interest shown in stormwater treatment (understanding why treatment wetlands are not appropriate for the Project), enabling fish passage, and working with Mana Whenua The fish passage being enabled through the culvert replacement at the Tirohanga Intersection Stream, Mana Whenua input as Project Partners, and the overall Project vision to enhance the mana and mauri of Te Awa Kairangi, were detailed in response to the queries from the Whaitua Committee.

Fish & Game were particularly interested in understanding the river features which protect habitats and how fish passage will be enabled through both construction and operation. It was agreed a Project area walk-over would be undertaken with relevant Project specialists and more information about construction methodology and the proposed conditions would be provided to Fish & Game, which they will share with their members and provide feedback on.

8.5.9 Not for profit groups

Consultation and feedback

In February 2021 **E Tu Awakairangi Public Arts Trust** (the Trust) made contact to highlight the importance of including public art within the Project. In response, their feedback on the approach to public art contained within the draft ULDF was sought. June 2021 meetings with the **Hutt City Rotary Club and Rotary Club of Hutt** are booked to present the plans for RiverLink, focusing on the development of river trails and connections as this portion of the RiverLink Project builds on the existing trails which were originally partly funded and driven by the Rotary Club.

A meeting was also held with **Generation Zero** in March 2021. The key Project feedback that came through included prioritising safety and mode shift through road and bridge design e.g., segregated cycle routes and lower speed limits and connecting key destinations to the active transport paths and providing for growth in patronage at the new Melling Station, including reducing park-n-rides for kiss-n-ride facilities.

Response to feedback

The ULDF was updated to integrate examples of public art proposed by the Trust, and the Project design plans were updated to better provide for mode shift and improved safety by:

- Making provision for 'kiss-n-ride' spaces and other facilities for pedestrians and cyclists such as cycle parking in the design for the new Melling Station

- Altering the cycle paths to better connect to key destinations such as the new Melling Station, and the wider cycle network (Te Ara Tupua and the wider local network) including separate, segregated, and shared pathways.

8.5.10 Walking and cycling advocacy groups

Consultation and feedback

Consultation with local cycle advocates from **Hutt Cycle Network, Cycle Wellington, Doctors for Active Safe Transport, Great Harbour Way Trust and Port Nicholson Poneke** began by way of meeting and correspondence in November and December 2020, where feedback on early cycle design concepts and options for the Project was sought. Feedback included:

- Being clear about the connections /routes (to wider networks) that RiverLink is seeking to deliver
- Designing the routes to be appropriate to the level of use anticipated
- The interchange design is not conducive to cyclists and SH2 through the interchange should include a separated cycle path for cyclists
- The southbound paths located south of Melling are poorly designed, and if retained as proposed are a deterrent to the use of the wider cycling corridor
- Cycling paths along the river do not exist on the east bank, and are interrupted on the west bank, which is an issue. Further, there should be a separated cycle option along these paths

After the cycle design was further refined, updates on how the design had been changed in response to their feedback by way of a letter and a meeting in February and March 2021 was provided. The advocates were also invited to the public open days.

In May 2021, a meeting was also held with **Living Streets Aotearoa**, who supported the initiatives within the Project which improve accessibility to pedestrians, and the retention of the Riverbank Market. Segregated walking and cycling facilities are supported on both bridges, not just the pedestrian and cycling bridge, and safe pedestrian access from the Western Hills to the train station was identified as important. Pedestrian access to the new Melling Station should be prioritised, and the number of park-n-ride spaces reduced.

Response to feedback

The design of the cycle network was amended to provide an option for a direct connection to the Pito-One to Melling section of the Te Ara Tupua shared path by extending the path along the rail corridor to the new Melling Station.

A separated southbound cycle movement through the interchange has been provided via a cycle path which allows cyclists to exit the shoulder of the motorway, cross under the exit ramp, and re-join the shoulder. The cycling paths along the riverbank have been updated and run along both the banks of Te Awa Kairangi. Portions of the path which are anticipated to have higher numbers of cyclists are proposed as segregated paths.

The design of the new Melling Line station has not been amended to prioritise pedestrians over vehicular use of Pharazyn Street. Traffic modelling indicates that the use of Pharazyn Street post-Project construction will continue to be high (Pharazyn Street is currently classified as an arterial road) – the design accommodates both the anticipated cycle and vehicle uses.

8.5.11 Utility providers

As summarised below, GW, Waka Kotahi and HCC have worked with network utility providers with assets in the Project Area to understand the location of existing services and discuss the necessary relocations, upgrades, new services, and mitigation of potential effects required as a result of the Project.

GW, Waka Kotahi and HCC will continue consulting with the operators to individually identify and develop a management approach to protect and / or relocate their respective assets. Draft conditions are also proposed requiring the consent holders work with the network utility operators to ensure that the Project does not adversely impact the safety or efficiency of the network operations.

Wellington Water Limited

Consultation with Wellington Water Ltd (WWL) - as the managers of GW and HCC's assets in the area - has been undertaken between November 2020 and July 2021 at both executive and operational levels regarding the design features and the interaction between the Project and WWL's assets which include water mains, main sewer lines, stormwater management and other smaller services which need to be relocated. WWL indicated that seismic resilience and enabling access for servicing are important factors in the relocations. These requirements will be met by working with WWL to identify the appropriate methodology to protect their assets as required by the proposed conditions relating to network utilities.

WWL also operate water supply bores into the Hutt Aquifer that have the potential to be impacted by the Project's bridge pile construction and river excavations, if the construction effects are not well managed. WWL have flagged their concern to ensure the potential for effects on the aquifer are both understood and mitigated through regular meetings since November 2020, and by providing preliminary comment on the draft hydrogeology report as it was developed. The potential construction effects will be carefully managed through the proposed conditions relating to bridge piling and groundwater monitoring to ensure that the aquifer is not affected by the works. Further detail of the issues raised by WWL, an assessment of the Project's effects on groundwater and proposed mitigation measures are provided in the Hydrogeology Assessment (Technical Report #4).

Transpower

GW, Waka Kotahi and HCC have consulted with Transpower, in relation to potential impacts of the Project on the high voltage overhead transmission line which runs across the river in the Project area and the Melling Substation. Transpower's assets are not directly affected, i.e., there is no need for asset re-location, but there is potential for construction related air quality and vibration effects to affect their adjoining or overhead infrastructure. Transpower has identified that mitigation measures such as clearances will be required during construction to avoid affecting their assets. These requirements will be met by working with Transpower to identify the appropriate methodology to protect their assets as required by the proposed conditions relating to network utilities.

Electricity, gas, and phone/internet

Consultation has been undertaken with **Chorus** and **Vodafone** (fibre optic network operators), **Powerco** (gas network operators), and **Wellington Electricity** (electricity network operator), in May 2021. Feedback predominantly related to confirming what assets are in the Project area and understanding the timing of the works and when the relocations would be required. The utility providers agreed in principle with the proposed approach that a detailed relocation methodology would be developed in consultation with the operators at detailed design phase. In the interim, the operators agreed to provide the design standards to be met during relocation where possible, and to continue working with the Project team to develop a high-level approach.

8.5.12 Emergency service providers

Fire & Emergency Services provided feedback via Social Pinpoint (described in section 8.6 below) that their main concern was ensuring that the access requirements for emergency vehicles were accommodated in the Project design. In May 2021, a meeting was held to share the plans for the Project and confirm that the new Melling bridge and transport network design will meet the Fire and Emergency NZ access guidelines. A May 2021 meeting was also held with **Wellington Free Ambulance** who confirmed they have no concerns but wish to keep updated on the Project. The **NZ Police** were also invited to the meeting but indicated that they do not anticipate the Project having any impact on police service delivery. All organisations will continue to be updated both through general Project communications to interested parties as the applications progress, but also as required by the proposed conditions relating to communications to local organisations and businesses.

8.5.13 Lower Hutt community

Residents from **Williams Grove** requested a meeting with the project team to address their concerns and receive information for the project. Nine residents raised questions and concerns relating to land and property values, street access during construction, parking losses, demolition of buildings, compensation for construction effects, design details regarding new active transport infrastructure and the future uses of the area. Agreements were made regarding future communication and consultation methods that would continue through the consent process, and during construction.

8.6 Public consultation

The pre-lodgement phase of community consultation focused on those living or working within Lower Hutt, as they will be directly or indirectly affected by the Project. Public consultation began in February 2020 with information provided on the RiverLink website, which reflected information available in a ‘pop-up’ shipping container located in the riverside carpark most weekends, as show in Figure 41 below.

Figure 41 - Open day at the 'pop-up' RiverLink shipping container

The information provided included indicative designs, timeframes, and the overall outcomes to be achieved by the Project. Publicity about the Project has been a complementary consultation activity for RiverLink, taking advantage of Project investigations such as ground investigations and ecological survey work to publicise and share information about the Project. Updates on the Project were shared through posters, Facebook posts, social media, the shipping container, newsletters, newspaper and radio advertising, information in GW and HCC facilities such as receptions, libraries and Melling train station, presence at significant community events and website updates throughout the year.

In November 2020, promotion of a public information day was made via digital advertising, website promotion, newspaper advertising, social media, posters in the shipping container alongside personalised landowner letters.

The information day was held on 28 November 2020 at the Dowse Museum with a satellite open day at the shipping container located in the Riverbank Carpark. The open day shared the current designs for the Project and was well attended, attracting more than 200 visitors. Social Pinpoint -an online map consultation tool – became available for public comments on the same day. Social Pinpoint was advertised at the information day, as well as through social media, the RiverLink website, local newspaper advertising (in paper and online), and through posters around Queensgate Shopping Centre. Social Pinpoint remained open until 10 January 2021, with nearly 200 comments received.

On 13 February 2021, another open day was held, and the Social Pinpoint website became live again for further feedback. This open day was held at the Lower Hutt Events Centre, as well as the shipping container in the carpark. The team shared how the Project design had been refined, and the construction methodology had developed since the last open day. More than 200 people attended, whilst another 84 comments were made via Social Pinpoint which remained available for comment until 8 March 2021. The shipping container has also been used to present the Project to Eastern Hutt School students (see Figure 42 below). A presentation was also made to SeniorNet in March 2021, again to raise awareness of the Project.

Figure 42 - Local school presentation about RiverLink

The second open day, Social Pinpoint, and other feedback (the 0800 number and the RiverLink website) were advertised throughout January and February 2021. The communication channels included: social media, posters on trains, radio advertising, advertising in local newspapers (paper and online), a stall at the Petone Rotary fair, the pop-up shipping container located every weekend in the Riverbank carpark and, the RiverLink website.

From March 2021, leading up to the lodgement, the Project was further publicised through a variety of medias including Saturday ‘pop up’ container presence along the river and in the central city and the suburbs surrounding, as well as letterbox drop about the Project and its progress. The local promotion materials at Queensgate, on the radio, newspapers etc were updated to provide more information about the Project progress and provide answers to frequently asked questions (FAQs) received through Social Pinpoint and the earlier open days.

Feedback received

The main themes of the feedback received was as follows:

Cultural

- A holistic approach should be taken to the Project to realise the mana and the mouri of Te Awa Kairangi;
- RiverLink outcomes should not reflect the status quo, and there is a kaitiaki role for Mana Whenua;
- The Mana Whenua input into the Project is great but what about input from Pasifika communities.

Central City

- The Riverside Market should be retained throughout construction and operation and must remain in a central location for ease of access;

- The completed Project including new residential apartment buildings by Te Awa Kairangi are supported;
- The connection between the river and city needs to be strengthened to bring the city to life;
- The skatepark needs to be retained;
- The construction impacts on the local businesses need to be managed.

Property impacts

- Concern about the impact of the land acquisition on residents considering the limited house supply in Lower Hutt;
- Tenants in leased properties are uncertain about when they will need to move, and whether similar rentals will be available;
- Remaining residents on Marsden Street are concerned about the reduction in residential community and safety;
- Concern about management of construction effects such as dust, noise and vibration and parking of construction workers coming to the construction sites;
- Concern that access to the river should be retained during the construction period.

Transport

- Need for improved safety along shared path trails particularly for women due to the isolation of stopbanks and safety concerns;
- Desire for pedestrian connection over SH2 to Normandale / Jubilee Park;
- Increased provisions of cycle and electric charging facilities at railway station and separated cycle paths away from traffic are supported, but design detail at intersections and crossing points still need work;
- Parking must still be provided at the new Melling Station and the trains should run along the Melling line on the weekends too;
- The provision of a connected, high quality and safe walking and cycling network was supported. It doesn't currently appear well connected to Te Ara Tupua;
- The need to relocate Melling Station was questioned, and instead the provision of more park n ride facilities was suggested;
- The reduction in parking was not universally supported, and a plan needs to be developed to address the effects;
- The potential noise effect of SH2 need to be managed;
- The Melling railway line should be extended further north.

River

- Native bush planted around the river is supported;
- Accessibility around and to the river for a range of users was considered a priority;
- The improved flood protection should extend to Alicetown;
- The quantity of gravel extraction needs to be significantly increased to improve flood protection;
- The river health needs to be improved, including by reducing run-off of pollutants into it.

General

- The Project is a positive improvement to Te Awa Kairangi and is supported by the community;
- There needs to be more action – get on with the work;
- More facilities such as toilets and drinking fountains are needed, as well as child play facilities.

Response to feedback

To respond to the feedback, the following design changes and conditions have been developed:

- Opportunities for the local community to provide input into the Project have been provided through the Open Days and the online Social Pinpoint. Further newsletters and letter drops are being sent throughout May and June offering RiverLink presentations to interested community groups, where they have the opportunity to learn about the Project, and the submission process available to provide feedback;
- A condition has been proposed requiring consultation with the Riverbank Market operator to identify an appropriate new temporary location for the Riverbank Market during the construction period;
- A new skate park on the true left bank is replacing the existing skate park on the true right bank, with a proposed condition restricting the demolition of the existing skate park until the new skate park has been constructed;
- Construction impacts on local businesses are addressed by proposed conditions which require general and site-specific traffic management plans which minimise both delays and disruption to transport users and construction traffic effects on property (business) access. Conditions are also proposed which require on-going communication and consultation with residents and businesses affected by the construction activities, alongside conditions which require a parking review and a Transitional Parking Plan;
- To retain access to the river during the construction period, a staged approach has been adopted into the construction methodology to restrict the effects of construction to specific geographic areas and enable access to the remaining corridor. This is supported by conditions which require at least one side of Te Awa Kairangi to remain open during construction where possible, including access to a path or the Hutt River Trail;
- To improve the safety of the shared path trails proposed as part of the Project, the proposed conditions relating to the design of the river landscape and trails require the consideration of CPTED;
- To better connect to the wider cycling network, including Te Ara Tupua, the cycling network design has been amended to include the potential for a direct connection between the RiverLink cycle path and the Pito-One to Melling section of Te Ara Tupua;
- The interchange design, and the planning applications have been designed to not preclude the potential for the Melling rail line to travel further north in the future;
- The desire for native bush around the river has been given effect to by the development of a replanting plan which requires the 7.7ha of willows trees which will be planted to stabilise the river berms post-construction to transition to a native riparian vegetation planting in the mid to long-term. Revegetation plans for the Project have also been amended to include a wider range of indigenous vegetation.

8.7 Post-lodgement – on-going and future consultation

On-going communication will be undertaken post-lodgement of the resource consent applications and NoRs. This will include on-going discussions with Mana Whenua, key stakeholders, and affected landowners, sharing Project information with interested parties and providing updates via the Project website and local media.

Conditions of consent are proposed requiring a MWSG to be established at least six months prior to the anticipated commencement of construction works. The MWSG is to include representatives from Taranaki Whānui and Ngāti Toa and is to hold regular meetings throughout construction works until at least six months after completion of construction. As noted above, the formation of the MWSG is already underway.

In addition, a comprehensive communications plan will be developed and implemented prior to and for the duration of the construction works. There will also be specific consultation activities and input to the detailed design and environmental monitoring activities from Mana Whenua, affected property owners and the network utility operators whose services require relocation because of the Project. These matters are provided for in the draft conditions contained within Appendix A.

9. Assessment of effects on the environment

9.1 Introduction and summary of effects on the environment

Overview

The assessment of effects on the environment for the Project has identified a wide range of actual and potential positive and adverse effects on the environment.

The most significant positive effects of the Project relate to travel, flood resilience and Central City revitalisation. These effects include reduced congestion, improved flood resilience from a range of flood events, improved connectivity for pedestrians and cyclists, and revitalisation of the Lower Hutt city centre.

During construction there will be temporary adverse effects, including loss of habitat, sedimentation in waterways, dust, noise and traffic from construction activities, business disruption, and disruption to recreational and social activities.

The Project will have some permanent adverse effects including loss of tributary stream habitat to accommodate the new interchange and removal of vegetation. These effects are proposed to be mitigated or otherwise offset. Overall, the positive effects of the Project will be major, while the adverse effects will be acceptable.

9.1.1 Introduction

This section provides a summary of actual and potential effects of the construction, operation and maintenance of the Project and identifies whether they are positive or adverse and whether they are temporary or permanent.

Avoidance of adverse effects has been the first principle of the design of the Project. Where avoidance has not been possible, mitigation measures have been proposed and are reflected in the proposed designation and consent conditions.

9.1.2 Structure of the assessment

The following sub-sections in Chapter 9, identified in Table 38, describe the assessment undertaken for the key topic areas. A summary of the resulting assessment is provided below in section 9.1.3.

Table 38 - Effects on the environment assessment topics

AEE Section	Topic
9.2	River hydraulics and flood containment
9.3	Stormwater and operational water quality
9.4	Construction water quality and erosion and sediment control
9.5	Groundwater / hydrogeology
9.6	Geomorphology
9.7	Freshwater ecology
9.8	Terrestrial ecology
9.9	Marine ecology and coastal avifauna
9.10	Traffic and transportation

AEE Section	Topic
9.11	Noise and vibration
9.12	Air quality
9.13	Archaeology and historic heritage
9.14	Contamination
9.15	Landscape and visual
9.16	Natural hazards and geotechnical risk
9.17	Cultural values
9.18	Social and recreation impact
9.19	Economic impact
9.20	Land use, property and network utilities

9.1.3 Summary of effects on the environment

The actual and potential effects of construction, operation and maintenance of the Project are summarised in Table 39. This table provides a summary of the positive and adverse actual and potential effects of the Project, and the level and duration of these effects. Table 39 also demonstrates the scale of effect following the implementation of mitigation measures. These mitigation measures are identified in the assessments later in this Chapter and are summarised in Chapter 10 also.

Table 39 - Summary of effects on the environment following implementation of recommended mitigation measures

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
River hydraulics and flood containment			
Reduction of flooding outside of the river channel	✓		Significant positive
Increase in flood levels outside the river channel downstream of the Estuary Bridge		✓	Small negative
Decrease in inundation duration upstream of and adjacent to the RiverLink reach	✓		Moderate positive
1-2 hour increase in flood duration downstream of Estuary Bridge		✓	Moderate adverse
Stormwater and operational water quality			
Improved freshwater quality as a result of treatment of stormwater discharges (contaminants and sediment)	✓		Positive
Changes in hydrology (increased impervious areas and catchment area, and change in drainage patterns) resulting in flood risk in the receiving environment		✓	Negligible
Construction water quality and erosion and sediment control			
Reduced water quality from sediment laden runoff and increased risk of other contaminant discharges into the downstream receiving environment during construction from activities outside of the river corridor		✓	Negligible
Reduced water quality from sediment generation and transport of suspended sediment during in-river/stream works and activities within the river corridor		✓	Low adverse
Groundwater / hydrogeology			

[46] As described in applicable technical report

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Slight increase in seepage of groundwater to river due to deepened riverbed.		✓	Minor adverse
Approx. 0.25m drawdown of shallow groundwater level from riverbed excavation within 75m of the river		✓	Minor adverse
Potential impacts on groundwater from piling for Melling Bridge		✓	Minor adverse
Geomorphology			
Exposed river banks during construction susceptible to erosion		✓	Minimal adverse
Sediment release and increased downstream turbidity from construction activities		✓	Minimal adverse
Greater degree of security against bank erosion effects	✓		Moderate positive
Greater concentration of bed material deposition in the upper reach, allowing easier extraction and minimising frequency and magnitude of extraction along lower reach	✓		Moderate positive
Some improvement to the natural character of the river reach	✓		Moderate positive
Reduced flood damage and erosion vulnerability	✓		Moderate positive
Freshwater ecology			
Sediment and cement wash discharges affecting water quality		✓	Low adverse
Disturbances to freshwater habitat from gravel extraction and bed disturbance		✓	Low adverse
Impacts on freshwater fauna from disturbance activities (gravel extraction)		✓	Low adverse
Impacts on fish spawning and migration		✓	Low adverse
Effects on freshwater values from stormwater	✓		Positive Net Gain

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Permanent impact on freshwater habitats from bridge piles		✓	Low adverse
Fish passage effects from new structures		✓	Low adverse
Changes in river hydrology affecting cyanobacteria and periphyton growth		✓	Low adverse
Terrestrial ecology			
Vegetation and habitat loss through vegetation clearance and earthworks		✓	Low adverse
Loss of Threatened or At Risk flora specimens		✓	Low to Very Low adverse
Loss of habitat and direct mortality or injury to species, for example smaller, less mobile species (e.g. lizards, *W. urnula* snails, peripatus) that may be harmed during vegetation clearance or earthworks activities		✓	Low to Very Low adverse
Effects on riverine birds, including temporary removal of gravel beaches, disturbance, and potential direct mortality or injury		✓	Low adverse
Effects on forest birds, including loss of habitat, edge effects resulting in reduced habitat quality and potential direct mortality or injury		✓	Low adverse
Effects on grassland birds including temporary removal of mown grassland, disturbance, and potential direct mortality or injury		✓	Low adverse
Marine ecology and coastal avifauna			

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Effects from sediment discharged from earthworks and works within the river.		✓	Very Low adverse
Operational effects of stormwater contaminants on marine ecology.	✓		Net Gain
Sediment discharge effects on food supply and foraging ability of coastal avifauna		✓	Low to Very Low adverse
Operational effects of stormwater contaminants and bioaccumulation effects on coastal avifauna	✓		Net Gain
Traffic and transportation			
Support and enable an increase in mode share for active public transport modes	✓		Significant positive
Improved safety to cyclists and pedestrians within central Lower Hutt	✓		Significant positive
Improved multi modal access to the new Melling Station and central Lower Hutt	✓		Significant positive
More reliable bus journeys arising from the signalisation of roundabouts	✓		Significant positive
Safer and less congested environment in central Lower Hutt as a result of more through traffic movements on SH2	✓		Significant positive
Net reduction of 711 carparking spaces		✓	Moderate adverse
Construction traffic movements, traffic diversions to less suitable routes and property access		✓	Moderate adverse
Noise and vibration			
Project reduces road traffic noise at majority of PPFs	✓		Moderate positive
Project increases road traffic noise at 151-155 High Street		✓	Negligible
Noise from weekend operation of Melling Line		✓	Negligible

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Construction noise impacts		✓	Negligible through to moderate adverse
Air quality			
Dust and other contaminant emissions from demolition and removal of buildings, structures and pavement		✓	Minor adverse
Dust and other contaminant emissions from excavation, earth moving and material handling, including stockpiles, aggregate crushing and screening and silt drying		✓	Minor adverse
Dust and other contaminant emissions from vehicle movements		✓	Minor adverse
Transport-related emissions from operation of the road network	Neutral		Negligible
Archaeology and historic heritage			
Effects on other known archaeological and historic heritage sites resulting from Project construction		✓	Low adverse
Effects on unidentified subsurface archaeological remains during earthworks		✓	Low adverse
Contamination			
Disturbance of contaminants during construction and associated discharges of contaminants to air, land, surface and groundwater where there may be an effect on the environment		✓	Minor adverse
Discharge of contaminants during construction where there may be an effect on human health		✓	Minor adverse
Discharge of contaminants to ground and groundwater resulting from operational disturbance of contaminated soil during periodic maintenance works for subsurface works		✓	Minor adverse
Landscape and visual			

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Upper Reach – operational effects (e.g. the constructed active channel features) will over time naturalise, and the use of willows will reduce. Significant uplift in quality of experience and informal recreation resources. Overall improvement in visual amenity and visual characteristics of channel will improve and more indigenous plants will be added. Public access to and along Te Awa Kairangi will improve.	✓		Overall Moderate positive
Upper Reach - construction effects on natural landscape, urban landscape, visual amenity, natural character and public access will be mitigated with staging to limit the extent of works and disruption, plus early implementation of planting and reinstatement of public access.		✓	Moderate adverse
Lower Reach – operational effects include permanent removal of existing unmodified natural landforms and vegetation, including around the Melling interchange.		✓	Moderate to low adverse
Lower Reach - operational effects also includes permanent shift in urban character, including landmark structures and integrated korowai narrative. Increase in quality of built environment, integration of natural features and landscape changes. Greater variation in water movement with natural character gains with better quality structures. Enhanced access to and along Te Awa Kairangi and new pedestrian/cycle bridge.	✓		Moderate-high positive
Lower Reach - construction effects on natural landscape, urban landscape, visual amenity, natural character and public access mitigated with staging to limit extent of works and disruption, early implementation of usable sections of the River Landscape and reinstatement of public access.		✓	Moderate-high adverse
Natural hazards and geotechnical risk			

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Hazards for Project elements resulting from fault rupture, ground shaking, liquefaction, tsunami, etc		✓	Tolerable to acceptable risk
Cultural values			
The sites of significance and Te Awa Kairangi (sites have already been modified or destroyed therefore unlikely for works to further damage)		✓	Minimal adverse
Stormwater /construction water	✓		Positive
Ecology effects		✓	Minor adverse
Effects of transport infrastructure changes		✓	Support – will not materially affect
Social and recreation impact			
Improvement of social well-being for the wider community as a result of increased resilience and confidence in flood protection measures, improved access to active transport infrastructure and trains, reductions in congestion, improved access to Te Awa Kairangi and urban renewal and revitalisation.	✓		Positive
General disruption to local communities (residents, commercial business owners) disruption to travel patterns, temporary closure of public areas and facilities, as a result of construction activities		✓	Low adverse
Planning (pre-construction phase impacts) being fears and aspirations and the concern, stress, anxiety and worry, amenity character as a result of vacant shops and properties caused by the uncertainty of the Project commencement.		✓	Low adverse
Economic impact			
Increased economic and employment benefits	✓		Significant positive

Actual or potential environmental effect	Positive effect	Adverse effect	Scale of effect with mitigation[46]
Indirect economic benefits, such as increased night time and visitor economies, improved access for skilled workers and urban agglomeration and improving workforce amenity	✓		Positive
Loss of employment land, reduced movement and accessibility and reduced car parking to local business, industry and wider economy		✓	Low adverse
Land use, property and network utilities			
Individual property loss to meet Project land requirements		✓	Moderate adverse
Restriction in access to businesses during construction		✓	Minor adverse
Loss of visibility for businesses reliant on passing trade		✓	Minor adverse
Closure or relocation of businesses due to Project land requirements		✓	Moderate adverse
Change access to some properties		✓	Minor adverse
Impact on network utilities		✓	Minor adverse

9.2 River hydraulics and flood containment

Overview

Areas adjacent to the main river channel in Lower Hutt are known to be potentially prone to flooding; modelling of various flood events has demonstrated that existing stopbanks would be breached and areas of Lower Hutt inundated to varying degrees depending on the severity of the flood.

Modelling shows that the proposed stopbanks will largely eliminate all out-of-channel flooding to Lower Hutt in a 100-year Average Recurrence Interval (ARI) flood event in a 2020 climate, and significantly reduce the area of out-of-channel flooding and depth of out-of-channel flooding in a 100-year ARI flood event in a 2130 climate (taking into account climate change) and a 2,800 cumec flood event.

In the larger modelled flood scenarios, an increase in peak flood depth and extent around the river mouth is predicted to occur. This is because the containment of flood flows due to the RiverLink works means that a greater volume of flood flow will be conveyed downstream within the channel A review of the HRFMP will be undertaken to identify measures to mitigate this adverse effect.

When assessed in accordance with the GNS 'Risk-based Land Use Planning for Natural Hazard Risk Reduction' guidelines (2013), the flood risk reduces from 'Intolerable' to 'Tolerable' or 'Acceptable' for all modelled scenarios.

9.2.1 Introduction

The river hydraulics assessment has involved the development of a 2D dynamic fixed-bed hydraulic model of Te Awa Kairangi from Taita Gorge to the Wellington Harbour coast. This model has been used to inform the design (i.e. required stopbank heights) and assess potential flooding effects arising from the Project.

The river hydraulics assessment considers the effects of the Project on changes to flood levels, depths and velocities during frequent and extreme flood events, changes to flood duration, changes to scour potential during flood events, and changes to flow depths and velocities under low flow conditions.

The full River Hydraulics Assessment is contained in Technical Report # 1.

9.2.2 Existing river hydraulics environment

Over the subject reach, Te Awa Kairangi is a single-thread, gravel-bed river that is constrained between stopbanks on both sides. The river has been the focus of significant flood management work over the past century, including flood protection infrastructure such as stopbanks, edge protection and berm management works.

There are areas adjacent to the main river channel that are known to be potentially prone to flooding during events of differing severity. The HRFMP, prepared in response to this flood risk, calls for the upgrading of all Major Stopbanks to be designed to contain a flood peak of 2,800 cumecs without overflow. A flow gauge has been located on Te Awa Kairangi at Taita Gorge since 1979, at the upstream end of the 2D hydraulic model. Analysis of the gauged flow record from this site has been used to develop design floods to be used for channel conveyance assessments. Figure 43 plots a discharge time series of the nine largest floods on record (with peaks aligned in time).

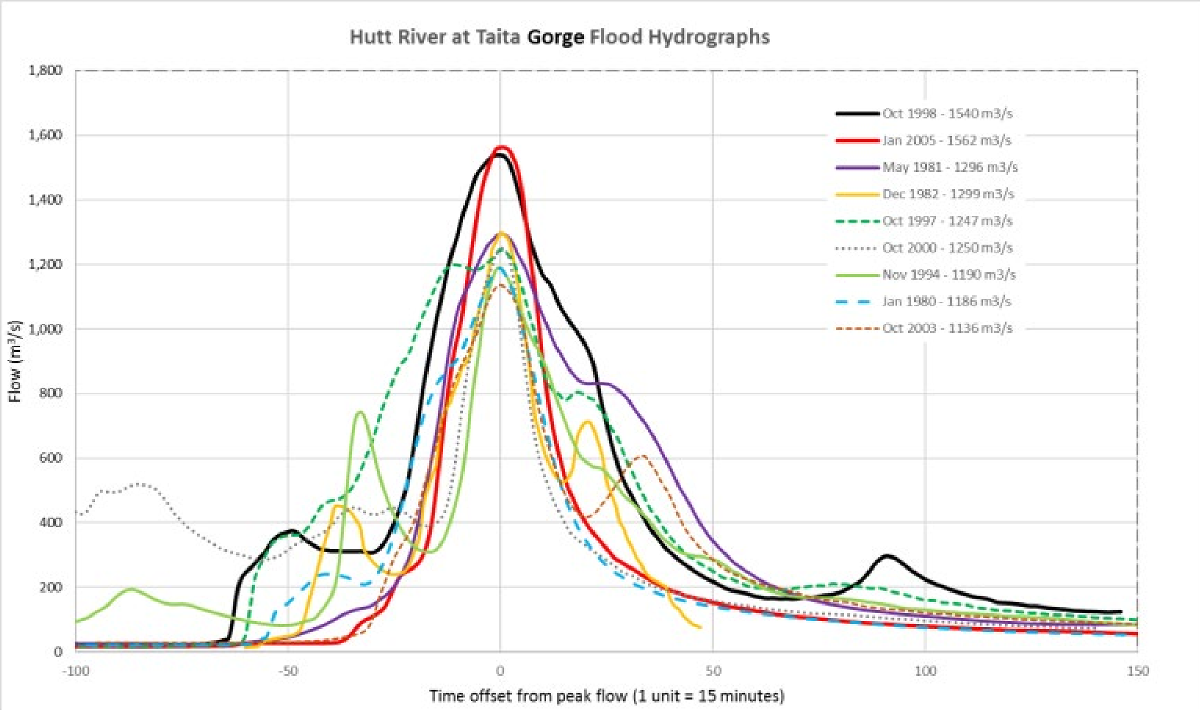


Figure 43 - Largest recorded flood hydrographs at Taita Gorge with peaks aligned in time

As indicated in Figure 43, the highest flood peak on record (1,562 cumecs) occurred in January 2005, and the second highest (1,540 cumecs) occurred in October 1998. Also visible from Figure 43 is that there have been several flood events that peaked at more than 1,200 cumecs. A flood of the design flood magnitude (2,800 cumecs) has not been observed in the gauged record. The mean annual flood has been calculated to be 869 cumecs.

Hydrological analysis of the flow record at the Taita Gorge has been undertaken, resulting in estimates of extreme floods to be used in further design, including the effects of climate change. In Table 40, a summary is presented that shows peak flows for a range of design event likelihoods (from 5-year Average Recurrence Interval (ARI) to 500-year ARI) across two climate horizons (present day and 2130).

Table 40 - Design flows for present day and future climate horizons

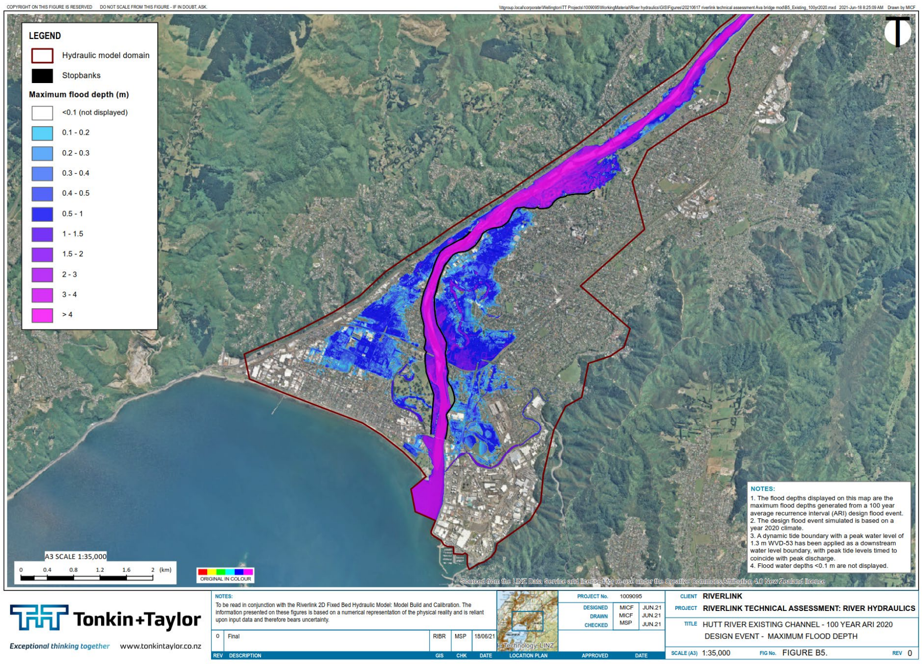
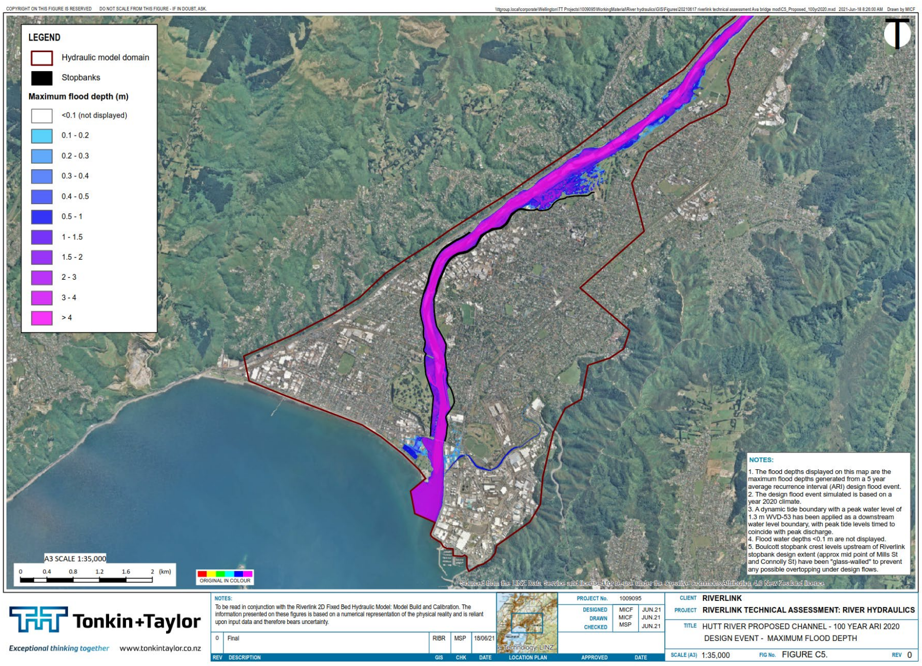
	Flood peak in cumecs for Average Recurrence Interval (ARI) of:						
	5 years	10 years	20 years	50 years	100 years	200 years	500 years
Current estimate based on historical series 1971-2019	1,101	1,282	1,470	1,714	1,897	2,080	2,320
Climate adjusted estimate to 2130 using 12-hour factors	1,441	1,674	1,919	2,235	2,473	2,709	3,021

9.2.3 Assessment of flooding effects

Effects on flood depths and extents in 100-year ARI event

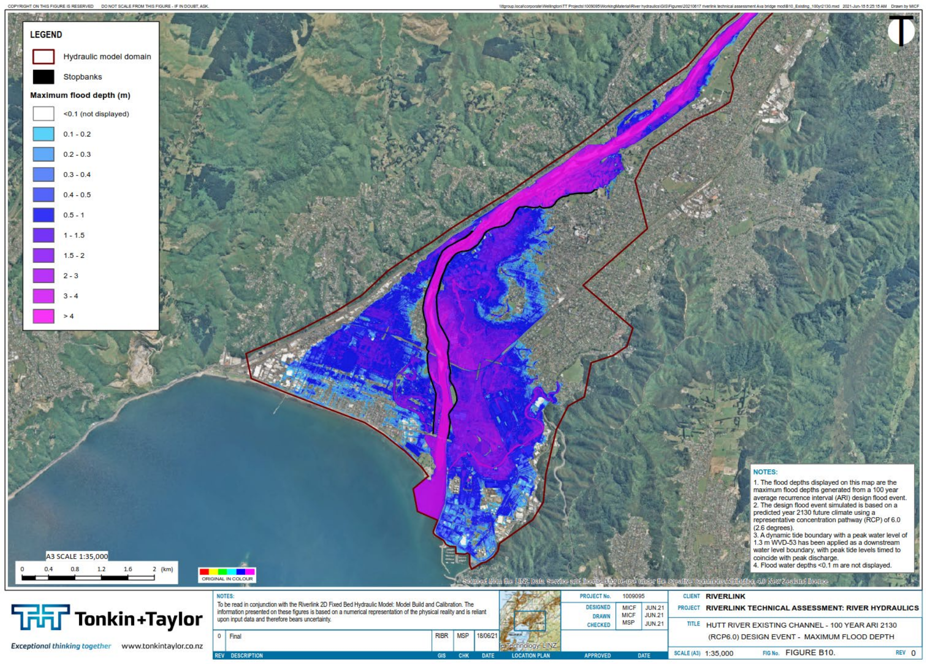
Maximum modelled flood depths and extents for the four different 100-year ARI flood event scenarios are shown in Table 41. The full-size flood maps reproduced below are provided in the River Hydraulics Assessment (Technical Assessment #1).

Table 41 - Maximum modelled flood depths and extents for 100-year ARI event

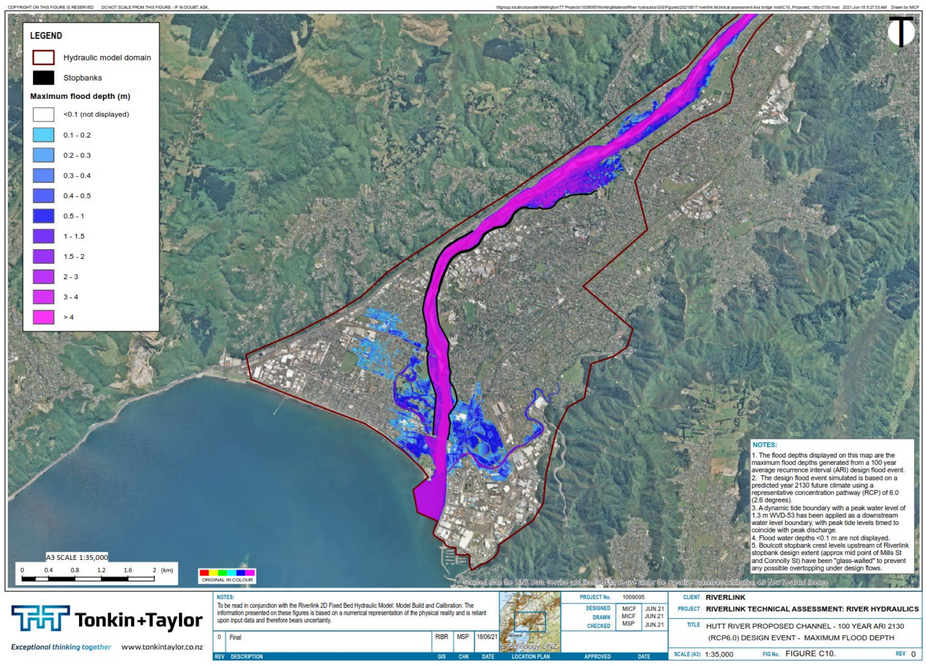
<table>
<tr><td rowspan="2">2020</td><td>Existing</td><td>
</td></tr>
<tr><td>Proposed</td><td>
</td></tr>
</table>

2130

Existing



Proposed

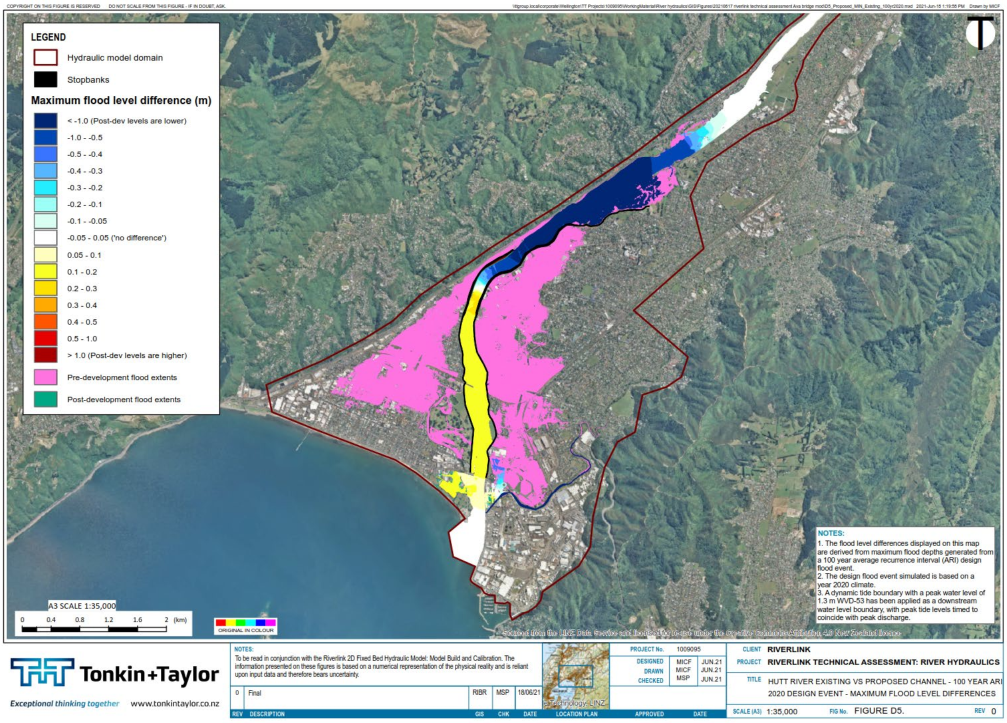


As Table 41 shows the RiverLink works will almost eliminate out of channel flooding in a present-day (2020) time horizon 100-year ARI event. This is assessed as a significant benefit to the community. Similarly, for the 2130 100-year ARI event, RiverLink works will substantially reduce flooding that would otherwise cover a very wide area through Lower Hutt City. This is again a significant benefit of the Project. The containment of flood flows in the 100-year ARI event due to RiverLink works means that a greater volume of flood flow will be conveyed downstream within the channel, beyond the RiverLink works.

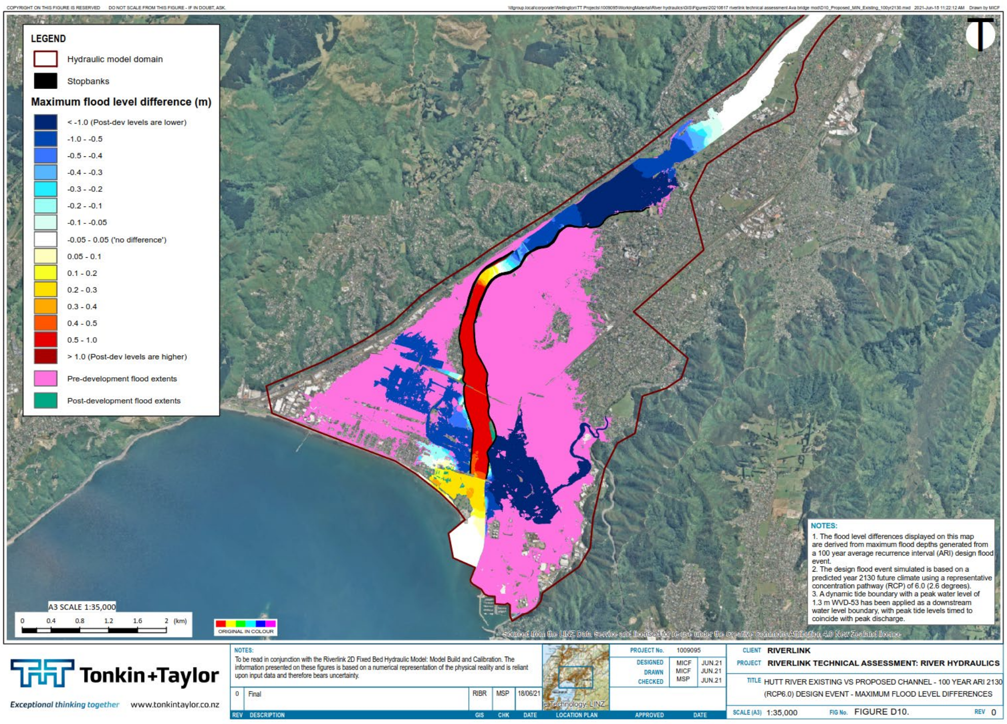
An assessment to determine changes to flood levels due to this upstream flood containment has been undertaken, with findings shown in Table 42. Areas of reduced flood levels are indicated in blue, increased flood levels in yellow-orange-red, no change in white, new areas of flooding in green, and complete removal of flooding in pink.

Table 42 - Modelled difference in peak flood levels for 100-year ARI event

2020



2130



As demonstrated in Table 42:

- The RiverLink works decrease the peak flood level by up to one metre within the channel of the RiverLink reach, for both time horizons.
- Downstream of the RiverLink reach, but within the stopbanked channel, the RiverLink works will cause an increase in peak flood level of up to one metre.

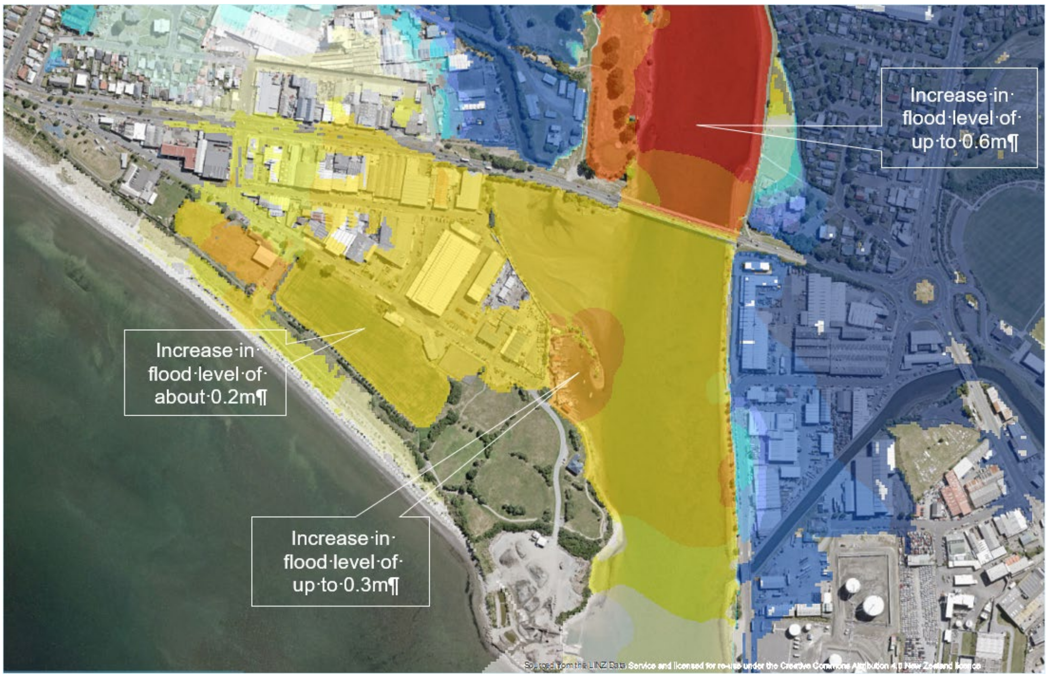
- Over wide areas of Lower Hutt City, the RiverLink works result in removal of flooding for a 100-year ARI event. For example, there are parts of Hutt Valley High School where flood depths are modelled to occur in excess of 1.5m in a present-day 100-year ARI event pre-RiverLink, which will become flood-free in this event after completion of the RiverLink works.
- Over small areas downstream of the Estuary Bridge, the RiverLink works have been shown to increase peak flood level outside of the stopbanked river channel. This is considered in more detail below.

In Table 43 the predicted peak flood level increases for the area downstream of Estuary Bridge (Seaview) are shown for a 100-year ARI event for 2020 and 2130 climate horizons. Annotations in the table indicate the predicted increase in specific areas.

Table 43 - Modelled difference in peak flood levels for 100-year ARI event

2020

2130



As demonstrated in Table 43:

- There are areas downstream of Estuary Bridge outside of the main channel where the peak flood level is expected to be higher as a result of the RiverLink works, since flood flows within the channel at the upstream (RiverLink) locations are contained.
- In a present-day 100-year ARI event, the modelled increase in peak flood level is generally less than 0.2m. This is a small effect comparable in magnitude to the absolute accuracy able to be delivered from such a model.
- In a 2130 100-year ARI event, an increase in peak flood level of more than 0.5m is expected within the main channel upstream of Estuary Bridge, and an increase of up to 0.3m is expected outside of the main channel downstream of Estuary Bridge. These are also relatively small effects.

Cardno has undertaken a survey of floor levels for properties downstream of Estuary Bridge that will be affected by increased peak flood levels as a result of the RiverLink works, as outlined at Table 43. This survey has been used to make a comparison between surveyed floor levels and hydraulic model results to examine the inundation effects on Seaview that could arise due to the upstream flood containment achieved by the RiverLink Project. A copy of the Cardno report is included in Volume 4 of the Application documents.

The land uses in the affected area are commercial and industrial properties, in addition to a number of boat sheds. The affected area includes properties on Port Road, Waione Street, Hautonga Street and Marine Parade. Table 44 outlines the modelled number of buildings inundated in the various existing and proposed scenarios of the Project.

Table 44 - Modelled number of buildings inundated at each event.

	100-year ARI event (2020 climate)	100-year ARI event (2130 climate)	2,800 m^3/s event
Existing scenario	36	75	96
Proposed scenario	37	91	101
Difference	1	16	5

It should be noted that the buildings inundated in the proposed scenario are not necessarily the same buildings as those inundated in the existing scenario, as it is dependent on the direction of flood, and some buildings that are inundated in the existing scenario will not be in the proposed scenario. Differences include:

- 100-year ARI event (2020 climate): Five additional properties on the left bank will be inundated rather than on the right bank due to changes in flood direction. One additional currently unaffected property on the right bank will be affected due to a wider flood extent, but other properties on the right bank will be unaffected.
- 100-year ARI event (2130 climate): All of the additional properties affected will be on the right bank due to a change in flood direction and wider flood extent.
- 2,800 m^3/s: All of the additional properties affected will be on the right bank due to a change in flood direction and the wider flood extent.

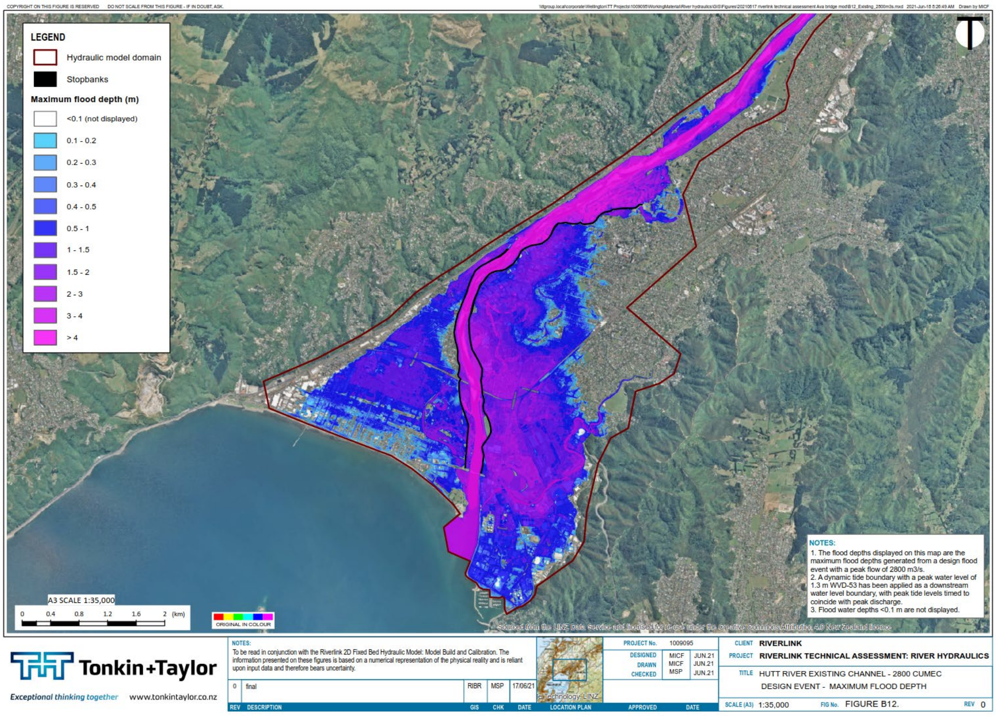
Cardno also compared the results of the floor level survey against the hydraulic modelling results plus a freeboard of 0.3m. When such a freeboard is added, 20-40 more properties are affected by flooding (depending on the scenario), however there is no significant difference between the existing and proposed scenarios (i.e. adding the freeboard to the existing and proposed scenarios does not significantly change the effects of the RiverLink works on flooding).

Effects on flood depths and extents in design 2,800 cumec flood event

Table 45 shows the modelled maximum flood depth for both the existing and proposed scenarios for the design 2,800 cumec flood. This shows that the proposed RiverLink works significantly decrease flood extent and depth over Lower Hutt City as a result of the RiverLink works, but that downstream there is still some spillage from the main river channel expected to occur.

Table 45 - Maximum modelled flood depths and extents for 2,800 cumec event

Existing



Proposed

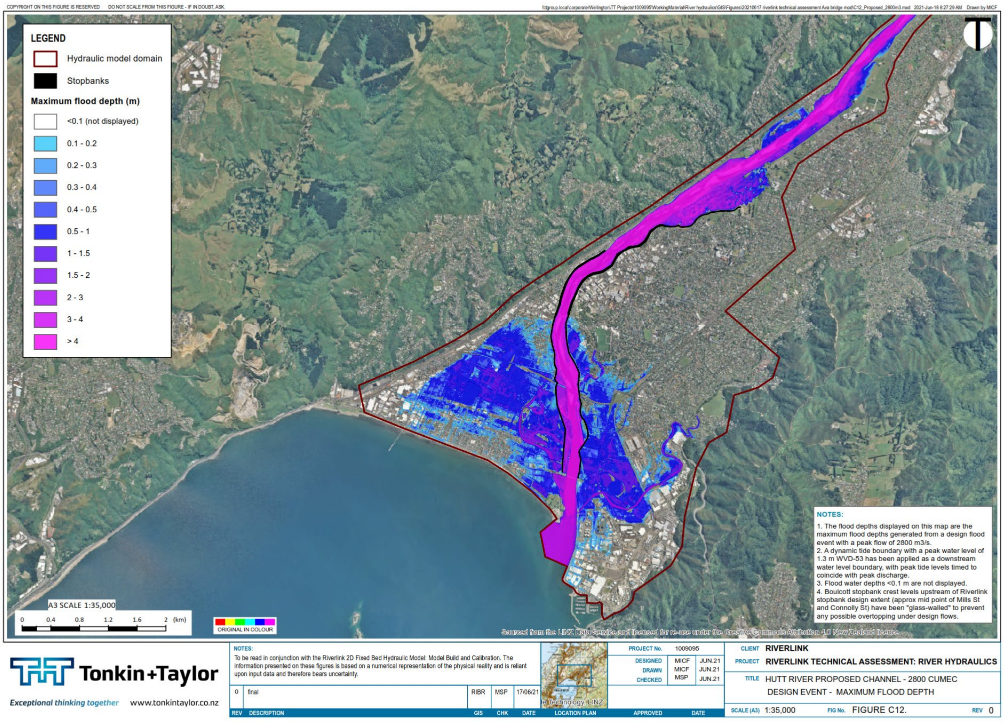
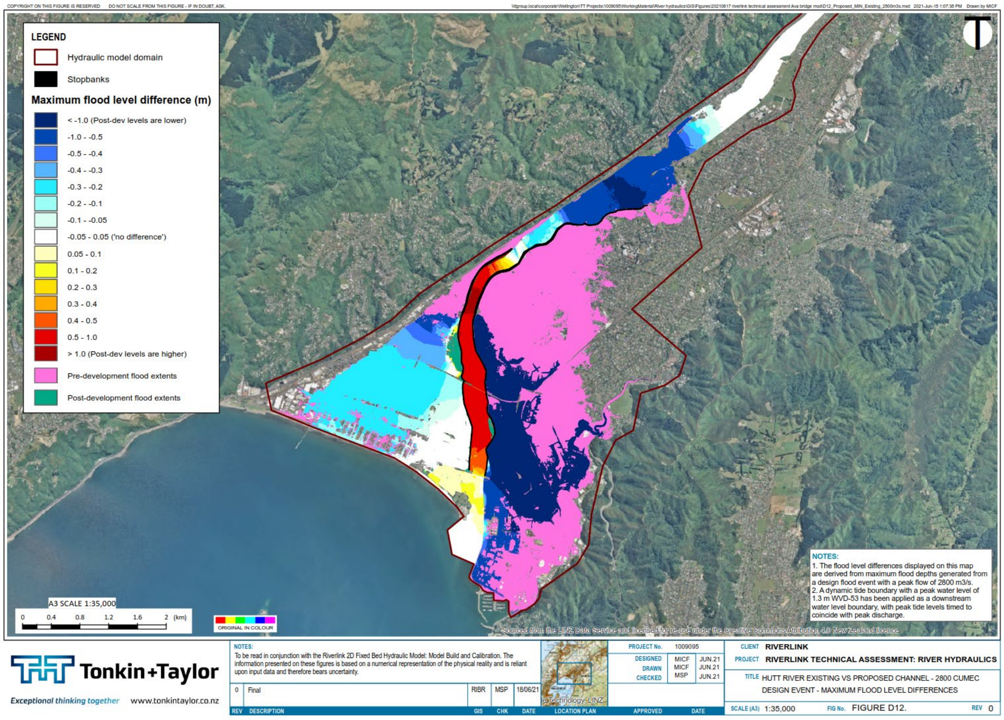
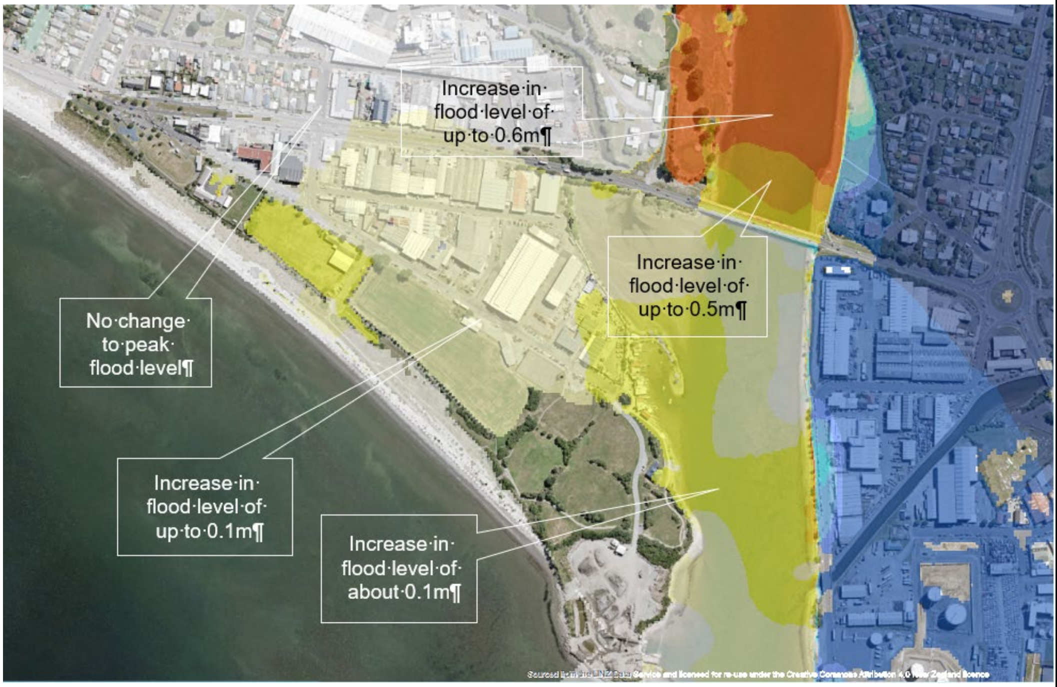


Table 46 shows the modelled flood level difference between the existing and proposed channels for the design 2,800 cumec flood. This shows that the Project will generally reduce flood extents (pink indicates areas that will no longer flood), and that there will be a notable predicted decrease in maximum flood level over wide areas (shown in blue shades) ranging from zero to in excess of one metre. There are also areas (particularly near the river outlet at Petone) where RiverLink works are likely to cause an increase in maximum flood level, indicated in yellow, orange and red.

Table 46 - Modelled difference in peak flood levels for 2,800 cumec event

Existing	
Proposed	

Effects on flood depths and extents in frequent design flood events

The 2D hydrodynamic fixed bed model has been used to simulate floods of ARI of 5, 10, 20 and 50 years, to enable assessment of the effects of the RiverLink works in response to events with a higher probability of occurrence than the 100-year ARI event and the design 2,800 cumec event.

Table **47** shows the modelled peak flood level difference plots for the 5 and 10-year ARI events, and

Table 48 shows the modelled peak flood level difference plots for the 20 and 50-year ARI design flood events.

Table 47 - Modelled difference in peak flood levels: 5 and 10-year ARI events

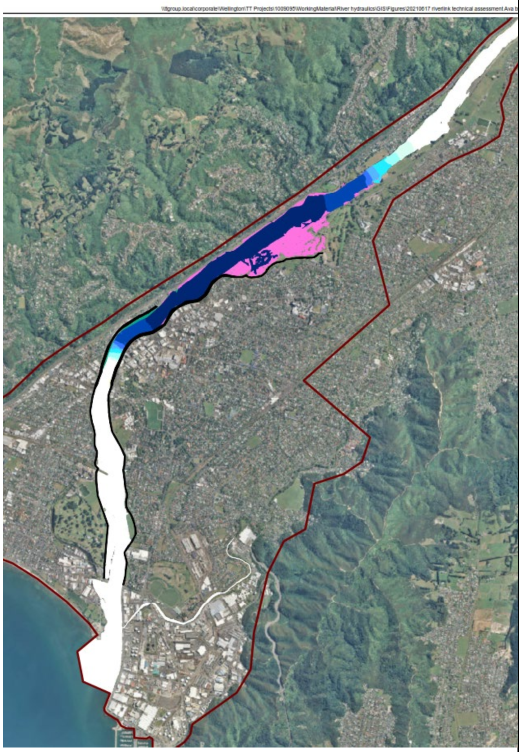
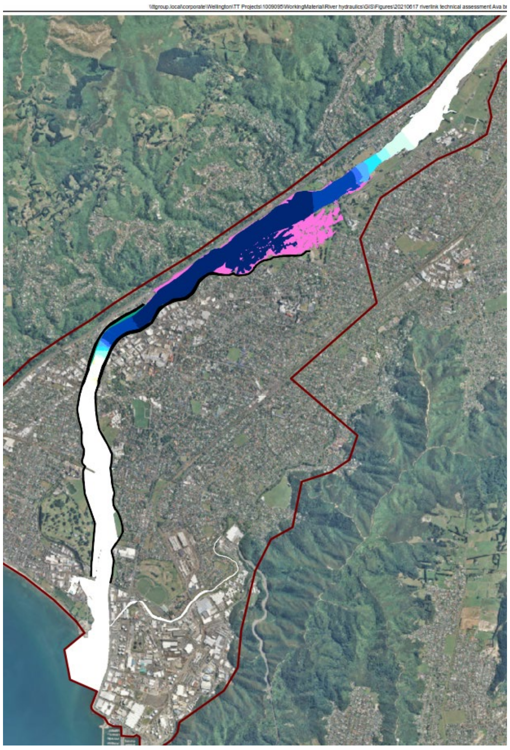
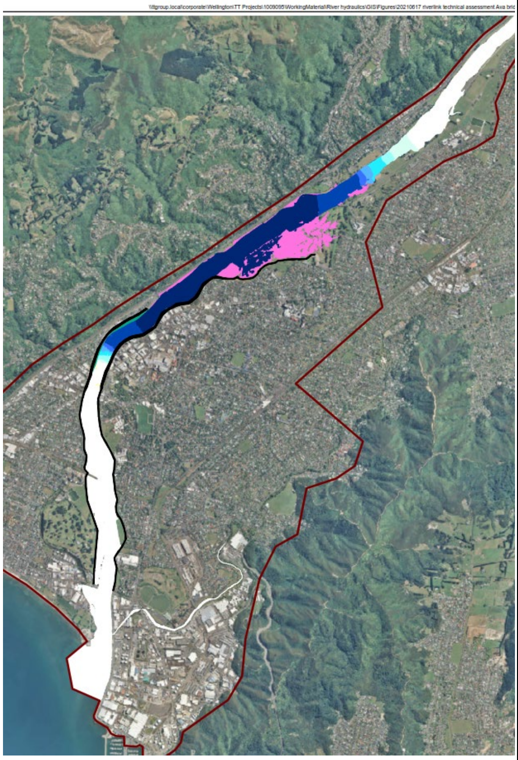
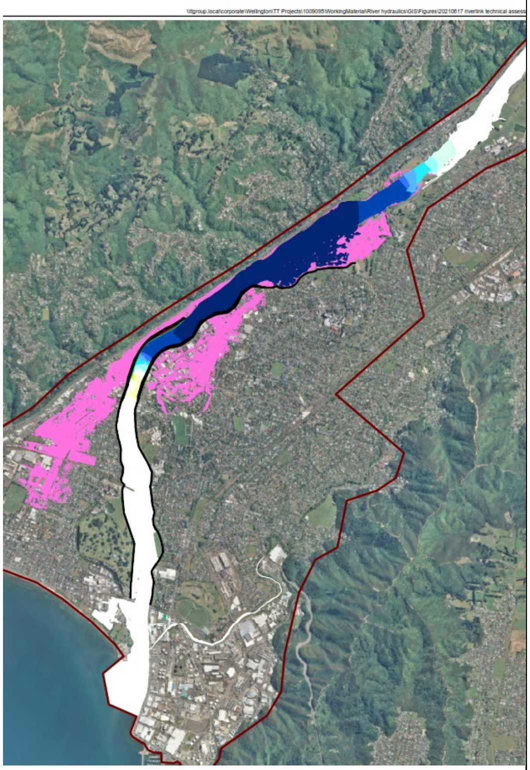
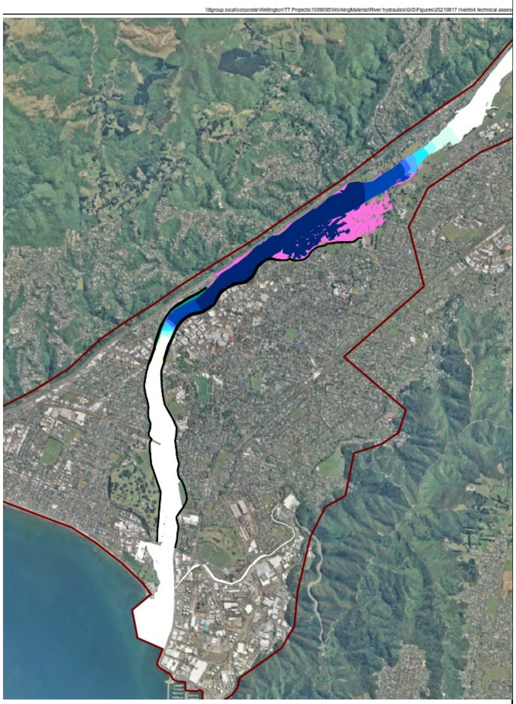
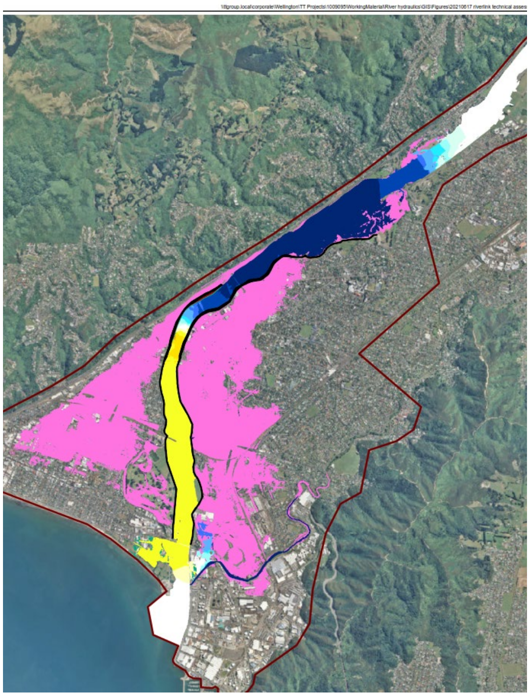
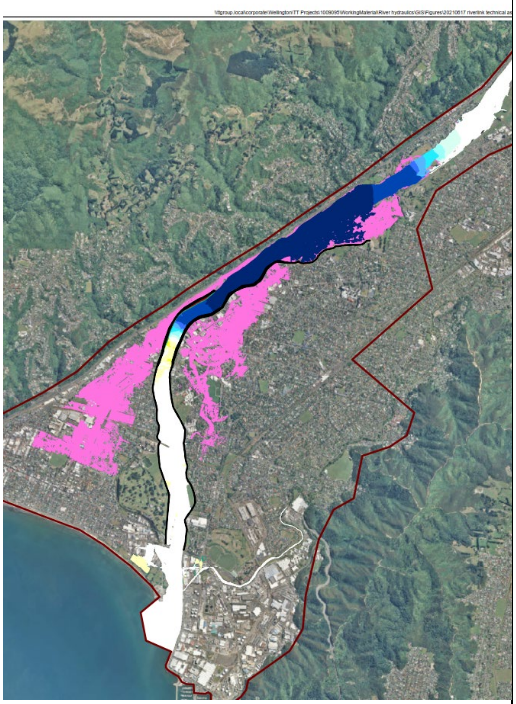
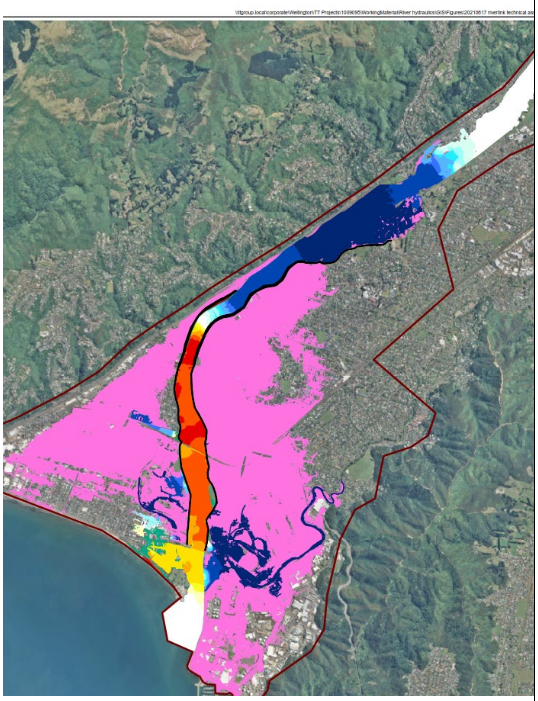
5-year ARI		
10-year ARI		

Table 48 - Modelled difference in peak flood levels: 20 and 50-year ARI events

20-year ARI		
50-year ARI		

The following is evident from these tables:

- The RiverLink works cause broad decreases in peak flood level in present-day (2020) events of ARI of 5, 10 and 20-year ARI.
- The same reduction in peak flood level is shown for the present-day (2020) 50-year ARI event, except for the relatively localised area immediately downstream of Estuary Bridge, where peak flood level increases of up to 0.1m are expected.
- In response to future (2130) flood events (5-, 10-, 20- and 50-year ARI), the RiverLink works have been shown to substantially reduce anticipated peak flood levels in areas that are located within the RiverLink reach, and reduce flood extents in areas adjacent to the

river upstream of Estuary Bridge. Downstream of Estuary Bridge the works have been shown to cause an increase in out of channel peak flood levels for 20 and 50-year ARI events.

The following is specifically evident in terms of cumec peak flows:

- Present-day 5, 10 and 20-year ARI events are contained within the existing channel. These have peak flows at 1,101 cumecs, 1,282 cumecs and 1,470 cumecs respectively. A present-day 50-year ARI flow of 1,714 cumecs is not contained within the existing channel. Under future climate (2130) conditions, even a 10-year ARI event (flow of 1,674 cumecs) will spill from the channel without the RiverLink works.

Effects on flood duration

As explained above, the proposed RiverLink works greatly reduce the predicted inundation extents in many different flood event scenarios. In areas where the extent is reduced, the inundation duration effectively becomes zero. In areas where the extent is not changed, inundation duration will be changed as an effect of the proposed works. It is important to note that the flood model does not include representation of local drainage features, therefore the results below may over-estimate actual inundation duration.

Analysis and figures in the river hydraulics assessment indicate that upstream of and adjacent to the RiverLink reach, decreases in inundation duration of up to 15 hours (in a 60-hour event) are expected, largely due to the flood capacity increases proposed, which enable faster draining during flood events. This is a positive effect, in that reduction in inundation duration in a flood event often means reduced inconvenience and reduced flood damage.

Increases in inundation duration are predicted downstream of Estuary Bridge. Although resulting in no significant change in events less severe than the 50-year ARI event, events more severe are modelled to increase inundation duration under a present-day climate from in the order of 3-4 hours to 4-6 hours (i.e. an increase of 1-2 hours). Such an increase is reasonably significant, however with the proposed mitigation (to review the HRFMP downstream of Estuary Bridge) this is considered to be a moderate effect.

Effects on scour potential

Riverbed scour occurs when the flow of water exerts a shear stress on the bed that the bed material is unable to resist. In general, more coarse sediments offer greater scour resistance than less coarse sediments. Generally, sediments are more coarse in upstream reaches than in downstream reaches, meaning that higher bed shear stress can be tolerated (without scour) in upstream reaches than downstream reaches.

The proposed RiverLink works eliminate bed shear stress in a large area outside of the main river channel, since flooding is eliminated in these areas. In a 100-year ARI 2020 event, slight increases to bed shear stress are predicted in-channel due to flood flow containment. Such an increase is likely to be countered by bed armouring (where bed material adjusts to the new flow regime).

Low Flows

Analysis shows that at low flows, the RiverLink works result in a slight deepening of some of the shallow depths compared to the existing scenario, with little to no change in the greater depths.

Effects on river management

Following the proposed Project works, river processes will begin to stabilise the river cross section through deposition and erosion. If such processes result in undesirable change to the channel, then active management of the riverbed will need to be undertaken.

Given the large conveyance capacity proposed for the RiverLink reach, less flood damage is expected to occur to the proposed channel than would occur to the existing channel in a given flood.

Flood risk for RiverLink Project elements

An assessment of the flood risks arising from the Project has been in general accordance with the GNS 'Risk-based Land Use Planning for Natural Hazard Risk Reduction' guidelines (2013). The likelihood scale used for probability descriptors is shown in Figure 44.

Level	Descriptor	Description	Indicative frequency
5	Likely	The event has occurred several times in your lifetime	Up to once every 50 years
4	Possible	The event might occur once in your lifetime	Once every 51 – 100 years
3	Unlikely	The event does occur somewhere from time to time	Once every 101 - 1000 years
2	Rare	Possible but not expected to occur except in exceptional circumstances	Once every 1001 – 2,500 years
1	Very rare	Possible but not expected to occur except in exceptional circumstances	2,501 years plus

Figure 44 - Likelihood scale (source: GNS natural hazard risk assessment guidelines, 2013)

Consequences have been assessed using the GNS guidance; descriptors for different impacts range from 'insignificant' to 'minor', to 'moderate', then 'major' and finally 'catastrophic'.

Risk has been assessed as a combination of likelihood and consequence, using the matrix shown in Figure 45.

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Likely	Acceptable	Tolerable	Tolerable	Intolerable	Intolerable
Possible	Acceptable	Acceptable	Tolerable	Tolerable	Intolerable
Unlikely	Acceptable	Acceptable	Acceptable	Tolerable	Tolerable
Rare	Acceptable	Acceptable	Acceptable	Acceptable	Tolerable
Very rare	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Figure 45 - Risk matrix (adapted from Figure 3.6 and Figure 3.7 of the GNS natural hazard risk assessment guidelines)

The adopted risk assessment approach was to define "functionally compromised" as when a building cannot continue to be used for its intended use immediately after a hazard event. For the purposes of this study, this was interpreted as being when the modelled flood level within a building footprint exceeded the inferred building floor level.

Table 49 - Summary of flood risk impact of Project (adapted from the risk assessment contained in Technical Report No. 1)

Scenario	Existing			Proposed		
	Buildings functionally compromised (No., % of total)		Risk Level	Buildings functionally compromised (No., %)		Risk Level
50-year ARI event 2020	Critical Social/cultural Other	6, 12% 28, 16% 1,333, 12%	Intolerable	Critical Social/cultural Other	0, 0% 1, 1% 77, 1%	Tolerable
100-year ARI event 2020	Critical Social/cultural Other	21, 41% 81, 45% 3,928, 35%	Intolerable	Critical Social/cultural Other	0, 0% 1, 1% 103, 1%	Acceptable
50-year ARI event 2130	Critical Social/cultural Other	42, 82% 148, 82% 6,924, 61%	Intolerable	Critical Social/cultural Other	1, 2% 2, 1% 317, 3%	Tolerable
100-year ARI event 2130	Critical Social/cultural Other	45, 88% 160, 89% 8,447, 75%	Intolerable	Critical Social/cultural Other	6, 12% 8, 4% 1013, 9%	Tolerable

Without the RiverLink works, the “existing” 2020 scenario and future 2130 climate scenario 50 and 100-year ARI events result in “Intolerable risk”. When the proposed RiverLink works are used in model simulations, flood risk for the 2020 climate horizon is reduced from “intolerable” to “tolerable” for the 50-year ARI event, and from “intolerable” to “acceptable” for the 100-year event. For the 2130 climate horizon both 50-year and 100-year ARI events result in “tolerable” risk.

Thus, RiverLink works have a substantial benefit in flood risk reduction.

9.2.4 Measures to avoid, remedy or mitigate actual or potential adverse flooding effects

Construction

Since there is a potential for a flood to occur during the construction phase, it is understood that construction sequencing will ensure that a channel at least as large as the existing will be maintained during construction.

Operational

In respect of the increase in flood levels in the areas below Estuary Bridge, GW will, as part of future review of the HRFMP and its implementation, consult with the affected communities to assess the hazard and risk and determine appropriate solutions.

9.2.5 Conclusion

Areas adjacent to the main river channel in Lower Hutt are at risk of flooding during large events; modelling of various flood events has demonstrated that existing stopbanks would be breached and areas of Lower Hutt inundated to varying degrees depending on the severity of the flood.

Modelling shows that the proposed stopbanks will limit virtually all out-of-channel flooding to Lower Hutt in a 100-year ARI 2020 flood event and will significantly reduce the area of out-of-channel flooding and depth of out-of-channel flooding in a 100-year ARI 2130 flood event and a 2,800cumec flood event.

Under all flood scenarios, an increase in peak flood levels is expected within the existing downstream stopbanks as a result of RiverLink, while a decrease in peak flood levels is expected within upstream stopbanks.

In the larger modelled flood scenarios, outside of the main channel, an increase in peak flood depth and extent around the river mouth is predicted to occur. This is because the containment of flood flows due to the RiverLink works means that a greater volume of flood flow will be conveyed downstream within the channel. A review of the HRFMP will be undertaken to identify measures to mitigate this adverse effect.

When assessed in accordance with the GNS ‘Risk-based Land Use Planning for Natural Hazard Risk Reduction’ guidelines (2013), the flood risk reduces from ‘Intolerable’ to ‘Tolerable’ or ‘Acceptable’ for all modelled scenarios.

9.3 Stormwater and operational water quality

Overview

RiverLink will incorporate significant upgrades to existing stormwater infrastructure in order to:

- Service the SH2 and Melling Interchange upgrades
- Provide an appropriate design life of pipes through the new stopbanks, and
- Make provision for future climate change impacts.

The scope of the stormwater upgrade, and the significant spatial and topographical constraints, limit the opportunity for large scale treatment and attenuation of flows within the Project area. Nevertheless, the design has addressed treatment and flow management and includes improvements where practicable, such as where road narrowing or closure is proposed.

The proposed stormwater design for the Project includes treatment of discharges from the area of the highway upgrade, the railway station development, the new Melling Bridge, some areas of road narrowing and for the Riverbank car park alterations. The treatment will result in a reduction in the contaminant load discharged to Te Awa Kairangi. This will result in improvements in water quality in the receiving environment, particularly during and immediately following rainfall events.

Localised flow increases will be minor and overall there will be a reduction in flows. On this basis, the effect of the Project on adjacent land and the receiving waters of Te Awa Kairangi will be negligible.

Overall, operational water discharges are expected to have a negligible adverse effect, and, in the case of water quality effects, a minor net beneficial effect on the receiving environment is expected.

9.3.1 Introduction

This section summarises the findings of the assessment of the actual and potential effects associated with surface water during the operation of the Project, as outlined in the Stormwater and Operational Water Quality Assessment (Technical Report #2). Surface water effects in relation to construction of the Project are summarised in section 9.4 of this AEE.

The Stormwater and Operational Water Quality Assessment describes the Project's operational water systems, including stormwater management devices. The approach to operational water management has been to minimise effects through design wherever practicable. The assessment also provides a detailed assessment of the potential effects, which are summarised below.

9.3.2 Assessment methodology and design approach

Assessment methodology

Stormwater discharges for the various catchments have been assessed for the pre-development (current) flows and the post development flows with climate change. Flows have been assessed for 10-year event flow (typical service level without surcharging; also referred to as 10% (ARI)) and 100 year event flows (extreme event service level; 1 % ARI).

Flows for the smaller developed catchments and highway catchments have been assessed using the Rational Method[47]. Flows for the larger undeveloped hill catchments have been obtained using the NIWA Stream Explorer programme which uses the Regional Method[48].

---

[47] The Rational Method is a simple flow assessment method for smaller catchments based on catchment area, perviousness of the catchment and rainfall intensity, based on time for runoff to get to the discharge point.

[48] The Regional Method is a flow assessment method developed by NIWA which uses catchment area and an assessed relationship with a network of reliable flow measurement sites

The criteria for assessment of climate change impacts for Waka Kotahi and HCC differ. Where outlets service culverts that cross under sections of SH2 that are being upgraded, a climate change allowance of 30% has been adopted. Climate change flows for outlets under the new stopbank servicing other areas for the site have an allowance of 20% in accordance with the Regional Standard for Water Services.

The assessment has also considered extreme events that exceed the design criteria, to assess where the resulting overland flow would occur (secondary flow paths).

Design approach

- The design approach to stormwater management for the various elements of the Project has been undertaken with the objectives of:
- achieving the relevant design level of service for the various Project areas, including provision for climate change
- upgrading infrastructure under the new stopbank to provide a 100-year design life, provide security during design flood events, and meeting GW Flood Protection's specifications for stopbank design
- providing treatment for runoff from Project works and for existing discharges where this can practically be achieved, and
- avoiding or mitigating adverse effects of increased flows, contaminant loads in discharges to Te Awa Kairangi
- avoiding or minimising habitat loss and impacts on fish passage.

Design criteria for SH2 works

The stormwater design for SH2 and the Melling Intersection is in accordance with criteria set out in P46 NZ Transport Agency State Highway Stormwater Specification which requires that stormwater design for State Highways:

a. considers climate change and allows for climate change impacts forecast out to 100 years;

b. meets the required levels of service for protection of the highway from flooding; and

c. includes treatment that meets the requirements set out in the Waka Kotahi Stormwater Treatment Standard for State Highway Infrastructure, May 2010.

Design criteria for HCC works

The stormwater design for HCC works will be in accordance with the Wellington Water - Regional Standard for Water Services

Where stormwater pipes or culverts pass through flood protection assets (i.e. stopbanks), design will be in accordance with GW's standards for stopbank design and river protection. Treatment is in accordance with Wellington Water's Water Sensitive Urban Design Guidelines and the Regional Standard for Water Services.

Treatment approach

A key constraint for stormwater management design for the Project is the existing spatial restrictions (as a result of existing development and low gradients) which limit the extent of practicable stormwater network upgrades and inclusion of treatment systems.

The highway realignment, combined with the stopbank reconstruction, mean there is little space available for treatment systems such as raingardens / wetlands to treat design flows from the interchange area. Stormwater system modifications and upgrades are therefore limited to those areas where there is significant work to the roading occurring. Where work is limited to road surface improvements, no modification to the existing stormwater system is proposed

Where renewed roading, hardstand (e.g. carparking) or streetscape improvements provide an opportunity to do so, the design has endeavoured to incorporate treatment. This includes installation of Gross Pollutant Traps (GPTs) within the stormwater network (e.g. traps in catchpits) to capture solids typically greater than five millimetres and/or installation of package raingarden systems with a relatively small footprint, which can be incorporated within proposed landscape works.

The design has also sought to daylight existing stormwater pipe outlets or provide more natural stormwater management where possible. However, these opportunities are limited by the highly developed nature of the Project area and the constraints imposed by needing to discharge flows through the stopbank system to Te Awa Kairangi at relatively flat gradients. The stormwater design has included assessment of stormwater volumes and quality, and identification of mitigation measures that can be adopted to avoid or minimise adverse effects or improve current stormwater management where there is an opportunity to do so.

9.3.3 Existing stormwater environment

Catchment description and values

All stormwater from the Project area is discharged to Te Awa Kairangi either via gravity or by lift pumps during periods of high flow in the River. The majority of the stormwater network was installed more than 40 years ago and little to no treatment of runoff occurs prior to discharge.

The Project catchment areas which feed into the existing stormwater networks can be divided into the western (TRB) and eastern (TLB) catchments of Te Awa Kairangi. The catchments have been described and assessed as a series of sub-catchments as shown on Figure 46 below.

The right bank catchment between the hills and the river consists of highway (SH2) and rail corridor adjacent to urban and commercial areas. The catchment is a mixture of green space and impervious surfaces. Stormwater flows from these areas discharge to Te Awa Kairangi either via gravity systems, where levels permit this, or via pumped systems.

The left bank catchment (the east side of Te Awa Kairangi) is a mixture of urban and commercial areas. The catchment is characterised by flat gradients and predominantly impervious coverage. The total left bank catchment is approximately 63 ha. Stormwater discharges to Te Awa Kairangi currently via gravity lines.

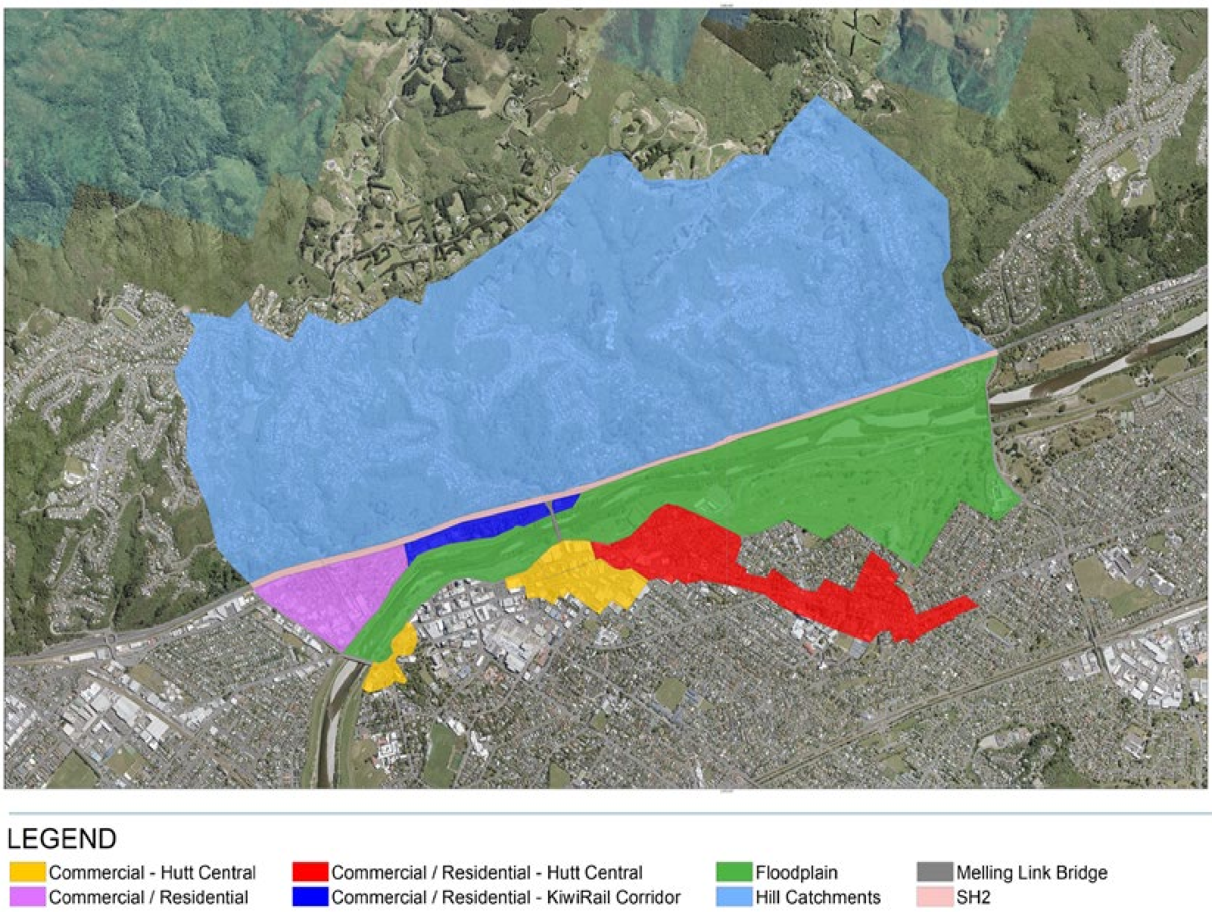


Figure 46 - Stormwater catchments

Culverts conveying stream flow

Three cross culverts which convey stream flow require replacement / re-construction across the highway and out to Te Awa Kairangi. These are described below and were shown in Figure 9 in Chapter 3.

a. The Jubilee Park cross culvert (Outlet 31): this takes flow from the Jubilee Park catchment and the two small catchments immediately to the east. The flow from the three catchments combines into one culvert that crosses under the highway and out to the river. Outlet 31 currently connects to a pipe system which runs parallel to SH2 that takes the flow from all three streams from the Western Hills, this existing pipe will be retained. The replacement Outlet 31 will connect to this existing pipe network.

b. The Harbour View cross culvert (Outlet 36b): this culvert conveys flows from the catchment above Harbour View Road out to Te Awa Kairangi.

c. Tirohanga Stream Culvert (Outlet 38): this culvert is approximately 150 m east of the existing Melling Link Bridge. It conveys stream flows under the highway and the adjacent carpark directly to Te Awa Kairangi.

9.3.4 Assessment of stormwater effects

Stormwater volumes within Project area

The overall change in peak discharge volumes for the various sections of the Project areas are relatively small.

The highway/interchange works will result in an increase in impervious area in the order of 2 ha and increase the volume of discharges from the highway. Spatial and topographical constraints prevent additional attenuation beyond that able to be achieved within the proposed raingarden facility. However, the increase in flows is considered minor and therefore the effect on flood levels in Te Awa Kairangi would be negligible.

Whilst there will be an increase in runoff from some areas of the Project, such as SH2 and the new interchange, there will be reductions in other areas, including the future KiwiRail corridor, station area and adjacent commercial area as a result of the new stopbank alignment. Consequently. The Riverlink Project will be hydraulically neutral, or there will be a net reduction in flows, when all areas of the Project are considered together.

Design of the stormwater system has considered inclusion of attenuation. However, the highly developed nature of the catchment and associated spatial constraints preclude the inclusion of attenuation, and given the very small change in flows, any effect on flood levels in the Te Awa Kairangi will be indiscernible and have no adverse effect on flood risk downstream.

In addition, the time of concentration for flows from the catchments within the Project area is short (0.5- 1.0 hr except for Speedy's Stream which is slightly longer at 2-3 hours) when compared with that of the Te Awa Kairangi (approximately 26 hrs). Therefore, coincidence of peak flows from the catchment with flows in the Te Awa Kairangi is extremely unlikely, further reducing the risk of any change in flows associated with the Project.

On this basis, any volumetric effects on Te Awa Kairangi and flood levels have been as assessed as negligible.

Secondary flow paths within Project area

The design that has been developed for the Project utilises existing discharge points and rationalises the number of pipelines through the new stopbank system. Relocation of a culvert alignment is only proposed in one location (Outlet 36b), in the vicinity of the new Melling Link Bridge, where the existing culvert alignment is within the bridge abutment. All outlets through the new stopbank are being replaced to provide a 100-year design life and the sizing of the outlets has included allowance for climate change.

The drainage networks are not being altered over the majority of the Project area, with change generally limited to the SH2 area in the vicinity of the Melling Link Bridge and the adjacent area. This includes the KiwiRail corridor, the new Melling Station, the new Melling Station carpark and commercial and residential areas.

Secondary flows within the Project area will be via overland flowpaths towards Te Awa Kairangi to outlets through the stopbank or to pump stations discharging to the river. When levels in the river prevent discharge, or the capacity of the pumps station are exceeded, ponding will occur in the lower lying areas outside the stopbank. Secondary flowpaths post development will remain substantially unchanged from the existing flowpaths, except for the fact that outlets and pump stations will have been sized to accommodate 100-year event flows with allowance for climate change.

In summary, the Project will result in an increase in the levels of service from the current condition and a reduced incidence of secondary flows and depths of ponding. On this basis the effects of the Project on secondary flow paths will be positive.

Downstream stormwater network

A Technical Memo addressing the risk of flooding increases within the local stormwater network downstream of the RiverLink project reach is provided in Volume 4 of this application (Memo entitled RiverLink Stormwater Network Flooding, dated 19 August 2021).

The assessment confirms that alongside the Project reach, reduced flood levels between the stopbanks will improve gravity drainage of stormwater from areas outside the stopbank to the river.

Downstream of the Project reach, an increase in flood level in the river (between the stopbanks) compared to existing will only occur in events greater than a 50-year ARI event, as a result of the increased containment through the RiverLink reach. In the existing situation, the stopbanks would likely breach (in an event in the order of a 50-year ARI event) and flow onto the urban floodplain downstream of RiverLink. The increase in peak river level is assessed as being up to 100mm in a 50-year ARI event, and 100-200mm in a 100-year ARI event. The effect of this increased peak river flood level on the stormwater network is negligible, since all network outlets contain flap gates (or other backflow prevention) that isolate the network from elevated river levels.

Over the period of time during which flap gates are closed (they are generally activated between the 2 year and 5 year ARI river flow), urban stormwater runoff needs to be temporarily detained within the network until river levels recede sufficiently to allow outflow. The duration of peak river flood levels has been modelled; this modelling indicates no change to the duration over which peak flood levels will be experienced pre and post RiverLink. Therefore, the duration over which flap gates may be closed is unaffected by the RiverLink works. Accordingly, extended periods of stormwater network flooding are not expected as a result of the changes to the river.

Water quality

The water quality of stormwater discharges from the Project area can be classified into three areas as shown in Figure 47:

- undeveloped/limited development including the bush clad hill catchments and the landscaped areas within the floodway;
- commercial / residential areas including the new Melling Station and carparking areas; and
- SH2 including the new interchange and the new Melling Link Bridge.

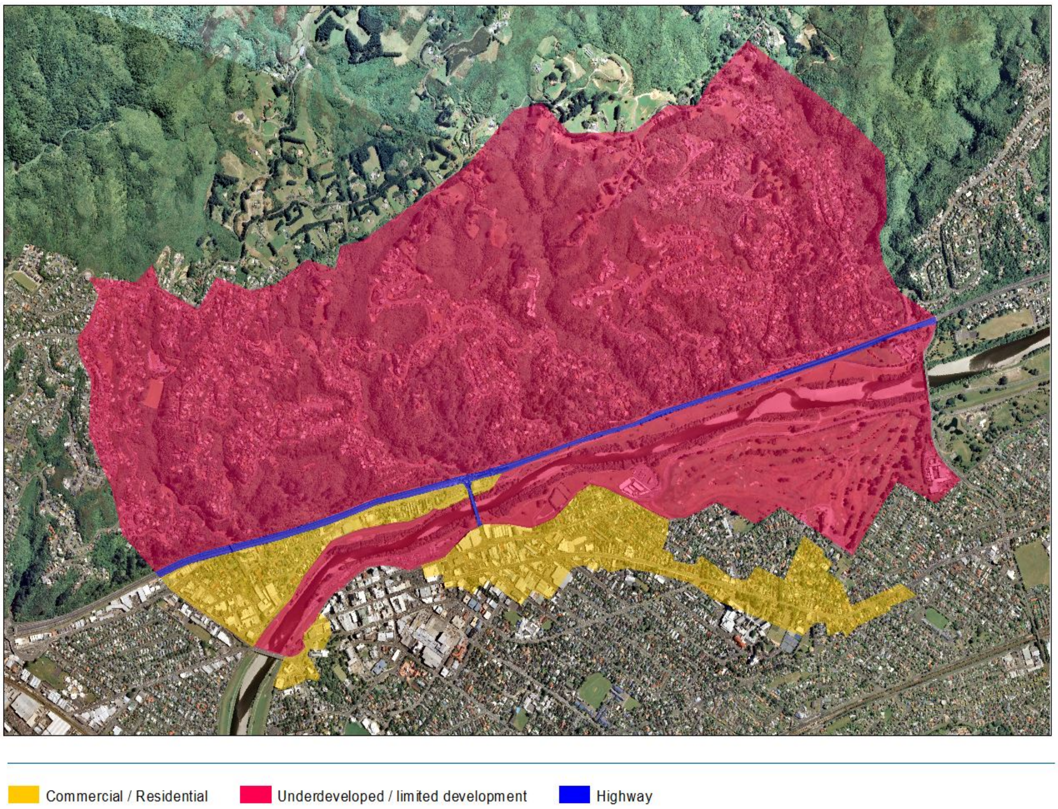


Figure 47 - Catchment classifications

Stormwater discharges from undeveloped/limited development areas, such as the bush clad hill catchments and landscape areas within the floodway, will be substantially unaffected by the Project. Contaminants in stormwater discharges pre-Project will generally be limited to low levels of naturally occurring nutrients and suspended solids. The Project is not expected to change the stormwater quality in these areas.

Spatial restrictions due to existing development and very flat grades within commercial / residential areas prevent retrofitting of new treatment facilities within the stormwater network. However, the Project activities within the commercial / residential areas will result in a reduction in contaminant loads to Te Awa Kairangi as a result of the following:

- there will be a reduction in area of the commercial / residential area on the west bank associated with the new Melling Station and stopbank relocation;
- there will be a reduction in railway carparking area, and the discharge will be treated prior to discharge which will result in a reduction in load; and
- the design includes the pedestrianisation and treatment of runoff of an existing road.

SH2 and Melling Link Bridge both carry large volumes of traffic, resulting in significant contaminant loads. As identified above, these discharges are currently untreated. The 1.3 km section of highway which is subject to substantive upgrades and the new Melling Link Bridge will include treatment of stormwater discharges in accordance with Waka Kotahi guidelines where this can practically be achieved. Treatment will include vegetated treatment swales and raingardens, with proprietary devices also being used where spatial constraints prevent the use of alternatives. Treatment of the discharges from the new Melling Bridge will be via a vegetated treatment swale in the floodway.

Despite an increase in impervious surfaces for both the highway and the bridge, the introduction of treatment devices will result in a reduction in the contaminant load discharged to Te Awa Kairangi compared to the existing situation.

Overall, the Project is expected to result in reduced contaminant loads to the receiving environment during and immediately following rainfall events. Due to the levels of dilution within Te Awa Kairangi, the overall effect will be a very minor positive effect (which may not be measurable).

Habitat loss and fish passage

The new Melling Interchange, and the associated relocation of the culvert under Harbour View Road, will result in the loss of a 25 m section of natural waterway between the highway and Harbour View Road. This section of waterway cannot be retained as part of the new works as it is the location of the new Melling bridge abutment and slip way for the new interchange, and cannot be reinstated within the immediate vicinity due to the topographical and spatial constraints. This section of stream will be infilled with a combination of hardfill and structural fill during construction of the interchange.

The replacement culvert will connect to an existing upstream pipe that is very steep. This upstream pipe is not being replaced. Flows in the existing pipe and the replacement pipe will be extremely high velocity preventing fish passage. The upstream inlet to the pipe is also in a small pond at the base of a waterfall which also likely inhibits upstream passage. The required grade and sizes of the replacement pipe will not allow fish passage, and given existing barriers in the section immediately upstream that are not being modified or replaced will not allow fish passage, it is not practical to provide fish passage and there would be no benefit.

An offset has been proposed to manage the effects of the loss of habitat in Harbour View Stream. This is described further in the Freshwater Ecology Assessment (Technical Report #6).

Outlet 38 will be affected by interchange works. Preliminary design for this culvert has been based on complying with the permitted activity criteria of the NESFW, with the invert appropriately embedded to allow the establishment of a natural bed within the structure. It is noted that this will be an improvement in regard to fish passage compared to the existing culvert here which is perched.

The Freshwater Ecology Assessment (Technical Report #6) has determined there are no other waterbodies where culverts are being replaced that require consideration of fish passage due to existing infrastructure or natural barriers that prevent fish passage, irrespective of the Project design. Despite this, the design has sought to include provision for automated penstocks/backflow protection structures to ensure that fish passage is not precluded should fish passage become possible in future.

9.3.5 Measures to avoid, remedy or mitigate actual or potential adverse effects

A range of mitigation measures have been recommended to manage operational effects of the Project. The measures include:

- Stormwater design for changes to local roads, the new Melling Station and hardstand areas in the floodplain be carried out in accordance with the requirements of the WWL Water Sensitive Urban Design Guidelines and Regional Standards for Water Services;
- Design for the SH2 upgrades and new Melling Intersection be in accordance with the Waka Kotahi Stormwater Treatment Standard for State Highway Infrastructure.
- Consideration be given to the design of stormwater pipes and culverts and potential rationalisation or amalgamation of infrastructure where it extends through newly constructed sections of stopbank to minimise the number of culverts under the stopbank as part of detailed design.

- Culverts be designed to allow for future flow increases associated with climate change and include backflow prevention from Te Awa Kairangi in accordance with GW Flood Protection requirements.
- The design for upgrade of the culvert conveying Tirohanga Stream (Outlet 38) include provision of fish passage consistent with the requirements of Regulation 70 of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020.
- Use of automated penstocks or non-passive flap gates where culverts are conveying flows from upstream waterways such that fish passage is not precluded by flap gates.
- Preparation of a comprehensive stormwater management plan for the Project area for the construction phase and long-term operation of the Project. The plan is to include, but not be limited to, the following.
    - Documentation of the stormwater treatment systems and control systems within the Project including location plan, role of the facility and inspection and maintenance requirements and who will be responsible for maintenance
    - Health and safety considerations for undertaking maintenance and environmental considerations for maintenance works including erosion and sediment control and disposal requirements
    - Record sheets for documentation of inspections and remedial and maintenance works undertaken

9.3.6 Conclusion

The Project will include significant upgrades to the existing stormwater infrastructure in order to service the SH2 and Melling Interchange upgrades, provide an appropriate design life of pipes through the new stopbanks and to make provision for future climate change impacts.

The scope of the stormwater upgrade, and the significant spatial and topographical constraints, limit the opportunity for large scale treatment and attenuation of flows. However, the design has addressed treatment and flow management and endeavoured to capture opportunities for inclusion of improvements to treatment where opportunities arise, such as road narrowing or closure.

Localised flow increases will be minor and overall there will be a reduction in flows. On this basis, the effect of the Project on adjacent land and the receiving waters of Te Awa Kairangi will be negligible.

The proposed stormwater design for the RiverLink Project includes treatment of discharges from the area of the highway upgrade, the railway station development, the new Melling Link Bridge, some areas of road narrowing and the Hutt City carpark upgrade. The treatment will result in a reduction in the contaminant load discharged to Te Awa Kairangi. This will result in improvements in water quality in the receiving environment, particularly during and immediately following rainfall events. Overall, volumetric operational water discharges are expected to have a negligible adverse effect, and, in the case of water quality effects, a minor net beneficial effect on the receiving environment is expected.

9.4 Construction water quality and erosion and sediment control

Overview

Discharge of sediment and other construction related contaminants could have a potential adverse effect on water quality, the aquatic habitat and biodiversity values of Te Awa Kairangi and affected tributaries. If not managed well, it could also have a potential adverse effect on the downstream marine environment.

A number of measures are proposed to avoid, remedy or mitigate any potential adverse effects on the receiving environment, including:

- an overarching Erosion and Sediment Control Plan (ESCP) based on current best practice guidance documents (submitted with this Application) and reparation of Site Specific Erosion and Sediment Control Plans (SSESCPs) to address the specific nature and unique constraints of specific activities / locations;
- avoidance of works in the active channel outside of 'low flow' conditions and time periods sensitive to the ecological value of the River;
- minimisation of the footprint and duration of works in the active channel by carrying out works in the "dry", through use of temporary bunds where possible;
- minimisation of the area of disturbance in the active river channel by staging of river channel disturbance;
- construction activities outside of the River are conducted in a staged and confined manner with progressive stabilisation to minimise the extent and duration of land disturbance associated with each activity;
- treatment of sediment discharges from activities outside the River Corridor using structural devices such as sediment retention ponds (SRPs), and chemical treatment where practicable;
- monitoring, using continuous turbidity sensors and grab sampling, to ensure erosion and sediment control measures meet Project performance criteria and to deploy adaptive management measures when performance criteria are exceeded; and
- regular review of performance and updating the ESCP and SSESCPs as required.

With the proposed management measures in place, potential adverse effects associated with the construction of the Project on water quality will be minor.

9.4.1 Introduction

This section summarises the findings of the Construction Water Quality Assessment (Technical Report #3). It provides an assessment of the actual and potential effects associated with construction activities that cause erosion and generate sediment discharges into the receiving environment and the potential adverse effects that those have.

The potential effects on ecology and habitat resulting from effects of construction related water quality in the receiving environment have been assessed in the Freshwater Ecology Assessment and Marine Ecology and Coastal Avifauna Assessment as summarised in sections 9.7 and 9.9 below.

9.4.2 Existing environment

The key aspects of the existing environment that relate to construction water management are outlined below.

Geology and sediment type

The geology of the area influences the type of sediment which may become available for erosion and sediment discharge as a result of Project works. Material subject to potential erosion by construction activities range from sands, silts, clays, gravels and peats in the eastern and western area and coarse river gravels, cobbles, and sands within the River Corridor.

Te Awa Kairangi within the Project area and in the downstream zone is also influenced by 'active' sediment transport processes, which naturally erode and deposit sediment within the river and harbour.

Te Awa Kairangi

Te Awa Kairangi has experienced significant realignment, straightening and stopbank works. Data indicates that Te Awa Kairangi is subject to substantial flow range and variability. Fluvial processes, sediment transport and water quality are linked to the flow regime of the River. This impacts water quality through erosion and turbidity.

Downstream (Te Awa Kairangi and Harbour)

The river mouth and Te Whanganui-a-Tara/Wellington Harbour function as the receiving environment for transported sediment. The accumulation of sediment is influenced by the gradient of the river, which slows velocity and turbidity causing sediment settlement. In addition, the tidal influence of the harbour and presence of salt water up to 2.9 km from the mouth of the river (Ewen Bridge) causes flocculation (particles joining together) and settlement of sediment on the river bed.

The natural sediment transport processes change the mouth and Petone Beach environments, which has occurred consistently over time. Some particles enter the Wellington Harbour in the form of a ‘wash load’, which settles on the Harbour floor, adjacent beaches or flows to the Harbour entrance.

Tirohanga Intersection Stream and other tributaries

The Tirohanga Stream is a small urban hillside stream with a catchment area of 20 ha. It drains stormwater from residential dwellings and roads in Tirohanga, travelling through the vegetated valley before crossing under SH2 and Tirohanga Road (via culvert) to Te Awa Kairangi. The land uses of the catchment affect baseline erosion conditions and sediment inputs into the stream. Land uses for the catchment include residential urban areas, paved road and steep vegetated hill areas.

Adjacent to the Tirohanga Intersection Stream there are a number of small streams and drains which feed into Te Awa Kairangi between the Melling Bridge and Ewen Bridge. The location of these stream and drains are shown on drawing A16-4381-C320 (Stormwater Overview) in Volume 5 of the Application. All these streams are on the western side of the Project. The names of these streams and their outlet numbers to Te Awa Kairangi in a southerly direction from the Tirohanga Intersection Stream are as follows;

- Tirohanga drain outlet (no outlet number);
- Harbour view stream drain outlet (36b);
- Jubilee Park North Stream outlet (31); and
- Jubilee Park South Stream (outlet 27).

All of these small streams are characterised as having steep upper reaches to the west of the motorway with a good vegetative cover of exotic trees and regenerating native vegetation. The lower reaches of the streams are piped from the motorway to Te Awa Kairangi. Stormwater for the local road network is directed into this pipe network. The water is discharged to the Te Awa Kairangi through flap cap culverts or pumped.

9.4.3 Existing water quality

Te Awa Kairangi

Te Awa Kairangi has experienced significant realignment, straightening and stopbank works and is subject to substantial flow range and variability. Fluvial processes, sediment transport and water quality are linked to the flow regime of the River. This impacts water quality through erosion and turbidity. When flows increase, the river becomes turbid and visually discoloured due to increased suspended sediment.

Sediment on the riverbed consists of an armouring layer of larger gravels and cobbles, and a protected layer of finer material. Transport of the protective gravel layer does not occur often. Sediment size at the river mouth decreases due to reduced slope and river energy.

Bed sediment has a D50[49] (average diameter)=22mm (which corresponds with small cobble). The trend of sediment transport in the Project area is aggradation, in other words, sediment in the Project area is building up and accumulating over time. This can restrict flow capacity, increase flood risk and create unfavourable river flow paths conducive to erosion in flood events.

During low and normal flows, Te Awa Kairangi runs predominantly clear with very little sediment transport. The majority of sediment transport, be that material bouncing along the bed or floating in suspension, occurs during flood events. As a result, the water quality of the river is a function of the 650 km^2 contributing catchment and becomes affected by sediment in temporary and sporadic events which vary in duration, magnitude and location depending on the nature of contributing rainfall events.

In addition to naturally occurring flood events, river water quality has been and continues to be influenced by flood protection works and various discharges into the river. The flood protection works include extraction of bed material, construction of edge erosion protection and channel reprofiling. These works are currently undertaken by GW Flood Protection, under Resource Consent WGN130264, an existing river maintenance consent for river maintenance and flood protection activities in Te Awa Kairangi and identified tributaries.

Assessments of effects and monitoring of river management works in Te Awa Kairangi in 2016, 2018 and 2019 found that sediment discharges from works in the river subside approximately 1 hour after the disturbance associated with the works have ceased and river water quality returns to ambient (i.e. returns to the natural state of water quality prior to commencing works) (Cameron, 2018; Cameron, 2016; Cameron, 2016; Cameron, 2019).

There are a number of storm water pipes on both the east and west side of the Te Awa Kairangi which discharge into to the river. Limited data is available to assess water quality at the outlets of the stormwater network.

In addition to naturally occurring flood events, River water quality has been and continues to be, influenced by ongoing flood protection works and various discharges into the river.

Tirohanga Intersection Stream and other tributaries

Water quality in the Tirohanga Stream has been assessed based on inferences from similarly steep hill catchments, which consist of a mix of vegetated bush and residential development. The annual sediment load is estimated to be between 6-26 m^3. Water quality is typically clear during median and low flows but becomes affected by sediment and road runoff during rainfall events.

In addition to the sediment load from the upper catchment, sediment can also be contributed by SH2 stormwater, with an estimated rate of sediment from SH2 of 0.64m^3/year. Road runoff from local roads may contribute sediment; but no specific data is available for the impact of local roads on water quality.

There is no water quality data for streams other than Tirohanga Intersection Stream. Whilst there is the potential for these streams to contribute sediment to Te Awa Kairangi, the amount is insignificant.

---

[49] D50 of 22mm means if a 22mm sieve was used to capture material 50% of this material would be retained within the sieve.

9.4.4 Construction water assessment methodology

The potential changes to the receiving water environment during the construction of the Project relate to changes in water quality arising from the discharge of sediment from earthworks during rain and flood events, disturbance of sediment from in stream and in river activities and discharge of other contaminants (such as oils, fuels, and cement) from general construction activities.

For the purpose of assessing the construction water quality effects, construction activities were grouped on the basis of location as follows:

- the Western Transport Corridor (western);
- the Eastern Lower Hutt city centre (eastern); and
- the Te Awa Kairangi and tributaries.

Within each of those zones is a combination of a number of different infrastructural elements of the Project. The construction activities required to create these infrastructural elements vary with regard to the nature of the activity, location, extent and duration.

A detailed outline of activities and construction methodologies are outlined in the Project Construction Methodology outlined in Chapter 5 of the AEE. The methodology adopts a staged approach, with six separate stages with concurrent staging of River works and bridge construction.

Works within the River Corridor footprint will occur concurrently to the six sequential stages proposed for stopbank and land-based works in the Eastern and Western zones and will be staged in their own separate sequence.

River corridor works will typically be constructed according to the following:

- Each stage will be approximately 500 m in lineal length;
- Each stage will contain its own sub-set of sequencing for specific construction activities, which will be described in SSESCPs; and
- Rapid stabilisation will be implemented for the sequences within the stage itself. An entire stage will be stabilised before commencing the next stage.

Land disturbance will occur in:

- smaller segments of the total area which are spatially separate from one another; and
- shorter and typically chronological time periods

While the entire Project area of disturbance is large (105 Ha), and the total Project duration is long (indicative construction duration of four years) the implication of the staged approach is that individual construction activities will occur while the rest of the site area is stabilised. For example, stopbank work will disturb only 11 ha in total with a smaller subset of the area be open at a particular location at any one time (e.g. no greater than 2 ha is expected). The potential effects of erosion and sediment control should therefore be considered in the context of the type of the activity (i.e. the nature of earthworks), its timing within the wider programme, the maximum open area which will be exposed, and the duration for which that area will be exposed for.

9.4.5 Assessment of effects associated with water quality as a result of construction activities

The impact of sediment discharges depends on the type, duration and footprint of works. Potential adverse effects of sediment discharges relate to impacts on aquatic habitat and biodiversity, impacts on the form and character of the River and Wellington Harbour, and effects of sediment on the River and Harbour’s habitat and biodiversity.

There are three situations for the generation of sediment associated with construction activities:

- works outside the river corridor subjected to rainfall.
- works in the floodplain (between stopbanks) which are engulfed by higher flood flows; and
- works in the active river channel

Potential adverse effects for these three scenarios are outlined in the following sections.

Land-based activities

Sediment generation from land-based Project activities such as earthworks, building and bridge construction, roading and drainage activities outside of the River Corridor will be influenced by rainfall.

Activities outside the River Corridor have a much lower potential for erosion, and discharges have the potential to occur exclusively in rainfall events. Sediment discharges will introduce new sediment from beyond the boundary of natural fluvial processes within Te Awa Kairangi. Types of sediment discharge could range from topsoil to silts, sands, gravels, organic and contaminated particles depending on the location and specific construction activity.

The extent of potentially contaminated land is discussed in section 9.14 below. In summary, there are 22 confirmed or potential contaminated sites which pose varying degrees of potential contribution to construction water quality effects. The magnitude of the effect and type of remedial works depend on the extent, type of contaminant, and toxicity to receptors. The extent of contaminated land will be documented in the Detailed Site Investigation and remedial works in the Contaminated Land Site Management Plan.

If no avoidance or minimisation measures are implemented, activities outside of the River Corridor have the potential to cause a decrease in downstream water quality, visual discolouration, sediment deposition, impact on aquatic habitat and natural character.

Potential effects of cement laden water

There is potential for the discharge of cement laden water from the site which has high pH and can result in ecological damage. To avoid this happening the ESCP requires the preparation of SSEMPs to identify if concrete is being used and the methods to avoid discharges and measures to be undertaken should a discharge occur.

The main activity using concrete will be the bridge construction and in particular the bridge piles. The potential for discharges of cement laden water is considered low due to the following:

i. The pours are contained within a casing or boxing;

ii. There is ability to control the volume of concrete to avoid over filling; and

iii. There is ability to limit the free water in the mix.

Potential effects of floods

The volume of sediment generated from earthworks and activities within the river corridor will be influenced by flood flows and high flows.

As noted above, the generation of sediment in the river corridor occurs naturally during flood events and the effects discussed here pertain to Project related erosion and sediment effects beyond ambient sediment transport processes.

Flood flow conditions in Te Awa Kairangi will see an elevation of the water level which, depending on the magnitude of this water level rise, has the potential to inundate and generate erosion in areas where works are taking place or have recently been completed.

In a flood event the source of sediment is the whole Te Awa Kairangi catchment of which the Project area forms less than 0.14% of the catchment. As a result, it is expected that during a flood event, the effect of construction activities on water quality will be negligible relative to the natural sediment transport processes occurring throughout the entire river catchment during a flood event.

For lesser flood events the areas of disturbance created by construction activities could generate sediment. However, these activities will have a limited effect due to the staged nature of construction activities and progressive stabilisation techniques which will be implemented.

Potential effects during normal flows

In periods of normal or low flow there is potential for sediment generation from activities being undertaken in the river channel. These being reprofiling of the river and gravel extraction, removal and construction of rock rip rap and vehicle crossings. The effect of these activities is partly driven by the suspension of primarily sand sediment.

The nature of sediment discharge will depend on whether sediment is derived from recently reworked gravel or from the disturbance of small pockets of silts and clays. Larger particles such as sands and gravels tend to fall out of suspension quickly but can be carried far in high energy events. While observations of the bed substrate by Cameron (2018) and as detailed in the Geomorphology Assessment (Technical Report #5) indicates sand is the only fine sediment present, there may be unknown pockets of fine sediments (silts and clay) which may also become suspended during normal flows and gives rise to effects associated with silts and clays.

As the river velocities associated with these flows is low the majority of suspended sediment will not travel as far as a flood event. The effect of this will be increased turbidity only while the activity is being undertaken and the settling of some sediment downstream.

If no avoidance or minimisation measures are implemented, activities undertaken within the river corridor during normal flows have the potential to cause a decrease in downstream water quality, visual discolouration, sediment deposition, impact on aquatic habitat and natural character.

9.4.6 Measures to avoid, remedy or mitigate adverse effects

A summary of the measures to avoid, remedy or mitigate adverse effects is set out below in terms the overall strategy of mitigation, core management measures and key monitoring components.

Principles of mitigation

As noted above, the overarching first principles and strategy for addressing the potential adverse effects of sediment discharges is:

- avoid the circumstances that generate sediment;
- minimise the potential to generate sediment; and
- mitigate sediment discharges through treatment processes.
- monitor the performance of measures and adapt to improve management of erosion and sediment.

Project approach to the management of construction water

Erosion and sediment control (ESC) measures will be implemented during the construction phase of the Project to avoid sediment discharges. Where this is not possible ESC measures will seek to manage the discharge of sediment from the Project and avoid or mitigate effects on the freshwater and coastal receiving environments. The ESC measures for the Project will be designed and implemented in accordance with the hierarchy above, designed to minimise the extent of erosion and capture and retain, to the fullest practical extent, any sediment generated from construction activities.

A continuous improvement monitoring programme will be implemented to inform the extent of construction activity on site and to influence and reduce the direct effect of construction works and associated discharges into the receiving environment.

Non-sediment contaminants (i.e. cement, flocculants, fuel, oil) may directly or indirectly discharge into the receiving environment from site activities. Management of these non-sediment contaminants will be subject to specific best management practice and industry guidelines.

ESCP and SSECP

A draft ESCP has been prepared alongside the Construction Water Quality Assessment, which sets outs the strategy to avoid, remedy or mitigate the potential effects of erosion sediment discharges to the receiving environment. This has been prepared as a draft for consenting purposes and is to be updated alongside the construction contractor prior to any construction works commencing.

A draft SSESCP template has also been prepared to demonstrate the framework for management of particular construction activities. The SSESCP demonstrates how measures can be tailored to the location, unique constraints and different teams of people involved in identified construction activities. Provision will be made for current and innovative best practice techniques, which go beyond guidance documents to be incorporated into the ESCP and SSECPs and adopted by the Project throughout its duration.

A draft Chemical Treatment Plan has also been prepared to demonstrate the procedures for use of flocculants and other chemical treatment systems at structural treatment devices (sediment retention ponds and decanting earth bunds). The Chemical Treatment Plan will sit within the ESCP and relevant SSESCP.

Both the final ESCP and the SSESCPs will be prepared in general accordance with the following documents:

- GW Erosion and Sediment Control Guide for Land Disturbing Activities (2021)
- NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure (2014), and
- GW Code of Best Practice for River Management Activities (2019).

Construction water management for the Project will be implemented in accordance with the above documents, as relevant to the specific works locations and activities, which provide information on the appropriate use, design and construction of ESC devices and methods in the Wellington region.

Core management measures

The full details of the core measures to avoid, minimise and treat potential adverse effects are outlined in the draft ESCP and SSESCP, which are appended to the Construction Water Quality Assessment.

A key element to minimising the potential for sediment generation is to undertake river reprofiling and widening works in standing water (or in the “dry”). This involves temporary bunds and diversion to separate active earthworks from the flow of the river. The use of separation structures will be deployed as much as is practical within the river channel but this is limited by constructability, which varies in difficulty across the river length. Table 50 provides an estimate of the “dry” and “wet” earthwork volumes.

Table 50 - Estimate of in river earthworks in flowing and stationary water.

Earthworks Scale	Cut	Fill
Total volume (m^3)	253,000	43,000
”dry” river bed works	164,500	19,500
”wet” river bed works (in flowing water)	62,000	14,200
”wet” river bed works (in standing water)	26,500	7,000

Works in the active channel

Key measures to minimise the effects of works in the active channel include:

- avoiding work in low flow and ecologically sensitive seasons. If this is not possible special procedures will need to be adopted to avoid adverse effects. For example, ecological monitoring to identify the presence of nesting sites and the establishment of suitable buffer areas;
- progressive staging from downstream to upstream (with a maximum disturbed active channel reach of 500 m at any one time) to minimise the area of disturbance and subsequently the volumes of sediment generation;
- restricting the daily work duration to 12 hours per day with 2 consecutive work free days within every 7 days to allow the River to return to ambient water quality, relieving the aquatic habitat from sediment exposure every day;
- temporary diversion and formation of protective bunds to minimise the extent of works carried out in flowing water;
- minimising the number of vehicle crossing points and undertaking a trial to determine how best to minimise sediment during crossing activities.

Works in the River Corridor

Key measures to minimise the effects of construction activities in the river corridor but outside of the active channel include:

- avoidance of works in heavy rainfall events to reduce the generation of sediment from active construction areas;
- progressive stabilisation to reduce the extent of disturbed surfaces and subsequent volumes of sediment generation;
- removing or capping areas of silts and clays with potential for sediment generation within the river corridor;
- use of silt fences to intercept sediment laden water before it discharges to the river;
- short term stabilisation (rock armour, hard fills and metals, geofabric) to minimise potential for sediment when rainfall events are forecast;
- use of structural treatment devices (such as SRPs, DEBs and CISs); and
- staging of permanent stormwater treatment installation at the beginning of the works period to provide a level of treatment which is higher than typical devices (e.g. SRPs and DEBs).

Works outside the River Corridor

Key measures to minimise the effects of excavation for construction activities outside of the river corridor include:

- avoidance of works in heavy rainfall events to reduce the generation of sediment from active construction areas;
- separating sources of clean water from active construction areas;
- staging of works to minimise the area of land that can generate sediment;
- use of sediment treatment devices (such as sediment retention ponds, decanting earth bunds and container impoundment systems) to treat sediment laden water before discharging to the river (via existing stormwater network or land);
- use of silt fences to intercept sediment laden water before it discharges to the river;
- chemical treatment to maximise performance of devices where reasonably practicable;
- deployment of the contain, test, and treat process in the case where sites are contaminated; and
- progressive stabilisation to reduce the extent of disturbed surfaces and subsequent volumes of sediment generation.

Contaminated land

In terms of construction water quality associated with runoff from contaminated land and associated remedial works, typical ESC measures to reduce effects from contaminated land on the environment include but are not limited to:

- ESC measures to reduce erosion and detain sediments on site (for contaminants that are absorbed or attached to soil particles). These measures include bunding or use of container impoundment systems to contain the stormwater so it can be treated and tested prior to discharge;
- contaminant testing and chemical treatment of any dewatering and stormwater runoff;
- staging works to take place when no rainfall is forecast; and
- disposal of contaminated water which is unsuitable for site treatment to trade waste or to off-site disposal to provide an alternative to discharging into the natural environment.

The completion of further investigations will identify the extent of contamination and measures that will be required to manage contaminated land. These measures will be included in both the ESCP (and relevant SSESCP) and Contaminated Land Site Management Plan (CLSMP).

Monitoring

Continuous monitoring processes are proposed and will be implemented throughout construction which will allow assessment of water quality for the duration of the construction programme. The continuous monitoring programme will include the following key components:

- rainfall gauges and weather forecasts will be monitored to identify rainfall events which may affect construction activities or water levels;
- in the event of rainfall events greater than 7mm/hr or 20mm/24 hrs rainfall contingency measures will be put in place. Such measures include temporary rapid stabilisation, cut off bunds and contour drains, surface roughening and flocculation of treatment devices;
- for discharges from outlets from treatment devices outside the river corridor, grab samples will be taken from discharges from the devices and in receiving waters, within the Project area and downstream of construction activities. Where turbidity exceeds 170

NTU[50] a minimum of 50 m downstream of reasonable mixing, a management process will be triggered to identify the probable cause and improvement measures required to prevent re-occurrences;

- for activities in the active channel, river water quality monitoring will be undertaken during construction using continuous telemetered turbidity sensors located upstream, in the Project area, and downstream, and supplemented by grab sampling in flowing and standing water within the Project area and downstream. Monitoring will be used to inform adaptive management actions, with proposed triggers outlined below:

Table 51 - Triggers

Trigger type	Change in Turbidity	Action
Proactive trigger	10 % Difference between the control and downstream of work area outside construction period above a baseline 15 NTUs	Investigate probable cause of exceedance. Implement improvement to measures. Undertake field monitoring.
Management trigger	15 % Difference between the control and downstream of work area outside construction period above a baseline of 15 NTUs	Undertake actions for the proactive trigger AND undertake an ecological assessment of the effect of the exceedances and report to GW

- in the event monitoring results demonstrate that turbidity exceeds the above triggers and indicate that the core management measures are not working effectively, then contingency measures such as reducing the maximum daily footprint and/or maximum work duration, installing geofabric in the internal structure of protective bunds and periodic re-armouring of excavated riverbed surfaces will be put in place; and
- in the event monitoring following the implementation of contingency measures demonstrate that adverse effects are still occurring a formal adaptive management process in consultation with GW (as regulator) and Mana Whenua will be implemented.

Small tributaries and drains

The key factor in the construction of new culverts and discharge structures will be minimising the need to work in the water. This is achieved by creating the new structures out of the current alignment and diverting the water around the construction area. These measures will be detailed in the SSESCP prepared for this construction activity.

9.4.7 Summary of effects of construction activities on water quality

Provided the measures to avoid, remedy or mitigate adverse effects outlined above are followed, the Construction Water Quality Assessment concludes actual and potential adverse effects of erosion and sediment discharges can be managed to a negligible or low level with any actual or potential effects restricted to short term effects within the construction period.

9.4.8 Conclusion

Construction activities if not properly managed have the potential to increase the risk of sediment-laden runoff and other contaminants being discharged to the receiving environment. The Construction Water Quality Assessment has assessed the effects associated with

[50] Nephelometric turbidity units

construction and made a number of recommendations which have been incorporated into the recommended conditions of consent included in Appendix A.

With the implementation of the management measures outlined above, the actual and potential adverse effects of erosion and sediment discharges can be managed to a negligible or low level with any actual or potential effects restricted to short term effects within the construction period.

9.5 Groundwater/hydrogeology

Overview

The Lower Hutt valley is characterised by gravel-rich layers in a thick sequence of alluvial and glacial outwash sediments, which host a significant groundwater resource. The Waiwhetu Aquifer is an extensive alluvial gravel layer that provides a significant proportion (40% -70%) of the annual municipal water demand for the Wellington Region, which underlies the Project area. The shallow Taita alluvium – Melling Peat and Petone marine beds are also expected to be encountered across the Project area as an overlay to the Waiwhetu aquifer. The Taita alluvium comprises coarse fluvial deposits with moderate to high permeability and forms an unconfined aquifer above the Waiwhetu aquifer connected with Te Awa Kairangi and other local surface water bodies such as the Tirohanga Stream and Waiwhetu stream. It is not used for water supply near the Project area.

The Project works could potentially affect groundwater quantity and quality. In particular, the proposed riverbed reshaping, and the construction of piles within the Waiwhetu aquifer, could potentially result in groundwater effects.

The riverbed reshaping is anticipated to result in slightly increased shallow groundwater discharges to the river within the Project area. Controls on sediment discharges during the riverbed works will minimise any potential effect on groundwater quality.

Construction of piles into the Waiwhetu aquifer could potentially result in contamination of the aquifer and depressurisation of the aquifer if incorrectly constructed. The proposed construction methodology for the piles that will penetrate the Waiwhetu aquifer is considered a robust and proven construction methodology to address the potential quality and quantity risks to groundwater.

Conditions and management plans are proposed to ensure appropriate controls are implemented during the works. With the recommended conditions and management measures, it is considered that the effects of the Project on groundwater can be appropriately managed and with suitable mitigation applied are considered to be minor.

9.5.1 Introduction

This section summarises the findings of the assessment of the actual and potential effects of the Project on groundwater arising from the construction and operation of the Project. A full assessment is provided in the Hydrogeology Assessment (Technical Report #4).

9.5.2 Existing groundwater environment and assessment methodology

A description of the existing groundwater environment in the Project area is provided at section 3.4.4.

The Waiwhetu Aquifer is an extensive alluvial gravel layer that provides a significant proportion (40% -70%) of the annual municipal water demand for the Wellington Region. Eight municipal water supply wells are located approximately 520 m – 1250 m south / south-east of the Project site. The water is treated and used for supply to Hutt City and Wellington. The wells are all approximately 40 m deep and screened in the Waiwhetu aquifer.

Groundwater modelling and long-term groundwater level monitoring undertaken by GW indicate that groundwater levels in the Waiwhetu Aquifer are influenced by river recharge and groundwater abstraction, as well as by tidal pressure effects. For that reason, the system is complex, and it is difficult to assess the natural groundwater level variability of the Waiwhetu Aquifer.

In the area of the bore field and the Project, the Waiwhetu aquifer is confined, and the aquifer water has an upward hydraulic gradient (when not pumped). This condition is known as artesian, and it usually means that the aquifer water is inherently protected from any surface derived contamination because the gradient opposes any leaching downward into the aquifer water. However, there is some evidence that pumping from the Waiwhetu aquifer at the nearby Waterloo well field by Wellington Water Ltd can generate downward hydraulic gradients to the Waiwhetu aquifer, which can increase its vulnerability to surface-derived contamination. For these reasons, it is important that the Waiwhetu aquifer is protected from any contamination or breach through the aquiclude that could be created by the Project activities.

9.5.3 Assessment of hydrogeology effects

Works within the river

Gravel extraction from the channel and excavation and fill in the upper and lower berms are to occur between Kennedy Good and Ewen Bridges. The gravel extraction works are a combination of lowering the riverbed and widening the channel with protected banks, using either riprap or planting for berm protection.

The Project construction methodology does not envisage active dewatering to manage river or groundwater inflows for the river works component of the Project. Ongoing groundwater seepage to the river will continue during construction and will not result in a change to the groundwater flow direction.

During and immediately following the proposed riverbed reprofiling, the shallow groundwater discharge to the river within the Project area is expected to increase when compared to current discharge rates. This is due to an increase in hydraulic gradient between the river levels and shallow groundwater level.

Steady-state 2-D modelling has been undertaken to understand the difference in river inflows or groundwater flow patterns after construction (i.e. after excavating and lowering the riverbed). This modelling, in conjunction with current monitoring data, has been used to assess the seepage of shallow groundwater to the river expected near the Project area (from Melling Bridge to Ewen Bridge, i.e. the area being deepened). The assessment indicates that, as the riverbed is deepened, the rate of seepage from groundwater to the river will increase slightly (ranging from 0.1 to 0.4 m^3/day per lineal metre of river) when compared to current discharge rates. Current discharge rates reflect the present riverbed elevation and average groundwater levels as monitored in the Project's piezometers (September 2020- April 2021). Even when conservative assumptions are applied (i.e. negative hydraulic gradient caused by pumping the Waterloo wellfield and removal of the confining layer (aquitard)), the increase of seepage from groundwater to the river is small, ranging from 0.8 to 1.2 m^3/day per lineal metre of river. Modelling results under very conservative assumptions indicate the additional Waiwhetu aquifer losses (under 7-Day Mean Annual Low Flow (MALF) conditions) are in the order of 71 m^3/day to 210 m^3/day, representing a very small percentage of the total aquifer volume and pumped daily rates from Waterloo wellfield.

Previous modelling analysis (Earth in Mind Limited, 2014) indicates that the confined Waiwhetu aquifer is relatively insensitive to small bed level variations. The modelling results and Hydrogeology Assessment are in agreement with this previous conclusion. As a result, any changes to the confined aquifer groundwater levels from the proposed river works are expected to be minor. Increased turbidity in Te Awa Kairangi from the works may result in an increase in turbidity in the shallow groundwater of the Taita aquifer. However, due the nature of the aquifer (i.e. sand and silt) the suspended sediments are expected to be filtered by aquifer material within a short distance from the river. It is important to recognise that flood events already occurring naturally in the river recharge the shallow aquifer with water which has increased turbidity associated with the flood event.

Further, management of the river water quality during construction through measures to be detailed in the ESCP are expected to further minimise any potential to affect the groundwater quality in the shallow aquifer, such that any effects are assessed as low.

Modelling results indicate that under river flood conditions with simultaneous high pumping at the Waterloo well field, river losses to groundwater are expected to increase by up to 0.4 m^3/day per lineal metre of river, when compared to the existing state (which is less than 0.01 l/s per lineal metre). Most of the river losses are expected to be to the Taita Alluvium with only up to 85 m^3/day of additional flow expected to reach the Waiwhetu aquifer. This additional inflow rate is considered to be negligible and immeasurable when compared to the Waiwhetu aquifer volumes of water. Therefore, no measurable change to the Waiwhetu aquifer water quality properties at the Waterloo bore fields are expected that could be attributed to the proposed works.

Following completion of the bed reshaping works, the long-term operational effects are expected to be similar to those anticipated during construction. Initially, shallow groundwater discharges to the river within the Project area are expected to increase when compared to current discharge rates, which will result in a slight decrease in water level in the shallow aquifer. As aggregates are deposited on the riverbed over time due to natural river processes, the shallow groundwater discharges to the river will start reducing slowly to current levels. These changes are all expected to be within ranges previously observed in the area, and any effects are expected to be minor. The construction of the stopbanks and berms are not expected to affect the current groundwater flow direction or materially alter the river/groundwater interaction.

Overall, the effects on groundwater quantity and quality from the riverbed re-shaping are expected to be minor.

Assessment of effects on groundwater during construction of Melling Interchange, Melling River bridge and pedestrian / cycle bridge

In order to construct the Melling Interchange, Melling River bridge and pedestrian / cycle bridge, piles are required to be constructed. The potential adverse effects from these works include:

- If incorrectly constructed, the piling could result in localised aquifer depressurisation and provide a potential pathway for an increased flow of groundwater into and from the artesian aquifer
- The piles may create a pathway for contaminants to enter the confined artesian aquifer, and
- Discussions with Wellington Water Ltd have identified a potential concern that the act of piling may result in disturbance of sediment in the Waiwhetu aquifer, which could affect the turbidity at their supply wells.

The proposed construction methodology for the piles that will penetrate the Waiwhetu aquifer, and specifically the use of a double casing methodology and sealing (grouting) around the casing of the aquiclude, is considered a robust and proven construction methodology to address the potential quality and quantity risks to groundwater. The proposed methodology is expected to be suitable to manage the risks of leaching and or leaking water from and to the Waiwhetu aquifer.

No adverse effects are anticipated during the operation of the Project from the bridge piles. The piles are of limited extent spatially. Groundwater flow will re-establish around them, and they will not impede the groundwater flow. No additional long-term effects on groundwater are anticipated from the bridge piles.

Assessment of effects from other construction activities

Other construction activities with potential effects on groundwater quantity or quality include:

- Removal of the existing Melling Bridge
- Ground improvements for the SH2 bridge abutments, and
- Excavation and associated dewatering

The potential effects of these activities are described below.

The existing Melling bridge will be deconstructed (removed) to the riverbed level. Existing bridge piles will be cut to riverbed level. This will minimise/eliminate disturbance of the underlying aquifers. No effects on groundwater quality or quantity are expected as a result of these works.

Ground improvements (driven concrete piles) for the SH2 bridge abutments will extend to -1 m RL and will be founded in the Taita Alluvium. These piles are not expected to breach the aquiclude, are of small diameter and length, and will not impede the shallow groundwater flow. The proposed driven concrete piles are not expected to be drilled through contaminated soil. Site specific soil sampling will be undertaken before construction starts to confirm that the piles will not be drilled through contaminated soils. No adverse effects on groundwater quality or quantity are expected from this activity

For Project excavation works and associated dewatering, it is recommended that the CEMP should provide a dewatering assessment. This should be undertaken during detailed design or possibly earlier for tendering purposes, when exact locations and dimensions of excavations that may require dewatering (utilities replacement, construction of culverts, pump stations etc) will be known.

9.5.4 Measures to avoid, remedy or mitigate actual or potential adverse effects

A range of conditions and management plans are proposed in the Hydrogeology Assessment to ensure the effects on groundwater from the Project are consistent with the assessment and are minor overall. These include:

- A Groundwater Management Plan to manage activities to avoid potential adverse effects on groundwater during construction of the Project, including monitoring groundwater during the riverbed changes and piling works;
- An Artesian Aquifer Interception Management Plan that will include a Grouting Management methodology for construction of the bridge piles;
- All tools must be cleaned and disinfected with appropriate solvent, including the steel casings that will be utilised for the construction and encasement of the bridge piles. Tools should be cleaned and disinfected in between each pile;
- Construction of the bridge piles is to be in accordance with the construction methodology set out in this application (Chapter 5), including the use of pilot bores to confirm geology at the exact location of the piles. Should any changes be proposed, these will be provided to the consent authority (GW) for approval prior to construction commencing;
- Installation of two piezometers (50m to 100m from the riverside) at the location of the new Melling Bridge to monitor groundwater; and
- A CEMP to control excavations that may encounter groundwater, including measures to avoid and/or mitigate any potential effects from dewatering activities and appropriate discharge of pumped water.

9.5.5 Conclusion

The main two activities of the Project which may result in effects on groundwater are the proposed riverbed reshaping, and the construction of piles within the Waiwhetu aquifer.

The riverbed reshaping is anticipated to result in slightly increased shallow groundwater discharges to the river within the Project area, however the change is not expected to be significant, with any changes to river flows and groundwater levels in the shallow aquifer in close proximity to the new channel likely to increase slightly (ranging from 0.1 to 0.4 m^3/day per linear m) when compared to current discharge rates. This represents a very small percentage of the total aquifer volume and pumped daily rates from Waterloo wellfield. Controls on sediment discharges during the riverbed works will minimise any potential effect on groundwater quality.

The proposed construction methodology for the piles that will penetrate the Waiwhetu aquifer is considered a robust and proven construction methodology to address the potential quality and quantity risks to groundwater. The pile construction methodology should be reviewed once geology is confirmed at the locations of the piles and updated if required. Any updates on the methodology and technical justification will be approved before commencement of pile construction. Monitoring is proposed to record groundwater levels and monitor groundwater quality prior to, through and following construction of the piles in the Waiwhetu aquifer. This will allow actual changes to groundwater to be checked against those estimated and appropriate responses to be implemented, if needed.

Conditions and management plans are proposed to ensure appropriate controls are implemented during the works. With the recommended conditions and management measures, it is considered that the effects of the Project on groundwater can be appropriately managed and with suitable mitigation applied are considered to be minor.

9.6 Geomorphology

Overview

The geomorphology assessment focuses on the changes proposed within the river corridor floodplain, in particular to the active river channel and its margins. The design channel of the upper reach (Kennedy Good Bridge to Transpower substation) provides for a 100m wide active channel, with 30m wide lower berms providing a vegetated buffer zone. The design channel of the lower reach (Transpower substation to Ewen Bridge) provides for a 70m wide active channel, with 10m wide lower berms. The design channel for these reaches is intended to achieve increased gravel deposition in the upper reach, and reduced gravel deposition in the lower reach.

Short-term effects on geomorphology during the Project construction phase could include exposure of erosion-prone riverbanks to flooding, sediment release resulting in increased turbidity, sediment transport and deposition downstream, and channel and bank edge distortions. These Project construction effects can be minimised by staging the sequence of works in the river corridor, restricting working areas and re-establishing exposed banks and disturbed berm areas as soon as possible, such that minimal adverse short-term effects on geomorphology are expected during Project construction.

Positive long-term effects on geomorphology anticipated to occur from the Project include increased deposition of gravel along the upper reach, and reduced deposition along the lower reach, allowing for an easier and less disruptive sediment management regime. In addition, the increased width of the active channel will allow a more natural channel sinuosity and meander mobility, leading to an overall improvement in Te Awa Kairangi's geomorphic condition.

Overall, the construction effects on geomorphological processes require mitigation measures managing the sequence and extent of works to minimise potential adverse effects, while the longer-term operational effects of the Project on the geomorphology of Te Awa Kairangi along the Project reach and its natural character are positive.

9.6.1 Introduction

This chapter provides a summary of potential effects of RiverLink on the geomorphology of Te Awa Kairangi. The full assessment of effects is contained in Geomorphology Assessment (Technical Report #5).

Geomorphology is the study of the interactions of waterways and landforms, their processes, interdependence and connectedness. The geomorphology assessment is focused on the changes proposed within the confined river corridor floodplain, and in particular to the active (bed material transporting) river channel and its margins. In the context of RiverLink, geomorphology is defined as the form and behaviour of the river within the Project area. The form of the river is defined by the key characteristics of width, section shape, plan form meander pattern, and longitudinal profile including the pool-riffle-run sequences. The behaviour of the river includes its plan form mobility as well as the sediment transport characteristics, including deposition of gravel on the bed.

Te Awa Kairangi flows from the peaks of the southern Tararua Range, southward along the Wellington fault line in the Hutt Valley, and then across a short aggradation reach to discharge into Wellington Harbour.

Naturally the river would have migrated across its wider floodplain as confined between the eastern and western hills before arriving at the river mouth estuary where present day Petone is located. Over the last 100 years the river has been extensively managed with the channel confined and stopbanks built to manage the flood risk to the adjacent Lower Hutt city centre.

The river channel is relatively narrow with a steep grade until it reaches the Project area, where it transitions to adapt to sea level at its outlet. There is a major change of grade around the Kennedy Good Bridge, with a lesser reduction in grade upstream of the Ewen Bridge, where the river bends away from the Wellington Fault. The Project is being undertaken in the lower reaches where Te Awa Kairangi naturally deposits gravel on the bed, geomorphologically defined as a deposition zone.

The width of the river channel within the Project reach has narrowed significantly in the past 100 years, due largely to anthropogenic activity constituting river control works and gravel extraction over the period of settlement on the River floodplain. In addition, there is the possibility that a reduced sediment supply due to limited flood and seismic activity in recent decades, and a reasonably well vegetated and stable upper catchment has contributed to a natural narrowing of the river channel.

The riverbed material is relatively coarse, with the median size reducing from a diameter of around 50mm at the upstream end of the Project reach to around 25mm in the middle and lower reaches. Based on recent work by Cameron (2018)[51], the dominant sediment particle size expected to be in the water column as a result of in-river works is sand (0.06 – 2 mm diameter), being approximately 10% of the total bed sediment within the Project reach. With regard to fine silt/clay sized sediment (< 0.06 mm diameter), based on the Project footprint and the specific silt/clay yield, the amount of silt/sand particles likely to be present in the Project reach will be insignificant (<0.5%) relative to the natural supply of the entire catchment.

The overall suspected sediment load generated by the catchment is estimated at 90,000 t/yr. Of this, approximately 70% will be less than 0.06mm in diameter (fine silt/clay size sediment), representing approximately 100t/k^2/yr for the 693 km^2 Te Awa Kairangi catchment. Based on the Project footprint and predicted silt/clay yield, the proportion of fine particles which create suspended sediment are expected to be insignificant.

[51] Cameron, D.J. (2018). Baseline Monitoring of Aquatic Habitat Quality and Fish Communities (Hutt River)

9.6.2 Assessment methodology

The assessment methodology has been based on design investigations and assessments of risk and impacts on the natural character, relevant to the Project reach. This included the design methods, the evaluation of alternatives, consideration of residual risk from the uncertainties and limitations of both the design and the future maintenance regime, and qualitative assessments of the natural character of the reach. The operational and construction effects of the Project have been assessed separately.

The methods used in the design of the river corridor measures, and the assessment of effects has been derived from on-going investigations and evaluations of effects over a long period of time, as upgrade works have been developed and implemented along the River.

The Project area has been divided into two reaches for the purpose of the geomorphology perspective; the Upper Reach from Kennedy Good Bridge to the Transpower substation and the Lower Reach from Transpower substation to Ewen Bridge. A reach of a river has a natural character, which is expressed in its form (channel shape and pattern) and functional relationships (of flow, sediment transport and vegetative interactions). An assessment of the natural character of Te Awa Kairangi has been undertaken where the river reach is first characterised by general type, as it relates to its catchment setting, and then, for that given type, measurable local conditions are used to evaluate and rank the reach, to give a natural character index (Fuller, Death, & Death, 2015).

The following information was used to assess the changing nature of the river reach and the impacts this has on the operational phase geomorphic processes and character of the river reach:

- Assessment of any changes in the natural character of the reach and how the processes of flooding, sediment transport and channel movement and meander migration may affect the character of the reach. The interaction and relationship connections between the physical processes and the reach biology and ecological systems have also been considered and assessed.
- Monitoring variables of the Natural Character Index have used to give an indication of the potential degree of change because of the Project. This NCI assessment has been applied to the Otaki and Waikanae rivers, as well as Te Awa Kairangi/Hutt River in the Wellington region.

The geomorphological construction effects assessment has considered the quantities of earthworks in the channel and berms, and the duration of these earthworks, construction requirements to secure the rock linings/groynes below river bed levels, requirements for temporary works, particularly diversions and bunding of working areas, and the sequencing of the works and the geomorphic implications of the proposed progressive channel enlargement in an upstream direction.

9.6.3 Assessment of construction and operation geomorphology effects

Construction effects

Construction of the Project will require large earthmoving equipment working in the active channel of Te Awa Kairangi for a significant period of time. Foundations of the rock linings below the river bed level will require excavation within the active channel, while temporary works to relocate and divert the low flow channel away from working areas will also be required.

Construction activities will include excavation along the riverbanks, creating exposed raw banks that are very susceptible to erosion in flood events. Such erosion is a risk to bank stability and would cause damage to works in progress. Limiting the length of banks exposed and areas of channel worked on at any one time will minimise these effects.

The requirement to excavate within the active channel means there will be sediment released and increased turbidity in the downstream channel. The relatively coarse nature of the channel bed material, and the downtime over nights and weekends means that turbidity effects should not be extensive. Sedimentation and turbidity effects are addressed in detail in section 9.4 of this AEE.

During construction, there will be channel and bank edge distortions, with transition effects and temporary exposures that will affect river channel dynamics and hence the transport of bed material along the river channel.

There is the possibility that the rate of sediment transport into the downstream reach will increase during the construction phase and in the years immediately following construction. This would be a result of the disturbance of the armour layer on the riverbed and the exposure of more mobile underlying sediments as well as the removal of mature bank vegetation. If this occurs, further deposition would take place along the lower reaches of the river, below Ewen Bridge, where there is already a build-up of gravel that is affecting channel capacity.

In summary, the requirement to undertake large-scale earthworks, to lower, widen and laterally relocate Te Awa Kairangi, as well as the construction of two new bridges and erosion protection works, means that the construction phase of the Project will, with the avoidance and mitigation measures proposed, have minimal adverse short-term effects on the river channel character and morphology, and could potentially increase short-term sediment deposition in the downstream reach.

Operational effects

Bank Erosion

The Project works include extensive widening and relocation of the main river channel. Without the proposed bank protection works (rock lining, vegetation buffers), there would be long lengths of raw riverbanks that would be highly prone to erosion. This could put the newly constructed stopbanks at a high risk of failure and could also add significant volumes of additional sediment to the system. However, the proposed measures, once established, will provide a much greater degree of security against bank erosion effects than at present.

Sediment management

The Project design is based on a concentration of bed material deposition in the upper reach, to allow easier extraction and minimise the frequency and magnitude of extraction along the lower reach. Once constructed, the design channel will enable more gravel extraction from gravel bars above low flow water levels along the upper reach. The design conditions will therefore allow for an easier and less disruptive sediment management regime.

Habitat

The proposed widespread earthworks and lateral shifting of the river corridor have the potential to affect the quality and diversity of the aquatic and terrestrial habitat, since virtually all existing edge vegetation along the Project reach will be removed and replaced with a different type and density of vegetation. These habitat effects are assessed at sections 9.7 (freshwater ecology) and 9.8 (terrestrial ecology).

Natural character

The design of the river corridor works, and in particular the channel works, has been based on improving the geomorphic flexibility and natural dynamics of the River. The active channel area, where bed material transport takes place, will be widened and aligned to fit a natural meander pattern of the River. This will affect the pattern of flood flows and sediment transport, allowing a more geomorphologically natural river behaviour within the wider space available for the active river processes of sediment transport.

An assessment of the natural character of Te Awa Kairangi had been previously undertaken where the river reach is first characterised by general type, as it related to its catchment setting, and then, for that given type, measurable local conditions were used to evaluate and rank the reach, to give a natural character index (NCI) (Fuller, Death, & Death, 2015). A natural character index assessment was then undertaken for the Project based on this previous study, comparing the present river channel and the proposed. Measurements taken off the surveyed river cross-sections have been used to determine average changes in the river corridor and active channel, while aerial plans have been used to measure sinuosity along the Project reach. Pools have been assessed as those which are geomorphologically (and ecologically) significant, and rated as main or minor. It was considered appropriate to only use the main pools for the NCI calculations.

The geomorphological assessment, and natural character index figures derived from this, are provided at Table 52. Average values are given for floodplain and active channel widths.

Table 52 - Natural Character Index Assessment

	Lower reach		Upper reach	
(Average values for reach)	Existing	Design	Existing	Design
Geomorphology assessment				
Floodplain width (m)	159.1	161.5	wide	unchanged
Active channel width (m)	67.1	72.6	86.7	98.0
Channel sinuosity	1.08	1.11	1.06	1.06
Pool sequence (main)	3	3	3	5
Natural character index				
Floodplain width	1.00	1.02	1.00	1.00
Active channel width	1.00	1.08	1.00	1.13
Channel sinuosity	1.00	1.03	1.00	1.00
Pool sequence	1.00	1.00	1.00	1.67
Index (existing = 1.0)	1.00	1.03	1.00	1.20

The existing condition is given a value of 1, with the design index being the ratio of the criteria values for the existing and design conditions. The overall index is an average of the calculated values for the individual criteria. The change in this index is then an indicator of the proportional change from the existing conditions to that of the design, with an increase indicating a geomorphic improvement. A change of less than 0.05 (5%) is considered minor, while a change of greater than 0.1 (10%) is considered more significant. The Project will increase the width of the active channel, allowing a more natural channel sinuosity and meander mobility, particularly in the upper reach. In the lower reach, channel sinuosity will be more defined, allowing for natural meander, however there will still be an overly straight reach of unnatural form around the Melling Bridge.

As indicated by the natural character index values, the improvements in natural character are small from a geomorphic viewpoint in the lower reach, with relatively small percentage increases in the index value from 1.0 to 1.03 (+3%). The increases are more significant in the upper reach due to the more extensive channel widening, the index increasing from 1.0 to 1.20 (+20%).

The design will therefore give rise to some improvements to the natural character of the river reach while increasing the standard of flood protection. Key improvements include deeper pools, greater lateral freedom in the upper reach, more natural alignment and meander form in the lower reach, reduced frequency of in-channel interventions in the lower reach, and more in-channel features (scatter rock, large woody debris, rock spurs).

Flood damage and erosion vulnerability

In the years following construction, and prior to vegetation buffers becoming established, intensive maintenance activities will be required to mitigate vulnerability to flood events. Once the Project measures are fully established and effective in terms of the design standard, flood damage within the river corridor will be reduced and more easily remedied following flood events. In more extreme flood events there will be substantial damage to edge works and loss of berm land, however these events will be very rare. The Project will therefore reduce flood damage and erosion vulnerability while increasing flood capacity.

Summary

The completed Project will give rise to a river channel that will allow easier and less intrusive management of the river, with a better bed material deposition regime for sediment management, and an overall improvement in the river's geomorphic condition. Overall, the operational effects are assessed to be moderately positive.

9.6.4 Measures to avoid, remedy or mitigate actual or potential effects

The main mitigation measures proposed below to avoid, remedy or mitigate actual or potential geomorphology effects are, for both construction and operational stages, to minimise bank erosion, bed material disturbances and effects on sediment transport.

Construction

Without mitigation measures, the short-term effects of Project construction on the river channel and its geomorphic processes could be substantial. ESC mitigation as set out in section 9.4 above will mitigate the bank erosion and sediment risk detailed further below.

Bank erosion

Sequencing works within the river corridor is fundamentally important to limiting erosion risks. In addition to sequencing, restricting working areas and re-establishing exposed banks and disturbed berm areas as soon as possible, given seasonal and climatic limitations, is important.

Flood warning systems and planned responses to flood events for erosion protection and to limit damage to works in progress are proposed to minimise impacts.

Sediment management

Sequencing of works and restricting the area of disruption of the channel form and disturbance of the armouring layer of the riverbed would also minimise effects on the transportability of bed material. Monitoring of the river channel to determine any increase in sediment transport and deposition of gravel in the downstream reach is proposed to be undertaken during construction.

Operational

The long-term effects of the Project on the geomorphology of Te Awa Kairangi are positive due to the proposed bank erosion and sediment management measures included in the Project design and outlined below.

Bank erosion

Bank erosion effects resulting from RiverLink are proposed to be managed through rock rip rap linings in the lower reach of the Project area and vegetative buffers in the upper reach.

In the lower reach of the Project downstream of the Transpower substation, where the channel narrows from 100 m down to 70 m, the best (and proposed) option to manage lateral bank erosion is with the use of rock rip-rap linings. These bank linings will be effective in mitigating the risks to flood protection measures from lateral erosion, and reducing the addition of further sediment into the lower reaches of the River from erosion in small to moderately large flood events. During very large design floods (2800 cumecs) these rock linings would likely fail in places due to significant riverbed scouring and bed mobility, resulting in significant sediment inputs from the upstream catchment and bank erosion. Following such an event, it is expected there would be repair and recovery of displaced rock and extraction of deposited sediment.

Since the design channel is 100m wide upstream of the Transpower substation, and since the stopbanks are set well back from the channel, greater flexibility in erosion management measures allows for wide vegetation buffers to be used along this reach. Once established, these vegetative buffers can effectively manage bank erosion during smaller floods, but would likely see some erosion during larger flood events. However, this is considered beneficial since it allows for more natural river planform variability, channel movement and migration of the main flow channel. Vegetative buffers will consist of the fast growing and proven method of planting willows for frontline protection, with natives planted behind and in panels amongst the willows.

Sediment management

Effectively managing sediment transport and deposition trends is fundamental to the long-term success of flood mitigation measures and to maintain a geomorphologically functioning river system. Without management, continuing sediment deposition will fill the channel such that agreed levels of flood protection are not achieved. Therefore, the river channel has been specifically designed to manage the long-term transport of gravel bed material through the Project reach.

The upper reach upstream of the Transpower substation, with a channel width of 100m and 30m vegetative buffers, has been designed as a preferential deposition reach, such that less frequent interventions are required in the downstream channel. The key benefit of this design is that it allows for the long-term extraction of gravel bed material in this upper widened reach to largely occur on dry beaches rather than in the wetted channel.

Overall, the design of having a widened dedicated sediment deposition and extraction zone in the upper reach and the narrower zone with less intervention in the lower reach, is considered an appropriate and effective way of mitigating the adverse effects of future sediment management within the Project extents.

9.6.5 Conclusion

Short-term effects on geomorphology during the Project works phase could include exposure of erosion-prone banks, sediment release resulting in increased turbidity, sediment transport and deposition downstream, and channel and bank edge distortions. These Project effects will be minimised by sequencing works in the river corridor, restricting working areas and re-establishing exposed banks and disturbed berm areas as soon as possible, such that minimal adverse short-term effects on geomorphology are expected during Project construction.

Long-term effects on geomorphology anticipated to occur from the Project include increased deposition of gravel along the upper reach, and reduced deposition along the lower reach, allowing for an easier and less disruptive sediment management regime. In addition, the increased width of the active channel will allow a more natural channel sinuosity and meander mobility, leading to an overall improvement in Te Awa Kairangi's geomorphic condition and natural character.

Overall, the construction effects on geomorphological processes require mitigation measures managing the sequence and extent of works to minimise potential adverse effects, while the longer-term operational effects of the Project on the geomorphology of Te Awa Kairangi along the Project reach and its natural character are positive.

9.7 Freshwater ecology

Overview

The Project area includes approximately 3 kilometres of Te Awa Kairangi. The section of Te Awa Kairangi within the Project area, as well as the downstream section of the river, have high ecological values, with high-quality macroinvertebrate communities, and diverse and abundant fish communities including At-Risk and Nationally critical fish species such as longfin eel, īnanga, bluegill and giant bully, and lamprey. Three tributaries are located on the TRB of Te Awa Kairangi, within the Project area; the Harbour View Stream, Tirohanga Intersection Stream and the Tirohanga Stream. Of the three additional tributaries within the Project Area, two do not project natural stream outlines to Te Awa Kairangi. The remaining tributary – the Jubilee Park Outlet – will require replacement/construction. Freshwater habitats within the tributaries are generally of a lower quality compared to the main Te Awa Kairangi channel, and are considered to have moderate ecological values.

Short-term effects on freshwater ecological values during the Project construction phase could include the temporary modification of freshwater habitats, impacts on freshwater fauna, temporary fish migration and spawning restrictions, and water quality effects resulting from sedimentation and cement wash. These Project effects will be minimised through the implementation of fish salvage protocols, good practice ESC measures, and construction methodologies, such that the overall effects during the Project works are expected to be minor.

Potential long-term effects anticipated to occur from the Project include reduced fish passage, loss of stream ecological function and habitat area within Harbour View Stream. A variety of measures to avoid, minimise and mitigate the long-term effects of the Project are proposed to be implemented. Residual adverse effects resulting from the loss and modification of stream habitat which cannot be avoided, minimised or mitigated are proposed to be addressed by offsetting, which is aimed at achieving no net loss of ecological function.

Overall, the proposed mitigation and offset measures are expected to appropriately address the long-term effects of the Project on freshwater ecology, with overall effects on ecological values expected to be minor.

9.7.1 Introduction

This section summarises the findings of the assessment of the actual and potential freshwater ecology effects arising from the Project. The full assessment is contained in the Freshwater Ecology Assessment (Technical Report #6).

9.7.2 Assessment approach

All ecology effects of the Project (i.e. freshwater, terrestrial and marine) have been assessed using the Environment Institute of Australia and New Zealand Ecological Impact Assessment Guidelines 2018 (second edition) (the EcIA Guidelines), which is a four-step process for assessing the potential effects of a project.

The EcIA Guidelines have been used to ascertain the following:

1. The level of ecological value of the environment;
2. The magnitude of ecological effect from the proposed activity on the environment; and
3. The overall level of effect to determine whether an effects management response is (i.e. mitigation) is required.

9.7.3 Assessment of effects on freshwater ecology values

The potential effects of the Project on freshwater ecology values can be grouped into those associated with the Project construction, which are generally temporary in nature, and permanent effects that will continue beyond the Project works.

Actual and potential temporary effects from Project works (construction)

Sediment and cement wash discharges

In the absence of controls, there is potential for an uncontrolled discharge of sediment laden water into the receiving environment during Project works, which could reduce water clarity and result in excess deposited sediment on the riverbed. Corresponding effects from increased sedimentation on in-stream ecology could include reduced habitat quality, impacts on feeding and food supply, and disruptions to migration and spawning. There is the potential for cement wash to be released during Project works specifically during the construction of bridge pile structures. The release of cement wash can cause temporary changes to water quality (specifically pH) that has the potential to affect the freshwater fauna present within the Project area and in the lower Te Awa Kairangi.

Ecological values are High within Te Awa Kairangi Project area and the lower Te Awa Kairangi, and Moderate within the tributaries. Without any mitigation the magnitude of effect to Te Awa Kairangi is potentially Moderate due to the potential for the unmanaged sediment and cement wash discharges to partially change the existing baseline condition temporarily. Within the tributaries the magnitude of effect is potentially Low due to a discernible change in the baseline condition. Therefore, the potential unmitigated overall level of effects of sediment and cement wash within Te Awa Kairangi Project area and the lower Te Awa Kairangi, taking into account the value of the receiving environments, is High within Te Awa Kairangi, and Low within the tributaries.

Freshwater habitats

The disturbances to the freshwater habitat through gravel extraction and the associated riverbed disturbance is expected to occur on a large scale and will have an unavoidable impact on freshwater habitats within the Project area. Gravel extraction and channel re-alignment works can cause a major change to freshwater habitat types. Specifically, such works often result in a reduction of pool and riffle habitat and an increase in run habitat, and nearly always a loss of hydraulic complexity and associated substrate diversity. These effects are only of relevance during the Project works phase of the Project because once construction activities have ceased it is anticipated that freshwater habitats within the Project area will revert to or re-establish to conditions similar to that prior to construction activities occurring. The Project works will affect a significant length of river (approximately 3 km) and the quality of freshwater habitat within the reach is likely to be reduced temporarily.

The construction of bridges within Te Awa Kairangi will require temporary causeways formed from mounded river gravels, which will be removed as part of bed reprofiling. It is anticipated that the riverbed will reform, and habitat will return to the pre-works condition once the structures are removed.

The Project works will affect a significant length of Te Awa Kairangi and smaller sections of tributaries and the quality and diversity of freshwater habitat within each of the proposed staged reaches is likely to be reduced temporarily for a period of a few months after that stage of works is completed (depending on river flows post construction).

Ecological values are High within Te Awa Kairangi within the Project area and Moderate within the tributaries. The potential magnitude of effect to freshwater habitats during Project works without mitigation is Moderate within Te Awa Kairangi and Low within the tributaries. This is due to only a short-term temporary partial (for Te Awa Kairangi) and minor (for the tributaries) change away from existing baseline conditions where a minor effect will occur on the freshwater habitats. Therefore, the overall level of effects without mitigation is High for Te Awa Kairangi and Low for the tributaries.

Freshwater fauna

Aquatic macroinvertebrates

Te Awa Kairangi

The gravel extraction/ river bed disturbance activities that will be undertaken during Project works will directly impact the aquatic macroinvertebrate communities during Project works and for a period of time post completion of works.

It is anticipated that there will be a temporary decrease in the abundance and diversity of the macroinvertebrate community from Project works within affected areas of Te Awa Kairangi, and that this will result in the baseline conditions being discernibly or partially changed. However, in terms of the recolonisation of the macroinvertebrate community to impacted sites within the Project area, there are sources of healthy and diverse macroinvertebrate communities located upstream of Project area and these could resource the recolonisation of impacted areas. Following completion of Project works the natural recolonisation of macroinvertebrates into the affected area will occur over time.

Ecological values are High within Te Awa Kairangi Project area and the lower Te Awa Kairangi. Without mitigation the direct magnitude of effects on the aquatic macroinvertebrate community would be Moderate due to the potential for the temporary loss of species and a potential change to the baseline macroinvertebrate community, this combines to give an overall magnitude level of effect without mitigation of High.

Tributaries

Streambed disturbance within the tributaries could impact on macroinvertebrate communities. Any effects are expected to be localised and temporary with no lasting effects on the aquatic macroinvertebrate community following completion of the Project. Ecological values within the tributaries are moderate, and the effects on macroinvertebrates are expected to be low due to the temporary nature of the construction activity and only a minor shift away from existing baseline conditions. This results in an overall 'Low' level of effect.

Freshwater fish

Te Awa Kairangi

A diverse fish community is present within Te Awa Kairangi Project area, of which several 'At risk' and one 'Nationally vulnerable' species where identified. Of these, bluegill bully were the dominant species identified. It is likely that overall, this species is most at risk from direct impacts due to gravel extraction. Primarily, as bluegill bully were the numerically dominant species, and are expected to spawn and live within the swift water clean cobble areas within riffle habitats of Te Awa Kairangi.

Overall, it is anticipated that impacts of gravel extraction on fish species will occur at the impact site, as a result of:

- Change from preferable habitat (riffle) to non-preferable habitat (run) at the impact site
- Displacement of fish at the impact site to downstream habitats during gravel extraction
- The restriction of upstream movement
- Potential changes to fish movement associated with spawning behaviour

Although Project works are short term and temporary in nature, it is considered likely that gravel extraction works will contribute to a temporary decline of fish abundance and diversity within affected areas of Te Awa Kairangi.

In summary, ecological values are High within Te Awa Kairangi in the Project area and the lower Te Awa Kairangi. Without mitigation the direct magnitude of effects on native fish would be Moderate due to the baseline condition being partially changed temporarily and the overall effect without mitigation is High.

Tributaries

The fish population present in the tributary streams was sparse and appeared to be restricted to shortfin eel and banded Kōkopu (both are non-threatened native species). Although fish diversity and abundance within the tributary sites was low, Project works are still likely to impact any fish species that may be present within the tributary sites. Any effects are expected to be short term and temporary and are expected to potentially have only a discernible change to the baseline condition.

Ecological values are Moderate within the Project area tributaries. Without mitigation the direct magnitude of effects on the fish community would be Low due to the baseline condition being discernible changed temporarily. Following completion of Project works the underlying character of the environment will be similar to predevelopment where there hasn't been a loss in open stream length and overall there will be a Low level of effect.

Fish spawning and migration

Fish spawning

Multiple fish species present in Te Awa Kairangi catchment utilise available habitat in the catchment for spawning. Of particular note is the identification of potential inanga spawning habitat within the lower Te Awa Kairangi nearer the section of tidal influence. In addition to inanga, bluegill bully are also known to spawn in the clean gravel/cobble reaches of the Project area and the kōkopu species may spawn in the immediate riparian vegetation of the tributaries if appropriate habitat is available.

Project works are likely to occur during the spawning periods for fish species known to inhabit Te Awa Kairangi catchment. Therefore, there is potential for the proposed works to affect one or more key elements of the existing spawning habitat for fish species likely to spawn within the Project area. Additionally, without a robust management and monitoring plan the loss of a moderate proportion of the known population or range of the key identified species could occur. This could result in a partial change in the existing baseline compositions of fish populations that spawn within the Project area, this is consistent with a moderate magnitude of effect.

Ecological values are High within Te Awa Kairangi within the Project area and the lower Te Awa Kairangi. Without mitigation the potential magnitude of effect is Moderate. For Te Awa Kairangi a combination of a High ecological value and a Moderate magnitude of effect without mitigation combines to give a High overall level of effect.

Moderate ecological value within the Project area tributaries along with moderate magnitude of effect will result in an overall level of effects without mitigation of moderate.

Migration

Multiple fish species present in the wider Te Awa Kairangi catchment migrate both upstream and downstream within the main Te Awa Kairangi and to many of the tributary streams during different stages of their lifecycle. The Project works are likely to occur during fish migration periods for species known to occur within Te Awa Kairangi catchment. Therefore, there is potential for the proposed works to affect one or more key elements of the existing population or range for migrating fish species within the Project area. This could result in a temporary partial change in the existing baseline composition of the fish community.

High ecological value in Te Awa Kairangi along with a moderate magnitude of effect will result in an overall high level of effects without mitigation. Moderate ecological value in the tributaries along with a moderate magnitude of effect will result in an overall moderate level of effects without mitigation.

Actual and potential permanent effects from Project works (operational)

Freshwater habitat

The replacement Melling bridge and the pedestrian bridge and rock lining on the river banks will result in permanent features being constructed both on the riverbanks and within Te Awa Kairangi river channel. Current design indicates that three piles will be constructed within or immediately adjacent to the active river channel for the replacement Melling Bridge, and one pier will be constructed immediately adjacent to the active river channel for the pedestrian / cycle bridge, while rock lining work would be limited to downstream areas of the Project area and limited to river banks only. An area of approximately 53 m^2 of surface riverbed habitat will be occupied by permanent works for bridge piles. The design of the two bridges has been optimised to minimise the number of piers within the main river channel.

Whilst the permanent structures and the rock lining will result in a permanent change to the riverbed, the underlying character of the surrounding riverbed will revert to conditions similar to pre-development, and will result in only a minor change from the baseline condition due to the minor loss of riverbed habitat. The loss of habitat is not anticipated to change the known freshwater fauna community present in the impacted reach. Consequently, while ecological values are High within the Project area, the potential magnitude of effect from the construction of the new bridge pilling on the river habitat is Low due to a minor change in the baseline condition. However, this is not anticipated to change the known freshwater fauna community present in the impacted site. This results in an overall level of effect of Low without any mitigation.

Stream habitat loss at Harbour View Stream

The middle reach of Harbour View Stream is to be realigned and piped to the south of its current position. The affected reach will be where the additional SH2 lanes are required for the new interchange. This will result in the loss of approximately 25 linear metres of stream habitat to infilling. The section of stream that is to be piped has been assessed as having Moderate ecological value.

The loss of this open channel has been identified within the Project design as being unavoidable, due to the relocation of the Melling bridge (i.e. location of Melling bridge abutment) and widening of SH2. Post the construction of the Melling bridge and SH2 realignment the stream reach will not be able to be reinstated due to topographical and spatial constraints. Additionally, the new piped section will not provide fish passage as it is being connected to the very steep existing pipe which conveys water under Harbour View Road. This replaced pipe section will therefore have a grade and size to tie into this existing upstream network which will prevent fish passage from occurring.

The loss of this section of stream will alter the existing baseline features of the reach. Additionally, the proposed loss of stream length will fundamentally change the post-development composition of the affected reach. Harbour View Stream has been assessed as having moderate freshwater values. A moderate freshwater value, combined with a high magnitude of effect, results in a high overall level of effect. The loss of this reach of the Harbour View Stream cannot be avoided, remedied or mitigated. Accordingly, offsetting of this effect by improving the ecology at a proposed offset site is proposed.

Fish passage

Tirohanga Stream

Project works that are occurring within this area are not expected to have an effect on the current culvert placement or alignment. Therefore, there is no expected effects to fish passage from the intended Project works.

Tirohanga Intersection Stream

The existing SH2 culvert that interacts with the Tirohanga Intersection Stream is perched. Migratory fish (e.g. shortfin eel and banded kōkopu) were identified upstream of the culvert, this indicates that fish passage is occurring at times. However, this is likely limited by high water velocity, culvert gradient, length of culvert, and the outlet perch which is probably restricting fish passage to climbing species only.

The Project works will see the Tirohanga Intersection culvert replaced with a culvert that is in accordance with the stream simulation design principles within the NZ Fish Passage Guidelines. By following the best practice outcomes within the Guidelines there is likely to be an improvement in fish passage at this culvert. As a result, the culvert replacement is expected to have a positive effect on fish passage.

Harbour View Stream

Fish passage is currently restricted in the Harbour View Stream by the perched upstream culvert outlet and extensive piped sections under SH2 and Harbour View Road (approximately 120 m and 90 m, respectively). No fish or koura (freshwater crayfish) were observed during the survey of the open channel reaches. Piping of the open channel will result in further restrictions to any potential or future fish passage. Adverse effects on fish passage already exist due to the length of stream currently piped and its gradient under SH2 and the gradient and high velocities within the upper Harbour View Road piped section. However, through piping the remaining section, fish passage will be further limited which may result in the potential loss of the range of species in the area.

Overall, the magnitude of effect without mitigation is High, due to a loss and alteration of the baseline condition, and the overall level of effect is High in terms of effects of Project works on fish passage in the absence of mitigation.

Jubilee Park

The design includes the upgrade and replacement of the culvert outlet at Jubilee Park. There are no works that will incur the loss or disturbance of stream habitat (outside of that which is expected during culvert upgrading). Jubilee Park Stream outlet will not be designed in accordance with NESFW culvert requirements; however, the use of automated back flow prevention structures will be in accordance with NESFW requirements for flap gates, which means works to this culvert will not preclude fish passage should passage become possible in future.

Cyanobacteria and periphyton growth

The Project works will result in the permanent modification of approximately 3 km of Te Awa Kairangi. This will result in changes to the morphology of the river channel, and in turn could result in changes in river hydrology (including water velocity and water depth). These changes can impact on growth rates, composition, distribution, and abundance of cyanobacteria and periphyton species.

An assessment of potential low, median and high flow scenarios has been undertaken to determine the potential for changes to the extent of cyanobacteria and periphyton growths as a result of changes to channel morphology. Under all three modelled scenarios, there does not appear to be a large impact on the distribution and extent of water depths and velocities. Any observed changes are not likely to change the extent of cyanobacteria and periphyton growths through changes to channel morphology. Te Awa Kairangi within the Project area is considered to be of High ecological value. The magnitude of effect on the Project from cyanobacteria and periphyton as a result of the proposed changes to river channel morphology is Low. As a result, the overall level of effect is Low.

9.7.4 Measures to avoid, remedy, mitigate or offset effects on freshwater ecology values

Measures are proposed to address adverse effects on ecological values which are expected to incur a ‘moderate’ or higher level of effects as a result of the Project. As such, effects management measures are required to address adverse effects on:

- The potential release of sediment and cement wash within and downstream of the Project area;
- Potential effects on freshwater habitat during construction;
- Freshwater fauna: particularly aquatic macroinvertebrates and freshwater fish within the Te Awa Kairangi;
- Fish spawning within the Project area; and
- Loss of stream habitat and fish passage at Harbour View Stream.

The overall approach to managing adverse effects of the Project on freshwater ecology follows the effects management hierarchy, in accordance with principles outlined in the PNRP. The hierarchy requires that:

- Adverse effects are avoided where possible;
- Adverse effects that cannot be demonstrably avoided are minimised/remedied where possible;
- Adverse effects that cannot be demonstrably minimised are mitigated; and
- In relation to adverse effects that cannot be avoided, remedied or mitigated (residual effects), biodiversity offsetting is considered.

The full detail of how effects on freshwater ecology will be addressed is to be further developed in an Ecological Management Plan (EMP) and the ESCP; however, a summary of the proposed measures to be incorporated into management plans is provided below.

Sediment and cement wash discharges during Project works

To mitigate the potentially significant effects of sediment on water quality and in-stream ecology, an ESCP with Site Specific Erosion and Sediment Control Plans (SSESCP) will be developed. The ESCP and potential changes to water quality during the construction period are described in detail in section 9.4 above.

Monitoring of fine sediment (< 2 mm) cover downstream of the works areas will also be undertaken, with trigger levels to be developed. An adaptive approach to sediment control will be taken whereby if trigger levels are exceeded, additional treatment or limits on construction activities will be required.

Overall, as a result of the proposed controls, the effects on water quality from sediment and cement wash discharges are expected to be minor within Te Awa Kairangi and in the tributary streams.

Freshwater habitat

To minimise effects on freshwater habitat impacted by Project works, the length of river subject to gravel extraction at any one time will be limited to a maximum worked reach of 500 m, for no more than 12 hours per day and taking place on no more than 5 consecutive days.

To understand how the Project works are affecting the benthic habitat within each of the impacted river lengths, sediment particle size distribution monitoring will be undertaken at each of the impacted reaches to understand how the benthic habitat recovers from the Project works. Sampling will occur directly at the impacted reaches and at an upstream control site and will occur on four occasions: once ‘before’ impact, once ‘immediately after’ impact, and once four and seven weeks after the ‘immediately after’ sampling event. This will provide information on benthic habitat recovery. The results from these surveys will be interpreted in quarterly reports to assess the effectiveness of the ESCP, SSESCPs, and construction methodology. Any improvements to construction methodology and erosion and sediment control practices will be proposed and methodologies will be amended accordingly.

With the implementation of these measures, the overall effect of the Project on freshwater habitat is expected to be minor.

Freshwater fauna

To understand how the Project works are affecting the freshwater fauna within each of the impacted river lengths, fish and macroinvertebrate monitoring will be undertaken at each of the impacted reaches to understand how the fish community recovers from the Project works. Sampling will occur directly at the impacted reaches and at an upstream control site and will occur on four occasions: once ‘before’ impact, once ‘immediately after’ impact, and once four and seven weeks after the ‘immediately after’ sampling event. This will provide information on what species are recovering quicker and which are more sensitive to gravel removal. The results from fauna monitoring will be interpreted in quarterly reports to assess the effectiveness of the ESCP, SSESCPs, and construction methodology. Any improvements to construction methodology and erosion and sediment control practises will be proposed and methodologies will be amended accordingly.

With the implementation of these measures, the overall effect of the Project on freshwater fauna is expected to be minor within Te Awa Kairangi and in the tributary streams.

Fish spawning and migration

Direct effects of in-stream works on freshwater fish cannot be avoided during construction works. Fish Recovery Protocols will be implemented as part of the EMP, which includes fish salvage and relocation and provision of fish passage.

In regard to īnanga spawning if Project works are to occur during spawning season (March to July, inclusive), then prior to construction activities occurring, a survey to assess actual īnanga spawning is undertaken. If īnanga spawning is identified, then that habitat should be avoided between March to July inclusive. Any removal of identified īnanga spawning habitat should be replaced once Project works within the potential spawning locality are completed. With regard to Bluegill Bully spawning, the proposed works stand down period effectively addresses potential effects.

Potential disruption of native fish spawning and migration will be minimised through the development and implementation of the ESCP and SSESCPs, and stand-down periods for in-stream works and removal of potential īnanga spawning habitat. With the implementation of these measures, the overall effect of the Project on fish spawning and migration is expected to be minor within Te Awa Kairangi and in the tributary streams.

Loss of stream habitat within Harbour View Stream

Approximately 25 linear metres of stream habitat will be lost within the Harbour View Stream. As the stream loss cannot be avoided, remedied or mitigated, biodiversity offsetting is proposed to address the residual effects. The stream ecological valuation (SEV) methodology will be utilised to determine the quantum of stream offset works required to achieve no net loss of ecological function. This will account for the loss of values and adequately offset the effects resulting from the loss of habitat. A Stream Offset Plan will be prepared prior to the start of construction, which addresses the required offset, including location and type of offset.

9.7.5 Conclusion

Short-term effects on freshwater ecological values during the Project works phase could include the temporary modification of freshwater habitats, fish injury and/or mortality, temporary fish migration and spawning restrictions, and water quality effects resulting from sedimentation and cement wash. These Project works effects will be minimised through the implementation of fish salvage protocols, good practice ESC measures, and construction methodologies, such that the overall effects during the Project works are expected to be minor.

Potential long-term effects anticipated to occur from the Project include reduced fish passage within the Harbour View Stream and loss of stream ecological function and habitat area within Harbour View Stream. A variety of measures to avoid, minimise and mitigate the long-term effects of the Project are proposed to be implemented.

While many of the potential effects have been avoided, or minimised and mitigated to the extent possible, there are residual adverse effects resulting from the loss and modification of stream habitat within Harbour View Stream. These residual effects are proposed to be addressed by offsetting, which is aimed at achieving no net loss of ecological function.

During the construction process, efforts will be made to refine the design to further reduce effects on the freshwater ecology values identified within the Project area. Accordingly, the final amount of stream offset required will be calibrated to reflect the effects of the Project and the ecological gains that are achieved. Overall, the proposed mitigation and offset measures are expected to appropriately address the long-term effects of the Project on freshwater ecology.

9.8 Terrestrial ecology

Overview

The current land use within and adjacent to the RiverLink Project area is dominated by urban, recreational, residential and industrial uses. Indigenous forest and scrubland persist on the northern hillsides on the western side of the Te Awa Kairangi. Multiple areas of ecological significance have been identified in the landscape surrounding the Project area, both in the PNRP and the District Plan. Two significant natural resources sites (SNRs14 and 21) adjoin the proposed designation boundary. The potential effects on these areas are limited.

Eight vegetation/habitat types have been identified within the Project area. These habitats range in ecological value from negligible to high. The primary impact will be on the tall stature exotic vegetation, namely willows that have been planted for flood protection, 15.89 ha of this habitat type will be cleared. While this vegetation type has limited botanical value, it provides habitat for common native birds and the native carnivorous land snail W. urnula and has been assigned an ecological value of 'Moderate'. A further 1.65 ha of mixed broadleaved forest and scrub (including 0.05 ha of mature native vegetation), also assessed as having 'Moderate' ecological value is proposed for removal. The other vegetation/habitat types impacted are considered to have Negligible to Low ecological values, except for gravel beach habitat considered to be High value, which will be temporarily removed.

A total of 23.90 ha of vegetation/habitat mapped within the Project area is proposed for removal. This calculation does not include the gravel beach habitat as its spatial extent varies naturally and thus has not been measured.

Three nationally Threatened and At Risk plant species were identified in the Project area (plus two naturalised native species), and several other regionally Threatened or At Risk species could potentially occur in the Project area but were not confirmed during site investigations. Numerous Threatened or At Risk bird species are known to use habitat downstream of the Project area and likely disperse along the river corridor, through the Project area, on occasion. Threatened or At Risk species confirmed as regularly using the Project area include red-billed gulls, pied shag, black shag and New Zealand pipit. No Threatened or At Risk terrestrial invertebrate species were identified in the Project area, but two notable species, the native land snail *Wainuia urnula*, and the velvet worm *Peripatoides novaezealandia*, were incidentally recorded. One species of lizard, the Not Threatened northern grass skink was recorded in the Project area, but the mixed broadleaved forest and scrub adjacent to SH2 has been assessed as potentially supporting other lizard species including At Risk geckos and skinks.

A range of potential short and long term effects are anticipated as a result of the Project, including disruption of nesting and potential injury to birds, as well as a permanent loss approximately 23.90 ha across the eight identified vegetation/habitat types (excluding gravel beach habitat). This includes 1.65 ha of mixed broadleaved forest and scrub which has a largely native dominated canopy (including 0.05 ha of mature native vegetation).

A variety of measures to avoid, minimise, mitigate or offset the potential effects of the Project on terrestrial ecological values are proposed to be implemented. These measures include pre-clearance surveys to ensure birds are not nesting within areas to be cleared, seasonal restrictions on vegetation clearance in higher-value habitats, and re-vegetation to replace lost habitats.

Overall, the proposed mitigation measures will appropriately address the effects of the Project on terrestrial ecology, with overall effects on terrestrial ecological values expected to be low to very low.

9.8.1 Introduction

This section summarises the findings of the assessment of the actual and potential terrestrial ecology effects arising from the Project. The full assessment is contained in the Terrestrial Ecology Assessment (Technical Report #7).

9.8.2 Assessment of effects on terrestrial ecology

Vegetation

A total of 23.90 ha of vegetation is to be cleared for the project, out of a total designation footprint of 26.96 ha.

A significant proportion of vegetation in the Project area (15.89 ha or 67% of vegetation to be cleared) is tall stature exotic planting planted for flood protection, which is required to be removed to facilitate the reshaping of the River. This vegetation type has limited botanical value but provides habitat for common native birds and a carnivorous land snail and has been assigned an overall ecological value of ‘Moderate’.

Approximately 1.65 ha of mixed broadleaved forest and scrub will be removed to facilitate the construction of the new Melling Bridge and associated interchange upgrade. The majority of the areas of mixed broadleaved forest and scrub being impacted by the Project occur immediately adjacent to SH2 and are degraded by associated edges effects and pest plant incursions. Notwithstanding this, some individual mature native trees including hīnau, tawa, tītoki, pōhutukawa and pukatea will be removed (totalling 0.05 ha). The vegetation removal will also result in the creation of new habitat edges, altering the composition and health of adjacent vegetation.

Edge effects will be limited to the mixed broadleaf forest as the other habitat types are already isolated amongst a highly modified landscape generally characterised by mown grass or developed areas. Any reduction in landscape / habitat connectivity from the Project will be minimal for the same reason.

The overall level of effect without mitigation on habitat types within the site range from Very Low to Moderate, with the majority being Very Low or Low.

Two SNRs, Jubilee Park Bush (SNR21) and Harbour View Bush (SNR14), are located adjacent to the Project area.

No vegetation will be removed from either SNR as a result of the Project. However, given the proximity of the SNRs to the works, habitat degradation resulting from edge effects could arise due to adjacent works.

The extent of the edge effects is likely to be limited as both impacted SNR margins are already near an existing edge, and the works footprint is setback from the SNR margins by a minimum of approximately 10 m. Hence vegetation will be retained between the footprint and the edge of the SNR, and the SNR edge will not be fully exposed. Furthermore the works are occurring downslope so sediment runoff will not be an issue.

A small number of individual Threatened or At Risk species, including planted and non-planted kānuka, mānuka and northern rātā will be removed during vegetation clearance, namely within areas of 'mixed broadleaved forest and scrub' and 'native amenity plantings'. As these species are widespread, the loss of a small number of individual plants will not have a discernible effect on the populations in the wider landscape, and as such the magnitude of effect of their loss is considered Negligible, resulting in an overall effect of Low.

There is a small possibility for small numbers of Regionally Threatened or At Risk plants to be present within the Project area, such as *Eryngium vesiculosum, Geranium retrorsum and Hypolepis dicksonioides*. These species are known to occur in the Hutt Valley, however, the population sizes of these plants in the wider landscape are unknown but likely to be limited. The potential level of effect without mitigation on these species is assumed to be Moderate to Low, given these species have not previously been identified in the Project area, the limited scale of clearance of the broadleaved forest and scrub (the most suitable habitat for the particularly cryptic species), and the level of degradation of the habitat being removed relative to the habitat available in the surrounding hills. All of these factors suggest it is highly unlikely that these species have been overlooked. If they are present, it is very unlikely to be more than the occasional individual.

Terrestrial invertebrates

Potential direct impacts on terrestrial invertebrates include mortality and habitat loss during vegetation clearance. Potential indirect effects include displacement into adjacent habitats and habitat degradation resulting from the creation of new edges. Notable invertebrate species (*W. urnula* and *P. novaezealandiae*) were observed in the 'tall statue exotic planting' and in an area contiguous with the 'mixed broadleaved forest and scrub'. Other species of native land snail occur in the forested hillslopes forming the eastern boundary of the Hutt Valley, and may also occur in habitats on the site.

As outlined previously, a large extent of 'tall stature exotic planting' (15.89 ha) is required to be removed. It has limited ecological value but is inhabited by the carnivorous land snail, and has been assigned an ecological value of Moderate. The removal of this habitat will likely result in the mortality of all snails resident in the habitat unless salvage undertaken; this could result in the loss of a high proportion of individuals of the local population. The magnitude of effect without mitigation has been assessed as High.

Approximately 1.65 ha of 'mixed broadleaved forest and scrub' is proposed for removal, which amounts to less than 1% of the forested habitat that covers the western hillslopes of the Hutt Valley. As a result, this is unlikely to result in discernible effects on the peripatus population at a local or landscape scale.

Effects on other terrestrial invertebrate species are considered to be Low-Negligible as a small amount of potential habitat is proposed for removal, most of these habitats are highly modified, and Threatened species have not been identified in the wider Hutt Valley area.

Lizards

The Project requires removal of 15.9 ha of 'tall stature exotic planting (flood protection)' and 1.9 ha of 'rough grassland/ weed field' over approximately 3.5 km of the River length within the Project area. While these habitats appeared suitable for ground-dwelling skinks, the lack of observations despite a comprehensive survey effort throughout Project area suggests this area contains negligible herpetofauna values.

The removal of 1.65 ha of 'mixed broadleaf forest and scrub' equates to approximately 46% of the 3.7 ha of that habitat type available within the Project area, but only 0.13% of the adjacent indigenous forest habitats. The effect would represent a minor shift from baseline character and quantum, and therefore a Low magnitude of effect without mitigation on herpetofauna populations would likely result.

Given the limited mobility of lizards, the removal of this habitat will likely result in the mortality of lizards resident in the habitat unless salvage is undertaken. Notwithstanding a low magnitude of effect, native lizards are protected under the Wildlife Act 1953 and hence management to minimise mortality during habitat removal will be required to meet statutory obligations under the Act, as well as good practice no net loss biodiversity outcomes. The vegetation clearance will also create new edges, subjecting adjacent habitat to increased edge effects resulting in habitat degradation resulting from weed and pest invasion and higher levels of exposure to wind and light. However, given the limited width of the existing edge being removed, it is likely that the adjacent habitat is already exposed to edge effects to varying degrees. The magnitude of effect without mitigation has been assessed as 'Low'.

Birds

There are several species of riverine birds which have been confirmed to regularly use the river corridor within the Project area, including the red-billed gull and the pied shag. There are also a number of riverine and coastal bird species which use habitats downstream of the Project area, such as shore plover and white heron. Black-billed gulls have also been observed upstream of the Project area. The large scale modification of the river channel as a flood measure management will have effects on coastal and riverine birds. Effects on coastal and riverine birds within and downstream of the Project area are expected to include:

- During the Project construction, there will be a temporary removal of all gravel beach habitat within the Project area, which could result in disturbance of roosting birds and potential injury and/or death (this is considered to be very unlikely)
- A potential decrease in habitat quality downstream due to sedimentation effects, and
- Total removal, and associated disturbance, of 15.9 ha of tall stature exotic vegetation along the river corridor which is potentially used by shags for roosting.

The potential magnitude of effect without mitigation is considered to be Moderate for riverine birds (excluding black shag) using the Project area, and Low for riverine and coastal birds downstream of the Project, given the temporary nature of the works and the small proportion of total available habitat which will be affected.

Works are proposed adjacent to a known black shag nesting site beside SH2. There is potential for long-term damage to the site resulting from root disturbance of the macrocarpa tree that provides the nesting site. The potential magnitude of effect on black shag is therefore considered High in the absence of mitigation measures, given the risk of disturbance or destruction of a confirmed nesting site.

A number of At Risk forest birds have been confirmed in the surrounding Hutt Valley area and may visit and/or move through the Project area. Potential effects on forest birds include:

- Loss of 1.65 ha of mixed broadleaved forest and scrub comprising roosting, foraging and nesting habitat for native birds. The habitat preferences of the At Risk forest birds suggest it is very unlikely that the other habitat types which are to be cleared as part of the Project works are of value them
- Edge effects along areas of clearance degrading adjacent habitat remaining
- Potential, although unlikely, disturbance, injury and/or death during vegetation clearance for any birds nesting within trees to be cleared, and
- Potential for temporary indirect effects from dust and noise during construction.

There is a potential risk of mortality or injury to riverine, coastal and forest bird species from vehicle strike and movement barrier associated with the new Melling Bridge, however, this is considered unlikely given the number of bridges already occurring in the existing environment.

Whilst the ecological value of forest birds is Moderate, because there remain significant areas of high quality habitat outside the Project area and no At Risk forest birds have been observed regularly in the habitat to be removed, the magnitude of effect without mitigation is considered to be Low, the overall level of effect of the Project without mitigation on forest birds is expected to be Low.

The At Risk New Zealand pipit has been confirmed as present in the Project area. The temporary loss of all mown grassland during construction (to be replanted following construction of stopbanks) will result in a temporary loss of foraging habitat for the pipit. Approximately 1.9ha of rough grassland / weed field (potential nesting habitat) will be permanently lost as a result of the Project. These result in a minor loss of foraging habitat for NZ pipit. There is also potential for disturbance, injury and/or death during clearance for any pipit nesting within the grassland / weed field to be cleared. The potential magnitude of effects on the pipit is Low, which combined with a High ecological value, results in an overall potential Low level of effect on pipit in the absence of mitigation.

Bats

No effects on native bats are anticipated from the Project.

9.8.3 Measures to avoid, remedy, mitigate or offset effects

A range of measures are proposed to address potential adverse effects of the Project on terrestrial values. Effects management measures are proposed for all habitats and species which have been assessed as having an overall level of effect of ‘Moderate’ or higher prior to mitigation measures. The ‘effects management hierarchy’ has been applied, whereby effects are avoided where possible, then minimised, mitigated and finally offset to address residual adverse effects.

The detailed methodology for implementing the effects management measures will be developed through the Ecology Management Plan, which will document the permanent mitigation measures, including restoration, management and maintenance of ecological mitigation.

Measures to avoid, minimise, mitigate or offset effects

Measures to avoid, minimise and, mitigate effects during the construction of the Project include:

- Minimisation of vegetation loss, including through site management and the construction methodology, and through the use of vegetation protection fencing (or similar) to delineate the zone of works
- Staged vegetation clearance with revegetation as soon as practicable to minimise the cleared area at any one time
- The black shag nesting site will be avoided. An arborist assessment will be undertaken to establish setbacks from the macrocapa black shag nesting site, and monthly surveys of the roosting colony by an ecologist when works are occurring in proximity (within 50 m). If there are signs of abandonment, adaptive management measures will be implemented
- Vegetation clearance of the ‘mixed broadleaved forest and scrub’ habitat adjacent to SH2 will avoid peak forest bird breeding season (September – January inclusive). This habitat is considered the highest value potential bird breeding habitat in the Project footprint. For the remaining areas of vegetation clearance, these are much lower habitat quality. Consequently, rather than blanket seasonal restrictions, pre-clearance nesting surveys will be undertaken to establish that there are no birds present
- Vegetation clearance in lizard habitats should be avoided during colder months (May-August) when lizards are less active and less likely to be detected or survive relocation.

- Survey of ‘tall stature exotic planting (flood protection)’ prior to clearance for snails and salvage and relocation if found.
- Development of a Lizard Management methodology within the EMP which will outline standard practice survey and relocation methodology.
- Potential for disturbance, injury and/or death of NZ pipit during clearance will be minimised through the use of nesting deterrence methods such as mowing of rank grass.

Measures to avoid, remedy, minimise and offset effects following construction of the Project include:

- A minimum of 27.27 ha of revegetation will be undertaken in the Project area. This includes plant maintenance and weed control with the objective of improving the quality of revegetated areas over the long term compared to the levels of degradation of the existing vegetation in the Project area. Implementation of a replanting plan to return parts of the floodplain into indigenous forest. The exotic willows will be planted with an indigenous mix which will replace the native amenity planting removed. Proposed revegetation and landscaping is outlined in the Indicative Landscape Plan, Drawing Nos. A16-4381-L201-208, and will be undertaken wholly within the Project area. Replacement planting in the alluvial floodplain will offset the loss of habitat on the hillslope above SH2.
- Developing a landscape planting plan for the site as part of the EMP. The species mix for replanting will be selected to replace threatened or At Risk species of vegetation that will be cleared as a result of the Project, such as kānuka, mānuka, northern rātā.
- Promoting bird breeding in the river corridor by designing the river park to direct people away from specified gravel beaches to limit potential ongoing disturbance.
- The potential for injury and/or death from vehicle strike and movement barrier associated with the new Melling Bridge and other road upgrades will be mitigated through careful selection of roadside planting species to avoid species that attract foraging and hence minimising potential for vehicle strike.

With the implementation of these measures, the potential level of effects of the Project on terrestrial ecology are summarised below. Overall, the potential effects of the Project on terrestrial ecological values are expected to be minor or less than minor (low or very low) with the implementation of appropriate mitigation and offset measures.

Table 53 - Terrestrial Ecological Effect Summary

Ecological feature	Overall level of effect without mitigation	Overall level of effect with mitigation
Vegetation types		
Mixed broadleaved forest and scrub	Moderate	Low
Tall stature exotic planting with mixed understory	Low	Very Low
Constructed wetland	Very Low	Very Low
Native amenity planting	Very Low	Very Low
Low stature amenity planting	Very Low	Very Low
Dwellings with associated ornamental gardens	Very Low	Very Low
Rough grassland/weed field	Very Low	Very Low
Threatened and At Risk plant species		
Kānuka	Low	Low
Mānuka	Very Low	Low

Ecological feature	Overall level of effect without mitigation	Overall level of effect with mitigation
Northern rātā	Low	Low
Eryngium vesiculosum	High	Low
Geranium retrorsum	High	Low
Hypolepis dicksonioides	Moderate	Very Low
Korthalsella salicornioides	High	Low
Peraxilla tetrapetala	High	Very Low
Solanum aviculare var. aviculare	High	Low
Trichomanes elongatum	Moderate	Very Low
Terrestrial invertebrates		
Wainuia urnula urnula	Moderate	Low
Peripatoides novaezealandiae	Low	Very Low
Other terrestrial invertebrate species of note that may occur in the Project area including the At Risk land snail Allodiscus pallidus	Moderate – Very Low	Low– Very Low
Lizards		
Northern grass skink	Very Low	Very Low
Raukawa gecko*	Very Low	Very Low
copper skink*	Very Low	Very Low
ornate skink*	Low	Very Low
Ngahere gecko*	Low	Very Low
Barking gecko*	Low	Very Low
Threatened and At Risk coastal and riverine birds		
Black-billed gull	Moderate	Low
Shore plover	Moderate	Low
White heron	Moderate	Low
Reef heron	Moderate	Low
Caspian tern	Moderate	Low
Red-billed gull	High	Low
Pied shag	Moderate	Low
Black shag	Moderate	Low

* These species were not actually observed in the Project area but may occur in the area at very low numbers (in the case of Threatened and At Risk plants), or may use the area on occasion (in the case of more mobile fauna such as birds). Hence these species are expected to experience minimal adverse effects associated with the Project.

9.8.4 Conclusion

A range of terrestrial ecology values exist across the Project area and in the surrounding environment. The majority of these are considered to be reasonably low value due to the highly modified nature of the environment. However, some high value ecological features have been identified, including the presence of threatened and at-risk birds, notable invertebrate species and lizards.

An EMP will be developed and will incorporate a range of measures to minimise and mitigate effects on terrestrial values. With the implementation of these measures, the effects of the Project on terrestrial values are expected to be low or very low.

9.9 Marine ecology and coastal avifauna

Overview

The Project is located 3.5 km upstream of the Te Awa Kairangi river mouth, which is a tidal estuary. Marine ecology comprises of four locations with different sediment and taxa characteristics. High species diversity, richness and abundance is located on the Ngauranga to Petone foreshore. Moderate diversity, abundance and richness is located at the Te Awa Kairangi river mouth, Korokoro Estuary and Wellington Harbour. Coastal avifauna is diverse and includes a number of At Risk and Threatened species. Avifauna habitat within the coastal marine area downstream of the Project site includes riverine, estuarine, intertidal, near-shore and off-shore. These habitats provide foraging opportunities for coastal avifauna.

It is unlikely that there will be any more than a negligible amount of Project-related fine sediment that will reach the marine environment. A moderate marine ecological value and a negligible magnitude of effect of construction activities will result in an overall very low level of effect arising from the Projects' construction phase. Stormwater treatment will improve operational phase water quality and result in a net gain in ecological value resulting from the Projects' operation phase.

Low to very high avifauna ecological values along with a negligible magnitude of effect of construction-generated deposited sediment on prey times will result in an overall very low to low level of effect on coastal avifauna. Low to very high avifauna ecological values along with a negligible magnitude of effect of construction-generated suspended sediment on the foraging ability of coastal avifauna will result in an overall very low to low level of effect. Low to very high avifauna ecological values along with a positive magnitude of effect of operational stormwater on coastal avifauna will result in an overall Net Gain level of effect.

Proposed mitigation measures include the implementation of the ESCP and minimisation of production of fine sediment.

9.9.1 Introduction

This section summarises the findings of the assessment of the actual and potential marine ecology and coastal avifauna effects arising from the Project. The full assessment is contained in the Marine Ecology and Coastal Avifauna Assessment (Technical Report #8 in Volume 4 of the Application).

9.9.2 Assessment of effects on marine ecology

Assessment of construction effects

Marine Ecology

Construction activities involve land-based earthworks and disturbance of the riverbed material within flowing water causing mobilisation of natural sediments into the water column. The potential effects on the marine receiving environments from construction are related to sediment discharged from the earthworks and works in the river. Deposited sediment and TSS may, in turn, adversely affect sensitive marine organisms through smothering and clogging of filter-feeding structures and gills. Effects on organisms are a factor of volume of fine sediment (concentration of suspended sediment and depth of deposited sediment) and duration of exposure. The level of these effects also depends on the nature and values of the existing receiving environment. This can have negative impacts on the physiological condition of filter feeding taxa.

Marine Ecology Effects Threshold

Marine ecology effects thresholds were calculated to gain an understanding of the estimated area affected by suspended sediment at minimum biological effects threshold concentrations and durations of exposure. The effect on species and TSS concentrations are summarised below:

Table 54 - Laboratory trial results of the effect of TSS on marine invertebrates that are present in Wellington Harbour

Species	Effect detected	TSS concentration and duration of exposure at which effects were measured	Reference	Wellington Harbour
Pipi - (*Paphies australis*)	Reduced condition	75 g/m³ (exposure >13 days)	Hewitt et al., 2001	Uncommon. Unlikely to be present in the muddy upper harbour.
Wedge shell - (*Macomona liliana*)	Reduced survival	300 g/m³ (exposure >9 days)	Nicholls et al., 2003	Common
Cockle - (*Austrovenus stutchburyi*)	Reduced condition	400 g/m³ (exposure >7 days)	Hewitt et al., 2001	Common

Many marine invertebrates are susceptible to the discharge of sediment as most taxa have limited mobility, whereas fish, especially upper harbour species that are used to a muddy depositional environment, are highly mobile and will move to areas that are less affected for foraging. Tolerant communities are located in the Te Awa Kairangi river mouth and subtidal areas of Wellington Harbour, with some sensitive organisms located in the intertidal area located immediately adjacent to Te Awa Kairangi.

Sediment discharges

It is assumed that there will be negligible disturbance and transport of fine material to the marine environment throughout the earthworks phase of this Project. Elevated levels of TSS based on disturbance of sand sized particles within the water column are unlikely to reach effects thresholds for sensitive marine organisms of greater than 80mg/L for a duration of more than 3 days, as turbidity is likely to clear within an hour of works finishing or the conclusion of a flood event. Likewise, sediment deposition is unlikely to reach effects thresholds for sensitive species of more than 5-10mm for more than 3 days as the coarser sized particles will most likely fall out of suspension before they reach the marine environment.

There will be negligible cumulative effect of fine sedimentation in the harbour, as there is likely to be very little fine sediment associated with the works. Overall, the magnitude of effect of Project related sediment discharged to the marine environment is negligible, as change will barely be distinguishable, approximating to the “no change” situation. Moderate ecological value along with a negligible magnitude of effect will result in an overall very low level of effect.

Coastal Avifauna

The only potential construction effects of the Project on native coastal avifauna in the coastal marine area receiving environment (from Seaview Bridge to the Te Awa Kairangi river mouth and wider Wellington Harbour) that have been considered for this assessment are impacts of Project-generated sediment on the foraging ability of coastal avifauna and their food supply. These effects are only of relevance during the construction phase of the Project.

Potential impacts on food supply and foraging ability

Construction will result in mobilisation of natural bed sediments into the water column and associated deposition from land-based earthworks and disturbance of riverbed material. This may result in adverse effects on marine quality and impair the ability of visual foragers to locate prey. Increased deposition can smother and potentially kill benthic invertebrates and reduce prey availability for coastal avifauna. Prey fish may also be reduced in availability as a result of suspended sediments clogging gills.

Any potential effects on coastal avifauna are dependent on the amount of construction-associated sediment generated over and above baseline sediment levels, as well as the substrate grain sizes of the sediments. Potential effects are also dependent on the duration of exposure.

The locations where suspended sediment will deposit include Te Awa Kairangi itself and the river mouth. The assessment of effects on marine ecology above has determined that elevated levels of total suspended sediments based on disturbance of sand-sized particles within the water column are unlikely to reach effects thresholds for sensitive marine organisms. Likewise, sediment deposition is unlikely to reach thresholds for sensitive marine organisms.

The overall magnitude of effect of Project-related sediment discharged to the marine environment has been assessed as negligible. The impact of construction-generated sediment is considered to have a negligible effect on coastal avifauna within the Wellington Harbour coastal marine environment. A negligible magnitude of effect on low to very high value coastal avifauna species results in a Very Low to Low Overall Level of Ecological Effect.

Negative impacts on visual foragers will be negligible given the small amounts of Project sediment volume that will be generated above baseline levels (of which only a very small amount (<0.5%) of will include fine material (silt and clay)), the methods in place to manage suspended sediments, and the fact that materials will settle out in Te Awa Kairangi itself and the river mouth. Furthermore, these species are already subject to sedimentation in the River and associated elevated TSS levels as a result of rain and flood events in the catchment and as such should be habituated to changes in visual clarity while foraging. These species are also mobile and can move to other foraging networks if required. The impact of construction-generated suspended sediment loads will have a negligible magnitude effect on key coastal avifauna. A negligible magnitude of effect on low to very high value avifauna species results in a Very Low to Low Overall Level of Ecological Effect.

Potential effects on the Te Ara Tupua coastal avifauna mitigation measures

The coastal avifauna mitigation measures for the consented Te Ara Tupua project include the construction of offshore island roosting habitat in Wellington Harbour, predator control and the installation of little blue penguin nest boxes. None of these measures will be impacted by sediment discharge effects from the RiverLink Project.

Assessment of operational effects

Marine Ecology

Stormwater

Stormwater contaminants in surface sediment of the receiving environment are currently generally high. Stormwater treatment will be provided for in the Project where space and gradient allow for it to be built into the design It is unlikely that contaminants from the Project will influence the overall sediment contaminant concentrations given that high baseline of sediment contaminants and the low residual contaminant load in treated stormwater discharges. The magnitude of effect of any long-term change in sediment quality is expected to be positive and therefore there will be a net gain in marine ecological values.

Coastal Avifauna

Stormwater

The only potential operational effects considered for coastal avifauna are changes in sediment quality (i.e. stormwater contaminants) and associated bioaccumulation effects in prey as a result of the Project. The above marine ecology assessment determined that the magnitude of effect of any long-term change in sediment quality as a result of the Project's stormwater treatment will be positive and will lead to an overall net gain on marine ecological values in the receiving Wellington Harbour CMA environment. It is considered that the magnitude of effect changes in sediment quality associated with the Project will be positive for coastal avifauna within the receiving environment. A positive magnitude of effect on low to very high value avifauna species results in a Net Gain Level of Effect on coastal avifauna.

Summary

The construction and operational effects of the proposed Project on the marine receiving environment are summarised below:

Table 55 - Summary of construction and operational effects on the marine ecology and coastal avifauna

Ecological Component	Type of Effect		Species	Ecological Value	Magnitude of Effect	Overall level of effect
Marine Ecology	Construction	Sediment discharges	-	Moderate	Negligible	Very Low
	Operation	Stormwater	-	Moderate	Positive	Net Gain
Coastal Avifauna	Construction	Sediment discharge effects on food supply and foraging ability	Black-billed gull	Very High	Negligible	Low
			Reef heron	Very High	Negligible	Low
			Caspian tern	Very High	Negligible	Low
			Little blue penguin	High	Negligible	Very Low
			Red-billed gull	High	Negligible	Very Low
			South Island pied oystercatcher	High	Negligible	Very Low
			White-fronted tern	High	Negligible	Very Low
			Australasian pied stilt	Moderate	Negligible	Very Low
			Royal spoonbill	Moderate	Negligible	Very Low
			Pied shag	Moderate	Negligible	Very Low
			Variable oystercatcher	Moderate	Negligible	Very Low
			Fluttering shearwater	Moderate	Negligible	Very Low
			Black shag	Moderate	Negligible	Very Low
			Little black shag	Moderate	Negligible	Very Low
	Operation	Stormwater discharge effects	Black-billed gull	Very High	Positive	Net Gain
			Reef heron	Very High	Positive	Net Gain

Ecological Component	Type of Effect		Species	Ecological Value	Magnitude of Effect	Overall level of effect
			Caspian tern	Very High	Positive	Net Gain
			Little blue penguin	High	Positive	Net Gain
			Red-billed gull	High	Positive	Net Gain
			South Island pied oystercatcher	High	Positive	Net Gain
			White-fronted tern	High	Positive	Net Gain
			Australasian pied stilt	Moderate	Positive	Net Gain
			Royal spoonbill	Moderate	Positive	Net Gain
			Pied shag	Moderate	Positive	Net Gain
			Variable oystercatcher	Moderate	Positive	Net Gain
			Fluttering shearwater	Moderate	Positive	Net Gain
			Black shag	Moderate	Positive	Net Gain
			Little black shag	Moderate	Positive	Net Gain

9.9.3 Measures to avoid, remedy or mitigate effects

Construction

Mitigation of sediment discharge effects will be achieved by using best practice erosion and sediment control management, to reduce the amount of sediment that leaves the earthworks site and implementing adaptive management and continuous improvement principles. Other measures include:

- Measurement of water quality at sediment pond outlet, and upstream and downstream locations.
- Minimisation of the deposition of fine sediment in the marine environment should be prioritised over monitoring, as it is unlikely that results of deposition will be distinguishable.

9.9.4 Conclusion

The marine ecological values within the receiving environment are moderate. The upper reaches of the Harbour comprise fine sandy/mud and receive a high baseline load of sediment currently. The coastal avifauna ecological values within the Wellington Harbour CMA receiving environment range from low to very high.

Potential effects of the Project on the marine and coastal avifauna ecological values may occur from the discharge of construction phase fine sediment and the discharge of operational phase stormwater. Recommended measures to minimise sediment runoff include erosion and sediment control designed to GW and Waka Kotahi guidelines and standards, staging of works and storm event weather forecasting in order to stabilise open areas prior to the storm event occurring.

Sediment associated with the proposed river and land based works is unlikely to contain any more than a negligible amount of silt and clay and is therefore unlikely to have significant adverse effects in the marine receiving environment benthic habitats and on the coastal avifauna food supply and foraging ability.

Overall, with appropriate mitigation, it is considered that adverse effects would be very low.

9.10 Traffic and transportation

Overview

The Project delivers the following significant positive transport and traffic effects:

- The Project will support and enable an increase in the mode share for active and public transport modes, which is in accordance with several key national and local policies and strategies
- Improved safety to cyclists and pedestrians within central Lower Hutt as a result of the additional paths and crossing facilities delivered by the Project
- Improved multi-modal access to the new Melling Station and between the new Melling Station and central Lower Hutt City as the new bridge provides a more direct connection over Te Awa Kairangi segregated from vehicular traffic
- More reliable bus journeys arising from the signalisation of current roundabouts in central Lower Hutt, and
- A safer and less congested environment in central Lower Hutt City as a result of more through traffic movements occurring on SH2 as the delays at Melling Interchange are removed by the grade separation.

Some adverse effects will arise from the Project, including on the ability to access properties close to the Project area, including the Brockelsby Roofing Products and PetVet sites.

The Project results in a total reduction of 711 car parking spaces through the Project area. Without mitigation, the reduction in carparking may have a moderate adverse effect on the safety for all road users if appropriate management of available parking is not undertaken.

The construction of the Project will take several years and cover a wide area of central Lower Hutt. There will be delays, localised access restrictions for periods of the overall Project and there is the potential for adverse safety outcomes, especially for active transport modes. During some phases of construction there will be adverse effects on the reliability and journey times through SH2 and for access and egress to Lower Hutt central city.

The magnitude of these effects has been assessed as moderate.

To mitigate adverse effects, it is proposed that a comprehensive review of the management of all public parking is undertaken and to develop a transitional parking plan which identifies the optimum allocation of spaces between short and long stay parking. The frequencies and hours of operation of public transport are recommended to be increased where required to support mode shift away from private cars to mitigate the reduction in available parking. A Construction Traffic Management Plan (CTMP) is proposed, which should include consideration of temporary routes for pedestrians and cyclists and should limit delays on SH2 and key routes to minimise safety effects and delays during construction.

Overall, the Project will have significant positive transport and traffic effects once complete and moderate adverse effects as a result of the carparking reduction. During construction, moderate adverse effects are anticipated as a result of direct construction movements and traffic diverting onto less suitable routes to avoid delays.

9.10.1 Introduction

This section summarises the findings and the assessment of the actual and potential effects on the transport environment arising from operation and construction traffic associated with the Project, as outlined in the Traffic Impacts and Transport Integration Assessment (Technical Report #9).

The new Melling Station, grade separation of SH2, construction of a new Melling Bridge and new pedestrian and cycle bridge and reconfiguration of various roads proposed as part of RiverLink will result in significant changes to transport infrastructure and use patterns in Lower Hutt.

The traffic impacts and transport integration assessment addresses the effects of the Project on walking access and safety, the safety and accessibility for cyclists, effects on the efficiency of and access to and from bus services within the Project area, effects on access to and from the new Melling Station, changes to the provision of public parking in the Project area and vicinity, access to private properties, construction traffic effects, and mitigation of adverse effects.

9.10.2 Assessment methodology

Guidance and scope

The assessment has taken into account the guidance from Waka Kotahi Research Report 422 – Integrated Transport Assessment Guidelines (Abley, Durdin, & Douglass, 2010) (2010) (Research Report 422). In assessing physical and environmental issues associated with a proposal, the guidance states the following is necessary:

- Focus on all potential effects including cumulative effects;
- Consider the issues of congestion, induced traffic, social effects, land transport noise, air quality and climate change;
- Consider all proposals in the context of supporting a broader transport strategy;
- Be aware of changing public attitudes, expectations and perceptions;

Noting this guidance, the appropriate scope for the assessment includes:

- Active transport network (walking and cycling);
- Public transport network (including rail and buses);
- Road network (including rail and buses);
- Safety for all modes and users;
- Parking; and
- Property access.

Assessment years

Waka Kotahi Research Report 422 titled 'Integrated transport assessment guidelines November 2010', recommends that the future year assessment be for a year, at least 10 years into the future, for integrated transport assessments (ITAs) prepared in support of designations. The scope of RiverLink means construction will take approximately 4 years before the majority of construction is completed, as such a 2026 ‘opening year’ is considered to be the most appropriate. This is also considered to be the appropriate basis for the assessment of construction effects, noting this model scenario includes the impact of Transmission Gully on transport patterns. Noting the changing environment for both land use and transport, an assessment against current (2021) conditions is not considered appropriate.

Therefore, the assessment has been made against the following future scenarios, using clearly defined assumptions for future land use and transport infrastructure:

- Future network without Project (“Base Case” – 2026 and 2036), and
- Future network with Project (“Project” scenario – 2026 and 2036).

Assumed future transport environment

For the purposes of this transport assessment, the following assumptions have been made:

- Transmission Gully is open
- Public transport services (bus and rail) are not capacity constrained
- No grade separation of Kennedy Good Bridge / SH2 intersection, and
- The implementation of the Hutt City Cycle Network

9.10.3 Existing and future transport environment

Specific details of the existing transport environment are contained within Chapter 5 of the Traffic Impacts and Transportation Assessment (Technical Report# 9), and it is summarised in section 3.6 of this AEE. In addition, it is worth noting the existing safety environment for the Project area.

A summary of crashes recorded in the Crash Analysis System database for the Project area from 2016-2020 suggests that within the urban area of Hutt City, the majority of crashes do not result in injuries, likely linked to the generally low speed of vehicles in the central city. The frequency of crashes involving pedestrians and cyclists is of concern. There is a generally low level of infrastructure provided for vulnerable users, including pedestrians and cyclists at present. At the SH2 Melling intersection, the traffic signal-controlled lights on SH2 have demonstrated a propensity to generate shunt type crashes, where a vehicle crashes into the rear of a stationary vehicle. In addition, there has been one fatal crash involving a turning vehicle at the intersection.

9.10.4 . Assessment of operational transport effects

Transport mode share

The Project as a combined package provides improvements to all modes of travel to and through the Lower Hutt central city. The removal of the at grade intersection on SH2 will reduce the delays for through traffic on the SH2. One of the key positive effects from the Project is the increased integration between modes, specifically between the walking and cycling networks and the access points for both the bus and rail public transport networks. The motorised commute rate was 73.4% in the last available survey, compared to 6.9% for walking and cycling combined. Meaning, if only half of those currently driving changed to walking or cycling one day a week, the absolute number of pedestrians and cyclists would double. In addition, with the increased popularity and emergence of e-bikes and e-scooters this contributes to an increase in the potential catchment for active modes. Overall, the Project will have a significant positive effect on mode share, considered in terms of the reduced reliance on motorised vehicles for travel.

Active transport network

The Project includes an extensive network of measures to support the mobility of pedestrians and cyclists in the Lower Hutt central city and on the northern bank of Te Awa Kairangi.

The Project provides different types of facilities, including shared use, footpaths, segregated path/bridge (walking and cycling), on-road segregated cycle route, and on-road (non-segregated) cycling route. In addition, there are facilities to support pedestrians and cyclists crossing roads within central Lower Hutt City, at the Melling Interchange, Marsden Street and Railway Avenue intersection. A mid-block signal-controlled crossing will be provided on Pharazyn Street to support pedestrian and cycle movements between the new Melling Station and the bridge.

The proposed measures also link to existing and proposed routes in the wider area, including the Hutt River Trail, proposed cycle infrastructure by HCC, and further afield, the proposed Ngauranga to Petone and Petone to Melling components of Te Ara Tupua.

A key aspect of the proposals for the active travel facilities which form part of RiverLink is the range of measures that support different users, from families with young children who ride for leisure purposes, who require off-road facilities away from traffic, to commuters who require more direct and fast routes on roads. Based on the transport assessor's understanding of the network and informed by the community feedback received during Project Open Days, the Project design provides alternate routes that meet the alternate needs of these groups for the main desire lines.

It is therefore concluded that overall, the Project will not only be of benefit to existing active mode users but will also be supportive to new users and therefore be conducive in supporting a mode shift from cars to alternate modes.

Public Transport

Rail

In terms of the impact on passenger rail mode choice it is considered the Project will lead to a moderate positive effect overall on rail accessibility.

There are several benefits that result from locating the new Melling Station closer to the Lower Hutt central city, in terms of journey travel time, safety and access. In terms of journey travel time, by locating the new Melling Station closer to the Lower Hutt central city, the time and distance taken for the majority of passengers to complete the journey to their ultimate destination is reduced. In terms of safety, the addition of the direct pedestrian and cycle bridge will have a moderate positive effect on the safety of this connection, when considered in the context of future increases in passengers. In terms of access, the location of the new Melling Station and construction of the pedestrian and cycle bridge over Te Awa Kairangi to the central city will reduce the walking distance from the city centre to the new Melling Station from 700m to 500m and it will be segregated from traffic for 400m of that distance. Road crossings will also be via signalised crossings. The location of the new Melling Station is assessed as a moderate positive effect of the Project.

The new Melling Station will result in increased walking distance from Tirohanga Road and Harbour View Road to the new Melling Station, which in isolation is considered to be a moderate negative effect. Whilst the pedestrian route still requires three signalled road crossings, the cycle times and the volumes of traffic are reduced compared to the current crossing of SH2 at grade. The improved crossing facilities, compared to the current environment, partially mitigate the moderate adverse effect to a minor adverse effect overall.

Bus

While the Project results in changes to intersections and traffic flows in Lower Hutt central city, the only effect on bus routes is the need to amend Route 145, which serves the existing Melling Station and Belmont. Since this route specifically serves the existing Melling Station, the location of the new Melling Station results in the route needing to detour east from the Melling Bridge, via Pharazyn Street, and then back towards Belmont using the new interchange. This route is less desirable than the current route as it includes a loop which gives passengers the feeling of a longer trip. The new Melling Station includes a bus stop and loop within the proposed layout to facilitate this service alteration.

The improved travel times through Lower Hutt central city and along SH2 can translate directly to an improved journey time and reliability for the bus services, as they travel on the same network.

The Project also results in changes in traffic flows on several routes within the Lower Hutt central city that are used by buses, as there are no bus lanes segregating traffic from buses within the Project area.

Elsewhere, the conversion of roundabouts to signal controlled intersections in central Hutt City will increase the reliability of journey times. Overall, the effect of the Project on bus transport is assessed as moderate positive.

Road network

Traffic flows

The Project will result in a significant positive effect on the traffic flows on the SH2, given the traffic flow is uninterrupted with the removal of the at-grade signalised SH2 / Melling Link intersection. The modelling demonstrates that this makes SH2 the more attractive route choice than the local road network of central Lower Hutt, which results in a diversion of through trips away from Lower Hutt central city onto SH2.

Travel time, reliability

The Project will result in the following improved travel times through central Lower Hutt and along SH2:

- Travel time savings of about 1 minute and 5.5 minutes are predicted for the route from the Lower Hutt central city to SH2 north, and about 1.5 minutes and 3 minutes for the route from the Lower Hutt central city to SH2 south, in the morning and evening peak periods respectively.
- the travel time for inbound traffic towards the Lower Hutt central city is predicted to be improved by less than 1 minute, from both SH2 north, and south, in both peak periods.

Freight effects

The reduction in journey time and the improvements to journey time reliability are the key benefits to freight movements from the Project. These benefits are considered as moderate benefits in the context of the overall journey times and network.

The proposed changes to the road network within Lower Hutt central city are unlikely to result in significant effects for freight movements, as they would only impact those movements with an origin or destination within the Lower Hutt central city.

It is noted that the realignment of the Melling bridge to land at Queens Drive, and the conversion of the roundabouts to traffic signals will impact the route required to access some businesses to the east of the central city. In this respect there may be some minor adverse effects for freight movements due to the reduced manoeuvrability of freight vehicles compared to general traffic.

Safety

Melling Interchange

A standard approach has been used to quantitatively predict the frequency of crashes at the Melling interchange in the future. This approach uses the forecast traffic flows along with data on the road layout and data from similar intersections in New Zealand to create an estimated crash rate per year.

The current at-grade intersection has an observed injury crash-rate of four per year and is classed as a high collective risk with high personal risk. The intersection's crash record classifies it in the worst 10% of intersections in New Zealand for frequency of crashes resulting in personal injury.

The model estimates that with the proposed grade separation, the crash rate will reduce to 0.31 per year, which, is considered to be a significant positive effect on safety. The reduction in crash frequency is significant, and the removal of the potential for high-speed crashes between through traffic and turning traffic is especially significant in reducing the potential for serious or fatal crashes. The proposed overbridge also separates pedestrians and cyclists from the high volume, high speed through traffic.

Access to Melling Station

The new Melling Station will be served with a range of on and off-road cycle facilities, and the new pedestrian and cycle bridge. This is considered to make access to the new Melling Station significantly safer compared to the existing cycling route.

Central Lower Hutt

Two key factors result in positive safety effects in Lower Hutt central city. Firstly, the proposed changes to the SH2 Melling intersection are shown to result in a reduction of traffic through Lower Hutt, with more traffic remaining on SH2. This results in a minor positive effect, since it reduces traffic on roads where high numbers of pedestrians and cyclists are crossing and travelling. Secondly, and more significantly, the provision of the extensive network of segregated paths for pedestrians and cyclists provides for a significant positive safety effect. It is assumed that the networks will include appropriate facilities outside of the Project, provided by HCC. If this is not the case, potentially adverse effects could result when cyclists are placed onto unsuitable routes without transition to the wider area.

Resilience

The current transport network has limited crossings of Te Awa Kairangi between Lower Hutt central city area and SH2. Three bridges (Kennedy Good Bridge, Melling Bridge and Ewen Bridge) provide the existing crossings for pedestrians, cyclists, buses, freight and private vehicles. The Project raises the height of Melling Bridge and provides increased flood protection to the surrounding area, including local transport connections and to SH2.

Currently, if Melling Bridge becomes unavailable for crossing Te Awa Kairangi due to a natural hazard such as flooding or an earthquake, all transport movements would be focussed on Ewen Bridge or Kennedy Good Bridge. Access to Ewen Bridge would focus traffic through the central city area which, is already congested, and would impede public transport efficiencies. Pedestrians would also be forced to use Ewen Bridge which is a significant detour to get to and from the central city area and Melling Station (noting some pedestrians would use the Western Hutt station). In addition, there would be a significant reduction in the frequency of serious or fatal crashes at the connection between SH2 and the link to Lower Hutt central city (Melling interchange). Crashes often require temporary road closures to allow for treatment of those involved in the crash, recovery of vehicles and scene investigation. The reduction in crash risk therefore increases the network resilience.

The additional walking and cycling connections, including the new walking and cycling bridge between the new Melling Station and the Lower Hutt central city provide additional resilience by supporting alternative mode choices.

Parking

Overall, the Traffic and Transport Assessment concludes that the reduction in overall parking numbers is less relevant than the specific reduction in the number of spaces that are allocated for long term parking or short term parking. This is because someone will have a need for either all day parking, or short term parking, and their need for one type of parking cannot generally be replaced by a space in the other type. As such, the impact on any particular journey type will be dependent on the management of the 2,537 public parking spaces that will remain in the Project Area following the implementation of the Project.

There are currently 3,248 public car parks in the Project area. Once completed, the Project will result in the total loss of 711 public car parking spaces. This results in the reduction of public parking by 17.5% in the long term. These figures exclude the loss of the private parking for Harvey Norman and reduced capacity at the carpark adjacent to the Hutt City Church.

Potential adverse effects associated with the parking loss include:

- Localised obstructions where drivers wish to load/unload or make short stops and park outside of marked areas, obstructing footpaths, driveways or within a traffic lane.
- A likely displacement effect for commuters where some drivers choose to park further from the Lower Hutt central city in locations where on-street parking is available and walk into the Lower Hutt central city from there.
- Increased congestion may also occur as a result of drivers attempting to find a free parking space who circulate around Lower Hutt central city area. This is mainly associated with short stay trip types.
- There may be some trip suppression or diversion if people decide not to come to Lower Hutt central city and travel elsewhere.

The localised impacts on parking in different sections of the Project area are summarised below. This more specific assessment recognises that there are occasions where parking demand can be very locally focussed, such as when carrying large or weighty goods between businesses and vehicles.

- **Melling Area** - The decrease in parking in the Melling area of the Project of 28 public parking spaces is considered to be negligible as this loss represents approximately 5% of public parking in the same area. There will also be increased accessibility by other modes and specific parking provision for key destinations in the area such as the new Melling Station, Hutt City Church and service lane with parking for the Pharazyn Street commercial premises.
- **Pharazyn Street realignment -** The realignment of Pharazyn Street results in the removal of 138 existing on street car parks. The realignment facilitates the provision of 68 on-street car parks on the new road. The new Melling Station and construction of the new pedestrian and cycle bridge are expected to increase demand for parking on Pharazyn Street. As a result, the potential for adverse effects on the frontage properties on Pharazyn Street is high as a result of the proposed changes to parking. Developing the cycle lane option allowed for in the RiverLink designations adjacent to the railway corridor rather than the on-street facility would avoid this effect.

- **Marsden Street -** The realignment of Marsden Street results in the net loss of 9 on-street carparks (38 on-street carparks removed and 23 car parks provided on the re-aligned Marsden Street). This will impact parking available for the church that operates on the corner of Marsden Street and Victoria Street. This will have two effects – firstly, it will increase the radius of the effects of the church services as the parking radiates out from the church, and secondly the loss of parking will increase the distance that some of the congregation will need to walk. These effects are considered to be relatively minor. It is also noted that crossing facilities proposed by the Project at the intersection with Victoria Street will make it easier and safer to access the church site by foot.
- **Block Road -** The removal of Block Road will result in the loss of 21 parking spaces in total. These parking spaces are not replaced. The demand for parking in this area is associated with the train station. As the location of the train station is changing as a result of the Project the demand for the car parks in Block Road will reduce.
- **Lower Hutt central city** - In the Lower Hutt central city, the Project will result in the loss of 434 Riverbank carpark public spaces – this is a combination of short and long-term parking spaces. The other parking changes in the central city include:
  - Daly Street closure: The closure of Daly Street will result in the removal of 62 on-street car parks, and removal of through traffic looking for parking.
  - Fraser Street (southern High Street): Changes to the road layout at the southern end of High Street result in the removal of 8 on-street P120 car parks on Fraser Street. This is considered to be a minor effect in this location.
  - Dudley Street: Removal of 18 on-street car parks on Dudley Street facilitates an improved environment for pedestrian access through wider footpaths. This will make the availability of parking immediately adjacent to premises less likely but improves the ability to walk along Dudley Street, supporting those visiting multiple destinations. It is considered that the majority of those active in the street are currently arriving in the locale by other means than using the 18 parking bays to be removed, therefore the direct effect is considered to be moderate.

The reduction in on-street parking (short-term spaces) equates to approximately 5% of the total provision of short-term parking spaces within the central city. Surveys undertaken in 2020 demonstrated a maximum occupancy rate of 84% during the weekday and 81% on the weekend. It is expected that removing 5% of the parking supply would make finding a space more difficult but there will still be vacant parking spaces available for short-term use. The reduction in long-term parking in the Riverbank car park (from 854 to 420 vehicles) is significant – this represents some 10% of the public parking spaces in Lower Hutt city centre and it provides for all day parking without a time limit. Even with retention of nearly half the number of carparks following construction completion, the Traffic and Transport Assessment concludes the residual effect remains significant.

In addition, the reduction in long term parking has the potential to displace commuters into surrounding residential streets. This potential displacement effect is predicted to extend to a 15-minute walking catchment, which encompasses Penrose Street, and the roads north of Witako Street to the east of the city centre as illustrated in Figure 48.

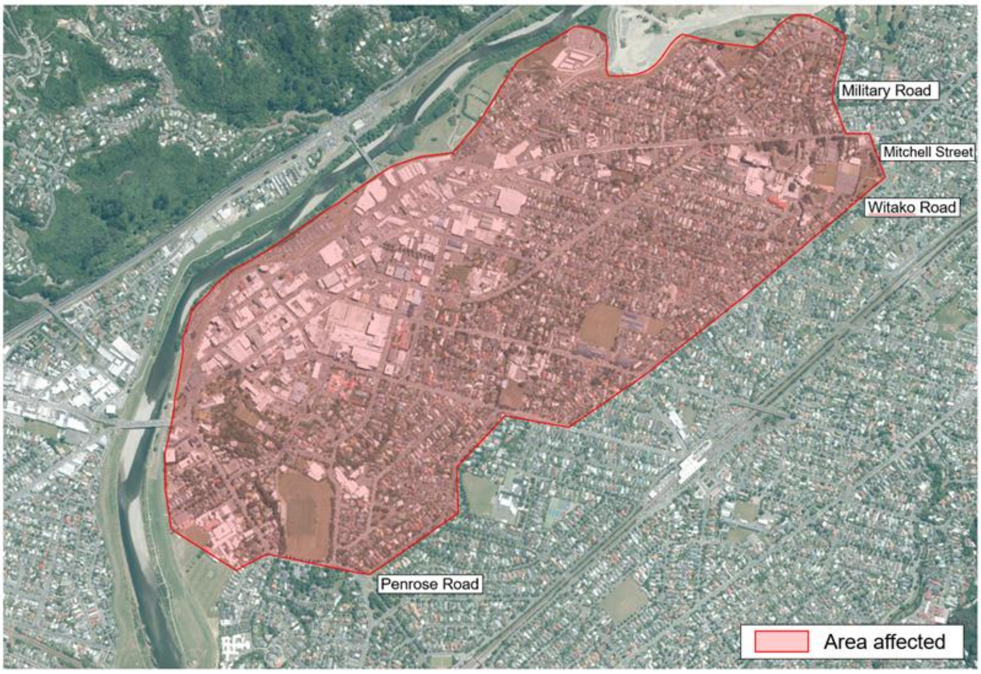


Figure 48 - Parking area of influence

The Traffic and Transport Assessment concludes that the potential adverse effects would be minor on the residents of potentially affected streets. This conclusion is reliant on the outcomes of the Parking Policy Review by Hutt City Council and a Transitional Parking Plan to manage parking during construction. The Parking Policy Review would consider the extent of required parking restrictions within the affected area.

- **Removal of Harvey Norman leased spaces -** Construction of the stopbank in front of the Harvey Norman store, and the subsequent reduction in size of their leased carpark in the river corridor will result in the loss of 103 car parks currently leased by Harvey Norman for staff car parking. Additional parking for shoppers is provided within the building, accessed via Rutherford Street. The effects of the loss of this parking will not directly impact the ability of the store to operate however it will have an adverse effect on Harvey Norman employees, including the potential for increased walking distance between parking and the store, and increased costs if utilising paid parking elsewhere. The effect of this loss of parking has not been assessed as a reduction in public parking, instead as an increase in the demand for public parking. The response to the removal of this option for staff parking is likely to result in a mode change towards active or public transport modes for some staff. Overall, the effect of the Project from the removal of the leased parking area is assessed as a minor adverse effect.
- **Melling Station car park** - The current available parking at the existing Melling Station is to be replaced with an equal number of parks at an equivalent location, therefore there is a negligible effect on parking in this location.

Property Access

A variety of changes to access to individual properties is required to facilitate construction and operation of the Project. This will require new accesses or changes to the way properties use the local road network. A detailed assessment of these changes is provided in the Traffic Impact and Transportation Assessment (Technical Report #9).

- **Rutherford Street -** the Project requires that Rutherford Street is raised by approximately 3m in order to connect the new Melling road bridge surface with the local road network. This will impact the access to PetVet at 53 Rutherford Street. Proposed retaining walls across the property frontage will result in changes to the pedestrian and vehicles access into and out of PetVet. These changes have the potential to be a significant effect property access. The retaining walls and batters along upper Rutherford Street terminate before the existing Brockelsby Roofing Products factory access point at 49 Rutherford Street. Delivery trucks will still use the same access point at 49 Rutherford Street. The ability to turn into this entrance across queuing traffic will be constrained and not desirable. Egress would be largely unaffected.

For the proposed alternative routes, there are concerns with the safety and efficiency of the turn into the site from Rutherford Street across three lanes of traffic approaching the signalled intersection. This is likely to lead to blocking of Rutherford Street due to the queues of vehicles on the approach to the stop line. The existing operation of the site is unsatisfactory in this regard, and discussions are ongoing between parties with an interest in the site which, may lead to revised operations within the site (not being serviced by B-train trucks) which could address this issue.

- **Queens Drive -** it is considered that the proposed changes to Queens Drive will result in a significant effect on the access for the Brockelsby Roofing products site. It is however noted that the current operations which involve reversing into the site from Queens Drive are not appropriate for an urban area, as they already create a safety risk to pedestrians, cyclists and other road users.
- **Marsden Street** - re-alignment of Marsden Street closes the existing connection to the off-road shared path running parallel with Te Awa Kairangi, and a new connection is proposed to ensure access.
- **Pharazyn Street and Daly Street** - a one-way slip lane is proposed to maintain access on Pharazyn Street for surrounding residential properties, therefore the effect of the Project on property access on Pharazyn Street is considered to be minor. Daly Street is to be closed and existing properties are to be demolished and replaced with buildings up to 5 stories. The new walking promenade together with ramps and stairs proposed on the west of Daly Street between Margaret Street and Andrews Avenue will provide access for pedestrians and cyclists to new development on Daly Street.

9.10.5 Assessment of construction transport effects

Whilst traffic and transportation effects are anticipated throughout the construction period, the most significant adverse effects will occur during Stage 3 with the closure of Rutherford Street to through traffic.

Site compound locations and access routes

The proposed site compound locations and local access routes are shown in

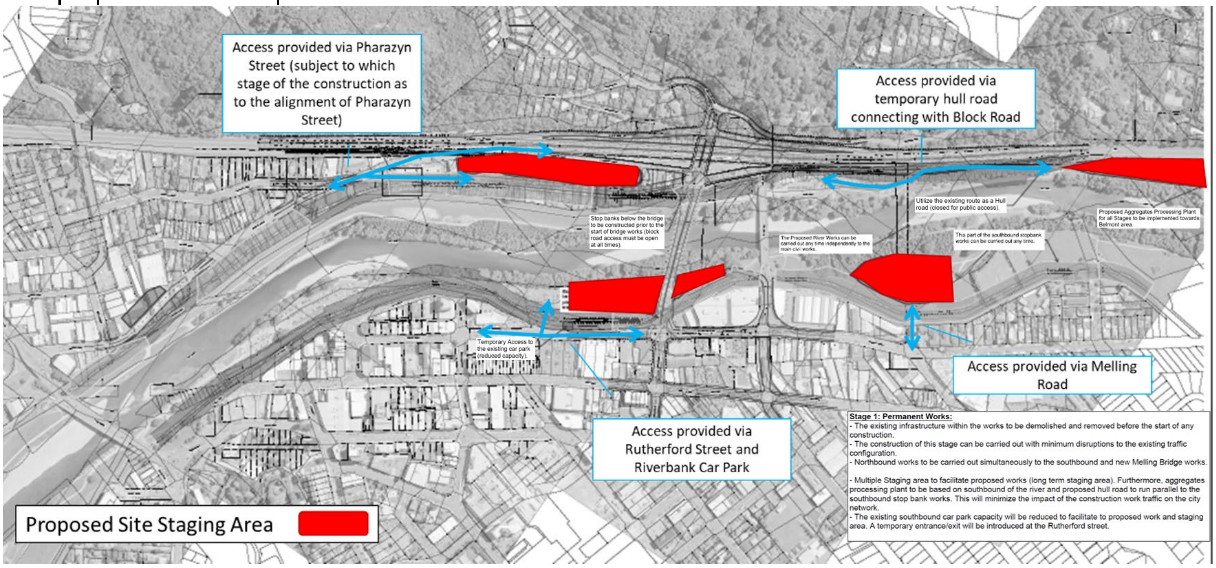


Figure 49.

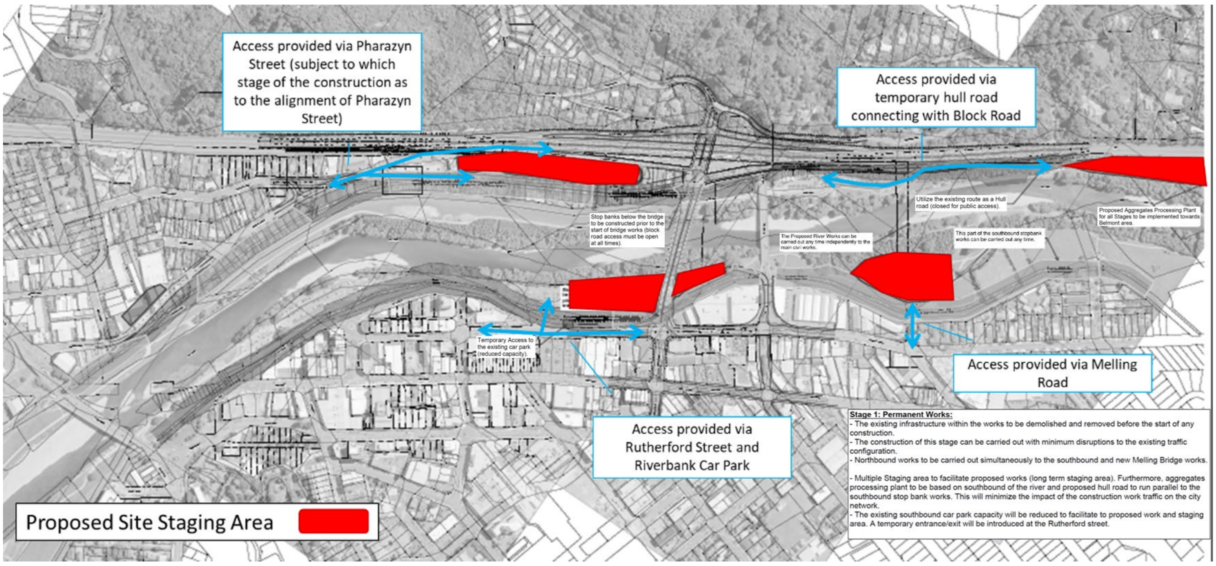


Figure 49 - Construction site compounds and vehicular access

Other than the local roads identified in blue above, construction traffic will generally use higher order roads to access construction areas, avoiding local roads to minimise disruption. A temporary haul road (from Pharazyn Street) and access from Kennedy Good Bridge and SH2 will also be created during construction.

Estimated construction vehicle movements

Construction vehicle movements have been estimated as a result of the following tasks: site establishment, traffic management, site clearance, earthworks, road works, landscaping, services protection and stopbank works.

Table 56 below summarises the construction traffic volume information. The values shown are one way traffic movements and therefore the total volume would double these numbers (i.e. delivery entering and exiting the site).

Table 56 - Summary of construction traffic volume information

Stage	Average one-way daily volume (vpd)	Peak one-way daily volume (vpd)
Stage 1	273	382
Stage 2	179	250
Stage 3	105	146
Stage 4	147	206

Stage 1 is anticipated to have the highest construction traffic, with an average of 546 daily movements and a peak of 764 daily movements expected during Stage 1. Generally, peak hour traffic (morning and afternoon) accounts for approximately 10 percent of the total daily traffic movements. This level of construction traffic is expected to increase the total traffic utilising local roads during construction, however, is not expected to increase congestion and / or delays within the area. As Stage 1 has the highest volumes, it is expected that during the remaining stages there would be a lower traffic volume during peak hour when compared with the analysis above. The majority of the traffic during Stage 1 will be utilising SH2 and Pharazyn Street for site access.

Private access effects during construction

Site compounds have been located to minimise interaction with local road users where possible, and to ensure the compounds are conveniently located with respect to the construction areas.

Residents living in close proximity to construction areas are likely to experience an uplift in construction traffic in the general area, which may have an effect on vehicles waiting to enter or exit their property. However, this is not likely to cause significant delays.

Temporary relocation of the Riverbank Market

Relocation of the Riverbank Market is required during construction. Two temporary locations have been identified:

a. North Daly Street development site (temporary car park)

b. Andrews Avenue and Dudley Street (on-street)

Use of the North Daly Street site would result in the loss of access to a potential temporary carpark on Saturday during the market operating times. Use of Andrews Avenue/Dudley Street would require road closures and a traffic diversion to enable set up, operation and pack down. Neither would result in significant impacts on parking since parking demand on the weekends is considerably lower than on weekdays. Construction activities would not impede visitor's safety accessing either location on foot or bicycle.

Road network effects

The following effects resulting from each stage of construction are discussed below:

- construction access and safety effects;
- Public road and access effects;
- Public transport effects;
- Temporary active travel effects; and
- Parking effects during construction.

Construction access safety effects

During Stage 1 temporary pedestrian and cyclist access will be facilitated along the western side of Te Awa Kairangi, vehicular access along Block Road will be restricted to only construction vehicles. Pedestrian and cyclist access to Belmont School will continue to be provided via the underpass under SH2, as one of the primary access routes to / from the school. The increase in heavy vehicle movement activity within close proximity to a school does increase the likelihood of an incident between a heavy vehicle and a vulnerable road user (student). During Stage 1 the level of traffic during the peak hour is expected to have a minor effect for drivers utilising Pharazyn Street.

The majority of construction traffic during Stage 2 will be accessing site compounds via SH2 and the existing Melling Bridge. It is expected that SH2 will be able to accommodate this increase in traffic utilising SH2 and Melling Bridge with negligible effect. The anticipated construction vehicle route for access during Stage 2 has assumed that all vehicles will be utilising Melling Link. The level of traffic during the peak hours is expected to have a minor effect for drivers utilising Melling Link. The construction vehicles are expected to increase travel time in the area.

Stage 3 is similar to Stage 1 beyond Pharazyn Street, and construction vehicles are expected to utilise Bridge Street, Railway Avenue and Hutt Road in order to access SH2.

During Stage 4 construction traffic will primarily access site compounds via SH2, Kennedy Good Bridge and Melling Bridge. There will be a minor increase to congestion and delays experienced on Melling Bridge due to the addition of construction vehicles.

Stages 5 and 6 have the same effects as Stage 4 in relation to construction access and safety.

Public road access effects

During Stage 1 the closure of Marsden Street is expected to affect vehicles accessing the Melling Train Station. There will be a slight increase to delays experienced by drivers on Pharazyn Street, but this is not expected to deter vehicles from using Pharazyn Street. A minor reduction in traffic on SH2 is predicted as a result of the increased travel time, although as the speed during the peak periods is constrained by congestion, the effects could be greater outside of the peak periods. This negligible effect on the SH2 is retained through construction stages 2 – 6.

Upgrade works to the intersection of Railway Avenue/ Marsden Street/ Ewen Bridge are expected to increase congestion within the local area, with traffic management lowering speeds through the intersection to facilitate access to Ewen Bridge.

During Stage 2, the access to Pharazyn Street will transition to a temporary road while upgrades are made to the intersection between Pharazyn Street and Marsden Street. The proposed upgrades to intersections along High Street will create a detour for vehicles. This is expected to increase the volumes along Queens Drive but is not expected to have a material effect on the congestion and delays experienced along Queens Drive.

The closure of Rutherford Street and the short section of Queens Drive is expected to have a significant adverse effect on vehicular access through central Hutt City during Stage 3. Congestion and delays on High Street will increase due to diversions being in place. The travel time for vehicles accessing Lower Hutt central city (Rutherford Street) is expected to increase during both peak periods. As a result there would be a moderate adverse effect on traffic flows through the Lower Hutt central city.

During Stage 4 roadworks along SH2 are expected to increase congestion and delays for drivers passing the construction area. The effect of this increase in congestion may encourage drivers to utilise Melling Bridge and Ewen Bridge in order to avoid the delays anticipated by the roadworks on SH2. With significant roadworks being undertaken within Lower Hutt, the travel times for vehicles accessing Lower Hutt from SH2 is anticipated to increase during this construction stage.

The Melling Interchange upgrade works are expected to restrict local access to Harbour View Road and Tirohanga Road during Stage 5. An increase in delay is expected for drivers wanting to access these roads.

The same effects are anticipated for Stage 6 as are set out in Stage 4 in relation to the roadworks along SH2. The works associated with decommissioning the existing Melling Bridge and associated intersection works is anticipated to have a minor effect on vehicle access travelling along Rutherford Street.

Public transport effects

During Stage 1 there will be an effect on the bus services that utilise the Railway Avenue/Marsden Street intersection in order to access Lower Hutt central city. Detours are not expected to be required however, the travel time through these areas are expected to increase. As a result of the partial closure of public access to the Riverbank Car Park during Stage 2, an increase in patronage of the bus network and train network is expected, with persons adjusting their mode of transport to access the Lower Hutt central city. There are expected to be more patrons utilising the train during Stage 4 as their mode of choice to/ from the Lower Hutt central city as a result of completing the pedestrian bridge connecting Lower Hutt central city. Stages 5 and 6 are not expected to have any effect on the public transport network.

Temporary active travel effects

Pedestrian and cyclist connectivity along Te Awa Kairangi and within the Lower Hutt central city is likely to be compromised during all stages of construction. While work is occurring on the intersections at High Street and Rutherford Street, there may be compromised connectivity from Melling Station to the central city. During stopbank construction stages, pedestrian and cycle access to the shared path on both sides of the river will be affected; pedestrians and cyclists will be required to use local roads for access. These combined effects are considered to be moderate negative effects that will exist during phases of the construction period. Not all effects will be for the entire duration of construction.

Parking effects during construction

The effect on available car parking as a result of Stage 1 is minimal. A temporary car parking area (providing approximately 150 car parks) is a potential option to be built in Stage 1 which is expected to mitigate the loss of carparking spaces experienced during to the Riverbank Carpark area closure (occurring in Stage 2). There will be a temporary removal of on-street parking spaces during the upgrade works to the Rutherford Street and Queens Drive intersection, which is expected to create a small reduction in available spaces within the Lower Hutt central city area during Stage 3. During Stage 4. It is anticipated that there will be a temporary removal of on-street parking spaces during the upgrade works to the Dudley Street, Margaret Street and Andrews Avenue, which is expected to create a small reduction in available spaces within the Lower Hutt central city area. When compared with the existing environment, during Stage 4 there will be fewer parking spaces available. During Stage 5, the potential temporary car parking area is proposed to be removed further reducing the car parking availability within the area. No further effects in relation to parking availability occur during Stage 6.

Overall, during the construction there are considered to be several moderate adverse effects that will arise. These include the potential for adverse safety effects both from direct construction movements and as a result of traffic diverting onto less suitable routes to avoid delays.

9.10.6 Measures to avoid, remedy or mitigate actual or potential adverse transport and traffic effects

While the Project will deliver significant safety, accessibility and journey time benefits, there are some effects related to parking and local access changes for which mitigation is proposed.

Parking

Since the Project delivers enhanced accessibility, safety and reliability for active and public transport modes, the Project itself forms part of the mitigation for the loss of parking, through the provision of alternate means for access. It is however recognised that for some trips using a car will remain a preferred mode to access the Lower Hutt central city, and as such there will be a need for parking to serve this.

To mitigate the effect of parking space removal, a review of the overall parking stock in Lower Hutt central area, including the public car parks not directly affected by the Project and wider on-street parking to provide an appropriate mix of short-term and long-term parking, loading bays and accessible parking spaces, is proposed. The review will consider the following:

- Parking time (duration) limits;
- Parking pricing strategy;
- Park & Ride (bus based);
- Signage for parking areas; and
- Enforcement strategies for Lower Hutt city centre

In addition to the parking review, a transitional parking plan may be required in order to phase the reductions to allow for the adverse effects of parking loss to be graduated. The transitional parking plan will:

- Identify and provide alternative parking locations (in addition to the potential 150 spaces identified adjacent to Daly Street) during construction to mitigate the loss of parking prior to the delivery of the full multi-modal benefits for the Project.
- Consider potential for temporary park and ride sites, enhanced public transport (bus and rail) services and active promotion of noncar-based access modes through a travel behaviour change programme.

Public transport

Planned increases to the frequencies of buses, and additional services on an evening and weekend will provide the additional capacity for the patronage that could change mode away from private car to public transport. Monitoring patronage on bus services through Metlink should occur to identify when capacity has been reached as a result of mode-change associated with the Project. This is considered to be a normal activity for the bus operator Metlink, so no specific condition is required in this regard.

Construction

The assessment of construction effects has shown that the biggest adverse effects occur during Stage 3 with the closure of Rutherford Street to through traffic. During this phase the following mitigation is anticipated to be required to avoid potential adverse construction effects:

- Restrictions on the lanes / speed required to be retained on SH2 throughout;
- Some restrictions (but retain contractor flexibility) on concurrent activity in Lower Hutt;
- Monitoring of delays on key routes;
- Retaining Melling line rail operational throughout construction with parking;

- Safe access to be retained for walking and cycling;
- Provision of protective barriers between Belmont School and the Block Road haul route;
- Limiting the duration of the closure of Rutherford Street and preventing other works that may reduce capacity on parallel routes during stage 3 of the RiverLink construction;
- Implementing a temporary lane configuration and signal phasing at Melling Link / Rutherford Street during construction;
- Provision of transitional / temporary public parking within central Lower Hutt; and
- A CTMP to be prepared to include all above matters in advance of construction commencing.

9.10.7 Conclusion

The Project will deliver significant positive transport and traffic effects in the Project area. The removal of the at grade intersection at Melling will produce safety and efficiency benefits for state highway traffic. The extensive network of walking and cycling paths and crossing facilities will promote accessibility and safety for active mobility users. The reduced journey time on SH2will reduce the desirability to use the local roads for through trips, delivering safety and efficiency benefits for local movements of all modes. There will be significant positive effects on the efficiency of freight and private traffic on SH2 as a result of grade separation replacing the current signalled intersection. The new Melling Station is in a location that is generally more accessible for those wishing to access Lower Hutt central city.

Some adverse effects will arise from the Project, including access restrictions to the Brockelsby Roofing Products site, and the increased walking distance to the new Melling Station from Harbour View Road.

The proposed re-configuration of car parking through the Project area is expected to result in a net loss of approximately 711 public car parks. This specific aspect of the Project is a moderate adverse effect when considered in the context of the total parking provision in Lower Hutt central city.

Several moderate adverse effects are anticipated to arise during construction, including the potential for adverse safety effects both from direct construction movements and as a result of traffic diverting onto less suitable routes to avoid delays.

To mitigate adverse effects, a comprehensive review of the management of all public parking will be undertaken to develop the optimum allocation of spaces between short and long stay parking. A CTMP, which will include consideration of temporary routes for pedestrians and cyclists, will aim to limit delays on SH2 and key routes to minimise safety effects and delays during construction.

9.11 Noise and vibration

Overview

Although construction noise modelling indicates that construction noise levels are likely to exceed the recommended noise limits at a number of noise sensitive receivers, implementation of best practicable option (BPO) mitigation measures (e.g. noisy works within standard construction hours, use of quietest practicable machinery) is expected to mitigate construction noise effects to an acceptable level. Similarly, although vibration risk levels are assessed as high for some properties, construction vibration effects are anticipated to be effectively managed through the implementation of the BPO mitigation measures. The development and implementation of a Construction Noise and Vibration Management Plan (CNVMP) is recommended.

The operational effects of the Project have been shown to range from a generally positive acoustics outcome through to a negligible adverse effect.

The exceptions to this are:

- At 137 High Street, where a change in the predicted road traffic noise level of +3 dBA forms a perceptible subjective change. However, the effect of this change is still considered minor and does not require mitigation; and
- At 151-155 High Street, where a change in the predicted road traffic noise level of +6 dBA forms a noticeable subjective change. An offer of building modification mitigation is proposed, to reduce the potential noise to 40 dB $L_{Aeq(24hr)}$.

Overall, the operational noise and vibration effects of the Project have been shown to range from a generally positive acoustics outcome through to a negligible adverse effect. With the adoption of the construction mitigation measures recommended, residual construction noise and vibration effects of the Project are considered acceptable.

9.11.1 Introduction

This section of the AEE provides a summary of potential noise and vibration effects arising from the Project. The full assessment is contained in the Noise and Vibration Assessment (Technical Report # 10).

9.11.2 Existing environment and assessment methodology

The noise and vibration assessment covers construction effects, as well as operational effects for road traffic and rail operations. The assessment has been undertaken in accordance with:

- NZS 6806:2010 Acoustics – Road traffic noise – New and altered roads (NZS 6806) (in relation to operational road traffic noise for the state highway works);
- changes in noise level from the local road changes and changes in noise and vibration levels from the railway line changes required for the Project, including NZS 6801:1991 and NZS 6802:1991 (in relation to operational noise impacts on residential properties from the relocated rail station);
- NZS 6803:1999 (in relation to construction noise); and
- The Waka Kotahi Construction Guide (in relation to construction vibration).

Overview of existing environment

Site observations, noise level measurements at key locations and acoustic modelling were used to assess the existing noise and vibration environment and to establish a baseline for assessing the Project's impacts. Reliance on modelling is considered the most robust approach given that the existing noise environment at most sensitive locations is controlled by road traffic, which is accurately represented by the modelling.

Construction noise and vibration assessment

Construction noise has been assessed against NZS 6803:1999 recommended construction noise criteria. Table 63 shows the recommended upper limits from section 7.2 of NZS 6803 for construction noise received in residential zones, while Table 58 shows the recommended upper limits for construction noise received in industrial or commercial areas.

Table 57 - NZS 6803 Recommended upper limits for construction noise received in residential zones and dwellings in rural areas

Time of Week	Time period	Duration of Works					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Weekdays	6:30am – 7:30am	60	75	65	75	55	75
	7:30am – 6:00pm	75	90	80	95	70	85
	6:00pm – 8:00pm	70	85	75	90	65	80
	8:00pm – 6:30am	45	75	45	75	45	75
Saturdays	6:30am – 7:30am	45	75	45	75	45	75
	7:30am – 6:00pm	75	90	80	95	70	85
	6:00pm – 8:00pm	45	75	45	75	45	75
	8:00pm – 6:30am	45	75	45	75	45	75
Sundays and public holidays	6:30am – 7:30am	45	75	45	75	45	75
	7:30am – 6:00pm	55	85	55	85	55	85
	6:00pm – 8:00pm	45	75	45	75	45	75
	8:00pm – 6:30am	45	75	45	75	45	75

Table 58 - NZS 6803 Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year

Time period	Duration of work		
	Typical duration L_{eq} (dBA)	Short-term L_{eq} (dBA)	Long-term L_{eq} (dBA)
7:30am – 6:00pm	75	80	70
6:00pm – 7:30am	80	85	75

Typical duration means construction work at any one location for more than 14 calendar days but less than 20 weeks, short-term duration means construction work at any one location for up to 14 calendar days, and long-term duration means construction work at any one location with a duration exceeding 20 weeks.

Based on the construction methodology, the total construction duration for the Project will exceed 20 weeks' duration, and hence 'long-term' duration noise limits are applicable for the Project, e.g. 70 dB LAeq and 85 dB LAmax between 7:30am to 6pm Monday to Saturday. However, construction activities (e.g. local road works) may often take less than 20 weeks to complete (in close proximity to any single noise sensitive receiver) due to the linear nature of the works area. As such, the 'typical duration' noise limits should be applied for construction activities within such work areas, e.g. 75 dB LAeq and 90 dB LAmax between 7:30am to 6pm Monday to Saturday.

Reference noise levels of construction equipment have been obtained from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites.

For construction vibration, there are no relevant provisions in the District Plan, therefore the Waka Kotahi Construction Guide, which provides construction vibration criteria based on standards from other countries, is adopted. These relevant criteria are provided at Table 59 and Table 60.

Table 59 - Waka Kotahi construction vibration criteria

<table>
<tr><th>Receiver</th><th>Location</th><th>Details</th><th>Category A</th><th>Category B</th></tr>
<tr><td rowspan="2">Occupied PPFs</td><td rowspan="2">Inside the building</td><td>Night-time 2000h – 0630h</td><td>0.3 mm/s ppv</td><td>1 mm/s ppv</td></tr>
<tr><td>Daytime 0630h – 2000h</td><td>1 mm/s ppv</td><td>5 mm/s ppv</td></tr>
<tr><td>Other occupied buildings</td><td>Inside the building</td><td>Daytime 0630h – 2000h</td><td>2 mm/s ppv</td><td>5 mm/s ppv</td></tr>
<tr><td rowspan="2">Unoccupied buildings</td><td rowspan="2">Building foundation</td><td>Vibration – transient</td><td rowspan="2">5 mm/s ppv</td><td>BS 5228-2 Table B.2</td></tr>
<tr><td>Vibration - continuous</td><td>BS 5228-2
50% of Table B.2 values</td></tr>
</table>

Table 60 - Transient vibration guide values for cosmetic damage (Table B.2 from BS 5228-2)

Type of building	Peak component velocity in frequency range of predominant pulse	
	4 to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s	50 mm/s
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

The Waka Kotahi Construction Guide states that[52]:

"If measured or predicted vibration levels exceed the Category A criteria then a suitably qualified expert should be engaged to assess and manage construction vibration to comply with the Category A criteria as far as practicable. If the construction vibration exceeds the Category B criteria then construction activity shall only proceed if there is appropriate monitoring of vibration levels and effects on those buildings at risk of exceeding the Category B criteria, by suitably qualified experts."

The Waka Kotahi Construction Guide also states that additional criteria should be used in the case of historic, vibration-sensitive or multi-storey buildings. Advice on such buildings is given in BS 5228-2 and DIN 4150-3.

[52] At page 23, Section 2.2

Operational road traffic noise – Waka Kotahi designations

Changes in road traffic noise resulting from changes to SH2 have been assessed in accordance with NZS 6806 as per the Waka Kotahi Guide to assessing road traffic noise (NZ Transport Agency, 2016). NZS 6806 does not set rigid noise limits, rather it gives a primary and secondary external noise criterion for buildings (A and B) and an internal noise criterion (C) if it is not practicable to comply with categories A or B. NZS 6806 requires that the BPO be identified to mitigate road traffic noise. The criteria for noise from altered roads and new roads with traffic volumes between 2,000 to 75,000 vehicles per day are shown in Table 61.

Table 61 - NZS 6806 relevant road traffic noise criteria

Category	Altered roads dB $L_{Aeq(24h)}$	New roads with a predicted traffic volume of 2000 to 75 000 AADT at the design year dB $L_{Aeq(24h)}$
A (primary external noise criterion)	64	57
B (secondary external noise criterion)	67	64
C (internal noise criterion)	40	40

Within the Waka Kotahi new designation, the new section of Pharazyn Street, the new grade separated interchange/SH2 on and off ramps and the new road bridge across the River are considered as new roads. All other roads within the new designation are considered altered roads. As such, noise levels at the PPFs identified have been considered both in terms of the altered and new road criteria.

NZS 6806 requires the following operational scenarios to be assessed and compared:

- Existing noise environment: existing roads with current traffic volume (2020);
- Do-nothing: existing roads with future traffic volume at the design year (2036);
- Do-minimum: proposed roads with no noise mitigation measures (2036); and
- Project with mitigation (if necessary): proposed roads with noise mitigation measures (2036).

PPFs in urban areas must be located within 100m of the nearest edge of the closest road for the criteria under Table 61 to apply. The PPFs are identified in the technical assessment. PPFs identified include dwellings on Pharazyn Street, Marsden Street, City View Grove, Harbour View Road, Gaskill Grove, Jenness Grove, Western Hutt Road, Onehuka Road, Tirohanga Road, Pomare Road and Raroa Road.

The Project design team has confirmed that the design road surface for SH2 will be open graded porous asphalt, SH2 ramps and interchange will be stone mastic asphalt, and local roads will be asphaltic concrete. Noise level predictions have been prepared using SoundPLAN computer modelling software.

Operational road traffic noise – HCC new designation

The District Plan excludes the effects of noise from vehicles being driven on a road within the meaning of section 2(1) of the Transport Act 1962, however section 16 of the RMA places an explicit duty to use the best practicable option to avoid creating unreasonable levels of noise regardless of the requirements of a District Plan. As such, changes in effects brought about by the alteration of existing local roads within HCC's new designation have been assessed purely in terms of changes in noise level, with reference to the operational scenarios of 'Existing', 'Do-nothing' and Do-minimum' taken from NZS 6806.

Operational rail noise

The District Plan also excludes the effects of train noise, other than when a train is within a railway station or yards. Nonetheless, section 16 of the RMA applies, therefore the operational rail noise assessment methodology compares the existing levels of rail noise at nearby PPFs to the predicted levels of rail noise arising from the changes in track alignment.

Operational rail vibration

The District Plan does not address the effects of vibration emissions from the use of rail tracks; therefore the assessment predicts levels of rail vibration at noise sensitive receivers arising from the new track alignment.

Operational noise – new railway station

Noise sources to be considered for the new Melling Station include mechanical plant/ventilation noise (if any), station public announcement system (if any), carparking within the Park and Ride facility, and stationary train idling in station.

Rule 14C 2.1.1(b) of the District Plan sets permitted activity limits for non-residential uses as specified in Table 62, measured anywhere within a Residential Activity Area. Residential areas surrounding the site are located in Noise Areas 2 and 3.

Table 62 - Residential activity areas maximum noise level

Noise Area	Maximum noise level, dB L_{A10}	Time
Noise Area 2	55	7.00am – 10.00pm
	45	10.00pm – 7.00am
Noise Area 3	50	7.00am – 10.00pm
	40	10.00pm – 7.00am

Rule 14C 2.1.5(a) of the District Plan sets a permitted activity noise limit within the General Business Area of 65 dB L_{A10}, measured at the boundary of the site on which the activity takes place.

9.11.3 Assessment of construction noise and vibration effects

Noise

Construction of the Project has an assumed start date of 2022, and the indicative construction timeframe is four years, divided into six sequential construction stages. Reference noise levels of construction equipment have been obtained and are detailed in the technical assessment. To simulate the worst-case scenario during construction, the two loudest items of equipment have been modelled as a point source to calculate the overall sound power level for each activity. The loudest modelled activity relates to impact driven piling for the construction of bridges crossing the river, which was modelled at 133 dBA.

Unmitigated construction noise levels from construction activities have been assessed at noise sensitive receivers within 100m of the Project works area. The results of this are documented in the technical assessment. These receiver locations are the first layer of the sensitive receivers surrounding the Project works area which are expected to be subject to the highest noise and vibration levels from construction. For each construction stage, the potential noise impacts on the sensitive receivers have been predicted using a construction noise model. The predicted noise levels represent a worst case 15-minute period of operation where the two loudest items of equipment are operating at full power.

The results of construction noise modelling indicate that construction noise levels are likely to exceed the recommended daytime noise limits at a number of noise sensitive receivers. It is however noted that the predicted levels are the worst-case scenario which would generally not prevail. Some exceedances may still prove significant even after all practicable forms of mitigation have been employed. Driven piling works for the construction of the new road bridge and the pedestrian bridge is predicted to have a significant impact at numerous properties. Mitigation measures are outlined at section 9.11.6 below.

Construction Vibration

The key typical construction vibration generating activities during construction of the Project are vibratory fill compaction and impact driven piling. An assessment of the vibration risk for specific properties has been undertaken and is provided at **Table 63**. Higher risk is defined as vibration levels that exceed 5mm/s PPV (potential to exceed cosmetic building damage criteria), medium risk is defined as vibration levels between 1 and 5 mm/s PPV (below cosmetic building criteria, but likely to be annoying to occupants of a building), and low risk is defined as vibration levels below 1 mm/s PPV (unlikely to cause annoyance). These risk levels depend on setback distances from the vibration generating activities.

Table 63 - Vibration risk assessment for construction activities

Activities	Risk	Sensitive receivers
Vibratory fill compaction	High	64, 70, 72 and 76 Victoria Street 22 (Hutt City Church), 31, 39, 79, 93 and 95 Marsden Street 34, 40, 55, 57, 57A, 59, 61, 63, 65, 67, 69 and 71 Pharazyn Street 7 and 14 Harbour View Road 39, 39A, 2/39B, 4/39B, 48-50, 54A and 54B Mills Street 1, 2/9, 3/9, 13 and 17A Connolly Street 2, 11, 13, 14, 15, 16, 17, 19, 27, 28, 33, 41, 45, 49, 53, 59 and 60 Rutherford Street 15 Daly Street 11, 15, 27, 35, 37, 47, 49, 55, 65, 67 and 71 Dudley Street 21 Andrews Avenue 36, 54, 78, 92, 129, 137, 118-128, 148, 149-151, 157-161, 167-175, 177, 191, 215, 217, 298, 330, 336, 337, 338, 340, 365, 369, 374, 403, 412, 417 and 418 High Street 9 and 12 Margaret Street 2 Osborne Place 2 and 134 Queens Drive 2 Pretoria Street 35 Railway Avenue 1 Market Grove 61-69 Woburn Road (St James Church)
	Medium	62 and 74 Victoria Street 29 and 44 Railway Avenue 61, 63, 81, 83, 85 and 87 Marsden Street 32, 49, 51 and 53 Pharazyn Street

Activities	Risk	Sensitive receivers
		39 Bridge Street 2, 4, 11 and 13 Williams Grove 1, 2, 3, 4 and 5 Gaskill Grove 4, 5, 6, 7, 8, 8A, 9 and 10 Jenness Grove 3 and 5 Harbour View Road 125 and 760 Western Hutt Road 25 and 27 Onehuka Road 17, 25, 29, 30, 31, 33, 35 and 39 Tirohanga Road 7 Ward Street 2 and 4 Market Grove 5 Andrews Avenue 2, 7 and 69 Rutherford Street 5 Kings Crescent 6 and 8 Pretoria Street 100, 101, 102, 105, 115, 195, 288, 290, 292-296, 411, 423 and 441-445 High Street 2 Osborne Place 11, 19A, 31B Connolly Street
	Low	51 Te Mome Road 105-107 Victoria Street 11 Onehuka Road 1, 1A, 2, 10, 12 and 23 Pomare Road 1, 4-14 and 11-23 Wairere Road 247-253, 250-260, 264-268, 270-282, 284 and 286-288 Grounsell Crescent 709 Western Hutt Road (Belmont School)
Impact driven piling	High	28 and 60 Rutherford Street 15 Daly Street
	Medium	65, 67, 69 and 71 Pharazyn Street 2, 3, 4 and 5 Gaskill Grove 4, 5, 6, 7, 8 and 8A Jenness Grove 3, 5, 7 and 14 Harbour View Road 125 Western Hutt Road 149-151, 157-161, 167-175, 177, 191, 195, 204, 210, 215, 217, 288, 290, 292-296, 298, 330, 336, 337, 338, 340, 365, 369, 374 and 403 High Street 9 and 12 Margaret Street 16, 27, 33, 41, 45, 53, 59 and 69 Rutherford Street 11, 15, 27, 35, 37, 47, 49, 55, 65, 67 and 71 Dudley Street 5 Kings Crescent 2 Osborne Place 6 Raroa Road
	Low	51 Te Mome Road 62, 64, 70, 72, 72, 76 and 105 Victoria Street

Activities	Risk	Sensitive receivers
		22 (Hutt City Church), 31, 39, 61, 63, 79, 81, 85, 87, 93 and 95 Marsden Street 2, 4, 11 and 13 Williams Grove 29, 35, 44 and 46 Railway Avenue 39 Bridge Street 32, 34, 40, 49, 51, 53, 55, 57, 57A, 59, 61 and 63 Pharazyn Street 1 Gaskill Grove 9 and 10 Jenness Grove 11, 25 and 27 Onehuka Road 17, 25, 29, 30, 31, 33, 35 and 39 Tirohanga Road 760 Western Hutt Road 7 Ward Street 1, 2, 4 and 7 Market Grove 61-69 (St James Anglican Church) and 75 Woburn Road 2 Queens Drive 5 and 21 Andrews Avenue 36, 54, 78, 92, 100, 102, 100, 101, 102, 105, 115, 125 129, 137, 118-128, 148, 403, 411, 412, 417, 418, 423, 424 and 441-445 High Street 2, 6 and 8 Pretoria Street 2 Osborne Place 1, 2/9, 3/9, 11, 13, 17A, 19A, 31B Connolly Street 39, 39A, 2/39B, 4/39B, 48-50, 54A and 54B Mills Street 1, 1A, 2, 10, 12 and 23 Pomare Road 1, 4-14 and 11 – 23 Wairere Road 247-253, 250-260, 264-268, 270-282, 284 and 286-288 Grounsell Crescent 709 Western Hutt Road (Belmont School)

It is standard procedure on large infrastructure projects for nearby buildings to be assessed by a suitably qualified and experienced building surveyor to establish the condition of construction prior to and post construction works.

It is noted that during the public consultation process, PetVet (53 Rutherford Street) has raised concerns regarding the potential for construction vibration to interfere with their surgery activities. It is anticipated that vibration levels from impact driven piling works could be up to 5 mm/s PPV at the foundations of 53 Rutherford Street. Surgical equipment and procedures undertaken within an operating theatre can be compromised at very low levels of vibration (e.g. 0.28mm/s PPV). Classification of this property in terms of DIN 4150-3 as part of a pre-condition building survey has been recommended and is allowed for under the proposed conditions of consent in Appendix A of this AEE. This will enable the quantification of the sensitivity of the building to construction vibration. Lower (i.e. more onerous) vibration criteria may be applicable to PetVet's activities than allowed for under the Waka Kotahi Construction Guide. To this end, the provision for a lower applicable limit is also allowed for under the proposed conditions of consent.

The heritage listed buildings and structures located adjacent to the Project works are outlined at Table 64 along with an assessment of the vibration risk associated with the vibration generating activities shown.

Table 64 - Vibration risk of heritage buildings and structures

Address	Vibration Risk	
	Vibratory fill compaction	Impact driven piling
125 Western Hutt Road (Lochaber)	Medium	Medium
760 Western Hutt Road (Casa Loma)	Medium	Low
149-151 High Street (Lower Hutt Post Office)	Higher	Medium
2 Queens Drive (Little Theatre and Library Building)	Higher	Low
61-69 Woburn Road (St. James Church)	Higher	Low
75 Woburn Road (Gatehouse, Vogel House)	Medium	Low

The construction vibration risk levels identified in Table 64 above are indicative and will be refined with the support of site-specific measurements at the commencement of construction vibration generating activities.

Similar to construction noise, it can prove impracticable to fully comply with all of the recommended vibration criteria at all properties at all times. Typical mitigation options include selection of equipment and construction methods to minimise vibration transmission and consulting with the community to manage activities in order to avoid works at sensitive times.

Summary

Construction works are inherently noisy and can often lead to high levels of vibration. A pragmatic approach needs to be taken when assessing the noise and vibration effects of any construction project. This is particularly true of public works projects that take place within the road carriageway (and beyond) where the nature of the works gives rise to high noise and vibration levels; there is often only a small distance between the works and adjacent sensitive receivers and the practicable options available for mitigation can also often be limited.

9.11.4 Assessment of operational road traffic noise effects

Operational road traffic noise – Waka Kotahi designations

The assessment and comparison of predicted levels with assessment criteria and predicted changes in levels, taking into account noise acoustics modelling, has been undertaken at all PPFs within 100m from the edge of the closest traffic lane for the new and altered roads within the Waka Kotahi new and altered designations. The results of this assessment are provided at Table 8 of the Traffic Impact and Transport Integration Assessment (Technical Report #9).

This assessment identifies that the differences in predicted road traffic noise levels between the 'Do-minimum' scenario (proposed roads with no noise mitigation measures) and the 'Do-nothing' scenario (existing roads with future traffic volumes at 2036) in 2036 range between -2dB and +2dB at all PPFs.

The predicted changes in road traffic noise levels do not exceed the thresholds specified in Section 1.5.2 of NZS 6806 at any assessment position at any one or more PPF, therefore the NZS 6806 altered road traffic criteria as shown in Table 61 are not applicable to this Project.

In terms of predicted road traffic noise levels from 'new roads' only, the highest predicted traffic noise levels from the 2036 'Do-minimum' scenario are up to 55 dB $L_{Aeq(24h)}$ at Nos. 3 and 5 Harbour View Road. This falls comfortably within the Category A criteria (i.e. 57 dB $L_{Aeq(24h)}$) for new roads under NZS 6806 as shown in Table 61.

A change in noise level of up to 2 dBA is considered a negligible/insignificant change as detailed in Table 65 below, as such no road traffic noise mitigation is required for the SH2 changes.

Operational road traffic noise – Hutt City Council local road changes

The operational noise assessment has also been undertaken at road traffic noise sensitive receivers within 100m of the new HCC designation, where local roading changes are proposed.

To provide context for the below discussion, a general, indicative guide to subjective responses and possible effects resulting from noise change is provided in Table 65 below.

Table 65 - Subjective perception of changes in noise level

Noise level change	General subjective perception
1 – 2 dBA	Negligible / insignificant change
3 – 4 dBA	Perceptible change
5 – 8 dBA	Noticeable change
9 – 11 dBA	Halving/double the loudness
> 11 dBA	More than halving/double the loudness

The human effects in terms of subjective perception form the basis of assessment for the changes in noise level resulting from the changes in road traffic from changes to the local road network associated with the Project. Due to the reconfiguration of vehicle routes in the Lower Hutt city centre, some streets will experience a drop in road traffic numbers (and therefore noise) whilst increases will occur in other streets.

The assessment identified that road traffic noise levels resulting from changes to the local road network associated with the Project (compared to the 'Do-nothing' scenario) are predicted to lead to a reduction in noise levels at 60 of the 74 noise sensitive receivers assessed. This reduction is sufficient to be noticeable at a number of these properties, i.e. equal to or greater than 5 dBA, representing a positive effect of the Project. Noise levels are predicted to remain unchanged at a further four of the receivers.

Noise level increases are predicted at 10 receivers; for 8 of these the noise level increase is between 1 to 2 dBA (negligible). A 3 dBA (perceptible) increase is predicted at 137 High Street, and a 6 dBA (noticeable) increase is predicted at 151-155 High Street. This predicted noise level increase is due to the predicted increase of road traffic numbers on roads near this property (i.e. Andrews Avenue).

151-155 High Street contains two levels of residential units above ground floor commercial spaces. A review of the resource consent application for that development[53] has indicated the residential units are designed to be naturally ventilated. Assuming that a window, when partially opened for ventilation, typically provides a sound reduction of between 10-12 dBA, internal noise levels of the residential units at 151-155 High Street are predicted to be approximately 54 dB $L_{Aeq(24hr)}$ in 2036 due to road traffic from the implementation of the Project.

It is anticipated that building modification mitigation at 151-155 High Street should be offered to reduce traffic noise intrusion from changes in the local road network traffic to habitable rooms at first and second floor levels on the south-western and south-eastern facades to 40 dB $L_{Aeq(24hr)}$.

[53] Resource consent application – proposed building redevelopment 151-155 High Street Lower Hutt – Lot 1 DP 90205 Lower Hutt, dated 5 December 2014, Valley Architectural Ltd.

Building modification mitigation is proposed to be offered to the property owner (ultimately it will be up to the property owner to accept or decline that offer and the practicality of undertaking modifications to this building, noting that it is listed as a heritage building in the District Plan, so a resource consent may be required). The 40 dB $L_{Aeq(24hr)}$ criterion has been selected as it is in line with the internal design sound level range recommended for living areas and sleeping areas of houses and apartments located within an inner city area under NZS 2107. This also accords with the internal noise level criterion (Category C) set out in NZS 6806.

Alternatively, should predicted traffic flow increases near 151-155 High Street be able to be moderated such that increases in noise level were limited to equal or less than 4 dB $L_{Aeq(24hr)}$ the requirement for building modification is not recommended, so could be avoided.

9.11.5 Assessment of operational rail noise and vibration effects

Future rail noise levels

A noise level survey to determine the train noise source levels was completed within the rail corridor; 5 metres from the nearest track that backs onto properties located along Pharazyn Street.

Changes to the rail alignment resulting from the removal of the existing Melling Station and its replacement with a new Melling Station approximately 450 metres west-south-west are minimal, only occurring parallel to properties at 57-63 Pharazyn Street with an associated change in horizontal and/or vertical alignment of less than 0.5 metres. The distance between the tracks and the residential properties is approximately 25m.

Noise levels at the sensitive receivers have been predicted using a railway noise model. Rail noise levels at the nearest noise sensitive receivers (i.e. Nos. 61 and 63 Pharazyn Street) are predicted to be equal to the existing levels with the new Melling Station in place.

Predicted rail vibration levels

Current rail vibration levels at the sensitive receivers closest to the proposed rail realignment (No. 57-63 Pharazyn Street) are predicted to be lower than 0.05 mm/s at the current speed of 50km/hr, which is a very low level of vibration and is generally accepted as being imperceptible. As the shortening of the operational track length is likely to result in the trains travelling slower past properties along Pharazyn Street, it is anticipated that rail vibration levels received at No. 57-63 Pharazyn Street will be imperceptible after the completion of the new Melling Station and Melling Line realignment.

New Melling Station noise effects

A site visit and noise level survey of the operation of the existing Melling Station were undertaken to identify the existing operational noise sources. It was observed that train idling noise was the only source of noise for the operation of the existing station. Trains were observed idling in the station for approximately 1 to 3 minutes. A sound power level of up to 86 dBA has been calculated from the noise levels measured of idling trains.

The Project also proposes for approximately 200 parking spaces within the park-n-ride facility next to the new Melling Station. The noise assessment assumes a worst case scenario where all 200 spaces either fill up/empty in one hour during daytime hours, and 20% (40 spaces) fill up/empty in one hour during night-time hours.

Noise levels at the representative noise sensitive receivers have been predicted using a noise model. The results show that the predicted cumulative sound levels generated by the new station and park-n-ride facility comply with the relevant District Plan permitted activity noise limits at all surrounding receivers.

9.11.6 Measures to manage potential adverse noise and vibration effects

Construction mitigation

Since it is impracticable to comply with noise and vibration limits at all receivers at all times, the most effective way to ensure that the Best Practicable Option (BPO) mitigation measures are being followed and that noise and vibration emissions are minimised is by advising the contractor(s) how to manage noise levels and the effects upon neighbouring properties. This is best achieved under the framework of a Construction Noise and Vibration Management Plan (CNVMP). Where the construction methodology under the CNVMP prior to construction commencing is insufficiently developed at that time, or where changes occur and are predicted to exceed applicable noise limits, the provision of Schedules to the CNVMP (aka Site Specific Construction Noise and Vibration Management Plans (SSCNVMPs)) are proposed.

The key mitigation measures proposed to achieve good construction noise and vibration management practice are provided below:

- Community consultation to inform affected receivers, since inherently high noise and vibration levels are generally tolerated because of the transitory nature of construction works;
- Noise and vibration training to be part of the site induction programme undertaken by all staff;
- The noisiest works should be kept within standard construction working hours where reasonably practicable;
- Driven piling works for the construction of the new road bridge and pedestrian bridge are to be attenuated using a timber cushioning shoe and shrouding noise curtains if at all practicable;
- A suitably qualified and experienced building surveyor is to determine the sensitivity to vibration of the buildings identified as being within the ‘Higher Risk’ category in Table 14 and all buildings identified under Table 16 of the Noise and Vibration Assessment (Technical Report. #10);
- Review available fixed and mobile equipment fleet, with a preference for more recent and silenced equipment whenever possible. Engine covers should be kept closed while equipment is operating. All combustion engine plant should be checked to ensure they produce minimal noise. Vehicles should be kept properly serviced and fitted with appropriate mufflers. Where practical, machines should be operated at low speed or power and should be switched off when not being used rather than left idling for prolonged periods;
- Plan to use equipment which is fit for the required tasks in terms of power requirements;
- As far as possible, material drop heights into or out of trucks are to be minimised;
- Mobile noise barriers or enclosures should be used when higher noise levels are predicted; and
- Where possible, the quietest machinery and methods available and practicable should be used.

All practicable mitigation, including a strong community consultation programme, should form the primary focus of efforts to manage effects. Where works are predicted to exceed the applicable noise limit(s), and the level, timing and duration of exceedance are considered significant, then temporary relocation of affected parties to alternative accommodation is to be allowed for as a mitigation measure for the Project. This should only be considered when the potential for all other forms of mitigation to reduce noise levels have been exhausted and a significant level of exceedance at a particular noise receiver will still occur, i.e. it is generally to be considered as the mitigation option of last resort.

The construction methodology will evolve, and detailed information will be developed as the Project progresses. The appointed contractor will be required to determine and implement the BPO mitigation measures prior to, and throughout construction in accordance with the Waka Kotahi Construction Guide.

It is proposed that the Contractor (once appointed) will develop and implement a Project CNVMP based on NZS 6803 and the Waka Kotahi Construction Guide. The CNVMP will as a minimum include:

- The construction noise and vibration criteria for the Project;
- Description of the works, equipment/processes and their scheduled durations;
- Machinery and equipment to be used;
- Hours of operation, including times and days of week when construction activities causing noise and vibration would occur;
- Identification of affected noise and vibration sensitive receivers where construction noise and vibration management and mitigation would be required;
- Management and mitigation measures to achieve compliance with the Project noise and vibration criteria wherever practicable;
- Methods for communicating and consulting with affected parties, and for responding to complaints;
- Methods for dealing with specific circumstances that may arise when full compliance with all of the Project noise and vibration criteria cannot be achieved; and
- Methods for monitoring and reporting on construction noise and vibration, including when full compliance cannot be achieved, or in response to complaints.

Operational mitigation

For operational mitigation measures, the following road surface types are proposed:

- SH2: Open Graded Porous Asphalt (OGPA);
- SH2 on-ramp/off-ramp and interchange;
  - The majority of the on/off ramps will be OGPA;
  - The approaches/departures near the intersections to the bridge will be Stone Mastic Asphalt (SMA); and
- Local roads (including new Melling River Bridge): Asphaltic Concrete (AC).

Building modification mitigation will be offered to the owners at first and second floor levels of 151-155 High Street. The intention is to reduce road traffic noise, arising from alterations to the operation of the local road network, to habitable rooms on the south-western and south-eastern facades, at first and second floor levels of 151-155 High Street, to 40 dB $L_{Aeq(24hr)}$. Alternatively, building modification mitigation would not be required if traffic flow increases near 151-155 High Street can be moderated such that increases in noise level are limited to equal or less than 4 dB $L_{Aeq(24hr)}$.

9.11.7 Conclusion

The operational effects of the Project have been shown to range from a generally positive acoustics outcome through to a negligible adverse effect.

The only exceptions to this are:

a. at 137 High Street, where a change in the predicted road traffic noise level of +3 dBA forms a perceptible subjective change. However, the effect of this change is still considered minor and does not require mitigation; and

b. at 151 – 155 High Street, where a change in the predicted road traffic noise level of +6 dBA forms a noticeable subjective change. However, with implementation of the building modification mitigation measures, or if traffic flow volumes can be limited such that increases in noise level are limited to equal or less than 4 dB $L_{Aeq(24hr)}$, recommended adverse effects are considered remedied.

Although construction noise modelling indicates that construction noise levels are likely to exceed the recommended noise limits at a number of noise sensitive receivers, implementation of the BPO mitigation measures is expected to mitigate construction noise effects to an acceptable level. Similarly, although vibration risk levels are assessed as high for some properties, construction vibration effects are anticipated to be effectively managed through the implementation of BPO mitigation measures. The development and implementation of a CNVMP is proposed in the conditions of consent set out in Appendix A to this AEE.

In summary, the operational effects of the Project have been shown to range from a generally positive acoustics outcome through to a negligible adverse effect. With the adoption of the construction mitigation measures proposed, residual noise and vibration effects of the Project are considered acceptable.

9.12 Air quality

Overview

Construction activities including demolition, earthworks, vehicle movement and material handling will result in the generation of dust and other construction emissions to air. The local receiving environment is reasonably sensitive and includes high and moderate sensitivity urban activities within 200m of the works in places. As a result, a high standard of dust management is recommended to mitigate potential air quality impacts. Provided the recommended dust control measures are implemented, offensive or objectionable nuisance or significant air quality impacts can be avoided, and residual effects will be minor at most in scale. Once the Project is likely to have only small impacts on air quality with incremental increases in the impacts of SH2 traffic flow and reductions in impacts along key local links, such as Ewen Bridge and Queens Drive. Ambient PM_{10} and NO_2 concentrations in the area are predicted to continue to remain well within the health-based assessment criteria levels. As a result, there is unlikely to be any material increase in exposure of people in the local environment to ambient air contaminants.

9.12.1 Introduction

This section summarises the findings of the assessment of actual and potential effects on air quality arising from the construction and operation of the Project outlined in the Air Quality Assessment (Technical Report #11).

9.12.2 Nature of the discharges to air

During construction of the Project, potential discharges to air include the following:

- Dust (particulate matter) is the main construction contaminant, comprised main of coarse particulate matter that may cause nuisance or property soiling effects. Coarse particulate will tend to deposit in close proximity to the source, and deposition of dust typically occurs within 100 m of the source with deposition minimal beyond a distance of 200 m in most circumstances. Dust emissions could also include a small proportion of fine particulate or hazardous components with a potential to affect human health with sufficient exposure.

- Odour could potentially be emitted during the construction phase if odorous contaminated soil is disturbed (Refer to the Contaminated Land Technical Report – Report #13).
- Engine combustion by-products from construction vehicles, plant and machinery.

During the operational phase of the Project the following contaminants will be emitted to air from local roads:

- Combustion by-products from vehicle engines, including fine PM_{10} and $PM_{2.5}$ fractions of suspended particulate matter, nitrogen dioxide (NO_2) and carbon monoxide (CO), each of which can affect human health if sufficient exposure occurs in the community.
- Fine particulate from vehicle brakes, tyre and engine wear.

9.12.3 Existing air quality environment

The environmental setting is described in relation to the following aspects:

- Land use and sensitivity to air pollutants;
- Meteorology and topography; and
- Background air quality and emission sources.

The Project is located in an urban environment which contains a range of adjacent urban activities with varying sensitivity to air contaminants potentially emitted. There is likely to be a continuum of sensitivity of adjacent activities – high sensitivity residential activities located to the northwest, north and south ends of the Project; moderately sensitive commercial activities in the Lower Hutt city centre; and low sensitivity light industrial activities and open spaces located along the alignment of Te Awa Kairangi and Pharazyn Street.

The Project is located in relatively flat terrain on the western side of the Hutt Valley floor. The meteorology and propagation of emissions of this area will be influenced by the Western Hills. Data illustrates a strong prevalence for winds from the north-northwest and north-northeast direction, with a secondary prevalence for wind in the opposite direction and infrequent winds from east and west. Wind over the Project area is likely to be channelled by the Western Hutt Hills with a northeast to southwest orientation. Winds of more than 5m/s (dust pick up and propagation are most likely to occur) are most frequent from the north and north-northeast; the Project area is sheltered by the hills and as a result wind speeds will likely be lower.

Background levels of contaminants emitted by the Project are likely to currently exist in the Project area. These contaminants include dust from construction activities and wind over the bed and banks of Te Awa Kairangi; combustion contaminants including PM_{10} and $PM_{2.5}$ particulate and NO_2 from solid and vehicle fuel combustion. In general concentrations of these contaminants over the Project area are currently likely to be well within the benchmarks set in the National Environment Standard for Air Quality (NESAQ) and air quality in the area overall is of a reasonable standard. Based on PM_{10} levels measured by GW in the last five years, the Lower Hutt airshed in which the Project area is located is not currently classified as ‘polluted’ under the NESAQ.

9.12.4 Assessment of construction and operational air quality effects

Construction

For the purpose of the construction air quality assessment, the Project area and surrounds have been divided into five sectors:

- River works northeast of the Melling Interchange - includes activities such as stopbank earthworks and material handling, on-site screening of excavated material for construction use and movement of heavy vehicles over unsealed surfaces, which have the potential to generate dust emissions of a reasonable intensity. Activities within a distance of 200m of the works in this section (beyond which dust deposition is likely to be minimal beyond) include residential areas of in the suburbs of Boulcott, Belmont and Harbour and commercial areas of the Lower Hutt city centre. The sensitivity of activities in these areas is generally moderate or high and a high standard of dust management and control will be required to mitigate dust impacts.

- Works in the river and urban renewal and revitalisation southwest of the Melling Interchange - have potential dust generating activities as the riverworks to the northeast as well as building/structure and road pavement demolition and removal. This will occur within 200m of urban developments in the suburbs of Melling, Belmont, Harbour View and the Lower Hutt city centre and a high standard of dust management will also be required in this area.
- The aggregate processing plant will include activities such as crushing, aggregate screening, material storage and handling that have the potential to generate significant dust if not well managed. The proposed processing site is located to maximise separation from dense urban development. There are some dwellings along Pomare Road and the Transpower Substation within 100m of the plant (where the bulk of dust deposition is anticipated). The potential for deposition is reduced for dwellings 100-200m from the plant. Given the nature of processing activities and proximity of sensitive neighbouring activities, specific dust management restrictions are recommended for aggregate processing activities in this area.
- Dust emissions from the SH2 Melling interchange and new Melling Station upgrade works - anticipated to generate dust emissions of a reasonably strong intensity from demolition, earthworks, material handling and vehicle movements on unsealed surfaces. The road and rail works will be carried out within 200m of urban development in Melling, the Lower Hutt city centre, Belmont and Harbour View. River works will occur in close proximity and upwind of dwellings in the Melling residential area adjoining SH2, which will require attention to management of dust effects.
- The construction works in the Lower Hutt city centre - will involve demolition that has the potential to generate substantial dust, and associated road pavement and material handling generating less intensive dust. This area of works is in close proximity to urban activities with a moderate sensitivity to dust and will require a high standard of dust management.

In summary, there is potential for emissions of dust and other contaminants from construction activities, including from potential HAIL sites. Prior to the implementation of mitigation measures, the overall effect of the Project is considered to be significant. Provided that the proposed control measures are implemented, offensive or objectionable nuisance or significant air quality impacts are likely to be avoided. Whilst it is unlikely that all construction emissions will be fully contained or internalised, the residual effects will be localised to areas close to the Project area and minor at most in scale.

Operational

The potential operational air quality impacts are associated with transport emissions from local roads on ambient air quality. The Waka Kotahi estimations of background PM_{10} and NO_2 levels in the Project area indicate that these are at an 'acceptable' level against the NESAQ, World Health Organisation Air Quality Guidelines and PNRP criteria and targets. Traffic emissions from local road links and SH2 are predicted to make relatively small contributions to ambient PM_{10} and NO_2 concentrations compared to the relevant NESAQ and World Health Organisation air quality assessment criteria.

Construction of the Melling Interchange is predicted to result in an incremental improvement to the impacts of emissions from SH2 due to a change to more free flowing traffic from the current flows, noting that these contributions are relatively small. The Project is likely to result in modest improvements in the air quality impacts of emissions from key road links in the area (including SH2).

Overall, the operational assessment indicates that air quality is currently likely to be of a reasonable standard in general in the local area. The Project is predicted to result in small changes to emissions from local roads and associated impacts on local air quality. Air contaminant concentrations are predicted to remain well within health-based assessment criteria. It is anticipated the Project will not result in any material increase in exposure of people in the area to transport related air pollution.

9.12.5 Measures to avoid, remedy or mitigate actual or potential adverse effects

Construction

A range of mitigation and monitoring measures have been proposed for the construction air quality effects of the Project, to minimise emissions of dust and other contaminant and exposure to those contaminants at sensitive locations. The measures include the following, to be secured through a Construction Air Quality Management Plan, as required by the Waka Kotahi Air Quality Assessment Guide:

- Controls over the location of construction activities;
- Dust suppression techniques to control dust emissions;
- Regular visual monitoring of activities and emissions to allow management measures to be updated and improved on an ongoing basis; and
- Continuous instrumental monitoring of weather conditions. This can be achieved with a dedicated weather station within the Project area or by using the GW weather station at Birch Lane through access to continuous online data to monitor trigger levels.

Details of monitoring and management measures should be refined once detailed design is completed and the Contractor who will be responsible for implementation is appointed.

Operational

Due to the small scale of predicted air quality impacts associated with the Project, further operational air quality measures are not required.

9.12.6 Conclusion

The Project has the potential to affect local air quality during the construction phase of the Project as a result of dust and other construction emissions, and during the operational phase through changes to vehicle emissions from local roads.

The environmental setting of the proposed construction activities varies in sensitivity to dust and other construction emissions (including high and moderate sensitivity activities). As a result, a reasonably high standard of dust control is proposed. Provided that mitigation measures are implemented, it is considered that construction impacts will be no more than minor in scale.

Local ambient air quality is currently likely to currently be of a reasonable standard, and it is anticipated that the operational emissions will result in minimal changes in adjacent air quality. Operation of the Project is not anticipated to result in any material increase in exposure of the local community to transport related air pollution and further measures to mitigate operational air quality impacts are not required.

The proposed mitigation measures for the construction phase are included in the proposed conditions of consent in Appendix A.

9.13 Archaeology and historic heritage

Overview

The Project is located in an area associated with both Māori and early European settlement The archaeology and historic heritage assessment identified 20 known archaeological and/or historic heritage sites within and immediately adjacent to the Project area. The Project area is already heavily modified, and most archaeological/historic heritage material and features are likely to have already been destroyed as a result of previous activity. Adverse effects on archaeological sites will be avoided to the extent practicable. Where this is not possible, mitigation measures include:

- Active monitoring of earthworks in areas of significance, and an On Call Procedure.
- Visual and virtual records of representative examples of the buildings scheduled for demolition.
- Installation of interpretive material detailing specific archaeological and historic heritage sites and general history of Māori occupation and culture.
- Feasibility assessment to determine the potential to relocate and reuse Melling Station.

Separate to the RMA approval process, a single general archaeological authority for the Project will be sought from Heritage New Zealand Pouhere Taonga. Overall adverse effects on known and potential archaeological and historic heritage values are likely to be low.

9.13.1 Introduction

This section of the AEE provides a summary of potential effects on known and potential historic heritage and archaeological sites. The full assessment of the archaeological and historic heritage assessment is provided in the Archaeological and Historic Heritage Assessment (Technical Report #12).

9.13.2 Existing archaeology and historic heritage environment

The RiverLink Project area is situated within a wider area that has been occupied for several centuries, first by Māori and later in conjunction with mid-19th century settlers. Settlement in Lower Hutt has centred around Te Awa Kairangi from the earliest days of human activity in the area. This included development and construction of pā and kāinga and associated cultivations located along the river and through to the Petone foreshore. Te Awa Kairangi was used as the main transport throughfare and as an important source of food and other resources. From the mid -19th century this was augmented by the construction of the first Hutt River bridges, which allowed increased travel by land through to Wellington City and the Wairarapa and created opportunities for further commercial and residential growth in Lower Hutt.

The archaeological and historic heritage assessment divided the Project area and surrounds into 12 areas for the purpose of identifying and assessing values and effects. The assessment identified nine specific archaeological sites within the Project area. Six of these have been recorded as a direct result of archaeology and historic heritage assessment while the other three had been recorded previously. A further five recorded archaeological sites have been identified in close or related proximity to the Project area. In addition, there are a further six heritage sites within or in close proximity to the Project area. These sites are described in Table 66 below.

The assessment of Melling Railway Station, Casa Loma (175 Western Hutt Road) and Lochaber (125 Western Hutt Road) is informed by separate built heritage assessments undertaken by Mr Ian Bowman, appended to Technical Report #12.

Table 66 - Summary of existing archaeological and historic heritage sites and areas

NZAA no.	Site name	Category	Significance	Condition	Within the Project works area
R27/733	Motutawa Pā	Archaeological Site	High regional cultural significance as one of few known sites of Lower Hutt Māori occupation. Low likely archaeological values due to subsequent alteration of the area and probable position in current river bed just north of the Project area.	There are no visible remains – likely destroyed.	No - Located just north of the Project Area within the current bed of Te Awa Kairangi. Unlikely to be physical remains of Motutawa Pā still present or within the actual Project area.
R27/732	Maraenuku Pā	Archaeological Site	High regional cultural significance as one of few known sites of Lower Hutt Māori occupation closely relation to 1840s regional conflicts. Low likely archaeological values due to subsequent construction of substation, probable position partly within current river bed and general alteration to the wider area through flood events, stop bank construction and alteration to the river course.	Probably largely destroyed by burn event of 1847 and subsequent development of the substation and river protection work (stopbanks, planting, alteration to the river course.	Yes - In general area of Connolly Street Substation to river.
R27/742	Te Ahi-o-Manono Kāinga	Archaeological Site	High regional cultural significance, as one of few known sites of Māori occupation and possibly the oldest site in the area Low likely archaeological values due to probable position partly within current river bed and general alteration to the wider area through flood events, stop bank construction and alteration to the river course.	No visible remains-likely destroyed.	Yes - Possible location of Māori kāinga, within current river bed of Te Awa Kairangi in a location opposite the Margaret street-Daly Street intersection.

NZAA no.	Site name	Category	Significance	Condition	Within the Project works area
R27/734	Hutt River Bridge Settlement	Buildings and historic sites (seven)	High regional significance as area of first colonial Lower Hutt settlement and bridge building	No visible remains - likely largely destroyed by subsequent redirection of river and construction of stopbanks and recreation areas.	Yes - General area from the Ewen Bridge north to the Daly Street-High Street Intersection into river bed and adjacent stopbanks and river flats.
R27/737	295-327 High Street area	Archaeological	Moderate local significance as area of colonial Lower Hutt settlement	No visible remains - likely largely destroyed by subsequent road and property development.	Yes
R27/737	High Street from Fraser St to Andrews Ave	Archaeological	Moderate local significance as part of wider Lower Hutt early bridge settlement	No visible remains - likely largely destroyed by subsequent road and property development.	Yes
Heritage List No. 7520	Lower Hutt Civic Centre Historic Area	Archaeological	High Local significance as centre of Lower Hutt civic development	Extant buildings and garden	No – adjacent to but excluded from Project area
Heritage List No. 4145	Former Post Office	Archaeological	High Local significance as noted heritage building	Extant building	No – adjacent to but excluded from Project area
R27/674 (part)	Bridge Street Carriageway (opposite 41 Bridge Street)	Archaeological	Moderate local significance as former part of one of oldest Lower Hutt cemeteries	No visible remains-likely destroyed by subsequent road development. Burials known to have exhumed and relocated as part of road widening 1908.	Yes - Former part of Wesleyan Methodist Cemetery in Bridge Street road reserve.
R27/674 (part)	Bridge Street Cemetery	Archaeological	High regional significance as one of oldest cemeteries in Lower Hutt.	Visible remains of graves (headstones, surrounds). Documented sub-surface burials (kōiwi) will be extant.	Yes - Remnant part of Wesleyan Methodist Cemetery (includes easement R.O.W. to rear of 57 Marsden Street).

NZAA no.	Site name	Category	Significance	Condition	Within the Project works area
R27/674 (part)	57 Marsden Street (Lot 1 DP 26266)	Archaeological	Potentially high local significance as a potential former part of one of oldest cemeteries in Lower Hutt.	No visible remains but GPR investigations carried out in 2016 show subsurface anomalies concordant with grave sites in terms of size and spacing.	Yes - Potential, former part of Wesleyan Methodist Cemetery currently covered by commercial buildings
R27/735	24-40 Marsden Street (even Nos. only), 59-75 Marsden St (odd Nos. only - part R27/735) and No. 56 Marsden Street	Archaeological and built heritage	High local significance as secondary settlement associated with early Lower Hutt and bridge construction.	No visible remains - likely largely destroyed by subsequent road and property development.	Yes
N/A	58-90 Marsden Street (even Nos. only)	Archaeological and built heritage	Low-moderate local significance as one a large number of Lower Hutt residential/commercial areas developed early 20th c	Extant mixed period, 20th c housing, no evidence of archaeological remains.	Yes
N/A	60-104 Pharazyn Street	Archaeological and built heritage	Low local significance as part of one of a large number of later 19th c Lower Hutt developments.	No visible remains-likely largely destroyed by subsequent road and property development.	Yes
N/A	Existing Melling Station Building and Environs	Historic Heritage Building	Low archaeological values. High regional significance as a rare Modern Movement Functionalist styled station and as part of a small group of railway buildings built at a similar period and in a similar style. This group of buildings is potentially nationally significant.	Extant 1950s station building, no evidence of archaeological remains.	Yes – building requires removal.
N/A	SH2 Normandale to Melling and 3 Harbour View Road	Archaeological and built heritage	Low archaeological values.	No visible remains.	Yes

NZAA no.	Site name	Category	Significance	Condition	Within the Project works area
HNZPT List No. 2889 R27/625	Melling to Pomare Road - Lochaber House and Wigwam area 125 Western Hutt Road	Historic Heritage Building and Archaeological	Moderate archaeological values as one a few 19th c dwellings to have been partially investigated in Lower Hutt (Wigwam). Medium heritage value	Extant pre 1900 building and gardens (Lochaber House). Remnant 1870s Wigwam house site, partially investigated under Authority 2019/068.	No – adjacent to but excluded from Project area
Heritage List No. 1324	Casa Loma 760 Western Hutt Road	Historic Heritage Building	Medium heritage value	Extant heritage building, no visible or likely archaeological remains	No – adjacent to but excluded from Project area

9.13.3 Assessment of the effects on archaeology and historic heritage

Thirteen out of the 20 archaeological and heritage sites will potentially be adversely affected by the proposed works:

- **R27/733 Motutawa Pā** - very low likelihood of physical adverse effects on archaeological values due to probable position in the river bed just north of the Project area. There are no visible remains and the site is likely already destroyed due to previous activity.
- **R27/732 Maraenuku Pā**- low-low/moderate likelihood of adverse physical effects due to high modification in area as a result of previous activity, including a burn event in 1847 and subsequent substation development and river protection work.
- **R27/742 Te Ahi-o-Mana Kāinga** - low likelihood of adverse physical effects due to probable position partly in the river bed and general alteration to river through flood events. There are no visible remains and the site is likely already destroyed due to previous activity.
- **R27/734 Hutt River Bridge Settlement** - low-low/moderate potential for physical adverse effects from disturbance to archaeological and heritage values due to historic river re-direction and stopbank construction. No visible remains and the site is likely largely destroyed due to previous activity.
- **R27/737 295-327 High Street/High Street from Fraser Street to Andrews** Avenue - low-low/moderate potential for physical adverse effects from disturbance to archaeological and heritage values, particularly in area of 289-297 High Street. No visible remains – likely previously destroyed by road and property development.
- **R277/674 (part) Bridge Street Carriageway (opposite 41 Bridge Street)** - low/moderate potential for physical adverse effects from damaging archaeological remains/kōiwi at depths below 1m. No visible remains-likely destroyed by subsequent road development. Burials known to have exhumed and relocated as part of road widening 1908.
- **R27/674 (part) Bridge Street Cemetery** - very high potential for physical adverse effects from encountering and damaging archaeological remains/kōiwi over whole site. There are visible remains of graves (headstones, surrounds) and documented sub-surface burials (kōiwi) will be extant.
- **R27/674 (part) 57 Marsden Street (Lot 1 DP 26266)** - Potentially high likelihood of disturbance to kōiwi and other archaeological material underneath buildings during excavation for storm water pump. There are no visible remains, but ground penetrating radar investigations carried out in 2016 show subsurface anomalies concordant with grave sites in terms of size and spacing.
- **R27/735, 24-40 Marsden Street (even numbers only), 59-75 Marsden Street (odd Nos. only - part R27/735) and No. 56 Marsden Street** - low-low/moderate potential for physical adverse effects from encountering archaeological material. No visible remains - likely largely destroyed by subsequent road and property development.
- **58-90 Marsden Street (even numbers only) -** low potential for adverse physical effects from encountering archaeological material, but loss of representative early-mid 20th century architectural landscape.

- **60-104 Pharazyn Street** - low potential to encounter archaeological material in the vicinity of 60-76 and 102-104 Pharazyn Street; low/moderate potential for physical adverse effects from encountering archaeological material in the vicinity of 76-100 Pharazyn Street. There are no visible remains - likely largely destroyed by subsequent road and property development.
- **Existing Melling Station and environs -** very low potential for physical adverse effects from encountering archaeological material as this is a 1950's building and there is no evidence of archaeological remains. Removal and potential demolition of the building could result in the loss of a building of high regional significance in heritage terms.
- **SH2 Normandale to Melling and 3 Harbour View Road** - no direct adverse effects identified as very low potential to encounter archaeological material and there are no visible remains.
- **Casa Loma – 175 Western Hutt Road** – no direct adverse effects as there will be no change to this property.
- **Lochaber – 125 Western Hutt Road** – no direct adverse effects as there will be no change to this property. Replacement of radiata pines at the intersection of Harbour View Road and the property access, which have to be taken out to create the new property access, is recommended by the built heritage specialist.

Historical river protection works and general city development works have already modified the most historic material and features. This includes the Maraenuku Pā site, Te Ahi-o-Manono Kāinga and the various "Hutt River Bridge" settlements and bridges north of Ewen Bridge and along the western end of High Street. There are significant areas across the Project area which have a very low likelihood of archaeology or historic heritage values being present, as no pre-1,900 or listed 20th century developments or buildings have been identified in these areas. As a result, with the exception of potential effects on Melling Rail Station, the overall potential adverse effects on archaeology and historic heritage values are low as a result of the RiverLink Project. For the Melling Station, the potential adverse effects from a built heritage perspective are regarded as high.

9.13.4 Measures to manage potential adverse effects on archaeology and historic heritage

The primary measure to manage potential adverse effects is to avoid, to the extent practicable, sites and areas with a high likelihood of actual, remaining, physical archaeological and historic heritage values, such as the Methodist cemetery on Bridge Street, the central area of Maraenuku Pā etc. Where adverse effects cannot be avoided, these will be minimised. Pre and post 1990 sites and places within the Project area will be investigated and recorded.

A general Archaeological Authority will be sought from HNZPT, which will include an On-Call Procedure for areas where archaeological sites have not been identified. An Archaeology and Heritage Management Plan (AHMP), developed in consultation with HNZPT and Mana Whenua, will set out the guidelines and requirements of both the Archaeological Authority for any pre-1900 sites and for any requirements for 20th century historic heritage sites and 19th century archaeological sites. This includes development of an On-Call Procedure for unexpected archaeological or kōiwi encounters.

The AHMP will also include any site-specific mitigation measures for sites of significance that cannot be completely avoided:

- Area 8 – 57 Marsden Street - carry out further non-invasive ground penetrating radar investigation and limit project works to ground level (or just below) where further GPR investigations indicate likely or possible burials. Active monitoring of earthworks and limit depths and building demolition.
- Active monitoring of earthworks in the areas as described in the Archaeology and Historic Heritage Assessment (Technical Report #12) as:
  - Area 2 (Maraenuku Pā adjacent to Connolly Street Substation down to the river);
  - Area 4 in the area between Daly Street-High Street intersection south to Ewen Bridge – Te Ahi-o-Momono Kāinga and Hutt River Bridge Settlement area;
  - Hutt River Bridges;
  - Area 6 289-317 High Street;
  - Area 7 around 36-137 High Street;
  - Area 8 in the areas of 24-75 Marsden Street and the former Wesleyan Cemetery in Bridge Street road reserve; and
  - Area 9 in the general vicinity of 76-80 and 100 Pharazyn Street.
- On call procedure for works carried out in the areas of:
  - Motutawa Pā and the remainder of Area 2 (excluding Maraenuku Pā);
  - Area 3;
  - Area 5;
  - Area 8 – 58-90 Marsden Street – even numbers only;
  - Area 10 – Melling Station
  - Area 11 – SH2 Normandale to Melling – in the vicinity of 3 Harbour View Road; and
  - Area 12 – Lochaber, unless earthworks will encroach on the property boundary, in which case adopt active monitoring.
- Visual and virtual records will be made of the buildings in Area 7, Marsden Street and Pharazyn Street scheduled for demolition.

With regard to the existing Melling Railway Station, the station cannot stay in its current location because of the new interchange. The Melling Line will be pulled south to connect with the new pedestrian/cycleway bridge and to enable construction of the new interchange. Given the significance of the station building, a condition is proposed which would require preparation of an assessment to determine whether it is feasible to relocate the station and reuse it as part of a new Melling Station. If it is not feasible to relocate and reuse the station, then a hierarchy of actions is proposed to reuse and record the building, in accordance with HNZPT guidelines, as part of the demolition process.

Whilst there are no direct effects on Lochaber House, at 126 Western Hutt Road, construction of the new access to this property will result in the loss of several radiata pines on Harbour View Road. The built heritage specialist recommends replacement trees of the same species are planted as close as possible to the existing location. The built heritage assessment also includes a recommendation for monitoring of vibration levels where these are determined to be of concern to the physical fabric of the building. This is reflected in the Noise and Vibration Assessment (Technical Report #10) and in a condition requiring building condition surveys for identified properties.

9.13.5 Conclusion

There are 20 known archaeological and historic heritage sites within the Project area, of which 14 are located within the Project works area. Four of the archaeological sites have high significance and are largely avoided by the Project with the exception of works within the existing road corridor. The remaining archaeological sites are all heavily modified by previous activity with little remaining material and have moderate to low significance overall.

The existing Melling Railway Station requires removal from its current location. The building has been assessed as having high regional significance. The feasibility of relocating and/or refurbishing the existing Melling Station as part of the new Melling Station will be assessed, to determine whether this is reasonably practicable.

A range of further measures to mitigate the adverse effects of the Project on archaeological and historic heritage values are proposed including applying for a single archaeological authority for the Project, and an AHMP to ensure that archaeological issues are managed appropriately during the construction phase of the Project. Mitigation measures are covered in the proposed conditions of consent set out in Appendix A.

The mitigation measures recommended above are considered appropriate, and the adverse effects of the Project on the archaeological and historic heritage values will be appropriately managed.

9.14 Contaminated Land

Overview

A Preliminary Site Investigation (PSI) has been undertaken covering the Project area. The PSI identified 22 potentially contaminated sites (based on the presence of current and historic HAIL[54] Activity) within, and adjoining, the Project area. A Detailed Site Investigation is recommended for 18 of those sites, being the sites that are rated as moderate and high risk. This work will be carried out prior to Project construction works commencing.

A Contaminated Land Site Management Plan (CLSMP) will then be developed that will identify the measures to manage potential effects on human health and the environment from working in or near contaminated sites during construction. By implementing the CLSMP throughout construction works, potential effects will be adequately managed, such that the overall post-mitigation level of effects from contaminated soil on the Project will likely be minor.

9.14.1 Introduction

The Project area contains a number of potentially contaminated sites, arising from historical hazardous land use activities.

Earthworks in or near contaminated sites have the potential to have adverse effects on human health and the environment during construction. To identify known and potentially contaminated sites within the Project area, a PSI was undertaken, which is appended to the Contaminated Land Assessment (Technical Report #13).

9.14.2 Existing contaminated land

Section 3.7.3 of this AEE describes the 18 sites with high to moderate risk of contamination as identified in the PSI.

[54] Hazardous activities and industries list

Out of the sites identified, two are high risk, being:

- 31 Marsden Street, 33 Marsden Street and 28 Bridge Street (former timber treatment activity), and
- 69-95 High Street (former dry-cleaning activity).

9.14.3 Assessment of contaminated land effects

Construction

Construction works associated with the Project will require significant soil disturbance. There is the potential that contaminated soils may be disturbed during the construction period of the Project, which would result in discharges of contaminants to air, land and water (surface and groundwater) where there may be an effect on the environment, and discharges of contaminants where there may be an effect on human health, including project construction workers, site workers and/or the public. A DSI will be prepared for those sites identified as being moderate to high risk in the PSI – this requirement is set out in the proposed conditions of consent included in Appendix A. The DSI will assess the suitability of each site for the intended land uses and identify areas requiring further assessment, management and/or remediation prior to the change of land use.

Potential effects on human health and the environment, as a result of disturbance of contaminated soils, will be managed through the implementation of a CLSMP and other specific management procedures that will be developed for construction (e.g. on site soil management practices, off site soil transport and disposal, implementation of the Project ESCP, and the management of dust and odour). With the implementation of the CLSMP and the other specific management procedures, any effects on human health and the environment from contaminated land during construction will be adequately managed and mitigated such that they are minor.

With appropriate mitigation and remediation measures, the site will be suitable for the intended land uses.

Operation

If unmanaged, there is the potential that any contaminated soils able to be safely contained onsite post construction could be disturbed during periodic operational maintenance works. Accordingly, in the event that known or suspected contaminated soil remains on site at the completion of works, an Ongoing Monitoring and Management Plan (OMMP) will be prepared by a suitably qualified and experienced person (SQEP) to manage this risk.

9.14.4 Measures to manage potential contaminated land effects

The CLSMP will detail the procedures to be implemented during construction to control the disturbance and movement of any identified contaminated, or potentially contaminated soils. These procedures will focus on managing the health, safety and potential environmental risk from contaminated land associated with the Project. In addition to the CLSMP the following measures are also proposed to be secured through conditions:

- Leaded paint and asbestos surveys will be completed prior to buildings being demolished
- DSIs will be prepared for sites identified as moderate to high risk within the PSI
- Upon completing earthworks a Site Validation Report will be prepared, and
- In the event that any known or suspected contaminated material remains on the site at the completion of works an OMMP will be prepared.

9.14.5 Conclusion

A PSI undertaken for the Project has identified 18 potentially contaminated sites located within the Project area as having a moderate to high level of risk of contamination. A CLSMP will be developed for the site area and will detail procedures to be implemented to control disturbance and movement of contaminated soils. Additionally, it is proposed that where a DSI recommends this, disposal of contaminated land is undertaken to a suitable location, and an Ongoing Monitoring and Management Plan is prepared following completion of works for any remaining contamination on site. Subject to appropriate mitigation and remediation measures being implemented, the site will likely be suitable for the intended land uses, and the overall post-mitigation level of effects from contaminated soil on the Project will likely be minor.

9.15 Landscape, visual and natural character

Overview

The Project works will have both adverse and positive landscape, visual amenity, and natural character effects. RiverLink will transform the landscape along this section of Te Awa Kairangi and greatly improve how the community experiences this environment and moves to and from the wider transport connections and the central city streets.

During the construction phase of the Project, overall the adverse effects for the upper reach will be moderate adverse and moderate to high adverse for the lower reach. Detailed construction management and sequencing will be required to manage these effects, to limit the extent of adverse effects at any one time and to ensure the long-term positive effects of the Project are realised as soon as possible in the programme.

Overall, and given time for the naturalised patterns in the active channel and the significant areas of planting to establish, the operational effects of the Project will be moderate positive for the upper reach and moderate to high positive for the lower reach. In the lower reach of the river the character and quality of the landscape will shift from a car and willow dominated landscape to an active river landscape, city-community interface and multimodal transport node. In the upper reach there will be marked natural landscape and natural character benefits due to the widening of the river, use of indigenous planting for flood protection and its informal recreation character will be enhanced.

9.15.1 Introduction

This section presents the findings of the assessment undertaken to determine the actual and potential landscape and visual effects of the Project. This includes consideration of effects on the natural and urban landscape (including relevant aspects of urban design), natural character of the river environment and visual effects. This assessment is supported by the Landscape and Visual Impact Assessment (Technical Report #14). Measures to avoid, remedy and mitigate potential adverse effects of the Project on the natural and urban landscape, visual amenity and natural character or enhance positive effects in these areas are further detailed in the ULDF in Volume 3 of the Application documents.

9.15.2 Assessment of landscape and visual effects

Operational effects

Upper Reach - Kennedy Good Bridge to Mills Street

Natural landscape

There are few remaining natural landforms within the proposed designation boundary. This is a highly modified environment managed for the purpose of flood protection. As the channel is wider and less confined in this reach, it has established a more braided or naturalised pattern.

On the TRB near the Kennedy Good Bridge, there are a number of short sections of channelised watercourses which are daylighted. There is a minor pattern of indigenous vegetation associated with these features and one is linked to the recently planted biodiversity wetland (the Belmont Wetland). Given the mitigation measures set out in section 9.15.3 including Project design measures, the proposal has prioritised an enhanced pattern of naturalised features. Given time for constructed active channel features to naturalise and the plan to reduce the use of willows, the effects on the natural landscape will be a Moderate-Low positive.

Urban landscape

Project works in this sector that are associated with potential adverse urban landscape effects relate to:

- Existing connections for the community- should the off street carparks at Kennedy Good Bridge and Harcourt Werry Drive not be retained
- Provision for safe and reduced conflict management – mitigation will require confirmed integration of flood protection and general maintenance and operations with cycle and pedestrian movement
- CPTED – detailed design measures will need to confirm planting approaches to ensure good sightlines to and from vantage points in the surrounding environment, natural wayfinding and clear entry and exit points within the river landscape.

In summary, given the integrated design measures set out in section 9.15.3, the Project will provide for a significant uplift in the quality of the experience in this sector, as a naturalised river landscape and informal recreation resource. Compared to the existing environment, and as a result of the design measures integrated to provide a varied, safe experience and integrated cultural narrative, this will result in moderate positive urban landscape effects.

Visual effects

Potential adverse and positive visual amenity effects are relevant to:

- Pedestrians and cyclists using the river landscape paths
- Motorists travelling on SH2 and Harcourt Werry Drive
- Motorists travelling on the Kennedy Good Bridge
- Cyclists and pedestrians travelling on the Kennedy Good Bridge
- Cyclists that continue to use SH2 and Harcourt Werry Drive
- Staff, students and visitors to the Belmont School grounds, and
- Residential properties in Belmont, who have an open outlook towards the Project.

The Project will transform the visual characteristics of the river landscape and have marked changes on the nature and extent of visual access to the active channel which contribute to visual amenity. There are no changes to the stop bank levels in this sector which mean that existing views from close residential properties will not be further confined or limited. Over time, and where it is possible to further reduce the pattern of willows to the edge of the active channel, indigenous plants will add further to the visual quality of the area, including for example by flowering rata and kowhai.

In summary, taking into account the mitigation set out in section 9.15.3 and while the effects will vary for particular viewing audiences, the Project will improve visual amenity. Overall, there will be moderate-high positive visual amenity effects resulting from the works in this sector, when compared to the existing environment.

Effects on natural character

The Project will require significant earthworks and vegetation removal to establish a newly aligned, deepened and widened active channel and lower berm removing all existing vegetation.

Potential adverse effects on natural character relate to the:

- Future active channel works including the interface of operating machinery with members of the public using the path network and beach areas
- Extent of naturalised indigenous planting that can be achieved at the outset and the way in which this will be perceived from the path network and the river. An undercover of grass would detract from natural character benefits, and
- Failure of the commitment to an indigenous flood protection solution through adaptive management, such that the vegetation is not allowed to revert (through successive replanting) back to willows. That is, over time, willow trees are proposed to be phased out, as the dominant cover. It is understood that willows may be needed as an interim measure in particular locations as part of the immediate response and medium-term flood protection, where the only other alternative would be to use rock lining (which would have greater adverse natural character effects).

In summary, taking into account the mitigation set out in section 9.15.3 in particular those integrated into the proposed design, the outcomes sought by the ULDF will establish a naturalised river landscape with enhanced natural character compared to the status quo. The design of the active channel will provide for greater variation in water movement and natural character gains are ensured by a range of other design elements. Measures to ensure long term operational requirements can be integrated to reduce their perceived dominance and the intended indigenous planting for flood protection and adaptive management to limit the use of willows long term are key to natural character restoration and enhancement. Overall, with these measures in place, the Project will establish moderate natural character benefits in this sector and these effects would increase overtime with the transition to indigenous cover.

Public access

There are no potential adverse effects in relation to public access through this sector. The Project will deliver improved access to and along Te Awa Kairangi.

Lower Reach - Mills Street to Ewen Bridge

Natural landscape

The existing landforms in the river landscape of this reach are highly modified including limited riffles within the active channel. Sections of the active channel edge are rock lined, in addition large areas of the lower berm on the TLB are occupied by car parking and the interface with the city streets feature retaining wall structures from Fraser Street to Melling Bridge.

Project activities that have the potential to create adverse effects to natural landscape are:

- Removal of the minor pattern of naturalised features in the river landscape during construction
- The Melling interchange works requiring earthworks and vegetation removal along the edge of SH2, which will have an impact of the escarpment landform and the habitats it supports along with 3 notable trees (31# black beech, #33 silver fir and #34 pohutukawa), and
- Road works within the dripline of other notable trees (where kerb lines remain unchanged).

In summary, the design has provided for additional naturalised features in the river landscape (as described in section 9.15.3), however, it also removes existing unmodified natural landforms and vegetation along SH2. Given time for establishment, the proposed planting will mitigate some of these potential effects, but there will be a permanent moderate-high adverse effect on the natural landscape features around the interchange including the removal of two large notable trees and around a proposed culverted watercourse. Overall, considering all components of the works, the effects on the natural landscape in this Sector will be moderate-low adverse.

Urban landscape

The Project provides a significant shift from a vehicle dominated river landscape and city edge environment to one that supports varied informal recreation activities, future development opportunities that front face the river and pedestrian and cycle priority.

The Project works that create potential adverse urban landscape effects relate to:

- Loss of 1900s residential homes on the TRB
- Removal of all buildings to the river side of Pharazyn Street
- Construction of the Melling interchange and removal of the existing Melling train station
- Interface with the construction of the new stopbanks with the existing buildings along Daly Street and the ramps required where the new Melling Bridge lands along Queens Drive and its intersection with Rutherford Street
- Construction of retaining walls associated with the new Melling Bridge, and
- Retaining walls at the edge of private properties required as part of the Melling Bridge embankments.

On the TRB there will be a loss of some early 1900s residential homes that contribute to the character of the community in the area. These will be replaced by the grassed embankment of the new stop banks and will include a low retaining wall (opposite the cemetery and commercial properties retained to the western edge of Marsden St).

Removal of all buildings to the river side of Marsden and Pharazyn Street to make way for the new Melling Station, pedestrian and cycle bridge and stopbanks/flood protection works is proposed. In terms of urban landscape effects these changes are not negative overall. They contribute to a shift in urban character, and, in part, this mitigates for the loss of the older residential homes in this area. Combined with other works proposed in this area, this shift establishes greater connectivity and improved amenity for the residential neighbourhood.

Works to create the interchange development have the potential to generate adverse urban landscape effects, as it will introduce significant new structure into this environment and the removal of the existing train station. However, large scale interchanges are common in the broader landscape, including the recently constructed SH58 interchange, and the connectivity gains as relevant to urban landscape matters, including the new train station, will be significant. The main potential issues to address will be design measures to integrate the retaining walls into escarpment edge of the highway to reduce their dominance and to provide for revegetation opportunities.

Retaining walls required for the TLB tie in of the new Melling Bridge also have the potential to generate adverse urban landscape effects. In terms of urban landscape matters the main potential issues to address include the interface of the bridge ramps with the stop banks and other required retaining walls in this area such that visual quality, CPTED principles and future urban development options are considered.

In summary, taking into account the measures set out in section 9.15.3 which include the design measures integrated into the Project and those secured through the ULDF outcomes, the Project will provide a significant uplift in the quality and character of the urban landscape in this sector, as an important waterfront environment for surrounding communities and a multimodal transport node. While there is the potential for some adverse urban landscape effects associated with these works, these are able to be mitigated appropriately including by additional measures described in Section 9.15.3. Compared to the existing environment, on completion of the Project works, including landmark structures and an integrated korowai narrative, there will be high positive urban landscape benefits for the River Landscape works, moderate-high positive urban landscape effects for the City-Community connections and moderate positive urban landscape effects for the transport works.

Visual amenity

The Project will transform the visual characteristics of the river landscape, surrounding commercial and residential communities and the Melling SH2 environment. It will result in marked changes to the nature and extent of visual access to the active channel which contributes to visual amenity.

Potential adverse and positive visual amenity effects are relevant to:

- Members of the public that are using the river, paths and activities within the river landscape:
  - Moving to and from the city via the new connection points including the new pedestrian cycle bridge and train station
  - That are using the new transport connections, moving on and off SH2, across the new vehicular bridge and who are travelling along the local roads that will be changed by the Project
- Commercial properties with a close and open outlook towards the river including from multi-level buildings such as from the chamber of commerce building
- Motorists travelling along SH2 and the existing and proposed vehicle bridge connections
- Motorists travelling along the local road network within the proposed designation boundary and immediate surrounds
- Residential properties with a close and open outlook to the river landscape off Mills Street and Connolly Street
- Residential properties with a close and open outlook toward the river landscape off Marsden Street, and

- Residential properties with an open, more distant view of the proposed works, primarily from the western hills and suburbs.

The Project will lift the quality and diversity of the built environment, integrate additional naturalised features and mitigate for effects on the escarpment landform, vegetation and stream. It will enhance visual access to the river landscape for nearby communities and users of the landscape including via the new pedestrian / cycle bridge over the river. There will be general positive visual amenity effects due the way the landscape will be articulated including more varied and activated gathering spaces and additional areas of mass planting with flowering species likely visible at a distance.

In summary, taking into account the design measures and those secured through the outcomes of the ULDF as set out in section 9.15.3 and while the effects will vary for particular viewing audiences, the Project will improve visual amenity. Overall, there will be high positive visual amenity gains resulting from the works in this sector, when compared to the existing environment.

Natural character

The potential adverse effects on natural character relate to the following activities:

- Earthworks and vegetation removal required to facilitate a deeper and wider river channel
- Modifications to the natural escarpment landform, and
- Partially culverting a stream.

The Project will require significant earthworks and vegetation removal to establish a newly aligned, deepened and widened active channel, lower and upper berm and this will remove all existing vegetation in the river landscape. Works associated with the SH2 interchange will require modification to the natural escarpment landform and the removal of regenerating vegetation and a further section of the stream to be culverted.

In summary, the outcomes sought, as set out in the proposed design and ULDF within 9.15.3, will enhance natural character. The active channel will feature greater variation in water movement and, although there will be additional structures in and on the edge of the river, natural character gains are ensured by their quality and articulation. Measures to ensure operational requirements can be integrated are also important in this sector along with habitat management; to limit the effects of likely greater disturbance by people. Overall, the Project will establish moderate-low natural character benefits in this sector and these effects could increase once detail design measures are confirmed.

Effects on public access

The Project will deliver enhanced access to and along the river. While the stopbank heights increase, the connections to and from the surrounding communities are improved compared to the existing. The connections to and from surrounding communities increase in number and are in more logical locations. The new pedestrian bridge and vehicle bridge proposed on the design and ULDF outcomes will provide new and enhanced vantage points as will the path network and sequence of ūranga. Overall, the effects on public access will be high and positive.

Construction effects

Upper Reach - Kennedy Good Bridge to Mills Street

Natural landscape

Effects on the natural landscape will be very high adverse as all existing naturalised features will be removed.

Urban landscape

Effects on the urban landscape relate mainly to the way in which public use is provided for and any changes to vehicle circulation that might be required. These effects will be, at worst, low-moderate adverse.

Visual amenity

Effects on visual amenity will be very high at the ‘active face’ of the construction site which will be staged. This will limit adverse visual amenity effects.

Natural character

Natural character effects in this reach are likely to be greater, as this reach has higher existing values. This will have a very high adverse effect.

Overall, the construction effects in Upper Reach for landscape, visual and natural character have the potential to be at least low to moderate adverse and, for natural landscape and natural character aspects of landscape, very high adverse at the active face.

Public access

Effects on public access are high adverse, as significant restrictions will be required to enable safe construction of the project over the indicative 4-year construction programme. These effects can be mitigated by staging to reduce the level of public access restriction by, for example, limiting the extent of works and keep one side of the river open to the public.

Summary

Overall, the construction effects in the Upper Reach for landscape, visual and natural character have the potential to be at least low to moderate adverse and, for natural landscape and natural character aspects of landscape, very high adverse at the active face; in the area impacted by the current stage of works. These effects can be mitigated by careful staging to limit the extent of the works and disruption to existing activities.

Lower Reach – Mills Street to Ewen Bridge

Natural landscape

Effects on the natural landscape in this sector will be very high adverse; all existing naturalised features will be removed.

Urban landscape

Effects on the urban landscape have the potential to be high adverse. There are a number of residential communities and the main commercial centre in close proximity to the proposed designation boundary. The proposal requires the removal of a significant number of houses and changes to local roads that will have an impact beyond the boundary. Loss of privacy, nuisance, and existing circulation patterns will arise. These effects will be the greatest along the TLB for the commercial properties directly interfacing with the new stop banks and where several larger scaled buildings will be removed.

Visual amenity

Similarly, there is potential for high and very high adverse visual amenity effects in the lower reach for the remaining Mills Street and Marsden Street community that will look out at the works and the commercial properties interfacing with the stop bank works.

Natural character

Natural character effects will be very high adverse due to the proximity of the active works area.

Public access

Effects on public access are high negative, as significant restrictions will be required to enable safe construction of the project over the indicative 4-year construction period. These effects can be mitigated by staging to reduce the level of public access restriction by, for example, limiting the extent of works and keep one side of the river open to the public.

Summary

The effects construction in the Lower Reach are likely to be high and very high adverse for most aspects of landscape where there are active works, due to the proximity of surrounding commercial and residential properties. Careful staging and disruption management, as proposed will help manage these effects, along with early implementation of the permanent works such that they are mitigated overall to moderate-high in the Lower Reach

Overall effects summary

Table 67 below sets out a summary of the scale of effects for each sector based on each type of effect and the mitigation and measures that have been incorporated into the design or secured through the outcomes of the ULDF are set out in 9.15.3 below.

Table 67 - Landscape and visual effects summary

Type of effect	Upper Reach	Lower Reach
Operational effects		
Natural landscape	Moderate-low positive	Moderate to low adverse
Urban landscape	Moderate positive	High positive
Visual amenity	Moderate-high positive	High positive
Natural character	Moderate positive	Low-moderate positive
Public access	Moderate positive	High positive
Summary of effects once permanent works establish	Moderate positive	Moderate-high positive
Construction effects (within the immediate area of effect)		
Natural landscape	Very high adverse	Very high adverse
Urban landscape	Low adverse	High adverse
Visual amenity	Moderate-high adverse	Very high adverse
Natural character	Very high adverse	Very high adverse
Public access	High adverse	High adverse
Summary of construction effects with proposed staging and mitigation	Moderate adverse	Moderate-high adverse

9.15.3 Measures to avoid, remedy or mitigate adverse effects

Mitigation proposed including those incorporated into the design and outcomes sought by the ULDF are set out in Table 68 below.

Table 68 - Mitigation incorporated into the Project design and ULDF

Effect type	Upper reach	Lower reach
Operational mitigation		
Natural landscape	· Reinstatement of a broader active channel; · Integration of indigenous planting within the lower berm flood protection as part of the korowai narrative; · Enhancement of terrestrial habitats overtime; and · Opportunities for existing biodiversity wetlands to be maintained, additional stream daylighting and watercourse outlets naturalised.	· Reinstatement of a broader active channel; · Minimisation as far as possible, of the use of stopbank retaining walls between the city and the stopbanks; · integration of indigenous planting within the lower and upper berm, and filling the batter banks of the interchange; · Enhancement of terrestrial and aquatic habitats overtime; and · Use of vertical and MSE type 'green' retaining walls to limit earthworks and modification of the escarpment landform and vegetation patterns and to provide for revegetation opportunities.
Urban landscape	· Increased provision of pedestrian and cycling facilities, and gathering spaces will have improved amenity; · Provision for improved amenity, safety and access at gathering spaces for all users including car parking areas; · A varied planting approach which offers opportunities to use plants as wayfinding devices and as mahinga gardens, for traditional uses; · Safe movement along the path network is promoted and CPTED is integrated into the design; and · Establishment of an integrated palette for built elements and quality of finish and identity including articulation of the korowai narrative.	· New vehicular bridge connection into the city centre and improvements to active transport connections; · Provision of logical, more accessible street connections to and from the river and its edge and utilisation of indigenous planting throughout the reach; · The network of shared and segregated riverside paths that link with the residential and commercial communities, and city entry/exit points and improved cycling connections; · Vehicle dominance will be reduced, promotion of multimodal transport use and streetscapes reconfigured to enforce pedestrian priority; · Provision of improved amenity and safety outcomes, opportunities for informal recreation activities and the integration of CPTED principles into design; · Establishment of design principles are established for retaining which reduce visual dominance / clutter; · Improved landscape setting through a landscaped carpark; and

Effect type	Upper reach	Lower reach
		· Establishment of an integrated palette for built elements and quality of finish/articulation and identity including articulation of the korowai narrative.
Visual	· Limiting the potential loss of visual access to the river; · Restoration, through the design, of natural character and lifts the quality of built components and enhances visual access to the active channel; and · Integration of the Korowai narrative provides a coherent and engaging palette of materials which enhances visual interest and amenity.	· Limiting the potential loss of privacy and visual access to the river for residents close to the new stop bank; · Visual environment for Marsden Street residential environs will be improved. Elevated residential properties on the Pareraho Hills will also benefit; · Mitigation of the visual amenity effects associated with the height of the stop banks and their interface with the city centre, including large scale retaining walls and embankments; · Prioritisation of the safety of the cycle and pedestrian connections through the use of CPTED principles; · Mitigation of potential increased severance from stopbank heights; · Creation of a city edge ūranga (linear gathering space) and temporary use contributes to the quality of the streetscape and activates the area; and · Integration of He Korowai narrative provides a coherent and engaging palette of materials which enhances visual interest and amenity.
Natural character	· Widened and deepened active channel, with constructed beaches, pools and riffles and more naturalised water movement; · Opportunities to naturalise the design of any rock groynes and the constructed beaches with plants used to protect the river edge; · Design and management strategies to restore and enhance terrestrial, riparian and aquatic habitats, including design or limiting access to selected beaches and greater areas of indigenous planting;	· Widened and deepened active channel, with sloped stop bank design and retaining walls to the edges; · Embankments to the active channel edge integrate indigenous species, and restore and enhance terrestrial, riparian and aquatic habitats. Removal of willows; · Removal of a significant area of car parking in favour of public gathering spaces; · Provision of improved visual and physical access to the active river channel including new vantage points;

Effect type	Upper reach	Lower reach
	· Measures to increase visual and physical access through to the river edge including experience of pool, beach and riffle environs and to vantage points where sweeps of the reach are visible; · Simplified design palette and reduced built forms; · Integration of cultural expression within the overall articulation of spaces and path network; · Provision of clear, safe working areas and separated or screened stockpile areas; and · Integration of cultural expression includes clear references to the natural world and the korowai narrative, of Te Ara Tupua.	· Bridge structures designed to include extended spans and simple sinuous forms; · Provision of steps and ramps to access the river landscape which are less industrial in character; · Limiting the extent, height and dominance of the interchange retaining walls and ramp embankments; and · Integration of cultural expression includes clear references to the natural world and the korowai narrative, of Te Ara Tupua.
Public access	· Enhanced widths of accessible routes of the walking and cycling paths, access to beaches and provision of gathering spaces through the river landscape; · Pedestrian and cycle priority; · Planting for improved visual access to the active channel including the integration of greater areas of biodiversity wetlands; and · Ūranga integrated along the active channel edge and improved access routes to beach areas.	· The new Melling pedestrian bridge and Melling vehicle bridge provides new and enhanced vantage points as will the path network and sequence of ūranga including improved accessible routes; and · Greater opportunities to experience the river environment through improved access to and from the city and nearby communities including accessible ramps.

Proposed mitigation for both sectors

In relation to both sectors the following additional mitigations measures are proposed:

- Provision of detail for temporary laydown and turn around areas in the river landscape design for the long term ongoing management and operations for flood protection.
- Detailed design that is guided by the ULDF.
- Integration of the cultural expression narrative as set out in the ULDF.
- With regard to natural character, further definition of measures located within management plans to enhance freshwater and terrestrial habitats including for migratory fish, roosting, nesting and foraging birds and plant species that maximise mahinga kai opportunities.
- A CEMP that provides for staging and sequencing to:
  - Limit the scale of the active face and minimise time to rehabilitation
  - Develop access and activity solutions with affected communities to limit loss of privacy and temporary access, including for residential and commercial businesses
  - Allow for early implementation and opening of parts of the river landscape with high amenity e.g. the upper reach river landscape or part of the lower reach city access connections, such as the new connection through Laings Road or at the end of Andrews Place
  - Prioritise early planting of both amenity and flood protection planting, and
  - Integrates best practice arboriculture measures to protect existing street trees and the notable trees along local roads included in the Project designation boundary.

9.15.4 Conclusion

The Project works proposed will have both adverse and positive landscape, visual amenity, and natural character effects. These effects will vary by Sector and relate to the main Project components - the river landscape works, the new city-community- river connections and the proposed transport connections.

The Project will transform the landscape along this section of Te Awa Kairangi and greatly improve how the community experiences this environment and moves to and from the wider transport connections and the central city streets.

The korowai narrative and integrated approach to cultural expression is central to these positive effects, as will be developed further in future stages of the Project.

9.16 Natural hazards and geotechnical risk

Overview

Natural hazards have shaped the Hutt Valley and Te Awa Kairangi into their current forms, and will continue to impact the Project area and wider region. The new Project elements that will be constructed for RiverLink are at risk from these natural hazards. Numerous active faults are located in the Wellington region, including the Wellington Fault itself which traverses the Project area, and gives rise to various earthquake-related risks.

The likelihood of rupture of the Wellington Fault, ground shaking from an earthquake and the associated liquefaction, lateral spreading, regional uplift/subsidence, tsunami effects and earthquake induced slope instability on the Lower Hutt hillside has been assessed as an 'event that does occur somewhere from time to time (once every 101 to 1,000 years)'. The likelihood of non-earthquake induced slope instability on riverbanks, as well as weak/unsuitable foundation conditions, has been assessed as an 'event that might occur once in your lifetime (once every 51 to 100 years). The likelihood of non-earthquake induced slope instability on the Lower Hutt hillside has been assessed as an 'event that has occurred several times in your lifetime (up to once every 50 years)'.

There are several natural hazards (fault rupture, ground shaking, lateral spreading, regional uplift/subsidence, slope instability on riverbanks) that could cause severe effects on Project elements. However, they are assessed as tolerable risks and low risk in terms of the relevant planning policies relating to natural hazard management.

The Project does not cause or exacerbate land based natural hazards in other areas.

The earthquake hazards identified in the assessment cannot be avoided unless the Project is not constructed, and cannot be remedied. However, the effects can be mitigated through design and construction.

Natural hazard risks to the Project will be addressed adequately and appropriately through standard detailed design and the Building Act 2004 approvals required for the structures concerned. Such design and construction can mitigate the effects of many of the natural hazards. Bridges should be designed and constructed with a seismic design philosophy to minimise the chance of a bridge span collapsing.

The flood hazard risk has been addressed separately to the geological related hazards.

9.16.1 Introduction

RiverLink is affected by numerous natural hazards, including fault rupture of the Wellington fault, ground shaking from various faults in the region, liquefaction, lateral spreading, regional uplift/subsidence, tsunami and slope instability.

The natural hazards assessment:

- Identifies and assesses the location and nature of existing natural hazards, including site hazards and fault rupture within the RiverLink Project area
- Assesses the resilience of new structures from the effects of natural hazards, and
- Undertakes a risk assessment of the Project to identify levels of risk and reach a conclusion on the acceptability of this risk.

The structures to be constructed as part of RiverLink are prone to natural hazards, including stopbanks, the grade separated interchange and new Melling Bridge, new pedestrian / cycle bridge in the Lower Hutt city centre.

Flooding is a natural hazard within the Project area, which is dealt with separately in section 9.2 of this AEE.

9.16.2 Existing natural hazards environment

Existing natural hazards and geological conditions are addressed in section 3.3.2 of this AEE.

9.16.3 Assessment methodology

The natural hazards assessment adopts a risk-based assessment based on the methodology outlined in the GNS guidelines (Saunders, Beban, & Kilvington, Risk-based approach to land use planning, 2013). These guidelines utilise a risk-based methodology for land use planning that examines the consequences of the natural hazards on the built environment and the likelihood of the natural hazards occurring, which are combined to quantify the level of risk to the built environment. The categories of risk, taken from the GNS guidelines, are 'acceptable', 'tolerable' and 'intolerable'.

Aspects of PNRP Policy P27 are relevant to elements of the Project since the beds of rivers are deemed to be 'high risk areas' under the PNRP and this policy provides a useful natural hazards assessment framework generally. Therefore, the natural hazards assessment gives specific consideration to aspects of PNRP Policy P27 (High Risk Areas) as follows:

(*b) "the hazard risk to the development and/or residual hazard risk after hazard mitigation measures, assessed using a risk-based approach, is low", and*

(c) "the development does not cause or exacerbate natural hazards in other areas."

The assessment also considers RPS Policy 51 and District Plan Policy 14H 1.1.1. In summary these policies require consideration of the frequency and magnitude of risk, including residual risk; whether future hazard mitigation works will be required; whether development will exacerbate existing natural hazards in the area; and the extent of engineering and emergency management measures that may be required.

The following natural hazards affecting Project elements have been assessed:

- Rupture of the Wellington fault
- Ground shaking
- Liquefaction
- Lateral spreading
- Regional uplift/subsidence
- Tsunami
- Non-earthquake induced slope instability on Lower Hutt hillside
- Earthquake induced slope instability on Lower Hutt hillside
- Non-earthquake induced slope instability on riverbanks, and
- Weak/unsuitable foundation conditions.

These natural hazards are those identified by GNS except for weak/unsuitable foundation conditions, which is not included in the GNS report, and sea-level rise, which is included in the GNS report (Saunders, et al., 2016).

Other natural hazards that could affect RiverLink, but that are not considered in the natural hazard assessment, are:

- Flood – this is assessed in section 9.2 of this AEE

- Severe wind, wildfire, drought and volcanic eruption – these hazards are not considered since they are not included in the GNS hazard assessment, and
- Sea level rise – not considered since the primary effects on RiverLink are changes to flooding and groundwater levels. Flood risk and groundwater effects are assessed elsewhere in this AEE.

9.16.4 Risk assessment of natural hazards effects on the Project

The following Project elements are at risk from natural hazards:

- Stopbanks
- Instream works
- Interchange bridge
- New Melling bridge
- Removal of existing Melling Bridge
- Local road changes
- Railway line and station changes
- Pedestrian and cycle bridge
- Promenade, and
- Associated works (culverts, stormwater systems, landscaping, lighting, utilities).

During construction of Project elements, the works will be exposed to the effects of natural hazards in the same manner as the completed works during their operational lives. The period of exposure during construction (approximately 1-2 years for each element) is relatively short compared to the operational life of each Project element, thus the risk assessment applied to the Project elements during their operational lives is also valid for the Project elements while they are being constructed.

Relevant to the natural hazard assessment, the stopbanks, interchange bridge, new Melling bridge and pedestrian and cycle bridge have been designed to an operational life of 100 years, while the instream works, local road changes, railway line and station changes and promenade have been designed to an operational life of 50 years.

Likelihood of natural hazards affecting the Project

The likelihood of natural hazards affecting the Project has been assessed and summarised in Table 69.

Table 69 - Likelihood of natural hazards

Natural hazard	Assessed probability	Indicative description frequency as per GNS guidelines
Rupture of Wellington Fault	10-15% in the next 100 years	Event that does occur somewhere from time to time (once every 101 to 1,000 years)
Ground shaking	1/1500-year earthquake for the interchange bridge	Event that does occur somewhere from time to time (once every 101 to 1,000 years)

Natural hazard	Assessed probability	Indicative description frequency as per GNS guidelines
	1/500-year earthquake for the new Melling Bridge 1/500-year earthquake for other Project elements	
Liquefaction	1/150, 1/500, 1/10000-year earthquake	Event that does occur somewhere from time to time (once every 101 to 1,000 years)
Lateral spreading	1/500-year earthquake	Event that does occur somewhere from time to time (once every 101 to 1,000 years)
Regional uplift/subsidence	10-15% in the next 100 years	Event that does occur somewhere from time to time (once every 101 to 1,000 years)
Tsunami	1/500-year earthquake	Event that does occur somewhere from time to time (once every 101 to 1,000 years)
Non-earthquake induced slope instability on Lower Hutt hillside	1/50-year rainfall event	event has occurred several times in your lifetime (Up to once every 50 years)
Earthquake induced slope instability on Lower Hutt hillside	1/500-year earthquake	Event does occur somewhere from time to time (once every 101 to 1,000 years)
Non-earthquake induced slope instability on riverbanks	Related to a 1/100-year flood event	Event that might occur once in your lifetime (once every 51 to 100 years)
Weak/unsuitable foundation conditions	1/100-year event	Event that might occur once in your lifetime (once every 51 to 100 years)

The risk assessment for each natural hazard on individual Project elements is summarised in Table 70.

Table 70 - Summary of risks from hazards

Element	Hazard										
	Fault Rupture	Ground shaking	Liquefaction	Lateral spreading	Regional uplift /subsidence	Tsunami	Non-EQ slope instability on Lower Hutt hillside	EQ slope instability on Lower Hutt hillside	Non-EQ slope instability on riverbanks	Foundation conditions	Overall risk
1. Stopbanks	T	T	A	T	T	A	A	A	T	A	T
2. Instream works	T	A	A	T	T	A	A	A	I	A	I
3. Interchange bridge	T	T	A	A	T	A	T	T	T	A	T
4. New Melling bridge	T	T	A	T	T	A	A	A	T	A	T
5. Removal of the existing Melling bridge	T	T	A	T	T	A	A	A	T	A	T
6. Local road changes	T	A	A	A	T	A	T	T	A	A	T
7. Railway line and station changes	T	T	A	A	T	A	A	A	A	A	T
8. Pedestrian and cycle bridge	T	T	A	T	T	A	A	A	T	A	T
9. Promenade	A	A	A	T	A	A	A	A	A	A	T
10. Associated works	T	A	A	A	T	A	A	A	A	A	T
Overall risk	T	T	A	T	T	A	A	A	T	A	T

Levels of risk	Acceptable (A)	Tolerable (T)	Intolerable (I)

Five of the ten hazards (fault rupture, ground shaking, lateral spreading, regional uplift/subsidence and non-earthquake slope instability on riverbanks) give rise to risks that are tolerable across all Project elements. The remaining hazards (liquefaction, tsunami, non-earthquake slope instability on Lower Hutt hillside, earthquake slope instability on Lower Hutt hillside and foundation conditions) give rise to overall risks that are acceptable across the remaining Project elements.

When correlating the above risk categories with those in the PNRP, ‘acceptable’ and ‘tolerable’ risk categories correspond with a PNRP risk of ‘low’, and the ‘intolerable’ risk category corresponds with a PNRP risk of ‘high’. On the basis that all risks to the Project have been assessed as either acceptable or tolerable in the GNS framework, the natural hazard risk to the Project is assessed as <u>low</u> in terms of PNRP Policy 27 b).

9.16.5 Risk assessment for effects of the Project on natural hazards in other areas

This section assesses how the Project may affect the risk of natural hazards in other areas. This assessment is relevant to PNRP Policy P27 c), which requires consideration of whether “the development does not cause or exacerbate natural hazards in other areas”. “Other areas” are considered to be restricted to the area surrounding the Project area, i.e. the Hutt Valley.

Construction of all of the Project elements will not cause or exacerbate natural hazards in other areas outside of the Project area.

Therefore, in terms of PNRP Policy P27 c), the Project does not cause or exacerbate natural hazards in other areas.

9.16.6 Measures to avoid, remedy or mitigate actual or potential adverse natural hazards effects

Construction

No specific mitigation measures to be applied to the construction phase for the Project have been identified, since the conclusions for mitigation outlined below relate to the design for the Project elements, and as such relate to the design to be implemented during construction.

Operational

Natural hazard risks to the Project will be adequately and appropriately addressed through standard detailed design and approvals required under the Building Act 2004 for the structures concerned. Therefore, mitigation requirements through designation or resource consent conditions are not recommended.

Stopbanks can be designed and constructed to mitigate weak/unsuitable foundation conditions and slope instability on the riverbanks. For other natural hazards, the only practical measure is to construct earthen stopbanks that are easily repairable after an earthquake.

The interchange bridge, new Melling Bridge and new pedestrian and cycle bridge need to be designed and constructed with a seismic design philosophy to minimise the chance of a bridge span collapsing onto SH2 and into the river respectively.

Other than weak/unsuitable building foundation conditions (which can be accounted for in design and construction using standard construction techniques), it is impractical to implement mitigation measures for local road, railway line and station changes.

The design of building structures will need to meet the current Building Act 2004 earthquake standards. Therefore, the replacement of current buildings with modern buildings will reduce the risk to life and property in the event of an earthquake, In terms of avoidance or remediation, the earthquake hazards identified in the above assessment cannot be avoided unless the Project is not constructed and cannot be remedied.

9.16.7 Conclusion

There are several natural hazards (fault rupture, ground shaking, lateral spreading, regional uplift/subsidence, slope instability on riverbanks) that will cause severe effects on Project elements. However, they are assessed as tolerable risks and low in terms of the relevant PNRP Policy.

The Project does not cause or exacerbate natural hazards in other areas.

The earthquake hazards identified in the assessment cannot be avoided unless the Project is not constructed and cannot be remedied. However, the effects can be mitigated through design and construction.

Natural hazard risks to the Project will be addressed adequately and appropriately through standard detailed design and the Building Act 2004 approvals required for the structures concerned. Such design and construction can mitigate the effects of many of the natural hazards. Bridges will be designed and constructed with a seismic design philosophy to minimise the chance of a bridge span collapsing and a seismic design philosophy that reflects this has been agreed with Waka Kotahi.

9.17 Cultural values

Overview

The Cultural Impact Assessment (CIA) has identified that there are sites of significance to Māori within the Project area, and Te Awa Kairangi is of particular importance. The Project area has strong association with multiple iwi and hapū, and was the site of transitional Pā, in addition to Te Awa Kairangi being a mahinga kai. The sites of significance and Te Awa Kairangi have been modified or destroyed to a degree that it is considered unlikely for works to damage or destroy archaeological sites. Mana Whenua generally support the works.

The proposed mitigation measures that are particularly relevant to cultural effects are the implementation of an Accidental Discovery Protocol, the treatment of stormwater before discharge to Te Awa Kairangi, providing for recognition of Māori sites and history through the design, enhancement of indigenous fish species habitat, and ongoing consultation throughout the Project through the proposed Mana Whenua steering group.

9.17.1 Introduction

The CIA for RiverLink has been prepared on behalf of Taranaki Whānui and Ngāti Toa Rangatira as Mana Whenua and Project Partners. This section of the AEE provides a summary of that assessment of potential effects on historical sites of significance to Mana Whenua, cultural values of Te Awa Kairangi and consultation with Mana Whenua. The full assessment is contained in the Cultural Impact Assessment (Technical Report #16).

9.17.2 Mana Whenua

The Project area has strong association with Te Āti Awa hapu of Ngāti Te Whiti, Ngāti Tāwhirikura, and others of Te Āti Awa nui tonu including Ngāti Tama, and historically with Ngāti Rangatahi, Ngāti Toa Rangatira and Ngāti Hāua. The sites of significance and cultural history of the area are outlined in section 3.2 of this AEE.

Te Awa Kairangi had been central to Māori in the Hutt Valley prior to the arrival of European settlers. The River historically was highly important for both with the earlier Whātonga people from the east coast to the later arriving Taranaki people from the west coast. The River was the source of life with an abundance of freshwater fish giving way to the sea fish in the estuary. Most of the Pā and kāinga up the valley were located close to Te Awa Kairangi or along its main tributaries.

The CIA identifies historical sites of significance for Mana Whenua and the cultural values historically in the Project area and its wider environs[55] along with the cultural values and uses of the Project area today. The identification of the traditional cultural values is derived from traditional uses of the Project area in both the river and the banks and cultural sites in or near the Project area. The key sites are Maraenuku Pā, which is now located in the bed of the river; Motutawa Pā, which historically extended into the Project Area (this pā was short-lived and not highly developed) and the Te Ahi a Manono kāinga. This site was located along the river near the current Lower Hutt city centre, although nothing remains today.

The CIA concludes that the Project is unlikely to further damage or destroy existing culturally significant sites and most have little if any archaeology associated with them and few have been investigated by any archaeological process. Each of these sites will be archaeologically examined and possible responses to them will be identified What remains is the history of each and the mana associated with each site.

One of the Project's major elements is the widening of Te Awa Kairangi channel and berms and the upgrade and raising of existing and construction of new stopbanks on both sides of Te Awa Kairangi between Ewen Bridge and Mill Street. Stop banking work can destroy Māori archaeological sites on the banks of rivers, however in this Project the CIA concludes that it is unlikely that archaeological sites will be destroyed because of the level of activity in colonial times. However, this does mean that archaeological remains could be accidentally discovered during works. The Archaeology and Historic Heritage Assessment (Technical Report #12 in Volume 3 of the Application) assesses the significance of all archaeological sites within the Project area. A general archaeological authority will be sought by the Project and conditions are proposed requiring development of an On-Call Procedure to manage unexpected finds.

The CIA identifies that the nature and design of the flood protection works will be important to Mana Whenua with respect to the character of the River. One of the issues identified in the CIA for Mana Whenua is the health of the River, particularly to maintain indigenous fish species such as tuna/eels (long and short finned), kōkopu (banded, giant and short jawed) and the īnanga that make up part of what are known as whitebait. The maintenance of these species often depends on how and when works are done in the river channel and to a lesser extent what is done on the berms.

Mr Morrie Love, the CIA author, considers that Iwi Māori will see some benefit arising from the Melling pedestrian bridge, particularly with improvements to access through public transport. The local road reconfiguration may provide some opportunities and does not appear to have any adverse cultural effects. Places for recreation and the improved ability to use cycle and walking paths generally have a positive health benefit to all.

The CIA identifies that, for iwi / Mana Whenua, the works in the bed and banks of the river are of high significance especially with the ecological health of the river. The planting of the berms in particular with a transition to indigenous trees and shrubs will help change the appearance of the river to something more like what it was prior to colonisation. The overall state of the River and its cultural significance should be at least maintained and preferably enhanced, in accordance with Te Mana o te Wai. Facilities should ensure that people and their animals respect those areas within the stopbanks and particularly in the river channel.

---

[55] That is the area within the proposed designation boundary, and immediate surrounds to the extent Project works extend beyond this boundary.

The Melling Intersection and bridge roading network changes will not materially affect Te Tatau o Te Po Marae or other cultural places such as the Te Puni Street urupa. There are no known Māori urupa within the site however there is an old Wesleyan burial ground in Bridge Street near the Ewen Bridge which may or may not have been used by local Māori. The changes in railway line alignment, which has always run past the back door of Te Tatau o Te Po marae on Hutt Road will have an effect on the setting of the Marae. A suggestion in the CIA is that naming of the new Melling Station could acknowledge the western hills above the new Melling Station and be called “Pokai” which also has the verbal meaning “to assemble”, providing a linkage to the Marae as well as the hills.

The quality of stormwater runoff from the Melling intersection and bridge, following treatment, will result in a significant reduction of contaminant load discharged into Te Awa Kairangi which will provide positive cultural outcomes.

The ULDF is underpinned by the Kaitiaki Strategy and the He Korowai o Te Awa Kairangi narrative (He Korowai) developed by Mana Whenua and advisers for the Project. He Korowai is drawn from the narrative of Te Ara Tupua, which is woven through all outcomes and opportunities set out in the ULDF. The further development and integration of He Korowai in the detailed design of the Project is supported in the CIA.

Urban renewal and revitalisation is supported by Mana Whenua due to improvements in access to public transport and recreation facilities. The local road reconfiguration does not appear to have any adverse cultural effects. Mana Whenua are not currently invested in building and infrastructure as no land assets were granted in Treaty settlements.

9.17.3 Measures to avoid, remedy or mitigate potential adverse effects

Various methods have been identified to mitigate potential adverse effects on cultural values in the Project area. The below measures are proposed to avoid, remedy or mitigate potential effects.

Active partnership and consultation with Taranaki Whānui and Ngāti Toa will be ongoing throughout the Project consenting process and through the detailed design and construction phases.

Mitigation measures for works in the river channel and berms are proposed and include:

- Maintenance and enhancement of indigenous fish habitat to be guided by the GW Code of Best Practice for River Management Activities (2019)
- Restrictions of works in the river channel in spring to enable the upstream migration of indigenous fish.
- Separation of work in dry berms by temporary bunds.
- Planting of active channel borders to enhance indigenous fish habitat, and
- Stormwater treatment before discharge to the river to maintain and enhance water quality.

Recognition of Māori sites of significance (Pā sites, battle sites and Boulcott Farm) is to be provided by the Project and can be treated by the Project with site interpretation. Use of naming parts of the Project can recognise key sites.

Mitigation measures for the Melling Intersection and bridges are proposed to be:

- Management of stormwater runoff from roads and carparks to Te Awa Kairangi, and
- An Accidental Discovery Protocol in place for Māori cultural material found during construction.

9.17.4 Conclusion

The Project area contains sites that are of cultural significance. A range of measures to mitigate potential adverse effects are proposed, in particular the use of an Accidental Discovery Protocol, recognition of sites of significance, stormwater treatment and enhancement of indigenous fish habitat. The Project can help to enhance the mana of Te Awa Kairangi and highlight its history and importance to Māori.

9.18 Social and recreation impact

Overview

The planning, construction and operation phases of the Project have the potential to generate both positive and adverse regional and local social effects. The Project is anticipated to have large positive impacts to the local and regional community, and as such the Project has a high level of support from the community. These benefits include the construction of the stop banks that will mitigate against future flood events, improved access and connection to Te Awa Kairangi from the Lower Hutt city centre, improvements to the Melling Interchange, and improved access to the train station. The Project will also have some significant impacts, and these are predominantly related to the construction phase that, for the substantial works, is anticipated to extend for around four years. Overall, the potential adverse impacts can be mitigated to a satisfactory level, and the ultimate benefits of the Project will far outweigh these impacts.

The planning phase of the Project (pre-construction phase impacts) impacts relate to fears and aspirations (feelings of stress and uncertainty regarding Project commencement) and amenity and character (vacant shops and properties).

There are both positive and adverse social effects identified during construction of the Project. The positive construction related effects include the opportunity for local construction job creation and business patronage. Negative impacts include uncertainty surrounding acquisition and the loss of community, traffic and river access issues, visual, noise and health impacts of construction, social connectivity, loss of carparks, access to the active transport along the Hutt River Trail, access to recreation facilities within the river corridor, and the need to temporarily relocate the Riverbank Market.

The operation of the Project will result in a number of positive social effects including increased resilience and confidence in flood protection measures, improved access to active transport infrastructure and trains, reductions in congestion, improved access to Te Awa Kairangi and urban renewal and revitalisation. Negative effects relate to a small area downstream of the river as it has an increased potential for flooding at peak flood level.

9.18.1 Introduction

This section outlines the social effects assessment in relation to the Project. These effects focus on the experiences (actual or anticipated, direct or indirect) of individuals, households, and communities' response to changes. The full technical assessment is contained within the Social Impact and Recreation Assessment (Technical Report #17) Assessment.

9.18.2 Assessment of effects and measures to avoid, remedy or mitigate effects

Assessment of social and recreational effects of the Project has been undertaken. Effects have been identified for the planning (pre-construction phase impacts) (highlighted in pink), construction period (highlighted in green) and during operation (blue). Table 71 summarises the effects identified with associated mitigation.

Table 71 - Assessment of social and recreation effects and mitigation

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Planning (pre-construction phase impacts)			
Fears and aspirations and the concern, stress, anxiety and worry caused by the Project commencement and future impacts.	Lower Hutt community, more specifically properties and business adjacent to the works	Early property purchase and regular, ongoing communication regarding Project timing and construction methodology.	Moderate negative
Amenity and character as a result of vacant shops and properties and can attract increased vandalism	Lower Hutt community, more specifically properties and business adjacent to the works	Implementation of the About Space program to target sites identified for property acquisition.	Moderate negative
Fears and aspirations			
Uncertainty around timing and location of works and how it will impact daily routines	Local residents, workers and visitors	Development and implementation of a communication plan, which requires ongoing and regular communication with the public and stakeholders. Communication should include information about alternative access and travel options, complaint management process and updates on construction phasing.	Slight negative
Long term stress and construction fatigue from extended period of construction	Local residents, workers and visitors	Staging of Project to consider minimisation of longer term impacts to specific stakeholders	Moderate negative
Increased resilience and confidence in the community that	Local Study Area	N/A	Large positive

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
infrastructure will prevent a significant flood event from causing catastrophic property damage or loss of life.			
The Project will facilitate improved access and connection to the River from the Lower Hutt city centre. This is a key community aspiration.	Local Study Area	N/A	Large positive
Loss of sense of community from property acquisition and changes to structure of existing town centre.	Local Study Area	Mitigation should occur in the early planning phases to ensure that properties are acquired in a timely manner to provide landowners and the surrounding community with certainty.	Slight negative
Potential improvement of social well-being for the wider community as individuals' perceptions of their life situation is improved through satisfaction that “something is being done” and perception or experience of improved quality of the environment in which they live due to improved provision of recreational infrastructure, better flood protection etc.	Local Study Area	N/A	Large positive
Increased potential for flooding at peak flood level as a direct consequence of the Riverlink works. Property owners will need to be informed of the potential impact to their site and this has	Properties identified downstream of the river	Consultation will need to be undertaken with these landowners. GW will, as part of future review of the HRFMP and its implementation, consult with the affected communities to	Moderate negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
the potential to cause fears regarding the impact of future flood events.		assess the hazard and risk and determine appropriate solutions.	
Personal and property rights			
Changes to how people live as a result of property acquisition including finding new accommodation, schools and other facilities.	Owners and tenants of dwellings required to be removed for Project	Project Partners to implement appropriate property acquisition process to assist residents through this process.	Large negative
Relocation of residential tenants as a result of property acquisition resulting in loss of social networks as well as stress and anxiety associated with relocation	Owners and tenants of dwellings required to be removed for Project	Project Partners to implement appropriate property acquisition process to assist residents through this process.	Moderate negative
Change to community composition and character along Marsden Street and Pharazyn as properties are demolished. The impact also relates to High Street with loss of businesses impacting on retail activity and feel.	Local community and residents with properties adjacent to those acquired	Project Partners to implement appropriate property acquisition process to assist residents through this process, particularly with regard to timing of demolition. Councils existing About Space programme is delivering a range of city centre activation initiatives and projects, in collaboration with local businesses, which will help mitigate any potential fluctuations of visitors to parts of Lower Hutt city centre during construction.	Moderate negative
Impact on privacy for properties located on the western bank due to increase stop bank height enabling walkers and cyclists to see into residential dwellings.	Properties on the Western Bank	Visual impact assessment to determine extent of privacy impact	Slight negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Social and recreation impact			
Loss of access and temporary closure to sections of walking and cycling tracks including the Hutt River Trail. Although access on at least one side of the river will be maintained throughout construction, there will be areas of localised works on the unimpeded side.	Local and regional residents and workers	A walking and cycling trail with a minimum width of 3 m should be maintained on one side of the river for the duration of construction. Any required detours around localised work should be clearly signposted and maintained to an acceptable standard.	Moderate negative
Increased congestion on cycle trails due to one side of the Hutt River Trail being closed	Local and regional residents and workers	Communication and appropriate level of signage to ensure bicycle riders are informed of changes to access to the Hutt River Trail and alternative routes	Moderate negative
Restricted access to areas of the river where people can touch the water	Local residents and visitors	Consideration is given to creating additional sites to access the water if existing access points are temporarily obstructed	Slight negative
Changes in traffic movement during construction could impact access to Belmont School and Boulcott Farm Golf course	Social infrastructure users	Communication with facilities regarding changes in traffic movement and potential	Slight negative
Construction works impact or prevent community events such as the Riverbank Market, Park Run, and other annual running events along the Hutt River Trail from being held	Local and regional residents and visitors	Review calendar of community events to plan works or relocate construction activities in order to minimise impacts to community events. This requires liaison with community event organisers.	Slightly negative
Loss of informal basketball court that is used after hours in the Lower Hutt City Centre Carpark	Local residents	Provide temporary activations after hours in areas such as car parks. Activations could include half courts similar to the basketball	Neutral

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
		court that was located in the Lower Hutt City Centre Carpark.	
Demolition of Block Road Skateboard Park during Stage 3	Facility users including local children and youth	Construction of a new skateboard park facility during Stage 2 of construction, this would enable a new facility to be completed prior to demolition of the existing facility.	Neutral
Loss of social infrastructure due to demolition of buildings including two childcare centres and a WINZ Service Centre	Facility users	Project Partners to implement appropriate property acquisition process including relocation to another suitable location.	Slight negative
The cycle path created will be a safe place for young children to cycle, enabling families from the greater Wellington Region to ride and spend time at locations along the River	Residents of Greater Wellington region	N/A	Large positive
Walking promenade along the Stop Bank will facilitate greater access for strollers and wheelchairs enabling a greater number of people to enjoy the Riverwalk	Residents of Greater Wellington region	N/A	Large positive
Improved cycling facilities particularly the construction of the pedestrian and cycle bridge will improve safety for cyclists. The works will connect to Te Ara Tupua the walking and cycling path that will connect Lower Hutt to Wellington.	Residents of Greater Wellington region	N/A	Large positive

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
The instream works will enable the creation of additional access points to the river enabling visitors to access the water. This will enable greater recreational activities such as paddling, swimming kayaking and waka activity.	Residents of Greater Wellington region	N/A	Large positive
Improved connections to the River Heritage Trail and Hutt River Trail establishing a regionally significant regional park that will connect Kaitoke Regional Park to Hikoikoi Reserve on Petone's Marine Parade. This will have health and wellbeing benefits to the broader Wellington Region.	Residents of Greater Wellington region	N/A	Large positive
The relocation of the Block Road Skateboard Park will enable the development of an improved higher quality facility that has greater accessibility to public transport and is in an area of higher visibility facilitating a higher level of patronage. In addition, this will reduce the risk of vandalism such as graffiti which has occurred in the current facility	Residents of Hutt City particularly children and young people	N/A	Large positive

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Creation of additional areas of open space including children's playgrounds at intervals along the riverbank providing additional play and recreation opportunities.	Residents of Hutt City particularly children and young people	N/A	Large positive
Access and connectivity			
Disruption to travel patterns with regard to changes in traffic movement and road closures particularly in the Marsden and Pharazyn Street areas. This has the potential to impact on daily routines such as travelling to work, school or to the local shops.	Road users, pedestrians and cyclists	CTMP and Pedestrian/Cycle Management Plan to provide for road safety and maintain on road pedestrian and cycle access. Mitigation methods should include regular communication regarding changes to traffic arrangements. Construction traffic will avoid utilising local roads and therefore minimise disruption to local traffic during construction works.	Moderate negative
Commuter cyclists using SH2 will have restricted access during Stage 3 when works focus on the Southbound SH2 carriageway	Commuter and other cyclists	The development of a Construction Environmental Management Plan which includes consideration of recreational connectivity along the river, including a walking and cycling trail with a minimum width of 3 m and/or access to the Hutt River Cycle Trail to be maintained, on at least one side of the river, throughout construction. Any required detours around localised work to be clearly signposted and maintained to an acceptable standard;	Moderate negative
Changes in the road network could impact access for emergency facilities causing delays in call out times	Emergency service providers	Regular communication with emergency service providers to ensure awareness of changes to traffic arrangements	Slight negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Impact on public transport services when works require train line closure or bus re-routing. This will impact travel time and ability to access transport services.	Public transport users	Working with transport providers to ensure communication regarding changes to public transport	Slight negative
Loss of car parking spaces at the Melling Station Park and Ride impacts on ability to access public transport	Public transport users	Working with transport provider to ensure communication regarding changes to public transport That a comprehensive review of the management of all public parking (on-street and off-street) is undertaken to develop the optimum allocation of spaces between short and long stay parking.	Slight negative
Loss of car parking at the Riverbank car park impacting on access to the Hutt City Centre	Local residents, workers and visitors	A temporary public car park (150 spaces) is an option to be developed on Daly Street which can be used by the public during construction. A review of all public parking (on and off-street) in central Lower Hutt should be undertaken, as part of this, HCC should undertake a review of the overall parking stock in Lower Hutt central city, including the public car parks not directly affected by the Project and wider on street parking, to provide an appropriate mix of short, long term parking, loading bays and accessible.	Slight negative
Changes to access to residential properties (particularly on Pharazyn/Marsden St intersection)	Local residents	Property access should be maintained at all times, however if this is not possible then there should be communication with property owners to ensure that works are coordinated to have minimal impact on daily routines.	Slight negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Upgrades to walking and cycling paths will enable improved access for prams and wheelchairs as well as learn to ride cyclists.	Local Study Area	N/A	Large positive
Improved accessibility of new Melling Station from town centre increasing the number of commuters who will walk and cycle to the station improving health and wellbeing and reducing car usage	Residents around Hutt City	N/A	Large positive
The location of the new Melling Station will increase walking distance for residents on the Northern Side of the existing bridge, particularly for residents of Tirohanga impacting their ability to access the station	Residents on the northern side of Melling Station	A review of feeder buses to the station should be undertaken to facilitate movement to the station.	Neutral
The new interchange and bridge will improve safety on SH2.	Broader Wellington Region	N/A	Large positive
Improved journey times from Hutt City to Greater Wellington as a result of the new Melling interchange.	Broader Wellington Region	N/A	Positive
Economy, businesses and employment			
Opportunities for the creation of local construction jobs	Local Study Area.	N/A.	Moderate positive.

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Patronage of local businesses by construction workers supporting businesses on High Street	Local Study Area.	N/A.	Moderate positive.
Loss of car parking impacting on access to the Hutt City Centre	Local residents, workers and visitors	A temporary public car park (150 spaces) will potentially be developed on Daly Street which can be used by the public during construction. The frequencies and hours of operation of public transport can be increased where required to support mode shift away from private cars to mitigate the reduction in available parking.	Slight negative
Displacement and/or temporary relocation of Riverbank Market impacting on ability of stall holders to retain their site. This has the potential to impact retailers and businesses in close proximity to the market that benefit from the additional clientele that the Riverbank Market attract to the local area.	Market stalls.	The Communication Plan should include an overview of the approach to consultation with the Riverbank Market including a description of how reasonable endeavours will be made to consult and resolve matters relating to the temporary and permanent arrangements to enable continuity of market operations prior to the commencement of any Construction Works affecting the Riverbank Carpark.	Large negative.
Potential disruption to access by customers and clients as a result of road changes	Local Study Area.	Access to businesses to be maintained as much as possible. In addition, on street parking should be encouraged by providing time limits that will discourage commuter parking in these parking spaces. That a comprehensive review of the management of all public parking (on-street and off-street) is undertaken to develop the	Moderate negative.

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
		optimum allocation of spaces between short and long stay parking.	
Additional demand for parking generated by the construction workforce	Local Study Area.	Parking for the construction workforce could be provided within the site compound areas. Demand could also be reduced by the contractor providing additional transportation e.g. minivans for local workers.	Moderate negative
Economic impact on businesses that have to relocate as a result of property acquisition resulting in changes to livelihood	Businesses that are subject to property acquisition.	Project Partners to implement appropriate property acquisition process to assist businesses through this process. Council's existing About Space programme to help mitigate any potential fluctuations of visitors to parts of Lower Hutt city centre during construction.	Moderate negative.
Removal of parking in the Riverbank carpark and on the local streets on both sides of the river has the potential to impact on existing businesses within the area particularly within the Lower Hutt City Centre. There is the risk that customers who would have supported local businesses will utilise the Queensgate Mall due to availability of carparking	Local businesses	Implement a transitional parking plan, which supports the phasing of the reduction in parking during construction and in the initial operation to allow for the availability of positive effects of the Project's mode shift opportunities to be realised prior to the full reduction in parking spaces	Large negative
If stallholders are concerned about the impact the temporary relocation will have on their business, there is the risk that they may not continue to operate	Riverbank Market businesses and the Hutt Valley community	Ongoing consultation with the Riverbank Market Operators and stall owners to determine an appropriate temporary site during works and then establishing a permanent	Neutral

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
within the Riverbank Market, and this will impact the future long term viability of the market. There is a risk that the Riverbank Market might not return to the modified Riverbank carpark once construction is complete.		facility in the modified Riverbank carpark upon construction completion	
Investment within the Hutt Valley area as a result of the RiverLink Project has the potential to increase due to improved amenity within the area.	Local Study Area	N/A	Moderate positive
Increase in property prices as a result of the flood mitigation works that offer increased protection in a significant flooding event	Local Study Area	N/A	Large positive
Amenity and character			
If stallholders are concerned about the impact the temporary relocation will have on their business, there is the risk that they may not continue to operate within the Riverbank Market. The Riverbank Market is a key feature in the area and a significant contributor to the character of the area, this has the potential to be impacted by the loss of stallholders.	Local and regional community	Consultation with market operator and stall holders regarding the temporary relocation process to minimise impact to the Market.	Moderate negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
Loss of social cohesion from temporary or potential permanent loss of Riverbank Market.	Local and regional community	Consultation with market operator to manage the relocation of the market and confirm that the temporary site can accommodate all stall holders	Moderate negative
Visual impact with residents of adjoining or overlooking a construction site for period of four years.	Local residents	Limited mitigation options	Slight negative
Improved open space and greenery surrounding the river will emphasise the importance of the river and enhance its connection to the Lower Hutt City Centre, which is a key community aspiration.	Hutt Valley Area	N/A	Large positive
Increased sense of pride in local area as a result of increased investment in the facilities and services that the community use including the walking and cycling trails and train station	Local residents	N/A	Large positive
Additional native plantings along the riverbanks improve visual amenity of the area and are valued by the community	Local residents	N/A	Moderate positive
If stallholders of the market are concerned about the temporary location of the Riverbank Market, this has the potential to impact the future long term viability of	Local residents	Consultation with the market owner and stall holders should continue to assess the suitability of the site as well as an operational plan to ensure that the stall holders,	Large negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
the market. There is a risk that the Riverbank Market might not return to the modified Riverbank carpark once construction is complete		particularly the large trucks are able to access the site.	
Environment			
Cumulative impacts on physical health, and overall wellbeing, from dust and noise emissions, particularly if it impacts on sleep, work or normal daily routines. Impact will be greater for shift workers, those working from home and those with younger families who are home during the day when the majority of construction will occur.	Local Study Area	Construction management plans to outline the hours of work.	Moderate negative
Construction noise will impact on services within social infrastructure facilities such as Belmont School, Hutt City Church, and has the potential to cause nuisance to those walking and cycling along the River or using Riddiford Gardens	Local Study Area	Construction management plans to outline the hours of work.	Slight negative
Dust will be generated during construction close to sensitive activities such as residential areas near Melling. This has the potential to impact on health particularly for vulnerable	Local Study Area	Dust management regime to be outlined within the Construction Management Plan to ensure that it meets the requirements of the area, particularly local residents.	Slight negative

Actual or potential effect	Local/Regional	Mitigation	Level of effect post mitigation
residents such as the elderly, young or those with respiratory issues.			
Vibration from roadworks or truck movements that impact on amenity and daily activities. Concern is particularly for sensitive receivers such as schools, shift workers and older residents.	Local Study Area	Construction vehicles to take into consideration dwelling and other sensitive receivers	Slight negative

9.18.3 Conclusion

The Project is considered to have an overall positive effect on social and recreation values. The positive effects include increased social wellbeing and security from the flood protection measures, improved access to active transport infrastructure and the railway station, reductions in congestion, improved access to the river and urban regeneration. Upon completion of the Project will have significant benefits for recreation including walking and cycling improvements, new open spaces, children's playgrounds and improved access to the River.

Negative impacts of the Project are mostly confined to the pre-construction phase and construction phase. These include people's fears and aspirations and the concern stress, anxiety and worry caused by uncertainty of the timing of the Project. Uncertainty surrounding acquisition and the loss of community, traffic and river access issues, visual, noise and health impacts of construction, loss of carparks and the need to temporarily relocate the Riverbank Market. Due to impacts largely being confined to this stage, it has been concluded the operational benefits of the Project will bring an overall positive effect to the community.

Key mitigation measures proposed by the Project Partners to address adverse social and recreational effects are:

- Development and implementation of a communication plan that requires ongoing and regular communication with the public and key stakeholders. This would include details on alternative access and travel options, complaint process, construction phasing, and Riverbank Market relocation consultation and approach
- A comprehensive review of the management of all public parking (on-street and off-street) to develop the optimum allocation of spaces between short and long stay parking
- CEMP to include consideration of recreational connectivity along the river, including a walking and cycling trail with a minimum width of 3 m and/or access to the Hutt River Cycle Trail to be maintained, on at least one side of the river, throughout construction. Any required detours around localised work to be clearly signposted and maintained to an acceptable standard; The CTMP should give consideration for access to local businesses to mitigate adverse impacts from construction
- Council's existing About Space programme is delivering a range of central city activation initiatives and projects, in collaboration with local businesses, which will help mitigate any potential fluctuations of visitors to parts of Lower Hutt city centre during construction
- Construction of a new skatepark undertaken during Stage 2 Construction to facilitate the operation of the new facility, prior to the removal of the Block Road Skateboard Park. This will enable a continuous level of service. The new skateboard park is to be of no lesser standard than the existing skateboard park, accessible by public transport, and developed in accordance with CPTED Principles
- Temporary activations in areas such as car parks (after hours) such as half courts similar to the basketball court that is located in the Lower Hutt City Centre Carpark.

The Social Impact and Recreation Assessment includes a recommendation to increase the frequencies and hours of public transport, if required, to support modal shift. This is not reflected in a consent condition as it is considered that this will happen as part of normal activities by the public transport operator Metlink.

9.19 Economic impact

Overview

Lower Hutt City is Wellington Region's second largest economic centre and is anticipated to have growth in demand for residential and commercial space in the city centre.

Construction and operation of the Project is expected to provide overall a net positive economic benefit to the local businesses, industries and economies of Lower Hutt City and Greater Wellington. The Project will generate a range of positive impacts during operation and construction, through increased employment, increased revenue to local businesses, urban renewal, flood resilience and transport improvements. Once complete, the Project is expected to deliver indirect economic benefits such as increasing the night time and visitor economies in Lower Hutt city centre, improving access to skilled workers, additional economic activity from urban agglomeration and improving workforce amenity.

The economic assessment has concluded that there are three matters with potential low adverse effects to Lower Hutt City; the loss of employment land; reduced movement and accessibility during construction, and reduced car parking following completion. However, these effects do not require specific mitigation strategies or conditions as their impact is low or can be addressed through the CTMP for the Project.

9.19.1 Introduction

This section provides a summary of the economic effects of the Project. The effects are assessed for the construction and operation stages of the Project, focussing on the impact on Hutt City and its city centre. The full technical assessment is contained within the Economics Assessment (Technical Report. #18).

9.19.2 Assessment of economic effects

Assessment of construction economic effects

The overall construction economics effects range from low negative to high positive.

Construction of the $703 million Project will generate significant employment and economic output and therefore will have a high positive impact on employment and economic output. The size and scale of the Project will require input from multiple industries and employ a significant number of workers. In addition to the direct capital expenditure and on-site employment, the Project will also lead to production-induced and consumption-induced effects.

Production-induced effects incorporates all the direct inputs and employment required to construct the Project, along with the industrial-support effects which relate to the flow-on employment and expenditure required to produce the inputs into the materials/services to support construction.

Consumption-induced effects captures all the additional economic and employment generated by the increased wages and salaries from produced induced effects of the Project as these industries and employed persons spend on household goods and services.

Construction of the Project will also indirectly support local businesses. This includes retail, accommodation, food services and construction businesses close to the Project area that are likely to receive the majority of the consumption induced economic benefits of construction workers and businesses seeks goods, services and materials close to the site.

Construction of the Project will result in the temporary and permanent loss of land within the Lower Hutt city centre and Melling. The temporary loss of land within the Lower Hutt city centre includes five properties along Daly, Rutherford and High Streets. These sites will provide car parking during construction and are planned to be redeveloped in the future to fulfil the aspirations of the Central City Transformation Plan. The permanent loss of land in Melling is not considered a significant economic effect overall, as the demand for industrial land is expected to decline overtime. Businesses will need to relocate and may experience some disruption finding alternative sites to operate from. Businesses currently operating in Melling do not appear to have made significant investments in specialised plant and equipment, compared to those located in other areas such as Seaview, which will not significantly limit their ability to find potential sites or locations to operate from. Some of the existing businesses may be able to relocate into Lower Hutt city centre.

Temporary realignment of transport routes to ensure safety of the community and enable construction. This will likely cause temporary reduced movement and perceived accessibility to and from businesses and industries located within Lower Hutt city centre. As a result, there may be a restricted number of routes to get there, and some routes may be longer compared to existing. The total provision of carparking will also be impacted by the construction of the Project.

Assessment of operational economic effects

Overall, the operational economic effects are considered to range from low negative to high positive.

The Project will act as a catalyst development for future development of the precinct of the Lower Hutt city centre, through improvements to the public realm, lighting, new recreation facilities, improved way finding and transport. These will have positive effects on the Lower Hutt city centre and increase its role as a vibrant high-intensity and mixed use precinct. The precinct development and activation outcomes of the Property will encourage development including a potential additional ~1,330 apartments and ~49,000m^2 of commercial office space to the city centre. If this was to occur, this would increase the resident (+~2,598) and workforce (+~2,715) population increasing the city centre's development and activation. The total estimated economic benefit of envisaged precinct development and how it enables the city centre's urban renewal and activation is estimated to be $422 million. This captures the expected increase in visitor expenditure, new resident and workforce expenditure and improved property values in the long term.

The flood resilience from the Project is a high positive economic impact. Once operational, the flood protection is expected to safeguard up to 3,000 dwellings, five schools and 600 businesses and the wider community from up to $1.1 billion worth of flood damage from a breach of the left bank during a 2,800 cumec event. This in turn will provide significant economic benefit of the Project and provides increased confidence for future investment in the region. The estimated avoided average annual damages (AAD) from the Project are $304 million, which is the average yearly value of direct, indirect, tangible and intangible damages from flooding in the region, over a long period of time, that would be avoided by the Project. The avoided AAD captures economic benefits such as avoided damages to property, avoided loss of economic production, avoided cleaning and repair costs and avoided mental health and wellbeing costs from dealing with a flood event. This is a significant economic benefit of the Project and will provide greater confidence for future investment in the region.

Congestion reduction and improved travel time is considered to have a positive economic impact. An economic impact assessment of these upgrades demonstrated a Benefit Cost Ratio (BCR) of 1. for the preferred option which demonstrates a discounted net present value of $303 million. Approximately $385 million of the identified benefits is attributed to travel time savings for road users. There are also potential travel time saving up to five minutes during peak hour. This is a significant benefit for private, public and freight road uses in the area. Business and industries utilising the road will also significantly benefit from the reduced travel time and improved accessibility to Lower Hutt city centre.

The Project will also assist Lower Hutt city centre's night time and visitor economies. Visitors will be attracted to the area to enjoy the new infrastructure and improved public spaces and recreation facilities. A potential $32.8 million of additional visitor expenditure could be achieved each year once the project is complete (Hutt City Council, 2020). This will likely increase the city centre's night time economy.

Greater access to skilled workers in Lower Hutt City is a positive impact. Improvements to travel times and connections to the city centre will increase the labour pool for businesses to draw from and encourage investment in the Wellington Region. Locations that provide access to the largest skilled labour market within a suitable travel time (30 to 60 minutes) are attractive locations for businesses to operate. As the Project will improve actual and perceived travel times and connection to and from Lower Hutt city centre, existing local businesses will benefit from an increased labour market to draw from, potentially making them more productive. This will also increase the attractiveness of Lower Hutt city centre as a place for new businesses seeking to establish operations in the region.

Urban agglomeration will increase economic output. Increased diversity and the opportunity to leverage the scale of local economic opportunity will enable the sustaining of businesses and production of tradeable goods and services. Additionally, the Project produces improved workforce amenity as an externality. The diversity of lifestyle, cultural choices, retail offerings and workforce amenity influence the long-term willingness of workers to remain in the location. The enhanced public realm of the Lower Hutt city centre will increase urban and natural amenity and provide new recreation opportunities.

The reduction in carparking may negatively impact the perceived accessibility of Lower Hutt city centre and businesses may be concerned this will negatively influence the ability to attract customers by private vehicle. Reduced car parking will occur in parts of Lower Hutt city centre, with other areas remaining unchanged.

Should the development and urban renewal of the city centre occur as a result of the Project, it is estimated that future new residents to the Lower Hutt city centre could generate a direct value add of approximately $141 million to the local economy (Hutt City Council, 2020). The additional expenditure generated is expected to offset any negative perceptions of accessibility generated by the loss of parking.

Overall, the potential effects on the community and economy as a result of the construction of the Project range from high positive to low negative, with loss of employment land, reduced movement and accessibility resulting in a low negative impact. Overall, operational effects range from high positive to low negative impact, with reduced parking resulting in a low negative impact.

9.19.3 Measures to avoid, remedy or mitigate actual or potential adverse effects

There are three potential adverse economic effects to local businesses, industry and wider economy arising from the construction and operation of the Project (loss of employment land, reduced movement and accessibility and reduced car parking). As all three potential adverse economic effects are identified as having a low economic impact, specific measures or conditions on development are not required to address the identified adverse effects because:

- Council has noted declining demand for employment land in the region in the long term;
- The construction methodology notes that access and movement will be maintained, when safe to do so during construction. It is also noted that a Construction Traffic Management Plan (CTMP) will be prepared for the Project to ensure access and movement is maintained as best as possible during construction;
- The Project will deliver a significant uplift of expenditure within the Lower Hutt city centre that will offset any potential loss of expenditure due to a perceived lack of accessibility to the Lower Hutt city centre from a reduction in car parks;

- The Riverside Promenade will deliver a high-quality public realm outcome and provide a range of spaces for cultural and recreation activity. This will attract more people to Lower Hutt city centre, increasing levels of activation; and
- In collaboration with local businesses, HCC's existing About Space programme is delivering a range of city centre activation initiatives and projects which will aid in mitigating any potential fluctuations of visitors to parts of the Lower Hutt city centre during construction.

9.19.4 Conclusion

The Project will generate significant positive economic and employment benefits during construction. Once completed the Project will enable future urban renewal and activation benefits to the Lower Hutt city centre, improve the flood resilience of business and communities along the River and provide transport improvements. The Project will also deliver additional indirect economic benefits such as increasing night time and visitor economies in Lower Hutt city centre, improving access to skilled workers, additional economic activity from urban agglomeration and improving workforce amenity. Overall, the construction and operation of the Project is expected to provide a significant positive economic benefit to the local businesses, industries and economies of Lower Hutt City and the wider Wellington Region.

9.20 Network utilities

Overview

There are a large number of existing infrastructure networks throughout the Project area ranging from local service connections to regionally significant rail, water, electricity and gas transmission infrastructure. Given the scale of the Project, effects on network utility infrastructure are anticipated and include impacts from temporarily or permanently relocating existing network utilities and from construction activities.

The Project team has consulted with network utility operators to identify the relocation and/or protection of network utilities and to develop appropriate measures to manage adverse effects on network utilities during the construction and operation of the Project. There are well-established procedures across the industry for the relocation and/or protection of network utilities arising from construction activities.

Potential operational adverse effects on network utilities have been avoided through design of the Project where practicable, or will be mitigated through relocation as part of the construction of RiverLink. Any adverse effects during construction can be managed through appropriate construction management measures.

9.20.1 Introduction

The Project is located in an urban area along a major transport corridor and therefore contains a large number of existing infrastructure networks including transmission lines and water infrastructure. This section of the AEE addresses network utilities with the exception of transport infrastructure which is addressed in section 9.10 of this AEE. The Project will have both direct and indirect effects on existing infrastructure networks including:

- Effects associated with temporarily or permanently relocating existing network utilities for the construction and operation of the Project, and
- Effects on network utilities from construction of the Project including from dust, ground settlement, and the accidental striking of services.

The relocation and/or protection of network infrastructure is a normal part of construction for a project of this scale. There are well-established procedures across the industry associated with the relocation and/or protection of network utilities. The Project team has consulted with network utility operators to discuss the relocation and/or protection required during construction and operation of the Project. Any adverse effects can be appropriately managed either by providing protection or by relocating the utility. Where practicable, the necessary mitigation works will be undertaken as enabling works prior to the main Project construction works.

Some of the existing infrastructure networks in the Project area are designated. Existing designations are set out in section 6.8.1 of this AEE.

9.20.2 Existing environment – network utilities

The existing network utilities along the Project are summarised in Table 72.

Table 72 - Existing network utilities

Network utility	Operator	Details	Affected by the Project?
Transmission lines	Transpower NZ Limited	110Kv overhead cables and Substation	No
Electricity distribution lines – overhead and underground	Wellington Electricity	Low and high voltage cables, circuit breakers and four substations.	Yes
High-pressure gas transmission or Gas distribution lines	Powerco Gas	Local gas distribution lines and gas main throughout the Project.	Yes
Communications network	Chorus	Fibre optic cables and cabinets throughout the Project	Yes
	Vodafone		Yes
Survey marks	LINZ	Numerous survey marks, including one surveyed as part of the Land Deformation Monitoring Network	Yes
Bulk water mains	Wellington Water Ltd (asset owned by GW)	450 mm diameter run-to-waste pipe from the nearby water supply bores	Yes
Water supply network	Wellington Water Ltd (assets owned by HCC)	300 mm diameter transmission ring main Local water supply distribution networks	Yes Yes
		Local water supply distribution networks	Yes

Network utility	Operator	Details	Affected by the Project?
Wastewater network	Wellington Water Ltd (assets owned by HCC)	Western Hills Main Sewer trunk main. Local wastewater networks.	Yes Yes
		Local wastewater networks.	Yes
Stormwater network and outlets	Wellington Water Ltd (assets owned by HCC)	Stormwater culverts outfalling through the existing stopbank	Yes
		Local stormwater networks	Yes
		Marsden Road stormwater pump station	Yes
		Tama Street stormwater pump station	No
		Existing open channels	Yes
Rail network assets	KiwiRail	Melling railway line	Yes

These utilities are shown on the Service Plans (series A16-4381: C101-C111) in Volume 5 of the Application.

9.20.3 Asset identification

To identify the network utilities within the Project area, a BeforeUDig request was submitted for the Project area to obtain existing services plans from network utilities. For water services, historic as-built plans were also requested from Wellington Water Limited.

All network utility operators with assets in the area were issued with preliminary design drawings of the proposed relocations and their confirmation of the existing asset locations sought.

9.20.4 Design approach

A significant amount of earthworks and underground excavation is required to complete the proposed utility works. It is expected that almost all of the utility services within the Project area will need to be demolished, replaced, and realigned.

The bulk of the impacted services are uncomplicated and will be straightforward to realign. Therefore, a Shared Service Trench (SST) is proposed as an economical solution to complete the works. The purpose of the SST is to contain (where possible) the network utilities in an accessible and shared space. However, some of the utility services relocations are complex and will require a specific design consideration during the final detailed design phase. Where possible (and appropriate) services will be included in the SST, but where this is not possible, an alternative location will be agreed with the relevant network utility operator.

The benefit of a shared trench is a reduction in the overall cost for relocation, as the bulk of the utilities can be relocated to the same place, which reduces the overall cost of the relocation and simplifies the future access requirements for network maintenance. See below for the proposed SST details. The relocation of services within the SST will also include ensuring that horizontal and vertical clearance requirements for each of the network utilities are met.

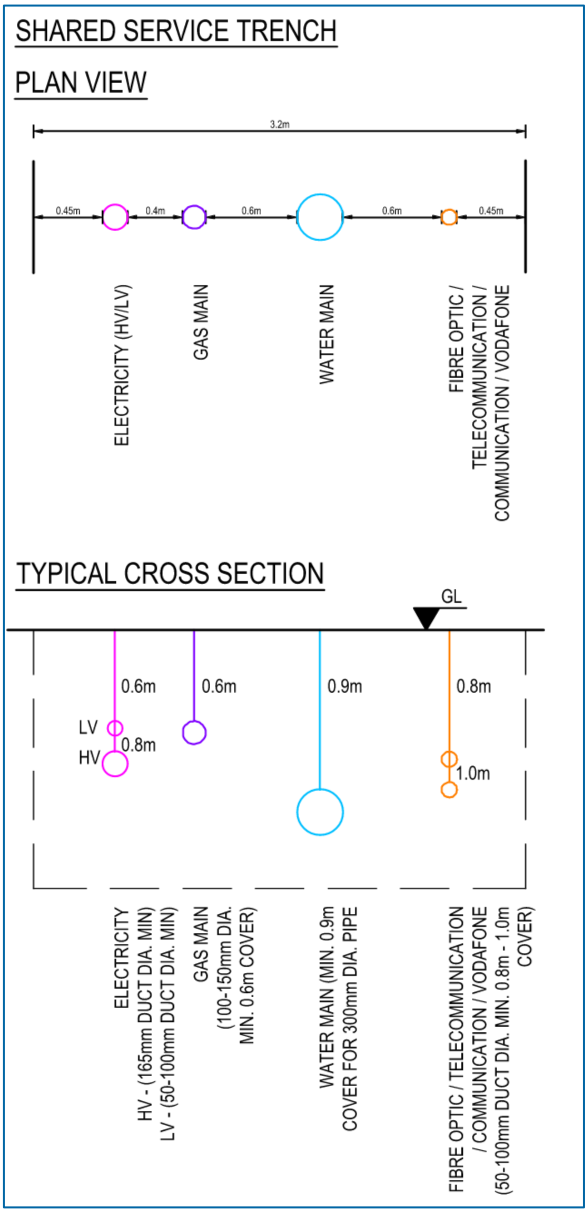


Figure 50 - SST plan and cross section details

The SST is based on the following assumptions:

- The SST excludes any gravity-based utility services (i.e., wastewater infrastructure) due to the proposed location of the trench.
- The general approach to service relocation is to provide a 4-5m service strip along with the proposed stopbank structure (where possible).
- The SST only includes shallow services (i.e., water main, gas main, electric cables, and Telecommunications)
- The width of the SST varies according to the ground profile along the stopbank, and this can influence the line taken by relocated services (i.e., the width of the SST will be adjusted as per required services clearance).

9.20.5 Assessment of effects on network utilities

Electricity transmission

There is a major substation just outside the Project area, with the Haywards – Melling B 110kV line running across the river through the Project area to Tower 30 in the Western Hills. The substation and line are owned and operated by Transpower.

The Project works avoid the substation and overhead lines, and no Transpower infrastructure is anticipated to require relocation or replacement as a result of the works. However, construction activity is anticipated below the Haywards-Melling line and in proximity to the substation site. Construction in proximity to the Transpower assets could give rise to the following potential effects on transmission lines and substations if not appropriately managed:

- Dust from construction causing arcing of lines.
- Dust, noise, and vibration can impact substation operations; and
- Machinery working in proximity to lines increasing the risk of electrical hazards if lines are struck

These effects will be managed through the refinement of the design and construction methodology during the detailed design phase in consultation with Transpower, and the implementation of specific measures during construction as agreed with Transpower. Consultation will continue with Transpower to facilitate this.

Local electricity transmission

Throughout the Project area, there are both above and below ground local electricity distribution assets owned and operated by Wellington Electricity.

High and low voltage underground cables are located throughout the Project area, predominantly within the urban land area between Ewen Bridge and the Melling Bridge. In the main, these cables will be relocated into the SST. There are also cables across the existing Melling Bridge deck which will need to be relocated to the service corridor proposed on the new Melling Bridge.

Existing low voltage underground cables in Tirohanga Road (beyond the proposed Tirohanga Road realignment works) do not require relocation, but will be protected during the construction period, to avoid any impact on their integrity or operation.

There are four substations to be relocated. Their existing and proposed new locations are summarised in Table 73 below.

Table 73 - Proposed substation relocations

Current location	Proposed location
On the stopbank side of Marsden Street, adjacent to Bridge Street	Adjacent to the SST at the southern end of the re-aligned Marsden Street
Adjacent to the existing SH2 southbound lane near the Melling interchange	Adjacent to the southbound entry ramp to the state highway, just north of the new Melling Station
Immediately south of the Rutherford Street / Queens Drive intersection	On the former Dulux site, north of the new Melling landing on Rutherford Street
Immediately south of Andrew Avenue on Daly Street	Immediately north of Andrew Avenue on the former Daly Street in vacant space adjoining the stopbank

Wellington Electricity has identified no immediate issues with the proposed SST approach and have no specific standards to be used. They agreed that where cables are no longer required (as they connect to properties being demolished), the cables will be removed. Wellington Electricity raised the need to futureproof assets relocated into the SST by providing extra ducts. They also identified the need to have the works carried out by an approved contractor.

Wellington Electricity has advised that a high voltage cable running along the TLB berm may need to be replaced, rather than relocated into the new SST, but this will be confirmed at or before the detailed design phase. It was agreed that consultation to develop the methodology for the asset relocation demolition and protection of retained assets would continue and would be finalised with Wellington Electricity during the detailed design phase.

Gas transmission and local distribution

There are gas mains and local distribution network throughout the Project area, predominantly within in the urban land area between Ewen Bridge and the Melling Bridge. These will be re-located into the SST. There is also a gas main located within the existing bridge deck of the existing Melling Bridge, which will be relocated into the new Melling Bridge service corridor.

An existing gas main in Tirohanga road (beyond the proposed Tirohanga road realignment works) will need to be protected during the construction.

It was advised by Powerco (who manage the assets) that there are a significant number of abandoned pipelines which can be left in situ or demolished within the Project area. Otherwise, where possible the services can be relocated into the SST, as long as the minimum separation distance from other assets is met. No permit is required to do so, but both high and intermediate pressure lines require a Powerco authorised person to supervise any work because of high health and safety risks and costs associated with any pipe damage.

It was agreed that consultation to develop the methodology for the asset relocation, demolition and protection of retained assets would continue, with Powerco providing their design and separation standards to inform this work. The final design and methodology will be agreed with Powerco during the detailed design phase.

Communication network

There are underground fibre optic cables throughout the Project area, predominantly within the urban land area between Ewen Bridge and the Melling Bridge. These cables will be relocated into the SST. The redundant local connections will be demolished and removed.

There are also fibre cables across the existing Melling Bridge, linking the central city area and Harbour View and Tirohanga Road. These assets will need to be relocated as the bridge will be demolished. Chorus has indicated that the relocation of these assets is likely to be the most complicated portion of their assets to relocate. In particular, the joints between the cables will need to be carefully located to protect their integrity.

The operators agreed that the process to refine the design and construction methodology for the relocations, demolition, and protection of retained assets will be undertaken in consultation with Downer (as the operational contractor of the Chorus owned assets) and Vodafone during the detailed design phase.

Survey marks

There are multiple LINZ survey marks including the Land Information Monitoring Network survey marks are located within the Project area. Most of the survey marks located within the proposed stopbank area, which will need to be relocated.

The process to refine the design and construction methodology for the relocations, demolition, and protection of retained survey assets will be undertaken in consultation with LINZ during the detailed design phase of the Project.

Rail network

The Project requires the construction of the new Melling Station approximately 500m south-west of the existing station, and the rail line itself will be realigned slightly south to make way for the proposed new state highway interchange.

Consultation has been carried out with KiwiRail, who have identified that the following elements will be affected and require relocation:

- Shifting and supply of track
- Relocation of end of track equipment
- Signalling work, which may include cable relocations, signal box work, and relocation of signals
- Relocation of overhead power poles
- Relocation of drainage where required (culvert extensions)

When the cycleway proposed alongside the rail line is progressed, installation of fences and retaining walls will also be required. Mitigation measures already identified as required by KiwiRail include the need for rail protection and temporary crossings. KiwiRail also require all works to be undertaken at night or during the weekend when the Melling Line is not operational.

Otherwise, it has been agreed that the relocation of KiwiRail assets will be managed by way of a Railway Management Plan. The Management Plan will be developed in partnership with KiwiRail and set out the standards and an agreed construction methodology for the works.

Water supply

There is a 450 mm run-to-waste pipe which runs under Queens Drive and discharges to the Te Awa Kairangi near the proposed Melling Bridge. This pipe is polyethylene and was constructed in 2017. The existing pipe alignment is directly underneath the proposed bridge abutments and passes through an area where the ground levels are increasing by approximately 3 m which would add too great a surcharge to the pipe. This pipe is likely to require diversion due to the load imposed by the bridge structure. It is unclear whether the outlet will be affected by the proposed river channel works at this stage. This will need to be confirmed during detailed design and the land use consent that is held for the outlet structure may, in that event, need to be varied.

There is an existing 300 mm ring main which is one of three major transmission ring mains in Lower Hutt. It is constructed of a combination of concrete-lined steel and cast iron, the majority of which was installed in the 1970s. The section crossing the Melling Bridge was installed in 2003. The ring main crosses the Melling Bridge, runs down Pharazyn Street on the west side of the river, crosses Ewen Bridge and then runs up High Street on the east side of the river. Sections of the ring main will be heavily impacted by the Project, primarily along the northern half of Pharazyn Street and around the Melling Bridge. The ring main will need to be diverted from the existing Melling Bridge to the proposed bridge, as well as diverted or protected in several areas where the proposed ground levels are significantly higher than existing.

The construction of a new pedestrian / cycle bridge as part of the Project provides the opportunity for increased resilience in the network. A valved tee with a blank flange could be installed on either side of the pedestrian / cycle bridge to facilitate a temporary crossing if necessary, following an earthquake or other event which damaged one of the existing river crossing locations.

The existing water main crosses SH2 at the existing Melling Bridge and runs north and south along the western side of SH2. Discussion with Wellington Water have indicated that some of these pipes may be abandoned, however Wellington Water may request that the SH2 crossing is maintained for future proofing and improved resilience. This will be confirmed by Wellington Water during detailed design.

There are a number of local water supply distribution mains that will be affected by the Project. Some of these will be redundant where existing houses are being removed. Some new connections will also be required, for example to the new Melling Station. These will be determined as design progresses and would generally follow the alignment of the proposed roads. No issues are anticipated with these local networks.

The Project proposes to divert the existing ring main along proposed road corridors and the proposed Melling Bridge. Wellington Water has not raised any significant issues with this approach, although they have indicated that they will undertake modelling to confirm the required capacity where the main is being renewed, and that it may need to be increased in size. Designing the water main diversions in accordance with the Wellington Water Regional Standard and Regional Specification and ongoing consultation with Wellington Water will facilitate the management of any potential adverse effects on water supply infrastructure.

Wastewater

The Western Hills Main Sewer is a 675-900 mm trunk wastewater main which runs through the Project area on the western side of Te Awa Kairangi. It drains wastewater from the Western Hills suburbs and Upper Hutt. At the northern end of the Project area, it runs along the western side of SH2. It crosses the highway upstream of the existing Melling Bridge and then runs along the TRB river berm, partially under the existing stopbank.

Structural calculations for the pipe indicate that large sections would fail due to increased loads where the ground level increases around the Melling Interchange and due to reduced cover or the pipe being exposed further south where the river is being widened and the stopbank moved. In addition, the increased cover at the proposed Melling Interchange would make the existing pipe prohibitively difficult and expensive to maintain. Due to these effects, the Western Hills Main Sewer will need to be diverted for approximately 1700 m through the Project area.

Four alignment options were presented to Wellington Water. These options are as follows:

1. Continuing on the western side of SH2 where the road levels do not significantly change through the new interchanged, then crossing SH2 and the new KiwiRail designation before running down Marsden Street and connecting to the existing alignment near Ewen Bridge. Some structural work/treatment would be required for the pipe near Ewen Bridge, where it is located within the TRB river berm and will be partially under the new stopbank. There are no active plans to realign the wastewater pipe out of the river berm downstream of Ewen Bridge
2. Crossing SH2 to enter the new KiwiRail designation before the interchange, continuing along the new designation under the cycle path (relies on KiwiRail acceptance), then through the new Melling Station carpark (at 4m depth but being in the car park provides some access benefits), then continuing along Marsden Street as per Option 1
3. Crossing SH2 in the same location of the existing wastewater pipe (upstream of existing Melling Bridge), running under the new southbound exit ramp, then requiring a 200m long tunnel that will have a maximum depth of 9.5 m below the new interchange, then continuing along Pharazyn Street and Marsden Street as per Option 1, and
4. Crossing the new stopbank above the old Melling Bridge, then continuing south on the TRB river berm. Lateral movement from seismic events and scour were raised as issues with this option.

Option 2 was indicated by Wellington Water as the likely preferred option based on the high level concepts presented. Further feedback on these options will be sought as the design develops. Initial feedback from KiwiRail indicates that it is not preferred, but that investigations should continue. The least preferred option is Option 4 which is likely to be impractical for future maintenance and unacceptable to GW who have a preference to remove services from within the river corridor.

Wellington Water has indicated that there is currently modelling planned which will inform the required capacity of the Western Hills Main Sewer and it is possible that it may need to be increased in size. This is unlikely to have a significant effect on the design at this stage but will need to be confirmed prior to detailed design.

There are a number of local wastewater mains that will be affected by the Project. Some of these will be redundant where existing houses are being removed. Some new wastewater connections will also be required, for example to the new Melling Station. These will be determined as design progresses and would generally follow the alignment of the proposed roads. No issues are anticipated with these local networks.

Designing the Western Hills Main Sewer and local network diversions in accordance with the Wellington Water Regional Standard and Regional Specification and ongoing consultation with Wellington Water will facilitate the management of any potential adverse effects on wastewater infrastructure.

Stormwater

There are a number of stormwater outlets which pass through the existing stopbanks on both sides of the river. It is proposed that sections of all stormwater pipes where they pass through the proposed stopbank are re-laid to achieve a 100 year design life.

The stormwater outfalls operate under gravity when river levels are low. Pump stations are also required so the outfalls can be pumped when river levels are high. New and upgraded pump stations will be required to manage the design flows.

The high level concept design has identified pipe clashes between the proposed Western Hills Main Sewer and some of the stormwater outfalls on the TRB. Due to grade constraints, the Western Hills Main Sewer will take precedence in these scenarios and the stormwater pipes will be re-routed to avoid pipe clashes.

For more detail on the stormwater methodology and assessment of effects, refer to section 9.4 in this AEE and the Stormwater and Operational Water Quality Assessment (Technical Report #2) in Volume 4 of the Application documents.

The Project team will continue to work with WWL to develop design and construction methodology for the re-location and protection of these assets during the detailed design phase. The intention is to develop a timeframe and process for the relocation of these assets alongside the local networks and the stormwater pump stations in time for the enabling works phase of the Project when much of the asset relocation is required.

9.20.6 Measures to manage potential adverse effects on network utilities

The general design philosophy adopted for the Project has been to avoid potential adverse effects on existing network utilities, wherever practicable. However, not all potential impacts can be avoided due to the large scale of the Project and the considerable number of network utilities located within the Project area needing to be re-located.

Consultation with the relevant network utility provider has begun and through this consultation process and design standards will be identified and the construction methodologies developed to avoid impact on these utilities.

These solutions typically involve one or more of the following approaches:

- Providing increased protection for the utility so that its operation is not adversely affected by the Project
- Providing access to the utility so that its operation and maintenance is not adversely affected by the Project
- Relocating or realigning part of the network utility to avoid or mitigate potential adverse effects, and
- Other specific measures (e.g. dust management) to address potential physical adverse effects on sensitive network utilities such as transmission lines.

Consultation with affected operators will continue during detailed design to ensure that any relocation, diversion or protection of network utilities will meet the requirements of the operators. Specific agreements will be developed with each affected network utility operator for detailed design and construction.

Specific measures are proposed during design and construction of some network utilities as discussed earlier in this section. These are summarised in Table 74.

Table 74 - Specific measures for network utilities

Utility	Potential effects	Proposed measures to mitigate effects
Transmission lines and substation	Dust during construction. Vibration during construction. Machinery strike.	Manage construction activities near transmission assets, working in consultation with Transpower to avoid any impact on their assets This includes achieving safe electric clearances between the works and Transpower's assets
Electricity distribution lines – overhead and underground	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Ongoing consultation with Wellington Electricity to confirm specific measures to be met for the relocations Manage construction activities near lines to protect existing assets Any relocation works is to be co-ordinated with Wellington Electricity's preferred/operational contractor.
High pressure gas transmission or Gas distribution lines	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Ongoing consultation with Powerco to confirm specific measures and standards to be met for the relocations to SST Relocate gas lines and mains in consultation with Powerco

Utility	Potential effects	Proposed measures to mitigate effects
		Manage construction activities near lines to protect any retained assets A standover is required for any work on high or intermediate pressure lines Any relocation works to be co-ordinated with Powerco's preferred/operational contractor.
Communications network	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Ongoing consultation with Chorus and Vodafone to confirm specific timing, measures, and standards to be met for the relocations Manage construction activities near cables and ducts to protect existing assets Relocate cables/ducts in consultation with Vodafone and Chorus. Any relocation works to be co-ordinated with Chorus' preferred/operational contractor (Downer).
Survey marks	Survey marks destroyed by construction activities	Consultation with LINZ to confirm specific timing, measures, and standards to be met for the relocations
Rail	Disruption to operation during construction Conflict with interchange or proposed cycleway alignment	Consultation with KiwiRail and the development of a Management Plan to agree and manage the approach and timing to relocation Construction work to take place only when the Melling Line is not in operation
Bulk water mains (run-to-waste pipe)	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction. Relocation of outlet will require amendment to the existing land use consent.	Manage construction activities near pipes. Relocate pipes where necessary in consultation with Wellington Water. Arrange amendment to the outlet land use consent if necessary.

Utility	Potential effects	Proposed measures to mitigate effects
Water supply network	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near pipes. Relocate pipes and maintain ring main. Improve resilience if possible. Design and construct new local water supply network where roads are being realigned.
Wastewater network	Continuity of supply during construction. Conflict with final alignment. Machinery strike during construction.	Manage construction activities near pipes. Relocate pipes. Design and construct new local wastewater network where roads are being realigned.
Stormwater network and outlets	Flooding of urban areas if network altered by changes to stopbank heights. Conflict with final align. Machinery strike during construction.	Replacement and upgraded pump stations to manage the design flow changes. Replacement of sections of culverts where affected by new stopbanks.

As required by the proposed conditions relating to network utilities, consultation with affected operators will be undertaken to ensure that any relocation, diversion, or protection of network utilities will meet the requirements of the operators. Specific agreements will be developed with each affected network utility operator during the detailed design phase, to manage any adverse effects of the required network utility relocation or protection.

9.20.7 Conclusion

Overall, any operational adverse effects on network utilities have been avoided or mitigated through design of the Project including planned relocation of utilities where required, with consultation with the network utility operators underway. Any adverse effects during construction can be appropriately managed through measures which will be developed in consultation with the network utility operators.

9.21 Property and land use

Overview

The Project affects commercial, residential, and industrial land uses on both sides of Te Awa Kairangi between the existing Melling Bridge and Ewen Bridge. In addition, public land, including roads, the river corridor and the adjoining public domain are also affected. This section provides an assessment of the effects of the Project on land use within the Project area and impacts on property and business during both construction and operation of the Project.

While many of the properties are required for various aspects of RiverLink, GW flood management is the critical underlying purpose for requiring many properties. Moving away from the river elements and works associated with the Melling Interchange and new Melling Bridge, and urban revitalisation and associated works and activities become more prominent. Also, on the TRB of Te Awa Kairangi between existing Melling Bridge and Ewen Bridge are works associated with the realignment of the Melling rail line and the new Melling Station and associated activities. The works associated with RiverLink also necessitate a number of roading changes and realignments on both banks of Te Awa Kairangi between existing Melling Bridge and Ewen Bridge.

The main property related effects of the Project are on:

- Properties with land that is directly required for the Project; and
- Properties within close proximity to the Project.

The land holdings range from land already acquired by GW, Waka Kotahi and HCC for RiverLink, and other public and private land holdings. Some private properties need to be purchased outright and there are some properties where part acquisition will be required. All property owners whose land is directly affected by the Project have been consulted and are aware that their property is required for the Project. Negotiations with landowners and the relevant Project Partner(s) are ongoing. The early acquisition of 100 of the required properties and Project design has specifically sought to minimise or avoid adverse property effects as far as practicable.

Owners of properties within close proximity to the Project are also subject to potential adverse effects and have been identified and where appropriate consulted. Effects identified in relation to those properties are those considered through the technical assessments, including those covering social impacts, traffic, noise, air quality and visual amenity. Actual and potential effects on adjoining properties have been identified in relation to the specific technical areas and appropriate mitigation has been devised. Actual and potential (including perceived) effects on property values are not considered to be a relevant consideration under the RMA.

The property-related effects also involve potential business disruption effects, including:

- Closure or relocation of businesses. – in relation to this, the PWA processes are available to address these matters. Mitigation measures proposed to address the residual business disruption effects include early consultation and support to enable business relocation (as appropriate) ·
- Reconfiguration of business operations on sites where partial land acquisition is required, to enable business continuity where land requirement will either impact on specific business operations or on-site manoeuvring. PWA processes are available to address these effects also.

9.21.1 Introduction

The land uses within the Project area are described in section 3 of this AEE. The bulk of the Project area traverses the Te Awa Kairangi corridor, but also covers commercial, residential, and industrial land uses on both sides of Te Awa Kairangi between the existing Melling Bridge and Ewen Bridge. This section provides an assessment of the effects of the Project on land use and property, including business activity, during both construction and operation of the Project. This section should be read in conjunction with section 9.18 of this AEE and in the Social Impact and Recreation (Technical Report #17) in Volume 4 of the Application documents.

For those properties required for the Project, which have not already been acquired on a 'willing seller, willing buyer' basis, the acquisition or lease of the land will be undertaken by the Crown or relevant council through the Public Works Act (PWA) process. The PWA establishes acquisition and compensation processes for this required land and as such, this specific matter is not considered further in this AEE.

This section first summarises the requirements for land required for works at a general, Project wide level, and then considers the types of property acquisition required (full, partial, disruption, etc), property effects, including for properties not required but in close proximity to the Project. Business disruption and positive business effects are also discussed.

9.21.2 Land requirements and works

While many of the properties are required for various aspects of RiverLink, GW flood management is the critical underlying purpose for requiring many properties. Moving away from the river elements and works associated with the Melling Interchange and new Melling Bridge, and urban revitalisation and associated works and activities become more prominent. Also, on the TRB between of Te Awa Kairangi between existing Melling Bridge and Ewen Bridge are works associated with the realignment of the Melling rail line and the new Melling Station and associated activities. The works associated with RiverLink also necessitate a number of roading changes and realignments on both banks of Te Awa Kairangi between existing Melling Bridge and Ewen Bridge.

For all works RiverLink must be viewed holistically. There are also many integrated and complex Project elements, especially between the Melling and Ewen Bridges. This is also a very restricted area between the Western Hills, and SH2 on the TRB and the Lower Hutt city centre on the TLB. Further, RiverLink is proposing a very different future for the area affected – it is a visionary project with a focus on Te Awa Kairangi; especially letting it have more room to move and a 'voice'.

A summary of matters relevant to the requirement for properties within the listed areas is set out below.

Pharazyn Street and Marsden Street:

- GW flood protection:
  - Widening of the river corridor (and river channel works) to enable the river to convey a 2,800 cumec flood and to allow the river space.
  - Shaping the river channel and corridor to increase resilience to flood events
  - Enabling the ongoing maintenance of the stopbanks (and river corridor)
  - Broader environmental and recreational mitigation associated with the RiverLink project.
- Waka Kotahi:
  - Locating the new Melling Interchange and new Melling bridge (including connections into the local road network)
  - Realignment of Pharazyn Street
  - Widening of SH2 to allow safe and efficient on and off ramps for the Melling Interchange (also applies to the western side of SH2)
  - Relocating and/or constructing the Melling rail line and the new Melling Station and associated infrastructure
  - Multi modal connections including cycleways and pedestrian linkages
  - Broader environmental and recreational mitigation associated with the RiverLink project.
- HCC

  - Landing and connecting the new pedestrian/cycle bridge
  - Local roading works and streetscape
  - Stormwater works
  - Broader environmental and recreational mitigation associated with the RiverLink project.
- KiwiRail
  - Realignment of the Melling rail line and associated railway infrastructure necessary to accommodate Waka Kotahi SH2 and Melling Interchange works
- GW public transport:
  - The new Melling Station and associated infrastructure (including a Park & Ride facility)
  - Safe multi modal access to the new Melling Station

Daly Street:

- GW flood protection:
  - Widening of the river corridor (and river channel works) to enable the river to convey a 2,800m cumec flood and to allow the river space.
  - Shaping the river channel and corridor to increase resilience to flood events
  - Enabling the ongoing maintenance of the stopbanks (and river corridor)
  - Broader environmental and recreational mitigation associated with the RiverLink project.
- HCC
  - Landing and connecting the new pedestrian/cycle bridge
  - Enabling future commercial/retail/residential developments to integrate with the stopbanks and Te Awa Kairangi and in the interim integrating the stopbanks with the central city through the provision of open space, active areas, laneways, temporary carparking, Riverbank market and other temporary urban activation activities
  - Pedestrian/cycle linkages
  - Local roading works and streetscape
  - Stormwater works
  - Broader environmental and recreational mitigation associated with the RiverLink project.

Rutherford Street (including Queens Drive widening and regrading):

- Waka Kotahi (solely roading)
  - Landing the new Melling Bridge onto the TLB of Te Awa Kairangi at the Queens Drive and Rutherford Street intersection
  - Providing safe and efficient access from and to the bridge and the local road network.

705 Western Hutt Road (solely GW flood protection):

- The site is the only undeveloped private property within the floodplain on the TRB of Te Awa Kairangi between Kennedy Good Bridge and Melling Bridge.
- As signalled in the Hutt River Floodplain Management Plan 2001 and the District Plan the site is within the floodplain, prone to high velocity flow, erosion, and loss of access.

- The site is strategically located where the slope of the river levels out between Kennedy Good Bridge and the river mouth and highly vulnerable with less than 50% of the land situated above the 1:100-year flood level.
- The site will enable GW to maintain and accommodate increased requirements as a result of climate change, channel capacity at this location providing enhanced flood protection on the TRB of the river, and the establishment of vegetation alongside the river corridor in this location.
- The site will also provide access to enable gravel extraction activities to be undertaken as required under the existing flood protection consents (anticipated at 25,000m^3 annually) and for the RiverLink Project with the reshaping of the river channel.
- The site will provide storage for western bank extraction and the related haulage of riverbed and berm gravel, including associated equipment and plant.
- RiverLink is associated with a shift in approach for flood management to giving the river more space to move, especially between the Kennedy Good Bridge and new Melling Bridge. The design requirements include the need for a wider channel and more flexible river edges at this location.
- Broader environmental and recreational mitigation associated with the RiverLink project.

9.21.3 Overview of property effects and business disruption

Effects on land use and property arise from three broad categories of physical effect. Each of these physical effects gives rise to different business disruption and land use effects during construction and operation activities. The categories include the following:

- Effects arising from the direct physical land acquisition. Key variables which influence the significance of the land use or business disruption effects include whether:
  - the whole site or only part of a site is required;
  - building or service removal / relocation is required;
  - the required land is from the front or rear of the site because frontage land is often of greater significance; and
  - the land includes accessways or other services / utilities integral to the site
- Effects on a property or land use arising from direct physical effect on adjoining land where this affects an easement or other property right (such as a right of way). The land use and business disruption effects derive from loss or changes to accessways or site servicing. This category of effects also considers effects on the operation of utilities over existing land uses; and
- Properties within close proximity to the Project. In these cases, adjoining activities and land uses are affected by effects resulting from the Project. This includes construction and operation effects. A number of these effects are considered elsewhere in this report (e.g. noise and vibration effects) and changes to the use (e.g. traffic volume and access), or operation of existing roads (e.g. accesses) or other network utilities.

The properties directly affected by the Project are shown on the Designation Plans (Volume 5 of the Application) and in the schedule of all the land required by the Project as set out on the application forms, in Volume 1 of the Application documents.

9.21.4 Design philosophy to minimising property, land use and business disruption impacts

The Project philosophy has been to avoid and minimise potential adverse effects on properties and business disruption through early acquisition of the property required for the works to avoid the need for compulsory acquisition, project design and road alignment where this is practicable. This has included:

a) acquisition of properties required for the works on a willing seller, willing buyer basis since 2016; and

b) specific consideration of the potential property effects in a number of the assessments of the alternatives processes as the Project developed. These are described in Chapter 7 of this AEE.

There are a number of examples where this assessment process has enabled potential effects to be avoided or has minimised potential effects. These include:

- In an earlier stage of the integrated project development as described in section 7.4, the Hutt River City Centre Project option assessment process included property impacts as a criterion. Two options were taken forward, one of which was chosen in part due to its (comparatively) smaller property effect resulting from the option.
- During the preliminary design phase option assessment (described in section 7.5 of this AEE), the different options to develop structures which interface with the stopbanks along Daly Street, and the various effects of those options were considered. The effects on adjacent development were included in the assessment. The option taken forward was chosen (in part) because the effect on adjacent development within proximity to the structures was minimal.
- Also, during the preliminary design phase, the options for improving the design of the Melling intersection were assessed and refined down to a shortlist of three options through both a multi-criteria assessment and a single stage business case assessment, which are described in section 7.5 of this AEE. The option analysis included assessment of the quantity of land required for each option. The option taken forward was that with the least effect on property (Option 9).
- In 2020, the Assessment of Alternatives process and assessment documented in section 7.6 was undertaken. The process was undertaken for six different sites and where the options had the potential to affect property, this was considered in the option analysis. At three of the sites (sites 1, 4 and 5), the greater requirement for private property acquisitions, and lesser ability to retain some property accesses were pivotal reasons why a number of options were discarded.

9.21.5 Quantifying the land effects for property and business disruption effects

The Project requires land from within a number of existing land uses (broadly defined by zones), within the total Project footprint of approximately 978,900m^2. The state highway and local road network comprise approximately 115,400m^2 of this total project area and the remaining land includes the zoned land from the District Plan summarised below. This is comprised of 136 properties. 100 of these properties have already been acquired for the Project on a willing seller, willing buyer basis, with another 36 still to be acquired (whether fully or partially).

- Approximately 69,000m^2 of residentially zoned land affecting 107 dwellings[56]. These effects are largely on the western side of the river in Melling. The properties on which 89

[56] Some properties have multiple dwellings

of these dwellings sit have already been acquired by GW, Waka Kotahi or HCC, but another 17 residential properties are required to be acquired in full. There is also one partial residential acquisition potentially required along Pharazyn Street to accommodate the proposed cycleway running alongside the Melling Line. Consultation with the landowner has begun. Any mitigation will be addressed through future discussions.

- Approximately 645,300m^2 of river and river side land zoned for recreation and open space purposes. The impacts on recreation and open space will be greater for construction than for the permanent physical works. The impact of this construction work on recreation land use is discussed in section 9.18 Social and Recreation Impact of this AEE.
- Approximately 62,500m^2 of commercial and business land affecting 61 businesses on 34 properties[57]. 17 of these properties have already been purchased, but 17 are still to be purchased in full or in part. The land requirements or the Project design will impact on the existing operation of a number of businesses, including:
  - on buildings and site operations;
  - on site accesses and site servicing which have the potential to impact business operations (e.g. along Queens Drive or Pharazyn Street);
  - on amenity and open space areas of sites which have the potential to impact on either development plans for business operations or on the amenity use/enjoyment of these sites.

Where the land has not already been acquired by GW, Waka Kotahi or HCC, and it is required either permanently or for construction, the acquisition of property rights, including leases, will be undertaken by the Crown or relevant council through the PWA process. The PWA addresses the issues of compensation for this required property or lease, including business loss and relocation.

9.21.6 Permanent full acquisition

Where property has already been acquired on a willing seller, willing buyer basis, and the property has subsequently been leased out, the leaseholders were aware the property was required for RiverLink when they leased the property. It was understood that their lease will cease in time for the Project construction period. These businesses have been informed and are aware of construction timeframes, and their respective lease agreements will finish before the Project construction begins. There are some properties which were purchased with leases which expire after construction is due to begin. Consultation with these tenants has begun with the intention of identifying appropriate mitigation measures to address the shortened tenancies.

The remaining property owners whose land is directly affected and have been informed and are aware of the potential for land or property rights to be acquired. Negotiations with landowners and the relevant Project Partner(s) are ongoing. Meetings with business owners and lessees as well as group forums with representatives from the business community, were undertaken during the Project development, as described in Chapter 8 of this AEE.

The full acquisition of properties with business occupiers required for the Project will result in business disruption impacts. These effects range from business closure to business relocation and will depend on the circumstances of the business owner and the particular economic circumstances of the business impacted. As noted previously, the PWA addresses issues of compensation for this required land.

[57] Some properties have multiple businesses

Of the properties still to be acquired, the types of businesses that will be affected by full acquisition can generally be categorised as follows:

- There are a number of small businesses, particularly on Marsden Street and Pharazyn Streets, including a mix of retail, service, production, and trade businesses. While relocation may be significant for some of these individual businesses, they are generally considered relatively 'mobile' or location flexible, and the relocation of these businesses is not considered to have an adverse consequential impact on the surrounding business activities (e.g., alternative businesses or relocation of businesses will not significantly disrupt other activities); and
- There are some medium and larger sized business operations, particularly around the Rutherford Street / Queens Drive area. The proximity of these businesses to transport networks and the Lower Hutt central area can be considered important factors to some of these businesses. Notwithstanding this, the specific businesses affected are not considered 'location' or resource dependent. As such relocation of these businesses or reliance on alternative similar businesses in the wider area was considered probable for surrounding business activities (in the context of wider business disruption impacts).
- The Ministry of Social Development Centre (the Centre) on High Street is location specific. The Centre needs to be in a central city location in order to be accessible to clients. Liaison with representatives is underway to determine an appropriate new location for the Centre, which is still within the Lower Hutt Central area

Mitigation measures proposed to address the residual business disruption effects include early consultation with these businesses to enable best opportunities for business relocation where such mitigation is considered the best practicable option.

9.21.7 Partial property acquisition and business disruption

In addition to full acquisition, there are number of business sites where a portion of land is required. As noted above, the Project has sought to avoid business disruption to the greatest extent practicable, and GW, Waka Kotahi and HCC have purchased as much land as possible in advance to minimise business disruption.

The land acquisition process under the PWA for the remaining properties to be acquired compensates an affected landowner for the loss of the land required for the Project and any loss in value of any balance of the land.

- Project effects and land requirements that affect buildings and site servicing or operations of businesses are as follows:
  - The Hot Spring Spas site on Queens Drive/ Rutherford Street. To accommodate the new Melling Bridge landing, the frontage of the property will be affected. This results in the building needing to be demolished and the site either regraded through placement of fill to raise the site up to the new road level or retaining walls being built on the property boundary to enable new building(s) to be constructed to interface with the new road level. Consultation with the landowner has begun and mitigation will be addressed through these discussions.
  - Access to Hutt City Autoworld on Queens Drive will be altered to accommodate the new road level created by the new Melling Bridge landing. Options being considered to address the affected access include re-grading the site or constructing a retaining wall on the boundary and change all access to High Street. Consultation with the landowner has begun and mitigation will be addressed through these discussions.
  - Changes to the level of Rutherford Street and level and edge location of Queens Drive to accommodate the new Melling Bridge landing will result in the frontage of the

    Brocklesby Roofing site on Rutherford Street being affected significantly. A retaining wall is currently proposed to be constructed on the new property boundary which significantly affects the access onto Queens Drive, rendering it unusable, and affecting the operations on site. Discussions on mitigation with the landowner and their tenant are on-going.
  - Wishart appliances and the Asbestos Survey Company on Queens Drive will have their access severed and building partially demolished as a result of changes to the level and location of Queens Drive to accommodate the new Melling Bridge landing. Consultation with the landowner has begun and mitigation will be addressed through the discussions with both the landowner and their tenant.
  - The south-west corner of Carpet Court on Rutherford Street is required to accommodate the new stopbank location, resulting in a reduction in car parking spaces and re-configuration of the access to allow for service vehicle movements. Discussions on mitigation with the landowner and their tenant are underway.
  - The land acquisition from the Assembly of God Church and Recreation Centre on Marsden Street requires a portion of their carpark. As a result, the parking space numbers will be reduced. To mitigate this, the parking configuration and access ways in/out will be reconfigured, and an additional public carpark will be provided on Marsden Street to provide new parking facilities in proximity to the site. Early consultation with the landowner to plan for access and vehicle manoeuvring during detailed design and construction planning will appropriately manage these effects.
- Project effects and land acquisition that will impact on site accesses and site servicing, which have the potential to impact business operations. These effects include:
  - Requirements that affect accessways, manoeuvring areas or works on road that will affect accessways to adjoining businesses on Marsden Street and Rutherford Street. Early consultation with landowners and businesses to plan for access and vehicle manoeuvring during detailed design and construction planning will appropriately manage these effects.
  - The property accesses for four commercial properties and six residential properties, along Pharazyn Street will be changed. Rather than directly accessing Pharazyn Street, they will permanently access a new ‘slip-lane’ off Pharazyn Street. The slip-lane has been provided to maintain access that allows for continuity of operation for all affected properties. Land may be required from Randwick Meats, to accommodate the new access configuration and the new cycleway proposed along the railway line at the back of the site.
  - The proposed cycleway connection to the Pito-one to Melling cycleway will require a strip of land from the back of the Abbeycourt Motel on Pharazyn Street. This will result in a reduced width behind several motel units. Consultation with the landowner has begun, and mitigation will be addressed through these discussions.

9.21.8 Temporary property and business disruption for construction

During construction, changes to accessways and loss of visibility for businesses reliant on passing trade and pedestrian access for their operation is a potential adverse effect. This effect is discussed in the section 9.19 (Economic Impact) of this AEE.

9.21.9 Planning approvals for businesses

The Project affects a number of sites operating under existing planning approvals, including existing resource consents. Implications on existing resource consents will be identified on a case-by-case basis with those directly affected landowners.

9.21.10 Positive business and property effects

Some businesses are likely to experience positive effects during construction, as a result of increased economic activity from the influx of construction workers to Lower Hutt. This benefit is likely to be experienced by service industries (e.g., restaurants, cafés and convenience retail outlets) and construction businesses (e.g. building supplies etc.). The wider positive business and property effects of the works are discussed in sections 9.18 and 9.19 of this AEE.

9.21.11 Methodology to avoid or mitigate adverse effects

Meetings have been held with all landowners whose land has been identified as directly affected by the Project. The purpose of these meetings was twofold, first to inform the landowner about the Project and the potential land required and second, to gain an understanding of how the site is currently used, the operational needs of each site and the potential effects that could arise as a result of land requirement. This consultation has enabled understanding of the composition and function of residential sites and local businesses within the Project area.

Where consultation signalled there was likely to be a significant effect on the use of land, opportunities to amend the construction methodology or design to reduce effects were taken. This has included:

- The design was amended to provide new public car park along Marsden Street to help mitigate the loss of car parking resulting from the partial acquisition of the carpark servicing the Assembly of God Church;
- The proposal to construct the Project in stages, and restricting the works to a geographic area, meaning that the construction impacts of the work (such as reduced accessibility or noise and vibration effects) are contained within a stage and an area, rather than spread across the full Project area for the whole four-year construction period;
- Alterations to existing property accesses (discussed in more detail in section 9.10) and the creation of new access points; and
- Relocation of businesses (if required).

In many circumstances it has not been possible to avoid entire or partial land requirement from businesses or residential properties not already acquired. Negotiations with landowners and the relevant Project Partners are ongoing.

Where avoidance has not been possible, mitigation measures proposed which will assist to alleviate effects such as ongoing consultation with landowners and businesses to enable business planning in response to the works including planning in response to the works and where required to facilitate business relocation (as appropriate).

9.21.12 Summary

To deliver the Project, a number of specific properties require either full or partial land acquisition and others will experience disruption during construction. This will result in moderate to significant site-specific adverse effects on some individual residential and business sites across the Project area. Where possible, effects have been avoided or minimised by early and willing property purchase before the Project consenting or construction periods begin.

Potentially significant adverse effects on business continuity have been avoided or minimised where possible by Project design. The effects are otherwise being mitigated by early and ongoing regular consultation with the remaining landowners.

10. Management of effects on the environment

Overview

The assessment of the effects on the environment in Chapter 9 of this AEE has identified a range of positive and adverse actual and potential effects from construction and operation of the Project. Potential adverse effects have been avoided where possible, or otherwise minimised to the extent practicable, and where this has not been possible mitigation or offsetting is proposed to ensure that the Project effects are appropriately managed. A suite of measures including conditions setting out environmental limits, as well as management plans are proposed. These are supported by appropriate monitoring and maintenance, which will be developed and implemented to manage actual and potential effects.

The management plan framework has two tiers of construction management plans proposed:

- An overarching CEMP, and
- A series of specific environmental management plan's (e.g. ESC, construction noise, air quality, ecology, etc.).

A draft CEMP, draft ESCP and SSESCP, and draft Groundwater Management Plan have been prepared. The CEMP is provided in Volume 4 of Application documents. The draft ESCP and SSECP is provided as appendices to the Construction Water Quality Assessment (Technical Report #3 in Volume 4 of the Application). The Draft Groundwater Management Plan is appended to the Hydrogeology Assessment (Technical Report #4 in Volume 4 of the Application). These draft management plans provide indicative details about how potential environmental effects will be managed and outline environmental monitoring which will be undertaken prior to, during and following construction. This will also provide an additional mechanism through which further measures can be implemented during construction and operation if required. Some management plans are proposed for the operational phase of the Project also.

10.1 Introduction

The assessment of effects on the environment in Chapter 9 of this AEE identifies a range of positive and adverse actual and potential effects from the construction and operation of the Project.

The design of the Project has sought to avoid or minimise adverse effects to the extent practicable through the iterative design and consideration of alternatives processes, which have been informed by numerous technical specialists, and the indicative construction methodology. The effects assessments identified a range of potential adverse effects that cannot be avoided and require remediation or mitigation and in some instances offsetting to appropriately manage adverse effects.

This section discusses the mitigation and other measures proposed and provides:

- The Project delivery framework, identifying how conditions and management plans will be implemented through the detailed design, construction and operational phases of the Project
- Identifies who the consent holders are and who is responsible for implementing conditions and management plans during the construction and operational phases of the Project
- Details of the management plans, the timing of their submission and duration and the approval mechanism for proposed management plans, and

- A summary of mitigation measures to manage adverse effects.

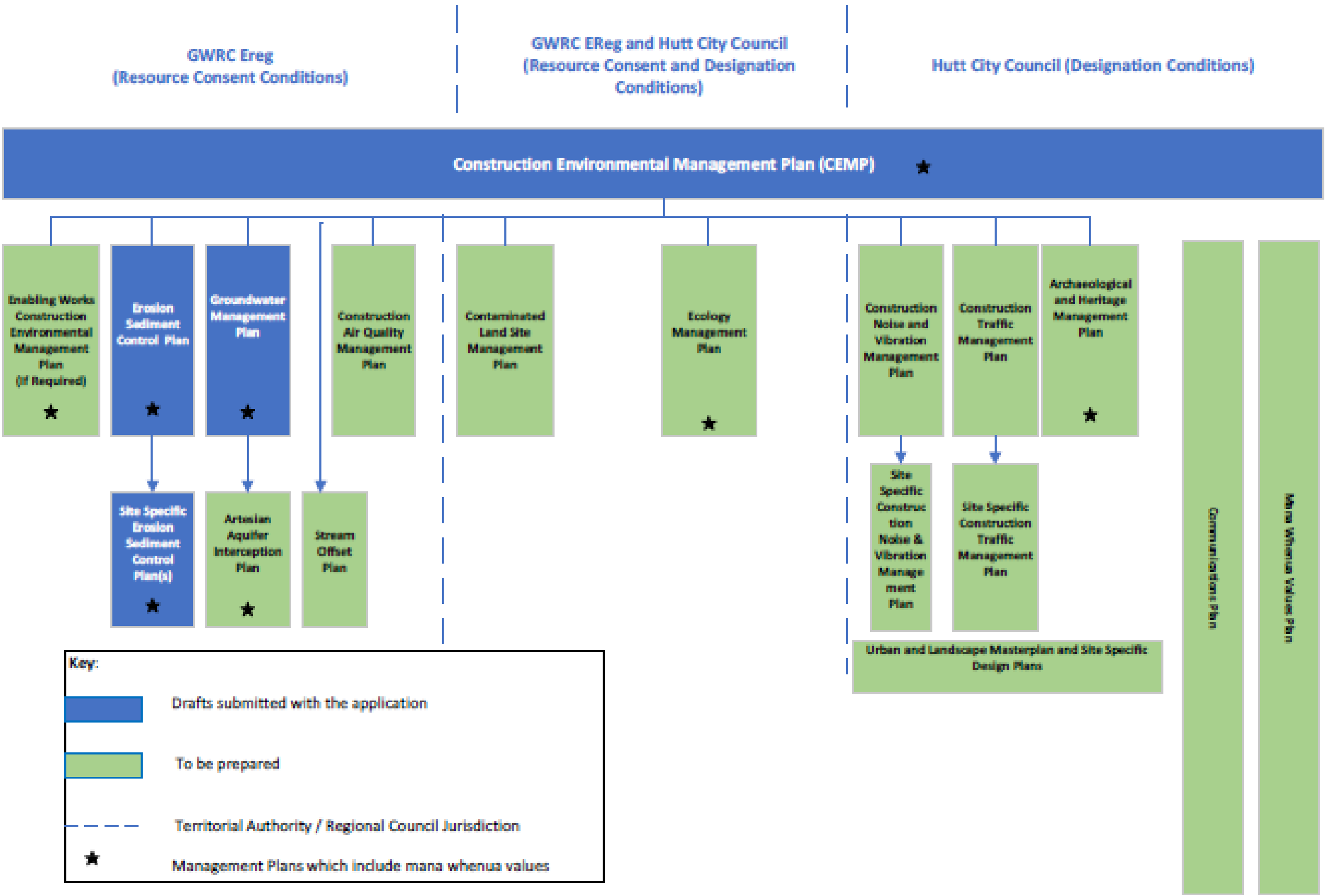
The mitigation, remediation and monitoring measures summarised in this chapter are reflected in the proposed conditions for the designations and resource consents in Appendix A.

10.2 Project delivery framework

Key to the future management of effects is the development and implementation of a suite of measures, including conditions, outline plans, management plans, monitoring and maintenance requirements. Collectively, this will form the Project delivery framework. This includes the need to manage areas of environmental sensitivity, to recognise environmental risk issues, and to identify the mechanisms to avoid, remedy or mitigate (and in some instances, offset for) any actual and potential effects.

Figure 51 shows the hierarchy of the various management plans to be implemented during the construction phase of the Project. It also indicates where draft management plans have been prepared now and included within this application.

Figure 51 - Management plan hierarchy



In addition to the resource management elements identified above, the requiring authorities and their contractor will implement other mechanisms to manage the design, construction and operation of the Project. This includes documented procedures in project management plans, health and safety plans, works delivery documentation and management systems.

10.2.1 Proposed conditions

Based on the mitigation and monitoring measures summarised in Table 76 at the end of this chapter, a suite of designation and resource consent conditions are proposed to ensure that the potential adverse effects that might arise from the construction, operation and maintenance of the Project will be appropriately avoided, remedied or mitigated. The proposed conditions address pre-construction (including enabling works), requirements relevant to the detailed design process, environmental limits and staging to minimise effects, management plans and monitoring as well as maintenance and the ongoing operation and maintenance of the Project. The proposed conditions are contained in Appendix A of this AEE.

Designations and resource consents are sought by GW, Waka Kotahi and HCC. While ongoing operational conditions will be bespoke to each relevant Project Partner, the intention is to have a single combined set of construction conditions applicable to all GW, Waka Kotahi and HCC approvals, as relevant to the designation or resource consent.

10.2.2 Outline plan process and supporting information

Section 176A of the RMA sets out the outline plan process. A requiring authority is required to submit an outline plan (or plans) of detailed works to HCC unless the exemptions in section 176A(2) apply, which includes where the details of the proposed work are incorporated into the designation. The RiverLink designations, in particular the drawings in Volume 5 for the proposed infrastructure works provide the level of detail required under section 176A. Therefore outline plans will not be submitted for the construction of the remainder of the Project, unless altered or additional works are required as a result of detailed design, or this arises during construction or operation of the Project.

10.2.3 Construction management plans

Many of the potential construction related effects of RiverLink are proposed to be managed through management plans and supporting site management and monitoring measures. These measures will be secured through the conditions which will outline their information requirements and how they will be implemented. The majority of the management plans will be developed during the detailed design and pre-construction phases of the Project. When the management plans are submitted to the relevant regulatory authorities, they will reflect the final design and construction methodology for the Project. Table 75 below outlines which management plans will be submitted to which authority for certification or for information prior to construction. The management plans that will be provided for information relate to matters that either are not the subject of a designation or resource consent (e.g. communication and consultation measures in the Communications Plan); or they are the subject of other council approval processes (e.g. the CTMP and the specific requirements of the road controlling authorities).

Each management plan will contain Project-specific methodology for avoiding, remedying or mitigating the actual and potential adverse effects arising from the construction of the Project, within the parameters set in the conditions. Management plans may be submitted in parts or in stages to address particular activities or to reflect the staged implementation of the Project.

Table 75 - Construction Management Plans

Resource Consent (RC) Condition or Designation Condition (D)	Management Plan	Approval mechanism	Relevant Authority receiving the Management Plan
RC & D	Communications Plan	For information purposes only	GW and HCC
RC & D	Mana Whenua Values Plan	For information purposes only	GW and HCC
RC & D	Enabling Works Construction Environmental Management Plan(s) – optional, only if CEMP not done at commencement of enabling works	For certification	GW and HCC
RC & D	Construction Environmental Management Plan (draft forms part of this application)	For certification	GW and HCC
RC	Erosion Sediment Control Plan and Site Specific Erosion Sediment Control	For certification	GW

Resource Consent (RC) Condition or Designation Condition (D)	Management Plan	Approval mechanism	Relevant Authority receiving the Management Plan
	Plan (draft forms part of this application)		
RC	Groundwater Management Plan	For certification	GW
RC	Artesian Aquifer Interception Plan	For certification	GW
RC & D	Ecology Management Plan	For certification	GW and HCC
RC	Stream Offset Plan	For certification	GW
D	Construction Traffic Management Plan, including any site specific Traffic Management Plan	For information	HCC
D	Construction Noise and Vibration Management Plan, including any site specific Construction Noise and Vibration Management Plan	For information	HCC
D	Archaeological and Heritage Management Plan	For certification	HCC
RC	Contaminated Land Site Management Plan	For certification	HCC (as per NESCS) and GW
RC & D	Construction Air Quality Management Plan	For certification	GW
RC	Urban and Landscape Masterplan and Site Specific Design Plans	For certification	GW and HCC

The scope of each of the management plans, including the purpose of the plan and the proposed content is set out in the sections that follow.

Mana Whenua

A Mana Whenua Steering Group (MWSG) is in the process of being established, as at July 2021. Once formally established, it will be implemented throughout the consent phase, detailed design and construction of the Project. The purpose of the MWSG is to set out how the Kaitiaki Strategy will be implemented in the Project's delivery and environmental management plans relevant to Mana Whenua values.

The Mana Whenua Steering Group will also seek to acknowledge the historic and living cultural values of the area to Mana Whenua whilst minimising potential adverse effects on these values.

A Mana Whenua Values Plan will be prepared in consultation with this steering group, which sets out the monitoring requirements and measures of interest to Mana Whenua for the construction phase. The required content of this plan is set out in the relevant condition in Appendix A.

Communications Plan

A Communications Plan will be prepared and implemented prior to, and throughout construction and the early stages of operation of the Project. The purpose of the Communications Plan is to set out how the public and stakeholders (including directly affected and adjacent owners and occupiers of land and affected residents and businesses) will be communicated with throughout construction.

The content of the Communications Plan is set out in the relevant condition in Appendix A The plan will be provided to the councils prior to construction commencing, for information.

Construction Environmental Management Plan (CEMP)

The CEMP sets out the measures to manage effects during construction. The purpose of the CEMP is to confirm the construction methods and management procedures used in order to avoid, remedy, mitigate potential adverse effects arising from construction activities.

A draft CEMP which outlines the contents of the CEMP provided in Volume 4 of the Application documents. The CEMP will be updated with the input of the construction contractors and will be provided to Councils for certification prior to construction commencing. The CEMP will clearly outline where other management plans are relevant for managing effects of construction during specific activities or within specific areas.

An enabling works CEMP, consistent with the scale of effects of enabling works, including demolition and removal of buildings, site investigations and installation of construction controls and laydown areas/construction offices etc (that are not otherwise permitted activities) will be prepared and submitted to Councils for certification prior to the start of enabling works.

Construction Noise and Vibration Management Plan (CNVMP)

The CNVMP provides a framework for the development and implementation of the Best Practicable Option for the management of construction noise and vibration effects, and as far as practicable to minimise any exceedances of the construction noise and vibration criteria.

Measures will be outlined within the CNVMP that are to be adopted to meet the noise and vibration criteria as set out in the designation conditions.

If the noise and vibration criteria is not able to be met, the CNVMP will outline the process to be followed to appropriately mitigate noise and vibration effects. The contents of the CNVMP are set out in relevant condition in Appendix A.

Any site specific CNVMPs will be provided to HCC in advance of construction works affecting the relevant activity/areas.

Construction Traffic Management Plan (CTMP)

The purpose of the CTMP is to manage the construction traffic and safety, including that of pedestrians and cyclists, associated with construction on a Project wide scale.

The contents of the CTMP are set out in the relevant designation condition in Appendix A and will be submitted to HCC for information purposes. In addition to the CTMP, HCC has other procedures for works on or near their roads including a requirement for Corridor Access Requests and requirements under the National Code of Practice for Utility Operators' Access to Transport Corridors under the Utilities Access Act 2010. Waka Kotahi is the road controlling authority for the State Highway network and has requirements for working on or near State Highways.

The CTMP will identify any specific activities or areas that require the preparation of a Site Specific Traffic Management Plan (SSTMP) any SSTMPs will be provided to HCC in advance of construction works affecting the relevant activity/area.

Contaminated Land Site Management Plan (CLSMP)

A CLSMP will be prepared prior to excavation in areas known or potentially contaminated land. The CLSMP is prepared for the resource consents required under the NESCS and the regional plans.

The purpose of the CLSMP is to set out the procedures and methods to be implemented during construction to control the disturbance and movement of any identified contaminated, or potentially contaminated soils. The procedures focus on managing the health, safety and potential environmental risk from contaminated land associated with the Project. The contents of the CLSMP are set out in the relevant resource consent condition in Appendix A. The CLSMP will be submitted to HCC and GW for certification and will be implemented during construction under the supervision of a Suitably Qualified and Experienced Practitioner.

Ecological Management Plan (EMP)

The EMP will set out the specific procedures, methods and monitoring requirements required to be undertaken for the Project in respect of ecological effects. It will include details of the mitigation and monitoring required for terrestrial fauna and flora (including avifauna) and aquatic fauna and flora. The contents of the EMP are set out in the relevant resource consent and designation condition in in Appendix A.

The EMP will be submitted to GW and HCC for certification and will be implemented for the duration of construction and associated post-construction monitoring of the effects of the Project.

Erosion and Sediment Control Plan (ESCP)

The purpose of the ESCP is to set out the measures to be implemented during construction to minimise erosion and the discharge of sediment within and beyond the boundaries of the Project works area. A draft ESCP has been prepared and is included as an appendix to the Construction Water Quality and Erosion Sediment Control report (Technical Report #3).

As a minimum, the ESCP will demonstrate how the requirements of the *Erosion and Sediment Control Guidelines for the Wellington Region (2002),* the *NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure (2014) and GW Code of Best Practice for River Management Activities (2019)* will be met. The ESCP will follow the principles set out in the draft ESCP in Technical Report #3.

The ESCP will identify any specific activities or areas that require the preparation of a site specific ESCP (SSESCP) any site specific SSESCPs will be provided to GW in advance of land or river disturbance affecting the relevant activity/area.

The ESCP will be supported by a Chemical Management Plan (CMP) outlining the specific design details for chemical treatment (flocculation) devices to be used on site, the dosage rates to be implemented for each device and the how the performance of chemical treatment devices will be monitored.

Construction Air Quality Management Plan (CAQMP)

The purpose of the CAQMP is to outline the dust management and emission controls to be applied by the construction contractor during construction to minimise the effects of dust and discharges of other contaminants to air.

The specific matters to be addressed in CAQMP include:

- Dust suppression measures including consideration of weather conditions and procedures for the use of water sprays on stockpiles and exposed areas of the site
- Procedures for visual monitoring of dust emissions

- Measures to manage hazardous air pollutants from the disturbance of contaminated soils including those containing asbestos
- Locating activities such as the aggregate processing and screening plants to maximise separation from sensitive receivers, and
- Complaints investigation, monitoring and reporting.

The CAQMP will include also include specific measures for the aggregate processing plant and aggregate screening activities.

Archaeology and Heritage Management Plan (AHMP)

The purpose of the AHMP is to set out the specific measures to manage archaeology and historic heritage during the construction and operation of the Project. The AHMP will be prepared by a suitably qualified and experienced archaeologist with support from a suitably qualified and experienced built heritage advisor, Mana Whenua and Heritage New Zealand and will include:

- Methods for recording existing archaeology and heritage features
- Identification of known and potential archaeology and heritage features
- Identification of the Project archaeologist and their roles and responsibilities
- Methods for protecting or minimising adverse effects on existing archaeological and heritage features during construction
- Specific areas/features where construction requires supervision from archaeological and/or built heritage advisors, and
- Clear protocols to follow where items or materials are discovered (On-Call Procedure).

Groundwater Management Plan (GMP)

The draft GMP will updated in consultation with the appointed contractor and Wellington Water to provide details of how groundwater, in particular the underlying aquifers, will be managed and monitored during and following construction.

The GMP will include details of:

- Groundwater monitoring bores including location and depth
- Proposed investigation bore locations
- Method for bore construction and piezometer installation
- Methods for frequency for groundwater monitoring
- Groundwater quality trigger levels, and
- Procedures to follow in the event of trigger levels being exceeded.

Artesian Aquifer Interception Management Plan (AAIMP)

The AAIMP will be prepared in consultation with Wellington Water and will provide details on how activities which have the potential to penetrate one or both of the underlying aquifers during the construction of the Project will be managed to avoid cross contamination between aquifers, and contamination of the aquifer systems, occurring as a result of bridge piling activities.

The AAIMP will include details of:

- The depth of the aquitard and the underlying aquifers
- The final construction methodology for piling activities which intercept the aquifer(s)

- Procedures to be undertaken during grouting to protect the aquifer/or grouting management
- Measures to protect the aquifer and the river from drilling muds and fluids during piling activities
- Trigger levels for stopping works affecting the aquifer(s), and
- Measures to ensure the piles are appropriately sealed to prevent leakage of the aquitard/aquifer(s) around the piles

Urban and Landscape Master Plan (ULMP)

The Urban and Landscape Master Plan (ULMP) secures key environmental detail necessary for mitigation of effects during the detailed design for the Project structural elements and landscaping. The purpose of the ULMP is to integrate the Project's permanent works into the surrounding cultural and environmental landscape and urban context and illustrate the cultural and environmental elements of the Project. The ULMP will also support the achievement of the objectives of the EMP and the planting establishment and management requirements in particular, through combining landscape planting, restoration planting and habitat rehabilitation where practicable.

The ULMP will demonstrate how the Kaitiaki Strategy, the relevant landscape and urban design principles, and design themes and outcomes identified in the ULDF (submitted with this Application as Volume 3 of the documents) have been applied to the detailed design drawings.

The ULMP will be submitted for certification to HCC and GW, in respect of river related elements.

Stormwater Operation and Maintenance Plan

The Stormwater Operation and Maintenance Plan will set out the details and maintenance processes required to maintain and operate the stormwater treatment devices for the Project. It will include:

- Documentation of stormwater systems, culverts, pipes and control systems;
- Health and safety considerations for undertaking maintenance; and
- Record sheets

10.2.4 Other plans

Parking Review

The parking review will provide direction and information to support decisions about the appropriate management and spatial distribution of carparks within and immediately adjacent to the Project area. The parking review will also enable the collection and analysing of data to understand user characteristics of the off and on street parking in the Project area. The parking review will be undertaken in consultation with business and residents in the Lower Hutt central area.

The parking review will include:

- Consideration of parking time (duration) limits;
- Parking pricing strategy options;
- Park and ride
- Signage for parking areas

- Parking enforcement strategies
- Parking survey

Transitional Parking Plan

The Transitional Parking Plan will manage the loss of public parking during construction of the Project and support the transition to multi-modal transport options to enable greater access.

The Transitional Parking Plan will include:

- Methods to manage the loss of public parking;
- Options to enable a transition from parking dependency;
- Methods to monitor via Metlink the patronage levels on bus services

10.3 Offsetting

Offsetting is required for two aspects of the project, in relation to freshwater ecology and terrestrial ecology.

10.3.1 Freshwater ecology

The assessment of effects in section 9.7 of the AEE identifies that there will be residual adverse effects following the implementation of the effects management hierarchy in relation to the permanent loss of 25 m of stream habitat in the Harbour View Stream. This loss cannot fully be addressed through avoiding, minimising or remedying effects, and as such the residual adverse effects require offsetting. The development of the proposed offset is guided by the NPSFM and principles in Policy 32 and Schedule G2 of the PNRP.

The effects management hierarchy of the NPSFM requires that: "*in relation to natural inland wetlands and rivers, means an approach to managing the adverse effects of an activity on the extent or values of a wetland or river (including cumulative effects and loss of potential value) that requires that:*

(a) adverse effects are avoided where practicable; and

(b) where adverse effects cannot be avoided, they are minimised where practicable; and

(c) where adverse effects cannot be minimised, they are remedied where practicable; and

(d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, aquatic offsetting is provided where possible; and

(e) if aquatic offsetting of more than minor residual adverse effects is not possible, aquatic compensation is provided; and

(f) if aquatic compensation is not appropriate, the activity itself is avoided"

The NPSFM also sets out further definitions of "aquatic compensation" and "aquatic offset" to be applied in conjunction with the "effects management hierarchy".

"*Aquatic compensation means a conservation outcome resulting from actions that are intended to compensate for any more than minor residual adverse effects on a wetland or river after all appropriate avoidance, minimisation, remediation, and aquatic offset measures have been sequentially applied".*

"Aquatic offset means a measurable conservation outcome resulting from actions that are intended to:

(a) redress any more than minor residual adverse effects on a wetland or river after all appropriate avoidance, minimisation, and remediation, measures have been sequentially applied; and

(b) achieve no net loss, and preferably a net gain, in the extent and values of the wetland or river, where:

(i) no net loss means that the measurable positive effects of actions match any loss of extent or values over space and time, taking into account the type and location of the wetland or river; and

(ii) net gain means that the measurable positive effects of actions exceed the point of no net loss

Policy P32 requires that *"Adverse effects on biodiversity, aquatic ecosystem health and mahinga kai shall be managed by:*

(a) Avoiding significant adverse effects, and
(b) Where significant adverse effects cannot be avoided, minimising them, and
(c) Where significant adverse effects cannot be avoided and/or minimised they are remedied, and
(d) Where significant residual adverse effects remain, it is appropriate to consider the use of biodiversity offsets.

Proposals for biodiversity mitigation and biodiversity offsetting will be assessed against the principles listed in Schedule G1 (biodiversity mitigation) and Schedule G2 (biodiversity offsetting).

It is noted that Policy P32 is subject to appeal.

The Project results in approximately 25 linear metres of stream habitat loss within the Harbour View Stream. The section of stream cannot be retained (avoided) as part of the new works due to the relocation of the Melling bridge (i.e. location of Melling bridge abutment) and widening of SH2. Nor can the stream habitat be retained (remedied) within the original vicinity, due to the topographical and spatial constraints. Furthermore, the designed piped section will have a grade and size that will tie into the existing upstream network, which will prevent fish passage from occurring. Therefore, fish passage through the new piped section cannot be mitigated.

The Freshwater Assessment (Technical Report #6) discusses the requirement for offset in more detail. As the stream loss cannot be avoided, remedied or mitigated, biodiversity offsetting is proposed to address the residual effects. The stream ecological valuation (SEV) methodology will be utilised to determine the quantum of stream offset works required to achieve no net loss of ecological function. This will account for the loss of values and adequately offset the effects resulting from the loss of habitat, and therefore is consistent with the "effects management hierarchy" as set out in the NPSFM and Policy P32.

The offset will be secured through a condition requiring a Stream Offset Plan. The SOP will set out the design, location and the quantum of offset required as a result of the adverse effects on freshwater associated with the loss of stream habitat from piping approximately 25 linear metres of stream habitat at the Harbour View Road tributary. The SOP will incorporate any feedback from the MWSG.

The SOP will:

- Confirm the total length of watercourse lost as a result of the Project
- Calculate the quantum and location of offset in accordance with the relevant SEV guidance

- Demonstrate that the proposed offset is like for like with regard to watercourse hydrology and substrate
- Where practicable, integrate any planting aspect of the offset with the restoration planting and habitat rehabilitation in the ULMP and EMP
- Describe how the anticipated outcomes used in the stream ecological valuation (SEV) will be achieved
- Describe monitoring methods and frequency
- Where practicable, incorporate any feedback from the MWSG, and
- Be consistent with Schedule G2 of the PRNP.

The SOP will be submitted for certification to GW.

10.3.2 Terrestrial ecology

The assessment of effects in section 9.8 of the AEE identifies that there will be residual adverse effects following the implementation of the effects management hierarchy in relation to the permanent loss of 1.65 ha of mixed broadleaf forest and scrub with moderate ecological values on the hillslope above SH2. This loss cannot be avoided and nor can it fully be addressed through minimising or remedying. As such the residual adverse effects require offsetting.

The revegetation programming forming the offset has been designing in collaboration between the Project ecologist and landscape architects. Replacement of the mixed broadleaf forest with a combination of 10.98 ha of indigenous forest and shrubland revegetation and 7.68ha of bioengineered willow planting with an indigenous understorey is considered offset because the vegetation removed will be replaced with better quality vegetation in a more threatened land environment - the alluvial floodplain as opposed to the hillslope ecosystem. Offset is considered an appropriate approach in this instance for the following reasons:

- The majority of the 1.65 ha of mixed broadleaved being removed is in early stages of regeneration and does not reflect the hillslope vegetation that historically covered the area;
- Unvegetated areas on the western hill slopes are very limited, hence, to achieve the required area of revegetation in this 'like-for-like' environment, the revegetation would need to be undertaken some distance from the point of impact compared to if it replaced in the nearby floodplain; and
- The topography of the hills means that development has been more limited in this area, and it is a less threatened ecosystem type compared to the indigenous forest that once covered the floodplain, which is now almost entirely removed across the developed areas of the Hutt Valley.

The Project ecologist’s opinion is that the proposed planning is comparative in area and quality to the vegetation being removed.

10.4 Summary of measures to manage adverse effects

The mitigation, remediation, management and monitoring measures for the Project are summarised in Table 76 below.

Table 76 - Summary of mitigation measures

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
Section 9.2	River hydraulics and flood containment	Increase in flood levels below Estuary Bridge Flood capacity impacts during construction	- Future review of the HRFMP - Construction sequencing to ensure a channel at least as large as existing to be maintained during construction	No	- Condition requiring GW to assess and identify treatments to address any increase in flood levels when it next undertakes a review of the HRFMP - CEMP requires flood capacity management during construction
Section 9.3	Stormwater and operational water quality	Improved freshwater quality as a result of treatment of stormwater discharges (contaminants and sediment)	- Stormwater treatment be designed and undertaken in accordance with relevant WWL and Waka Kotahi guidelines - Stormwater Management Plan - Maintenance of stormwater devices on an ongoing basis	No	- Conditions requiring stormwater treatment be designed and undertaken in accordance with relevant WWL and Waka Kotahi guidelines - Conditions requiring a Stormwater Management Plan and implementation of the Project in accordance with the Plan - Condition requiring maintenance of stormwater devices on an ongoing basis
		Habitat loss and impacts on fish passage	- Use of automated flap gates/backflow protection structures so fish passage is not precluded in the future	No	- Design
Section 9.4	Construction water quality and erosion and sediment control	Reduced water quality from sediment laden runoff and increased risk of other contaminant discharges into the downstream receiving environment during construction from activities outside of the river corridor	- Best practice erosion and sediment control measures to be set out in ESCP and SSESCPs, which are prepared in accordance with relevant guidance - Design and implement erosion and sediment control measures during construction, including structural and non-structural measures, to be in general accordance with relevant GW and Waka Kotahi guidance - Emphasis on timing, staging and sequencing of earthworks, to minimize disturbance footprints. This will form part of the ESCP and SSESCP development process - Progressive stabilisation of earthworks areas - Procedures for the refuelling and maintenance of plant and equipment to avoid discharges of fuels or lubricants to watercourses, measures to manage the storage of	Yes	- Construction sequencing, methodologies and management measures including chemical management - ESCP and SSESCPs - Active management provisions - Monitoring and reporting - CEMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
			hazardous materials and contingency procedures to manage accidental spills during construction - Implement meteorological, ecological and water quality performance monitoring		
		Reduced water quality from sediment generation and transport of suspended sediment during in-river/stream works and activities within the river corridor	- Specific procedures and construction methods will be implemented to manage potential adverse effects arising from works in the river corridor. These will be set out in the ESCP and an SSESCP - The ESCP and SSESCP development process will be in general accordance with the GW Code of Best Practice for River Management Activities - Where practical, in river activities and any associated works will be bunded off and undertaken in an offline (standing water) environment - Avoid construction works when flows are less than 1.2 cumecs - Limit works areas to 500 lineal metres at any one time - Limit duration of construction works to 12 hours a day for a maximum of 5 days in any 7 day period. - Implement meteorological, ecological and water quality performance monitoring, and rainfall contingency measures	Yes	- ESCP and SSESCPs - Construction sequencing, methodologies and management measures - Active management provisions - Conditions controlling footprint and duration of in-river works. - Monitoring and reporting
Section 9.5	Groundwater/hydrogeology	Dewatering of groundwater on sites that contain contaminants above levels for human health and ecological receptors	- Testing of groundwater to assess contaminant levels	No	- Specific condition requiring groundwater testing as per the CEMP
		Groundwater management and monitoring – construction	- Groundwater Management Plan (GMP) - Two piezometers be installed close to the Project area - Artesian Aquifer Interception Management Plan, including grouting management - Construction Environmental Management Plan, including management of excavation encountering groundwater	Yes Yes Yes No	- Specific condition requiring GMP - Specific condition requiring piezometers - Specific condition requiring management plans - - Specific condition requiring CEMP
		Potential groundwater effects of piling	- Confirm ground conditions at proposed bridge piles	No	- Specific condition requiring boreholes
Section 9.6	Geomorphology	Construction bank erosion	- Sequencing of works within the river	No	- ESCP
		Construction sediment transport	- Sequencing of works within the river	No	- ESCP
		Operational bank erosion effects	- Rock rip-rap linings and vegetative buffers	No	- Construction of the proposed design
		Operational sediment deposition within the Project reach	- Design of river channel to allow for deposition and management of sedimentation in the upper reach, resulting in less interventions in the lower reach	No	- Construction of the proposed design

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
Section 9.7	Freshwater ecology	Construction sediment and cement wash discharges	- Implementation of erosion and sediment controls including staging of works - Monitoring the impact of suspended and deposited sediment over time before, during and after Project works at each stage location - Setting target levels that will in turn direct an active management response	Yes	- ESCP - SSESCPs - Adaptive construction methodology
		Construction freshwater habitat effects	- Implementation of erosion and sediment controls including staging of works - Monitoring of sediment particle size: once 'before' impact, once 'immediately after' impact, and once four and seven weeks after the immediately after' sampling event. Post construction work monitoring for 2 years following construction - Setting target levels that will in turn direct an active management response	Yes	- ESCP - SSESCPs - Adaptive construction methodology
		Construction freshwater fauna effects	- Macroinvertebrate and fish sampling - Implementation of ESCP including staging of works that is adaptive and responsive to fish and macroinvertebrate monitoring results; standdown period from September to November for fish migration - Limit gravel extraction length to 500m - Works undertaken in dry conditions - Fish salvage and relocation to available habitat - Fish Recovery Plan as part of EMP - Inclusion of automated/active flap gates on any outlet structures that require flood control infrastructure	Yes	- ESCP - SSESCPs - EMP - Construction methodology
		Residual effects – loss of stream habitat and fish passage	- Biodiversity offsetting using the Stream Ecological Valuation method - Stream Offset Plan	No	- SEV method and Stream Offset Plan
Section 9.8	Terrestrial ecology	Permanent effects – loss of habitat as a result of vegetation clearance	- Replanting programme totalling a minimum of 28 hectares to replace 23.9 hectares of moderate value vegetation removed and return parts of the floodplain to indigenous forest that would have historically covered the area, including: - 7.73 ha of exotic willow planting with an indigenous understory for flood protection adjacent to active channel in upper reach of Project area - 0.57ha indigenous trees in the river corridor - 10.98 ha of indigenous broadleaved forest and scrub revegetation within and adjacent to active channel - 6.18 ha of indigenous ground cover planting - 1.81 ha of signature planting areas that are proposed to include weaving resources, wetland species and divaricating shrub mixes - 190 indigenous trees are proposed as street trees to replace the trees removed from the existing streetscape	Yes	- ULMP - Planting Establishment and Management section in EMP - Vegetation Removal and Management section in EMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
			- Regular maintenance of replanted areas for a minimum of five years to control pest plant incursions and replace any lost plants - Infill planting weed and pest control in remaining 2 ha of adjacent mixed broadleaved forest and scrub within the Project area - Limiting access to gravel beach areas of a minimum 5000 m^2, on each side of the River (totalling at least 10,000 m^2), to encourage birds back to the area		
		Effects on riverine birds and lizards from ongoing river maintenance works	- Avoiding works on the gravel beaches during the key nesting period for riverine birds to the extent practicable, and implementing pre-clearance nest surveys if this period cannot be avoided - Pre-clearance lizard surveys and salvage if more than 100 m2 of potential lizard habitat is to be disturbed as part of the maintenance activities. - Implementation of mitigation measures outlined in the Code of Practice for GW's existing river maintenance consent, including replanting any high value riparian vegetation removed, or where more than 100 m2 of any other riparian vegetation is removed	Yes	- Requirement for pre-clearance nest surveys linked to restrictions on timing of works - Invertebrate and Lizard Management section in EMP - Avifauna Management section in EMP
		Construction effects on fauna and vegetation	- Identify periods (such as breeding periods) where vegetation clearance must be avoided or otherwise minimized). Pre-clearance nesting surveys to be undertaken during the relevant breeding season prior to vegetation clearance. If native bird nests are identified, works will not proceed within 50 m of the active nest (for At Risk or Threatened species) or 20 m for other native birds until the young birds have fledged or the nest is naturally abandoned - Set-back for construction works to protect black shag roosting site - Minimisation of vegetation loss through site management and appropriate construction methodology. This should include avoidance of unnecessary vegetation clearance through the physical delineation of the footprint boundary and physical delineation of vegetation to be retained for the entirety of the Project footprint). - Staged vegetation clearance as construction progresses rather than all vegetation loss occurring prior to the commencement of construction activities - Pre-vegetation clearance lizard surveys, and salvage and relocation in the 'mixed broadleaved forest and scrub' habitat adjacent to SH2 - Vegetation clearance in potential lizard habitats to be avoided during colder months (May - August inclusive) when lizards are less active and less likely to be detected or to survive relocation		- EMP - Specific conditions placing restrictions on timing of works - ESCP - Vegetation Removal and Management section in EMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
			- Survey and salvage for W. urnula snails in the 'tall stature exotic planting (flood protection)' prior to clearance of this vegetation - Accidental discovery protocols for At Risk and Threatened flora and fauna across the Project area - Best practice erosion and sediment control management		
Section 9.9	Marine ecology and coastal avifauna	Construction effects	- Best practice erosion and sediment control management - Additional sediment management controls if water quality management triggers are exceeded	Yes – water quality measurement	- ESCP
Section 9.10	Traffic and transportation	Construction effects	- Preparation of a CTMP and SSTMP if required	Yes – as set out in the CTMP	- Methods as set out in the CTMP and SSTMP and secured through a condition. - Construction Methodology.
		Operational effects	- Review of the parking management of on and off street public parking - A transitional parking plan to phase the loss in car parking as a result of the Project.	No	- Secured through conditions relating to parking review, transitional parking plan
Section 9.11	Noise and vibration	Noise - Construction	- CNVMP and SSCNVMP, which include limits on working hours where reasonably practicable, use of appropriate equipment, equipment checks, operating requirements - Community engagement to keep community informed of noisy/vibration causing works - Noise and vibration training - Temporary relocation of residents to be offered where noise and vibration levels are predicted to be significant after all mitigation measures are implemented	To be confirmed in management plan(s)	- Condition requiring CNVMP/SSCNVMP - Training requirements in the CEMP
		Vibration – construction	- CNVMP and SSCNVMP, which include limits on working hours where reasonably practicable, use of appropriate equipment, equipment checks, operating requirements - Community engagement to keep community informed of noisy/vibration causing works - Noise and vibration training - Temporary relocation of residents to be offered where noise and vibration levels are predicted to be significant after all mitigation measures are implemented - Building surveyor to assess sensitivity to vibration of 'Higher Risk' category buildings in Table 14 and all buildings in Table 16 of the Noise and Vibration assessment	To be confirmed in management plan(s)	- Condition requiring CNVMP/SSCNVMP - Training requirements in the CEMP
		Noise – piling construction	- Bridge piling works to be attenuated using timber cushioning shoe and shrouding noise curtains - Driven piling works to be restricted to 7.30am – 6pm Monday to Friday	No	- CNVMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
		Operational road traffic noise	- Road surfaces to be constructed with OGPA and SMA as designed - Building modification mitigation offered owners of first and second floors 151-155 High Street	No	- Construct road surfaces as designed - Condition requiring building modification
Section 9.12	Air quality	Emissions associated with earthworks, demolition, crushing and stockpiling	- Water application or fogging sprays for emissions from Project activities where potential for off-site emissions towards highly sensitive receptors (HSRs), where within 200m of HSRs. Wet concrete cutting only - Limit speed limits on unsealed surfaces unless they are stabilized or treated - Pre-identification of asbestos and other materials with potential to generate hazards dust emissions. Removal in accordance with Health and Safety at Work (Asbestos) Regulations - Wind break fencing if visible wind-blown dust emissions - Minimise open excavation areas to extent practicable and stabilise exposed areas if not required further. - Stabilise and cover inactive stockpiles. Minimise heights and maximise stockpile separation from HSR and/or minimise dust exposure as far as practicable - Minimise works in dry, high wind speed conditions - Minimise drop heights - Maximise separation of crusher and screening plant from HSRs and avoid upwind exposure as far as practicable. Material dried to a dusty consistency not to occur within 200m of HSR - Enclose crushing plant if water availability is limited	Yes – Continuous monitoring of local meteorological conditions; regular visual inspection of dust generating activities; potential for continuous instrumental monitoring in specified locations – all set out in CAQMP	- CAQMP - Requirement to avoid discharges to air, including discharges of dust and odour, that are noxious, dangerous, offensive or objectionable beyond the Project Area - Procedures in the CSLMP to manage discovery of odorous contaminated material during works. - Equipment engines serviced in accordance with manufacturers' requirements and whether visible emissions occur outside cold start-up period.
		Emissions associated with vehicle movements	- Limit vehicle speeds to 15 km/h or less on unsealed roads unless they are treated or stabilised - Metal or otherwise stabilise frequently used access routes - Wet suppression or equivalent where potential for off-site dust emissions towards HSRs and within 200m of HSRs - Wheel cleaning at site exits to minimise tracking off site - Remove spilled or deposited material. Apply water in dry conditions to supress dust generation	Yes – Continuous monitoring of local meteorological conditions; regular visual inspection of dust generating activities; potential for continuous instrumental monitoring in specified locations – all set out in CAQMP	- CAQMP
Section 9.13	Archaeology and Historic Heritage	Discovery of artefacts during construction	- On Call Procedure (OCP) - Limit earthworks in specifically identified areas and actively monitor earthworks in specifically identified areas/sites	Yes, as set out in the AHMP	- AHMP - On Call Procedure
		Demolition and/or removal of post-1900 buildings	- Visual and virtual record of buildings scheduled for demolition or removal. More detailed recording of representative sample of typical periods/styles if appropriate - Consider options for relocation rather than demolition	No	- AHMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
			- Provision for development and installation of architectural heritage-related interpretative material with GW, Waka Kotahi, HCC and Mana Whenua - Uplift and salvage/reinstall existing, 20th century interpretative/commemorative material		
		Removal/relocation of Melling Station	- Feasibility assessment to determine whether relocation and reuse as part of the new Melling Station is reasonably practicable	No	- Feasibility assessment
		Damage to, demolition and/or removal of pre-1900 buildings/structures/sites	- Project-wide general Archaeological Authority - Avoid encroaching on specifically identified sites - Use of Ground Penetrating Radar to determine likely extent of further graves	No	- Design to avoid specifically identified sites - AHMP - On Call Procedure
		Potential impact on Casa Loma and Lochaber	- Planting replacement for Lochaber	No	- Replanting allowed in ULMP and EMP

Section 9.14	Contamination	Contaminated soils remaining on site after construction	- Ongoing Monitoring and Management Plan setting out:
			  ○ The nature, spatial extent and degree of residual soil contamination remaining on site; and
			  ○ Any ongoing monitoring required, and details how this information will be made available to other parties affected by contaminated soil
				Yes – as set out in the Ongoing Monitoring and Management Plan	- Specific condition requiring Ongoing Monitoring and Management Plan

		Effects on human health and the environment from earthworks in contaminated land	- DSIs to be completed on sites identified as high and moderate risk - Completion of leaded paint and asbestos surveys. - CLSMP prepared by a SQEP, setting out, among other things, procedures for the control of excavation and construction involving contaminated soil, and procedures for monitoring contamination levels during construction and excavation works. - Disposal of soil unsuitable for re-use at an appropriate facility. - Appropriately capping any contaminated soil remaining on site beneath impermeable surfaces	TBC based on DSIs TBC based on surveys Yes – a set out in CLSMP No No	- DSIs - Leaded paint and asbestos surveys - CLSMP - Requirement for suitable disposal - Requirement for appropriate treatment of remaining contamination
Section 9.15	Landscape and visual	Effects on landscape, visual and natural character	- Detailed design process to be in general accordance with the ULDF - Temporary laydown areas that reduce conflict with public users - Detailed design to provide for the integrated cultural expression narrative as set out in the ULDF - Integrate CPTED principles - Naturalised stream and stormwater outlets - Establish indigenous plants as part of the flood protection works in line with the outcomes sought in the ULDF - Off-street car park areas within the River Landscape near Harcourt Werry Drive and Kennedy Good bridge	No	- Development of detailed design and the ULMP - Where relevant incorporate some matters into the CEMP and EMP.

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
			- Integration of the SH2 retaining walls and bridge embankments, 'green' MSE walls and landform tie ins with the stop bank crest - Integration of retaining walls through Project wide colour palette and finishes - Safe pedestrian paths - CEMP to provide for staging and sequencing to - Limit open areas of earthworks - Limit loss of privacy and temporary access for residential and commercial businesses - Include early implementation and opening of parts of the River landscape with high amenity - Prioritise early planting for amenity and flood protection - Ensure best practice arboriculture measures are implemented		
Section 9.16	Natural Hazards and geotechnical risk	Natural hazard risk to Project elements	- None required, dealt with through standard detailed design and Building Act 2004 approvals	No	- No RMA mechanism required
		Seismic impacts on bridges	- Bridges to be designed and constructed with a seismic design philosophy	No	- Construct bridges as designed
Section 9.17	Cultural values	Positive long term permanent impacts improved water quality and recognition of Māori sites of significance	- Recognition of Māori sites and history - Planting of active channel borders to enhance indigenous fish habitat - Treat stormwater discharge before entering Te Awa Kairangi	No	- Specific matters to be secured by MWSG through input to various management plans, and specific conditions requiring cultural input, tikanga and kawa, attendance at regular meetings and monitoring.
		Negative impacts predominantly during construction on waterways, native vegetation and fauna	- Implement an On Call Procedure - Treat stormwater discharge before entering Te Awa Kairangi - Ongoing consultation with Mana Whenua throughout the duration of this Project	No	- Specific matters to be secured by MWSG through input to various management plans, and specific conditions requiring cultural input, tikanga and kawa, attendance at regular meetings and monitoring. - Specific matters to be inserted into the conditions relating to the ULMP, CEMP and CTMP. - Communications Plan. - Mana Whenua Values Plan.
Section 9.18	Social and recreation impact	Three adverse effects identified; the remainder are positive effects. Adverse effects relate to: -loss of employment land; -reduced movement and accessibility	- Development and implementation of a Communications Plan, including details on alternative access and travel options, construction phasing, and Riverbank Market relocation - A comprehensive review of the management of all public parking (on-street and off-street) to develop the optimum allocation of spaces between short and long stay parking - CEMP to include, consideration of recreational connectivity along the river, including a walking and	No	- Communications Plan - Parking Review - CEMP - CTMP

AEE Section	Topic	Actual and potential effect	Recommended mitigation (summary)	Recommended monitoring	Mechanism to implement measures
		-reduced car parking	cycling trail with a minimum width of 3 m and/or access to the Hutt River Cycle Trail to be maintained, on at least one side of the river - CTMP - including consideration for access to local businesses to mitigate adverse impacts from construction - Construction of a new skatepark prior to the removal of the Block Road Skateboard Park - Temporary activations in areas such as car parks (after hours).		
Section 9.19	Economic impact	Positive indirect and direct economic benefits	- None are required or proposed	N/A	- N/A
Sections 9.20 & 9.21	Land use, property and network utilities	Construction works disrupting business operations	- Involve businesses in the preparation of CEMP and CTMP	No	- Condition
		Effects associated with relocating existing network utilities during construction	- Development of scope, timing and methodology for relocation and protection of network utilities in consultation with network utility operators to ensure the ongoing safe and efficient operation	No	- Specific conditions requiring the development of a methodology for relocation and protection of network utilities in consultation with network utility operators to ensure the ongoing safe and efficient operation
		Closure or relocation of businesses on land needing to be acquired to accommodate the Project	- Public Works Act 1981 provisions will address this matter, but early consultation is being undertaken to enable business relocations as appropriate.	No	- Early consultation (currently underway)
		Reconfiguration of business operations on sites which need to be acquired to accommodate the Project	- Public Works Act 1981 provisions will address this matter, but early consultation is being undertaken to enable business re-configuration and relocation, as appropriate.	No	- Early consultation (currently underway)

11. Statutory assessment

Overview

The objectives and policies relevant to the Project include national, regional and district planning documents. An analysis of these is provided in this chapter, which covers the following documents:

- National Policy Statements
- Relevant regional plans
- City of Lower Hutt District Plan
- Other relevant plans and policy documents
- Relevant matters under the RMA including sections 171, 105, 107 and Part 2

Overall, the Project is consistent with statutory planning documents, particularly when the benefits of the proposal are considered alongside the proposed measures to avoid, remedy and mitigate any actual or potential effects.

11.1 Introduction

This section provides an analysis of the Project against the relevant statutory framework within which the designations are proposed and resource consents are sought. In particular, this section assesses the Project against the statutory requirements of sections 104, 105, 107, 171 and Part 2, being sections 5 to 8 of the RMA.

11.2 Assessment of relevant objectives and policies of planning documents

There are a number of provisions relevant to the Project. The following sections provide an assessment of the Project against the relevant provisions of the following planning documents:

- New Zealand Coastal Policy Statement;
- National Policy Statement for Freshwater Management;
- National Policy Statement for Urban Development;
- Regional Policy Statement for the Greater Wellington Region;
- Proposed Natural Resources Plan (appeals version);
- Operative Regional Freshwater Plan for the Wellington Region;
- Operative Regional Plan for Discharges to Land for the Wellington Region;
- Operative Regional Soil Plan for the Wellington Region;
- Operative Regional Air Quality Management Plan; and
- City of Lower Hutt District Plan.

The assessment of the relevant statutory planning documents in this chapter is supported by Appendix D. Appendix D sets out the full text of the relevant objectives and policies and groups them by key themes.

11.2.1 New Zealand Coastal Policy Statement

The objectives and policies relevant to the Project include Objectives 1-3 and Policies 2, 11, 13, 14, 15 and 22. These are considered below.

While RiverLink is not located within the coastal environment the Project was identified as having the potential to impact the downstream coastal environment as a result of sediment discharges and changes to water quality as a result of construction activities and contaminants. These activities have the potential to impact sensitive natural ecosystems and indigenous coastal flora and fauna downstream of the Project works.

Policy 22 relates specifically to the effects of sedimentation on coastal water quality seeking that use and development does not result in a significant increase in sedimentation levels and impacts in the coastal marine area. The Marine Ecology and Coastal Avifauna Assessment (Technical Report #8) has determined that elevated levels of total suspended sediments and sediment deposition based on disturbance of sand-sized particles within the water column are unlikely to reach effects thresholds for sensitive marine organisms and therefore the magnitude of effect in the coastal marine area is negligible.

Any discharges of sediment from the proposed in-river (wet) works and adjacent earthworks, and contaminants in operational stormwater, that do become entrained in the downstream water column will likely deposit in the same locations that sediment from the Te Awa Kairangi currently deposits. The marine and coastal avifauna habitats potentially affected by the Project could therefore include the soft sediment habitats of the Te Awa Kairangi estuary, Korokoro Estuary, the Ngauranga to Petone foreshore, Matiu/Somes Island foreshore and the subtidal soft sediment habitats within the wider Wellington Harbour.

The development of the RiverLink design and the specific construction methodology, which is subject to proposed conditions, has been determined following specialist investigations and has had regard to what has been shown to successfully manage effects during river maintenance activities in recent history. The specialist Marine Ecology and Coastal Avifauna Technical Assessment (Technical Report #8) concludes that the Project will have a negligible effect on indigenous coastal flora and fauna. Construction activities and associated discharges of contaminants are expected to continue to maintain, and where possible, enhance biological and physical coastal processes, recognising they are dynamic, complex and interdependent in nature.

No outstanding natural features and outstanding natural landscapes have been identified in the coastal environment as being potentially affected by the Project. There will be no significant adverse effects and potential adverse effects of the Project on natural features and natural landscapes in the coastal environment are limited to potential effects associated with water quality and consequential impacts on biophysical, ecological and geomorphological elements as a result of suspended sediment. These effects are proposed to be managed through the construction conditions and the ESCP.

Policy 11 provides direction on protecting coastal indigenous biological diversity. The key species potentially affected by the Project (captured by Policy 11(a)) include three Threatened species (reef heron, black-billed gull and Caspian tern) and 11 At Risk native species (fluttering shearwater, little blue penguin, black shag, pied shag, little black shag, royal spoonbill, South Island pied oystercatcher, variable oystercatcher, Australasian pied stilt, red-billed gull, white-fronted tern). There may be some risk of adverse effects on identified Threatened and At-Risk species that cannot be completely avoided, which is limited to potential disruption to some bird species' foraging habitat and behaviour as a result of sedimentation. Case law[58] has determined that 'avoid' in the context of Policy 11(a) of the NZCPS does not prohibit minor or transitory effects. As the Marine Ecology and Coastal Avifauna Assessment concludes that the impact of construction-generated suspended sediment loads will have a negligible magnitude of effect on marine ecology and Threatened or At Risk coastal avifauna as a result of sediment, and a positive effect as a result of stormwater contaminant improvement, the Project is consistent with Policy 11(a).

---

[58] Environmental Defence Society Inc v New Zealand King Salmon Co Ltd [2014] NZSC 38 at [144] and [145].

Policy 11(b) directs that significant adverse effects on identified habitats and ecosystems be avoided and that all other effects are avoided, remedied or mitigated. Te Awa Kairangi River Mouth, Petone Foreshore and Korokoro Estuary have been identified as habitats vulnerable to modification and the River Mouth and Korokoro Estuary are important routes for migratory fish species and ecological corridors between Wellington Harbour and upstream freshwater habitat. The Marine Ecology and Coastal Avifauna Technical Assessment has identified no significant adverse effects on these habitats as construction-generated suspended sediment will have a negligible magnitude of effect on these habitats. Any actual or potential effects on species or habitats identified in Policy 11(b) are therefore appropriately avoided, remedied or mitigated.

The Marine Ecology and Coastal Avifauna Technical Assessment describes all marine organisms detected in the downstream coastal environments are common throughout semi-exposed shores in New Zealand with no Threatened or At Risk marine invertebrate taxa identified. There are therefore no marine organisms in the potentially affected coastal environment captured by Policy 11(a) or (b).

When assessed against the potentially relevant objectives and policies, the Project is consistent with the NZCPS.

11.2.2 National Policy Statement for Freshwater Management

The Project involves comprehensive reshaping of the riverbed of Te Awa Kairangi within the Project area and the reconstruction and alteration of culverts, and as such, the NPSFM is relevant to the Project. An assessment of the relevant policies is provided below.

Policy 1 requires that freshwater is managed in a way that gives effect to Te Mana o te Wai. Te Mana o te Wai refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. Te Mana o te Wai seeks to protect the mauri of the wai (water) while restoring and preserving the balance between the water, the wider environment, and the community.

The six principles of Te Mana o te Wai inform the implementation of the NPSFM:

- Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater
- Kaitiakitanga: the obligation of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations
- Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others
- Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future
- Stewardship: the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations
- Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation

Te Mana o te Wai also includes a hierarchy of obligations that prioritises:

- first, the health and well-being of water bodies and freshwater ecosystems
- second, the health needs of people (such as drinking water)
- third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future

These principles and hierarchy of obligations are reflected in the Kaitiaki Strategy developed to support the Project, which seeks to provide holistic consideration of the approach to management of freshwater across all stages of the Project with the objective to enhance the mana and mauri of Te Awa Kairangi.

The Project gives effect to Te Mana o te Wai through the implementation of a long-term vision that has been informed through discussion and collaboration with communities and Mana Whenua to date, and ongoing into the future through the MWSG, which is being established for the Project. RiverLink has been developed to respond to the history of, and current pressures, on Lower Hutt as a result of hazards attributed to Te Awa Kairangi while having regard to the integrated approach to freshwater management and land use to avoid adverse effects (including cumulative effects) on the health and well-being of freshwater environments. A comprehensive suite of technical assessments has been undertaken to assess the effects of the Project, these assessments have been undertaken in an integrated manner, taking into account potential effects on the immediate receiving environment as well as the downstream coastal environment.

Policy 2 requires that tangata whenua are actively involved in freshwater management (including decision making processes), and that Māori freshwater values are identified and provided for. While these policies are in part focussed on plan development by local authorities for freshwater management, Mana Whenua are RiverLink Project Partners and the requiring authorities have worked in partnership with Mana Whenua during the development of the Project and are committed to maintaining this partnership and working alongside Mana Whenua throughout the Project's construction and operation via the MWSG, secured by conditions of consent. As described above, the Kaitiaki Principles which inform the Project design and implementation align with the six principles of Te Mana o te Wai and will provide the basis for ensuring that any effects on freshwater are appropriately managed during construction and through the long-term operation of the Project.

Policy 3 of the NPSFM requires freshwater to be managed in an integrated, whole of catchment approach. The development of the Project followed an integrated process, by which the interrelationships of various aspects of RiverLink and its effects were assessed and considered in the design of the Project. RiverLink has been assessed on a whole of catchment basis with effects on the receiving environment (at a catchment scale) including Te Awa Kairangi and the Wellington Harbour robustly considered by technical experts.

Policy 4 requires freshwater to be managed as part of New Zealand's integrated response to climate change; The severity and frequency of flood events is only expected to increase with climate change, and as the Project seeks to provide an integrated response to the effects of climate change through minimising the effects of flooding on private property and infrastructure, including regionally significant infrastructure, through proactive management of freshwater, the Project is consistent with this policy.

Policies 7, 8 and 9 require that the loss of river extent and values is avoided to the extent practicable, the significant values of outstanding water bodies are protected, and the habitats of indigenous freshwater species are protected, respectively.

As noted in sections 9.3 and 9.7 above, the loss of a section of the Harbour View Stream tributary and further restriction of fish passage cannot be avoided, and an offset has been proposed to ensure that river extent and values are maintained or improved. Further discussion of the alternatives considered, and reasons the loss of stream habitat cannot be avoided or minimised, can be found in the assessment against clause 3.24 of the NPSFM below.

While the affected reach of Te Awa Kairangi is not identified as an outstanding water body (with reference to Policy 8), as set out in the Freshwater Ecology Assessment (Technical Report #6), the Project will have effects on the values of Te Awa Kairangi and affected tributaries, particularly water quality and consequential effects on aquatic habitat and freshwater species in the downstream receiving environment during construction. Measures are proposed to minimise these effects to the extent practicable, including fish salvage and relocation, minimising fish passage restrictions and improvement of fish passage through a replacement culvert, erosion and sediment controls and carefully considered construction limitations. With the above measures in place, habitats of indigenous freshwater species will be protected and the impact on river values will be minimised to the extent practicable.

Policy 10 requires the habitat of trout and salmon to be protected so long as this does not compromise the protection of indigenous freshwater habitats. Te Awa Kairangi provides habitat to trout and is a popular river for trout fishing, and this has been considered in the Project design and construction methodology. Minimising effects on freshwater habitat, including habitat for trout and migration of trout to upstream habitat, has informed the design and construction methodology, particularly the construction phasing and approach to managing works in the active channel. Any construction related effects on trout will be limited in extent and duration (temporary) and overall the new channel will result in positive effects on trout in the medium-long term.

Policy 15 relates to enabling communities to provide for their social, economic, and cultural wellbeing in a way that is consistent with this NPS. As set out above, the Project has been informed by principles closely aligned with Te Mana o te Wai. The Social, Economic and Cultural Impact Assessments (Technical Report Nos. 17, 18 and 16 respectively) consider the Project is highly enabling of social, economic and cultural benefits for the surrounding communities.

Specific clauses of the NPSFM

Two specific clauses of the NPSFM, particularly relevant to consideration of the effects of the Project, have been considered as if they are already operative in a regional plan. These are assessed below.

3.24 Rivers

"The loss of river extent and values is avoided, unless the council is satisfied:

(a) that there is a functional need for the activity in that location; and

(b) the effects of the activity are managed by applying the effects management hierarchy"

As noted in sections 9.3 and 9.7 above, the Project results in the loss of 25 m of the Harbour View Stream. There is afunctional need for this work and reasons why this stream cannot be retained. In summary, there is a functional need for the loss of stream as this is the only practicable location for the abutment of the Melling Interchange bridge. Roading geometry requirements due to the constraints imposed by the location of the existing state highway and local roads mean that significant earthworks, further land acquisition and clearance of ecologically significant broadleaf forest would be required to site the bridge abutment elsewhere.

Meeting the functional needs test, the Project sought to apply the effects management hierarchy to manage the effects of stream loss. In this regard, a number of alternative solutions were considered to retain (avoid), otherwise minimise or remedy the loss of the values of this stream. These alternatives and the reason that they were not considered feasible are outlined in in Table 77 below:

Table 77 - Alternative solutions considered

Option	Comment
Installing a culvert along the alignment of the current channel and culvert beneath the abutment.	Abutment works require major ground improvement which prevent a culvert being installed in this location
Installing a culvert and outlet on the northern side of the abutment.	Requires the culvert to go through the abutment and the associated ground improvement similar to the option above and was therefore not considered further.
Installing channel on the south side of the interchange.	Requires additional land acquisition, significant additional excavation and clearance of established bush. Channel would be significantly steeper than existing and likely to require engineered energy dissipation or bed reinforcement. Downstream section of culvert between the channel and the river would need to be at a grade which would prevent fish passage.
Installing a culvert on the south side of the interchange but daylighting a section/ providing a new section of channel between SH2 and the river.	There are no suitable locations where this could be achieved due to SH2 and existing infrastructure.
Reinstating the stream or bridging the slip lane over the stream	The stream cannot be reinstated due to the topographical and spatial constraints. While reinstating the stream under the over bridge abutment may be technically possible, such an undertaking would result in a very significant structure and land acquisition and would be cost prohibitive.

None of the alternative options identified can avoid or remedy the loss of stream. The design has sought to minimise the extent of stream that is lost, but due to topographical and spatial constraints, minimisation is not possible (i.e. only the short 25m residual section of stream exists in this location anyway). The residual adverse effects of the stream loss have been assessed as more than minor and the Project therefore proposes to provide an offset to achieve no net loss of the ecological function. This offset will be secured via a condition of consent requiring a Stream Offset Plan to be developed for the offset.

3.26 Fish passage

"The passage of fish is maintained, or is improved, by instream structures, except where it is desirable to prevent the passage of some fish species in order to protect desired fish species, their life stages, or their habitats."

The Project has had careful regard to the maintenance and improvement of fish passage. Other than the loss of 25 m of the Harbour View Stream already discussed above, it is noted that the Project will not make fish passage any worse, and therefore maintains existing fish passage across the Project or will offset the effects where this is reduced. The Project is able to improve fish passage through some but not all structures that are proposed to be altered as part of the Project.

One outlet, Outlet 38, has been designed to comply with the NZ Fish Passage Guidelines[59] and the permitted activity conditions of Regulation 70 of the NESFW. It is noted that this will be a significant improvement to fish passage compared to the existing situation on this stream as the existing culvert is perched.

At Outlet 36b the grade and length of existing pipe and existing natural and structural barriers in the upstream section do not currently allow fish passage for all species. The reconstructed (replacement) culvert is required to connect to an upstream pipe that is very steep also restricting fish passage. This upstream pipe is not being replaced and therefore any flows in the reconstructed pipe will be extremely high velocity, continuing the existing barrier to fish passage.

Existing manual or passive backflow prevention structures at Outlets 27 and 31 and existing barriers in stormwater infrastructure (drop-structures and manholes) upstream currently restrict fish passage between the river and upstream catchments. The Project design includes automated flap gates (penstocks) at these outlets such that fish passage is not precluded, should existing fish passage barriers upstream of reconstructed outlets be removed, and fish passage becomes possible in the future. The proposed design therefore improves the fish passage situation at these outlets.

In conclusion, the Project is consistent with the NPSFM as a whole, and there are no specific directive provisions with which the Project is inconsistent.

11.2.3 National Policy Statement for Urban Development

The NPSUD requires councils to plan for growth and ensure a well-functioning urban environment for all people, communities and future generations. The NPSUD provides direction to make sure capacity is provided in accessible places, helping New Zealanders build homes in the places they want – close to jobs, community services, public transport, and other amenities our communities enjoy. Under the NPSUD, Hutt City is classified as a tier-1 urban-environment[60].

Objective 1 directs that New Zealand has well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future. Objective 4 requires that New Zealand's urban environments, including their amenity values, develop and change over time in response to the diverse and changing needs of people, communities, and future generations. Objective 8 requires that New Zealand's urban environments support reductions in greenhouse gas emissions and are resilient to the current and future effects of climate change.

Objectives 1, 4 and 8 are supported by Policy 1 and Policy 2. Policy 1 requires that planning decisions contribute to well-functioning urban environments that, as a minimum, amongst other things, have good accessibility for all people between housing, jobs, community services, natural spaces, and open spaces, including by way of public or active transport.

The Project seeks to increase accessibility between Te Awa Kairangi and the city centre and will provide improved access to the city centre from other areas of the community through the new Melling Station. The Project responds to the current and future effects of climate change by minimising the potential adverse effects of flooding events on private property and infrastructure, including regionally significant infrastructure. The Project, through enhanced accessibility and urban spaces which provide for a variety of uses and types of occupation, is

[59] Guidelines developed by NIWA (2018).
[60] The NPSUD applies to all planning decisions a local authority makes which affect an urban environment. Tier-1 urban environments are the 12 recognised cities in New Zealand, and have a greater onus on making their urban environments accessible, compact and efficient in context of emissions reduction and public transport effectiveness.

expected to increase the urban development capacity within the Lower Hutt city centre and nearby urban environments, fulfilling the broader objectives of the NPSUD and will attract people to the river corridor for active and passive recreation pursuits into the future. RiverLink is improving the quality, functional and vitality of the central city which positively contributes to a well-functioning urban environment. Similarly, the improved flood resilience and transport improvement contribute to a well-functioning urban environment. CPTED principles have been followed in the design to ensure adequate lines of sight and passive surveillance are provided to protect the health and safety of the community.

In relation to Policy 2, which requires local authorities to provide sufficient development capacity for housing and business land over the short, medium and long term, while not specifically providing residential development, RiverLink provides the opportunity for HCC to work with relevant property owners and/or future developers to carry out urban renewal and revitalisation works. These works and integration with the proposed infrastructure work will provide much needed development capacity in the Lower Hutt city centre.

Objective 5 requires that planning decisions relating to urban environments take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). This is supported by Policy 9 which sets minimum requirements for local authorities when taking into account the principles of the Treaty of Waitangi in relation to urban environments. GW, Waka Kotahi and HCC have taken a partnership approach with Mana Whenua in respect of the Project, which recognises the significance of Te Awa Kairangi to Mana Whenua. The partnership approach is further reflected by the Kaitiaki Strategy and the proposed conditions of consent. The requiring authorities are committed to maintaining this partnership and working alongside Mana Whenua throughout the Project’s design, construction and operation as provided for by the MWSG framework.

Objective 6 requires that local authority decisions on urban development that affect urban environments are integrated with infrastructure planning and funding decisions and respond to proposals that would supply significant development capacity. Policy 10 encourages councils to work together with infrastructure providers to achieve integrated land use, and the development sector to identify opportunities to increase urban development. The Project is aligned with these provisions as the Project has been developed as a partnership between local authorities that share jurisdictions but are also significant infrastructure providers and the design has been developed in consultation with other major infrastructure providers including KiwiRail and network utility operators. The Project once constructed will achieve the integrated development of infrastructure and land use in a manner that will optimise the opportunities for significant urban development in future.

For the reasons set out above, the Project is consistent with the NPSUD.

11.2.4 Regional Policy Statement for the Wellington Region

The Regional Policy Statement for the Wellington Region (2013) is a document prepared under the RMA that identifies the major resource management issues for the Wellington region. The RPS sets an over-arching framework for resource management issues in the region, with the detailed policy direction provided through the regional and district plans. As such, while an assessment of the Project against the RPS has been undertaken, to a large extent, the key policy direction which is relevant to the Project is provided by the regional and district plans.

Table 78 - Regional Policy Statement assessment

Theme	Relevant objectives and policies	Comment
Regionally significant infrastructure	Objective 10 Policy 39	The RPS requires particular regard to be given to the social, economic, cultural and environmental benefits of regionally significant infrastructure and to protect existing infrastructure from incompatible use and development. RiverLink is considered Regionally Significant Infrastructure (RSI) in the context of the Melling Interchange which is a key part of the Strategic Transport Network, and the upgrade of this RSI is therefore considered generally appropriate. In addition, the proposed new Melling Station will be an upgrade to that element of regionally significant infrastructure. In respect of potential reverse sensitive effects on existing RSI, the closure and re-alignment of local roads including Pharazyn Street, Marsden Street and Daly Street, and the re-location of the stopbanks, Melling interchange and the railway track re-alignment means the relocation or upgrade of a significant number of network utility services, some of which are RSI, is required as part of RiverLink. GW, Waka Kotahi and HCC have worked and will continue to work, with affected network utility providers to minimise disruption and allow for the continued safe and efficient operation of network utilities during construction and in the long term.
Development form and function	Objective 22 Policy 54 Policy 57 Policy 58	The RPS seeks the integration of land use planning, infrastructure and development and the provision and use of infrastructure in a way that is efficient and safe and co-ordinated with the development and operation of new infrastructure (Policy 57 and 58). The Project is expected to bring forward further development of land located within the Hutt city centre through improved access to public transport and transport related infrastructure and more attractive and ‘active’ urban spaces, and as such is consistent with the direction in the RPS. Policy 54 of the RPS requires particular regard to be given to the region’s urban design principles. Urban design has and will continue to be a key focus for RiverLink as the design develops with guidance from the ULDF developed for the Project.
Māori relationships and cultural effects	Objective 23 Objective 24 Objective 25 Objective 26 Objective 27 Objective 28 Policy 48 Policy 49	The RPS requires the principles of the Treaty of Waitangi to be taken into account and recognition and provision for matters of significance to tangata whenua. Recognition of the role of tangata whenua as kaitiaki and provision for tangata whenua involvement in management of natural resources has been achieved for this Project through the establishment/recognition of Mana Whenua as Project Partners, recognising the significant Mana Whenua values and connection of Mana Whenua to the Te Awa Kairangi environment.

Theme	Relevant objectives and policies	Comment
		The Project has ensured, through the relationship with Mana Whenua and the provision for ongoing involvement and support of Mana Whenua and recommended mitigation, that it will facilitate the protection of the relationship of Mana Whenua with the historic, traditional, cultural and spiritual elements of Te Awa Kairangi and supporting freshwater and terrestrial ecosystems. Adverse effects on indigenous biodiversity values have been appropriately avoided or mitigated where there is the potential for a reduction in historical, cultural and spiritual association held by mana whenua within Te Awa Kairangi. Indigenous biodiversity values and the spiritual connection of Mana Whenua to their land and waters are to be enhanced through providing for the role of Mana Whenua as kaitiaki and through the practical exercise of kaitiakitanga in restoring and enhancing areas throughout the lifecycle of the Project. Activities which may affect mauri, including stream loss associated with culverting will be avoided or offset through daylighting of an equivalent section of stream and planting and restoration of naturally occurring functions of ecological environments in accordance with a condition requiring a Stream Offset Plan.
Public access	Objective 18 Policy 53	The RPS seeks to maintain and enhance public access to rivers with indigenous ecosystems and habitats and areas with special amenity and significant historic heritage values. Given the implications of the flood protection works on the stopbank heights, careful consideration has been given to the provision of access to the river corridor from the city and surrounding urban environment. The Project seeks to enhance physical and visual access to the river corridor where possible to improve the connection of the community with river, noting that it has been considered appropriate to restrict access in some locations during construction and to protect and encourage biodiversity. The design of access points has considered people walking, cyclists and wheelchair users and ramps and steps have been integrated within the landform of the stopbanks to minimise impacts on the functionality of adjacent streets and to minimise the potential feeling of severance between local roads and the river corridor.
Heritage	Objective 15 Policy 46	Objective 15 and Policy 46 of the RPS seek to identify and protect heritage values, including consideration of the potential effects on heritage places, sites and areas. Policy 46 provides direction on matters to consider, in order to determine if an activity which affects heritage values is inappropriate. It is considered that the RiverLink Project is consistent with Objective 15 of the RPS. All listed historic heritage and

Theme	Relevant objectives and policies	Comment
		archaeological sites will be protected from inappropriate development as they are either outside the Project area, within the Project area but already destroyed by previous activity or, within the Project area but avoided due to design change. Active management of earthworks (including with an On Call Procedure) alongside further investigation for the Wesleyan cemetery, means that effects on historic heritage are low and works are consistent with the objective and policy. These measures will be secured via an Archaeological and Historic Heritage Management Plan (AHHMP). Whilst Melling Railway Station is not listed as a heritage building in the District Plan, nor on the HNZPT List, it has been identified as having high regional significance and potentially as nationally significant when considered as part of a wider group of railway stations of the same era. The RiverLink design means that the existing station cannot be retained in its current location – the railway line is being truncated some 250m to the south of its existing terminus and a new station is being constructed to connect in with the line in its new location and with the new pedestrian/cycle bridge to the Lower Hutt city centre. A condition is proposed which requires a feasibility assessment to determine whether the building can practicably be relocated to form part of a new station, including with the retention of heritage fabric. This is considered to be consistent with Objective 15 as it will determine what is appropriate. With regard to Policy 46, it is understood this policy ceases to have effect once HCC has plan provisions for the protection of sites with significant heritage value. Whilst there are existing provisions in the District Plan, they have not been reviewed since the RPS was made operative in 2013 and hence Policy 46 still applies. HCC is in the process of reviewing its District Plan. Construction of RiverLink will affect Melling Station and there is the potential that its heritage values could be destroyed, which is an irreversible effect. If the feasibility assessment determines that the station can be practicably re-used, this would also create the opportunity to remedy previous alterations to the station, which have detracted from its original structure. It is considered, through inclusion of the proposed condition, effects on the historic heritage of Melling Station will be managed appropriately.
Natural hazards	Objective 19 Objective 20 Objective 21 Policy 51 Policy 52	The RPS seeks to ensure that new development (including infrastructure) is located and designed to manage the impacts from natural hazards that may be experienced over their lifetime, that hazard mitigation works do not increase the risk and consequence of natural hazard events and that

Theme	Relevant objectives and policies	Comment
		communities are more resilient to, and better prepared for, the consequences of natural hazards. RiverLink will remove a significant flood constraint (Melling Bridge) and the new stopbanks and channel are predicted to substantially reduce out-of-bank flooding that has the potential to affect the community and the Hutt city centre. Within the RiverLink reach flooding is substantially reduced for the present-day (2020) 100-year ARI event and the reduction is more significant when consideration is given to a 100-year ARI event in the year 2130. Downstream of the RiverLink works, there are modelled increases in maximum flood level that occur as a result of the Project. This is to be managed progressively as part of the implementation of the HRFMP and is secured through a condition of consent requiring a specific review of the HRFMP to determine the acceptable risk level and options for flood protection at this location. The AEE has also considered fault rupture, ground shaking, lateral spreading, regional uplift/subsidence and slope instability. These risks are generally unavoidable, but assessed as tolerable risks and low, and can be mitigated through engineering design. The Project does not cause or exacerbate ground hazards in other areas. As such, the Project is consistent with the hazard direction in the RPS.
Water quality (freshwater)	Objective 12 Objective 13 Objective 29 Policy 40 Policy 41 Policy 42	The relevant objectives and policies of the RPS seek to manage freshwater quality to meet the range of uses and values for which freshwater is required, safeguard the life capacity of waterbodies and meet the needs of future generations by minimising the effects of earthworks and vegetation disturbance and contamination in stormwater from development. As described in sections 9.3 and 9.4 of this AEE, best practicable options will be adopted for both construction water and stormwater management and treatment. Earthworks and land disturbance will be managed in accordance with the ESCP to avoid, remedy or mitigate the potential effects of erosion and sediment discharges to the receiving environment. Land disturbance will be managed to retain soil and sediment on the land by implementing best practicable options for sediment and erosion control. The ESCP outlines the mechanisms proposed to manage effects of sediment generation such as open area limits, stabilisation requirements and refining the construction sequencing and programme to minimise the risk and severity of discharges. The re-development of urban areas and local roading upgrades will include improved stormwater treatment such as proprietary rain gardens and vegetated swales in

Theme	Relevant objectives and policies	Comment
		accordance with established water sensitive urban design guidelines where practicable. This will result in a reduction in contaminants entering the receiving environment compared to the existing situation. The Project design seeks to minimise the generation and discharges of contaminants from stormwater and to adopt the best practicable option for the treatment of every stormwater discharge. As a result, any changes in water quality associated with the Project are expected to be minor, and as such the Project is considered to be consistent with the RPS direction in relation to water quality.
Biodiversity and ecology	Objective 7 Objective 13 Objective 16 Policy 37 Policy 43 Policy 47	The RPS indigenous biodiversity objectives seek to ensure rivers support healthy functioning ecosystems and indigenous ecosystems and habitats with significant biodiversity values are maintained and restored. Policies seek to protect aquatic ecological function and to manage effects on areas with significant biodiversity values. As described in Chapter 7, a comprehensive alternatives assessment was undertaken, which sought to avoid or minimise effects on environmental values. Where this was not practicable, measures have been proposed to minimise effects on these values. In particular, restoration and enhancement of riparian margins to improve the opportunities and habitat available for biodiversity over-time, and provision for fish passage where possible, are proposed to protect ecological values and manage effects. Where fish passage cannot be maintained or provided provision for offsetting of stream loss and culverting has been proposed. Careful consideration has also been given to restricting access to the river and creation of new beach habitat where this is considered beneficial to protect and encourage biodiversity, specifically roosting and nesting riverine birds. Adverse effects will be managed through the implementation of an Ecological Management Plan. The Project is considered on balance to be consistent with the RPS direction on biodiversity and ecological values.
Take and use of water	Objective 14	The RPS requires that freshwater is allocated and used efficiently. Low flow depths will be maintained (and potentially increased) as a result of RiverLink. Temporary damming and diversion during construction will be undertaken within the river channel and is not likely to result in any water being diverted outside of the river system (no diversion outside of the river bed) and therefore minimum flows and water levels are not likely to be impacted. As such, the Project will efficiently use surface water and is consistent with the direction of the RPS.

Theme	Relevant objectives and policies	Comment
Discharges to air	Objective 1 Objective 2	The RPS requires discharges of odour, dust and smoke to avoid adversely affecting amenity and people's wellbeing, and also requires that human health is protected from particulate matter. The main effect of the Project is related to discharges of dust to air as a result of earthworks and construction activities. These discharges will be managed through best practice site management and specific mitigation measures during construction which will be secured in accordance with the CAQMP. With mitigation measures in place, potential offensive and objectionable effects on human health, property and the environment are not anticipated beyond the boundary of the construction site. The Air Quality Assessment confirms that with the implementation of an appropriate CAQMP the discharge of dust associated with construction of the Project will be appropriately managed. The Project is therefore considered consistent with the relevant objectives and policies of the RPS.

11.2.5 Proposed Natural Resources Plan[61]

The PNRP is the combined regional plan for the Wellington Region. Parts of the plan are currently under appeal. It is expected that appeals on provisions relevant to RiverLink will largely be resolved by the time of lodgement, but some relevant provisions are likely to be altered through consent orders during the intervening period. An assessment of relevant provisions, as per the Appeals Version 2019 (as at 1 July 2021) is set out in Table 79.

Table 79 - Proposed Natural Resources Plan assessment

Theme	Relevant objectives and policies	Comment
Integrated management	Objective O1 Objective O2 Objective O4 Policy P1 Policy P2 Policy P3	These objectives and policies of the PNRP relate to the holistic management of resources and recognising the intrinsic values of air, land and water to the social, economic and cultural wellbeing of the community RiverLink aims to enable urban growth and a vibrant central city, with improved flood resilience, and better transport links. By its very nature of providing a range of benefits, RiverLink has been developed in accordance with the principles of integrated management (Objective O2). The assessment of the Project has been undertaken on a whole of catchment basis (ki uta ki tai), including the Te Awa Kairangi and ultimately the Wellington Harbour, with potential

[61] Proposed Natural Resources Plan for the Wellington Region (Appeals Version 2019 as at 1 July 2021)

Theme	Relevant objectives and policies	Comment
		effects being considered and managed in an integrated fashion as consistent with Objective O1 and Policy P1. This also acknowledges the cross-boundary nature of Te Awa Kairangi as directed in Policy P2. Objective O4, which relates to recognition of the intrinsic values of freshwater and safeguarding its life supporting capacity, is particularly relevant to RiverLink, which has the potential to impact the freshwater. The Project design includes revegetation of the river corridor with native species to improve the opportunities and habitat available for biodiversity and restore and improve the mauri of the river over-time. Where there is limited information to assess impacts on the river, the development has taken a precautionary approach, including through the adoption of the recommended conditions in Appendix A, to minimise significant adverse effects as directed by Policy P3. The proposed construction methodology and implementation of the EMP, and the proposed offset, will appropriately protect the intrinsic values and safeguard the life supporting capacity of affected surface water.
Regionally significant infrastructure	Objective O12 Objective O13 Policy P12 Policy P13 Policy P14	The objectives and policies of the PNRP seek to recognise the benefits of RSI including having particular regard to the strategic integration of RSI and land use. The PNRP also seeks to ensure that RSI is not compromised by other activities. This includes avoiding, remedying and mitigating adverse effects on RSI as a result of new use and development. The Melling Interchange aspect of RiverLink is RSI, forming a key part of the Strategic Transport Network and the upgrade of this RSI is therefore supported by Objective O12 and Policy P13. As noted in Chapter 2 (Strategic Context) and section 11.3 (other matters) of this AEE, the Project has been developed in an integrated manner ensuring that RSI and the other infrastructure associated with the Project is compatible and supports (and enhances) the surrounding land use and the functional need and requirements of infrastructure, as consistent with Objective O13 and Policy P12. In respect of potential reverse sensitivity effects on existing RSI (refer Policy P14), relocation or upgrade of a number of network utility services is required as part of RiverLink, including water supply, wastewater, electricity, gas and fibre optic services. GW, Waka Kotahi and HCC have been, and will continue to, work with affected network utility providers to minimise disruption and allow for the continued safe

Theme	Relevant objectives and policies	Comment
		and efficient operation of network utilities during construction and in the long term.
Māori relationships and cultural effects	Objective O14 Objective O15 Policy P17 Policy P18 Policy P19 Policy P20 Policy P21 Policy P44 Policy P45	The PNRP (Objective O14) requires that the relationships of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga are recognised and provided for; kaitiakitanga is recognised; and Mana Whenua actively participate in planning and decision making. As per Objective O15, Mana Whenua are Project Partners and have actively participated in the development of the Project. As per Policy P18, Te Awa Kairangi is identified as Ngā Taonga Nui a Kiwa and areas both within the Project reach, and downstream, are identified as sites of cultural significance to Taranaki Whānui, including the Maraenuku and Motutawa Pā sites which were constructed on the banks of Te Awa Kairangi in the areas of the Transpower substation and Kennedy Good Bridge, respectively. The Project provides for the relationship of Mana Whenua with Ngā Taonga Nui a Kiwa and protects sites with significant Mana Whenua values, consistent with Objective O14. A CIA has been prepared on behalf of Mana Whenua. This assessment describes the relationships of Mana Whenua to the whenua and awa, and provides recommendations for mitigating effects on cultural values. The CIA describes that with the implementation of this mitigation the Project can help to enhance the mana of the river and highlight its history and importance to Māori, as consistent with Policy P19. In accordance with Policy P20, A Kaitiaki Strategy has been prepared by Mana Whenua advisors. Included within the strategy are eight principles that underpin the Te Awa Kairangi RiverLink vision, including design principles, approaches and outcomes, including Mana Whenua responsibilities and actions. Further opportunity exists for kaitiakitanga / guardianship through the process of design, implementation, maintenance and management in accordance with the Kaitiaki Strategy to deepen human, spiritual and cultural connection with the river environment. This is consistent with Policy P21 by recognising the relevant statutory acknowledgements as detailed by GW. As consistent with Policy P17, adverse effects on mauri have been assessed and the Kaitiaki Strategy and Mana Whenua Steering Group will recognise and provide for the role of kaitiaki in sustaining mauri.

Theme	Relevant objectives and policies	Comment
		Policies 44 and 45 seek to protect and restore sites with significant Mana Whenua values through managing adverse effects on these sites by following a hierarchy of avoidance of more than minor effects and, where more than minor effects are unable to avoided, minimising or remedying them. As noted above, the sites of significance to mana whenua within the Project footprint include the Maraenuku and Motutawa Pā sites. The CIA describes the Project is unlikely to further damage or destroy these sites and that there is little if any archaeology associated with them, noting though that these areas have not been investigated by any archaeological process. Appropriate measures in accordance with the AHMP will be undertaken during works in proximity to these sites and any artefacts or remnants found will be managed in accordance with the protocols in the AHMP and the HNZPTA alongside Mana Whenua. Recognition of these cultural sites is proposed through the ULDF. It is therefore considered that the adverse effects on sites with significant Mana Whenua values are minor and have been appropriately minimised through Project design. The Project is consistent with the Māori relationships and cultural effects direction in the PNRP.
Natural character and recreation amenity values (including public access)	Objective O9 Objective O10 Objective O17 Policy P9 Policy P10 Policy P24 Policy P48	The PNRP seeks to maintain and enhance recreational values and to protect and enhance the natural character of the CMA, rivers and lakes, and to maintain and enhance public access. In relation to recreational values, the Social Impact and Recreation Assessment describes how the Project will enhance the recreational opportunities and public access available to the community within and adjacent to the river corridor and will therefore enhance recreational values of Te Awa Kairangi through the RiverLink reach, once completed (Objectives O9 and O10 and Policy P9). Works will also increase opportunities for contact recreation and Māori customary use in accordance with Policy P10, through improved river access (e.g. via the proposed ūranga). The proposed recontouring of the riverbed to establish the channel results in a new natural meander pattern suitable for a widened channel. The Geomorphology Assessment outlines that the recontouring will result in a channel form more reflective of the river state if it was not a modified reach and as such will enhance the natural character of the river, consistent with Objective O17. The Geomorphology and Landscape and Visual Assessments describe that during the in-river works, there will be a substantial, but temporary, effect on natural character. These works will be staged and the

Theme	Relevant objectives and policies	Comment
		maximum footprint and duration of disturbance at any one time will be limited to minimise these effects to the extent practicable. Once the in-river works have been completed, the Landscape and Visual Assessment concludes that restoration and enhancement measures will over-time result in an increase in the natural character of Te Awa Kairangi, compared to the existing moderate natural character values as consistent with Policies P24 and P48. As such, during the construction of the Project there may be some inconsistencies with the policy direction in the PNRP, however, following completion of the construction works, the Project will enhance natural character, and maintain and enhance the landscape, visual amenity, recreation value and access to Te Awa Kairangi. Therefore, overall, the Project is consistent with the direction of the objectives and policies.
Natural Hazards	Objective O20 Objective O21 Policy P15 Policy P16 Policy P27 Policy P28 Policy P29 Policy P104	The PNRP seeks to manage the effects of natural hazards and climate change on people, the community and infrastructure to an acceptable level and to avoid inappropriate use and development in high hazard risk areas and the use of hard engineering structures unless there are no practicable alternatives. The PNRP also seeks to provide for the use and operation of existing flood and erosion hazard risk management activities and to recognise the social, cultural, economic and environmental benefits of new flood protection measures. RiverLink will improve flood protection of the Hutt city centre and the communities alongside the river within the RiverLink reach, reducing the hazard risk to people, property and infrastructure as consistent with Policy P15. As addressed in the Social and Recreation Impact Assessment (Technical Report #17), the social, cultural, environmental and economic benefits of flood hazard risk management are acknowledged (Policy P16). Objective O21 and Policy P27 of the PNRP seek to avoid use and development within high hazard risk areas (which includes the bed of rivers) unless certain criteria are met. In particular, Policy P27 requires that: • There is a functional need for the activity to be located in that area. • The residual risk after hazard mitigation measures is low. • The development does not cause or exacerbate hazards in other areas. • Adverse effects on natural processes are avoided, remedied or mitigated.

Theme	Relevant objectives and policies	Comment
		The works proposed in the bed of Te Awa Kairangi involve the recontouring and extraction of the riverbed to establish a new natural meander pattern within a widened river corridor. The Geomorphology and River Hydraulics and Containment Assessments confirm that proposed flood protection measures will reduce flooding hazards to Hutt city centre and the community. The proposed works in some instances are extensions or modifications to existing flood protection structures owned by GW. The intent of the design is to restrict flows to within the river corridor and therefore proposed flood protection structures have a functional need to occur within the river channel, as consistent with Policy P104. The Project will not cause or exacerbate hazards in other areas, rather it will reduce them as directed by Objective O20. The modelling in the River Hydraulics and Containment Assessment indicates areas of increasing flood depth and duration in the area below Estuary Bridge in the design events. This effect is proposed to be mitigated by a review of the HRFMP in this area by GW. Adverse effects on natural processes have been minimised to the extent practicable through the channel design and the Geomorphology Assessment describes that post construction of RiverLink Te Awa Kairangi will be more reflective of its natural state. In relation to Policy P28, the proposed flood protection works form part of a wider hazard risk management strategy (the HRFMP) and are considered necessary to protect existing and future development from unacceptable hazard risk and as such are supported by the PNRP. In accordance with Policy P29, the effects of climate change on biodiversity, natural hazards and aquatic ecosystem health and mahinga kai have been taken into account throughout the design process and it is noted that the requirements of the HRFMP which prescribes the design standards that the Project must achieve also includes consideration of the effects of climate change.
Contaminated land	Objective O43 Objective O51 Policy 89 Policy 95	The PNRP seeks to protect the environment from discharges from contaminated land and to avoid the creation of new contaminated sites. A risk-based PSI has been undertaken. From this PSI 18 sites within and immediately surrounding the Project area have been classified as having a moderate-high risk of contamination.

Theme	Relevant objectives and policies	Comment
		Effects from disturbance and discharges, especially any that are more than minor, from contaminated land will be appropriately managed through a CLSMP which will include best practice control measures and site-specific management techniques where necessary during the construction phase (Objective O43). The measures in the CLSMP will manage by avoiding and otherwise minimising discharges from contaminated land and will avoid creation of new contaminated areas. The Project is therefore consistent with the PNRP direction for discharges from contaminated land in Objective O51 and Policies P89 and P95.
Water quality	Objective O23 Objective O24 Objective O46 Objective O47 Policy P62 Policy P63 Policy P67 Policy P71 Policy P72 Policy P73 Policy P78 Policy P79 Policy P98 Policy P101	The PNRP seeks to ensure that the quality of groundwater, surface water and coastal marine area is maintained or improved (Objective 23) and water quality in rivers and the coastal marine area is maintained or improved such that it is suitable for contact recreation and Māori customary use (Objective 24 and Policy 63). The direction of the PNRP seeks to promote discharges to land over discharges directly to water (Policy P62). In relation to all discharges to land and water Policy P67 of the PNRP seeks to minimise the effects of all discharges by following a hierarchy which in the first instance avoids the production of contaminants and otherwise minimising the volume of the contaminants in any discharge using land-based treatment systems. Specifically related to earthworks, Objectives O46 and O47 of the PNRP seeks to minimise the amount of sediment laden run-off entering water. To achieve this objective, Policy P98 requires the use of good management practice to minimise erosion, control sediment run-off and to ensure areas of disturbance are stabilised and vegetation cover is restored. The Construction Water Quality Assessment has determined that, with the implementation of best practice erosion and sediment control which include treatment systems, and management of in-river works in accordance with the GW Code of Practice for River Management Activities (2019) as outlined in the ESCP, the Project's sediment discharges will result in a negligible contribution to the existing sediment loading of Te Awa Kairangi, and effects will be appropriately managed such that they are no more than minor (Policy P71). This is consistent with limits on the zone of reasonable mixing as directed by Policy P72, and will minimise scour, erosion and the potential for property inundation, which is consistent with Policy P79.

Theme	Relevant objectives and policies	Comment
		In relation to stormwater, Policy P73 for all stormwater and P78 (in relation to the state highway) of the PNRP seek to minimise adverse effects by reducing the level of contaminants through protecting sites with significant values, implementing good management practice, using source treatment and use of water sensitive urban design and the progressive improvement of infrastructure over time. While the existing state highway and interchange network does not have any stormwater treatment, the new highway and interchange works will include stormwater treatment, resulting in a reduction in contaminants in the receiving environment. Where practicable, the re-development of paved and urban areas and local roading upgrades will include improved stormwater treatment such as proprietary rain gardens and vegetated swales in accordance with established water sensitive urban design principles. This will result in a reduction in contaminants entering the receiving environment compared to the existing situation, and will maintain riparian margins which is consistent with Policy P101. The Project design seeks to minimise the generation and discharges of contaminants from stormwater and to adopt the best practicable option for the treatment of all stormwater discharges from the Project. There will be an improvement on the existing environment as a result of the proposed treatment. Therefore, the Project is consistent with the PNRP's direction to maintain or improve water quality.
Biodiversity and ecology	Objective O18 Objective O25 Objective O27 Objective O29 Objective O30 Objective O35 Policy P31 Policy P32 Policy P34 Policy P35 Policy P38A Policy P39A Policy P40Policy P41 Policy P41A Policy P70	The PNRP seeks to protect and restore ecosystems and habitats with significant indigenous biodiversity values, through the careful management of activities and effects. Te Awa Kairangi is a scheduled site (F1 and F1b) so falls for consideration under P40 and the mitigation hierarchy under P41. Tributaries are not identified as significant so fall under the hierarchy in P32. With the implementation of avoidance and mitigation measures outlined in the EMP and supporting management plans the Project will be consistent with the direction in the PNRP for the following reasons: Water quality, flows, water levels, and aquatic habitat will be actively managed and regularly monitored during construction works to maintain ecosystem health and mahinga kāi (O25). Natural flow characteristics and the range of water level fluctuations will be maintained (P31).

Theme	Relevant objectives and policies	Comment
		The value of Te Awa Kairangi estuary will not be adversely affected by sediment, so will be protected and brought to a healthy state (O18) to the extent practicable through this Project. Water quality will be maintained and where possible improved (P31 and P70) (refer water quality assessment above with regard to improved stormwater treatment proposed throughout the Project Area). Effects such as impacts on fish passage and habitat retention have been considered in relation freshwater fauna and terrestrial fauna, including aquatic species such as fish and koura, and indigenous species/taxa. Adverse effects will be avoided and otherwise minimised through fauna relocations prior to works and careful staging and on-site management of construction works (O29, O31, P31, P34, P39A, P41A) Connections between fragmented aquatic habitats will be restored, namely existing fish passage barriers will be remediated where practicable. In particular, the replacement Tirohanga Road culvert will restore fish passage (P31, P35). Habitats for indigenous birds will be protected and maintained or restored, and public access to high value bird habitat will be restricted to improve opportunities for successful breeding, roosting and feeding (O35, P31, P39A, P40, P41) In-river activities will be restricted at times and /or managed to minimise effects on critical life cycle periods of birds and aquatic ecology (P31) Riparian habitat will be restored and enhanced (O27, P31) The Project will avoid the introduction of pest plants and animals and contribute to the management of existing pest plants and animals (P31, P38A) The Project will have no more than minor effects on trout and will maintain (and likely improve) trout habitat in the affected reach (O30) In relation to waterbodies that are not identified in the PNRP as 'significant' and therefore fall for consideration under P32, significant adverse effects on ecological values have been avoided, with the exception of the Harbour View Stream which requires culverting that cannot provide for fish passage In relation to Harbour View Stream, P32 provides for the use of offsetting to address unavoidable adverse effects that cannot be mitigated or remedied. The loss of habitat in the Harbour View Stream is proposed to be offset in accordance with the criteria in Schedule G2 to achieve no net loss of ecological function.

Theme	Relevant objectives and policies	Comment
		In relation to P41, adverse effects on the significant indigenous biodiversity values of Te Awa Kairangi will be avoided or otherwise minimised such that they are no more than minor. In relation to the downstream marine environment also covered by P41, effects are assessed as negligible In summary, the Project is consistent with the policy direction in the PNRP in relation to ecological values.
Activities within the bed of rivers	Policy P102 Policy P103 Policy P104 Policy P106	Policy P102 requires that reclamation or drainage of the beds of lakes and rivers be avoided unless it meets certain exceptions. The exceptions provide for reclamation to be undertaken if the reclamation is associated with regionally significant infrastructure (RSI) and there are no other practicable alternatives. The reclamation is associated with the SH2 and Melling Intersection upgrades, which form part of the Strategic Transport Network and therefore meet the definition of RSI. As outlined in this AEE, there are no practicable alternatives as it is impractical and cost prohibitive to relocate the Melling Interchange bridge due to existing roads it needs to connect with. Other design options were discounted because of the required clearance of ecologically significant indigenous broadleaf forest, spatial and topographical constraints and additional land acquisition requirements. Policy P103 of the PNRP seeks to manage the extraction of gravel, sand or rock from the beds of rivers so that it does not increase flooding or erosion, reduce the flow of bed material to the coast to the extent that could result in coastal erosion, and does not exceed the rates of natural deposition unless this is required to manage aggradation. The Project design requires extraction of gravel to reduce flooding and erosion. The Project is not expected to change the mobilisation of bed material outside of the Project area, and as such is not expected to impact on flows of bed material to the coast in a way which could exacerbate erosion. Extraction required for proposed flood protection works may exceed the rates of natural deposition, but this is required to manage aggradation and improve the flood capacity in the river corridor. Policy P104 seeks to avoid more than minor adverse effects on structures that are part of existing catchment based flood and erosion control activities unless these activities are being undertaken by the owners of these structures (GW). The Project will result in more than minor adverse effects on existing structures but as GW are one of the applicants for

Theme	Relevant objectives and policies	Comment
		RiverLink, the activity will be "undertaken by the owner" and therefore the Project is consistent with this policy. Policy P106 seeks to manage the introduction and removal of plants in the beds of rivers. The Project is consistent with this policy as the proposed removal of existing plants and introduction of new planting is for flood protection purposes. Existing exotic planting will be replaced with new exotic planting for flood protection and interplanted with natives that over time will improve the biodiversity values of the riparian margins of Te Awa Kairangi. The Project is consistent with the direction of the PNRP for activities within the beds of rivers.
Take, use and diversion of water	Policy P110 Policy P122 Policy P123 Policy P125 Policy P126 Policy P129 Policy P130	<u>Surface water</u> The PNRP provides for the take, use, damming and diversion of surface water as long as flows are sufficient to maintain aquatic ecosystem health and sediment transport, and natural and recreation amenity values of the water bodies. The Project will involve temporary damming and diversion of water to enable river recontouring and gravel extraction. Any damming or diversion of water will be contained within the riverbanks, maintaining flows within the river system above minimum levels and provide for variable river flows. As such the temporary diversions will have no more than minor effects on aquatic ecosystem health or natural or recreation amenity values (P110, P122 and P129). <u>Groundwater</u> The PNRP seeks to protect existing takes from being compromised by new bores, sets requirements around construction of new bores, requires protection of groundwater quality and seeks to manage the effects of dewatering activities. Effects of the Project on groundwater quantity and quality have been assessed in the Hydrogeology Assessment. Project activities with potential effects on the groundwater system include (in relation to P125 and P126): • Dewatering of excavations during construction activities to provide a dry working environment • Construction of bridge and building foundations and piles which extend into (and through) the aquitard and into the underlying aquifers

Theme	Relevant objectives and policies	Comment
		• Installation of geotechnical investigation bores which extend into (and through) the aquitard and into the underlying aquifers A Groundwater Management Plan will be developed and implemented to protect groundwater quantity and quality and to avoid contamination between the aquifers and potential settlement effects during ground disturbance and dewatering activities. The Groundwater Management Plan is consistent with P123 as it will minimise the direct and cumulative adverse effects of groundwater works. To ensure that the underlying aquifers are appropriately protected during construction of deeper structural requirements (foundations/bridge piles) an Artesian Aquifer Interception Management Plan that will include a grouting management methodology will be developed and implemented (P125). All investigation bores will be constructed in accordance with the existing best practice methodology for investigations within the RiverLink Project footprint, and will be decommissioned when no longer in use in accordance with the approved methodology and relevant standards (P130).
Discharges to air	Objective O41 Policy P55	The PNRP seeks to manage discharge of contaminants to air to maintain air quality at appropriate levels to protect amenity values, human health and the quality of the environment. The Air Quality Assessment concludes that once operational RiverLink will result in a reduction of vehicle emissions (improving air quality) and that the main effect of the Project on air quality is related to discharges of dust to air as a result of earthworks and construction activities, namely gravel extraction and associated crushing and screening activities. These discharges will be managed through best practice site management and specific mitigation measures during construction which will be secured in accordance with the CAQMP. With mitigation measures in place, potential offensive and objectionable effects on human health, property and the environment are not anticipated beyond the boundary of the construction areas. This is consistent with the PNRP provisions in Objective O41 and Policy P55. The Air Quality Assessment confirms that with the implementation of an appropriate CAQMP the discharge of dust associated with construction of the Project will be appropriately managed. The dust emissions associated with construction of the Project

Theme	Relevant objectives and policies	Comment
		are therefore consistent with the relevant objectives and policies of the PRNP.

11.2.6 Operative Regional Freshwater Plan for the Wellington Region

The Regional Freshwater Plan (RFP) is the operative plan in the Wellington Region for managing freshwater issues, including water quality and quantity. A summary assessment of this regional plan is provided below.

Table 80 - Regional Freshwater Plan assessment

Theme	Relevant objectives and policies	Comment
Integrated Management	Objective 4.1.15 Policy 4.2.26 Policy 4.2.30 Policy 4.2.31	The RFP seeks to provide for appropriate involvement of tangata whenua, people and communities in freshwater management decision making and to provide for integrated management of freshwater resources. An extensive consultation programme has been implemented to ensure people and communities are able to be involved in decision-making, with a jointly notified consent process sought to enable the effects of use and development across the jurisdictional boundaries to be considered holistically (4.1.15 and 4.2.31). Additionally, relevant agencies and tangata whenua have worked through the Kaitiaki Strategy and will continue to do so via the Mana Whenua Steering Group to achieve integrated management (4.2.30). The RFP also requires a precautionary approach to freshwater where information is incomplete or limited. In the case of this Project, it is considered that there is adequate information on the potential effects on freshwater, such that a precautionary approach is not strictly required (4.2.26).
Māori relationships and cultural effects	Objective 4.1.1 Objective 4.1.2 Objective 4.1.3 Objective 5.1.3 Policy 4.2.1 Policy 4.2.2 Policy 4.2.3 Policy 4.2.4 Policy 4.2.5 Policy 4.2.6 Policy 4.2.7 Policy 4.2.8 Objective 7.1.4	The RFP (4.1.3) requires recognition of the tangata whenua values and that the principles of the Treaty of Waitangi are taken into account in the management of the Region's water bodies and river and lake beds. The Project has recognised and provided for the relationship of tangata whenua with taonga, ancestral sites and waahi tapu through the Kaitiaki Strategy (4.1.1). This will protect the mauri and quality of water as consistent with tangata whenua values (4.1.2 and 5.1.3), and ensure cultural values are not adversely affected, access to Te Awa Kairangi is retained and effects habitats of species harvested by tangata whenua are minimised and mitigated (4.2.1, 4.2.3 and 4.2.4). Recognition of the role of tangata whenua as kaitiaki and provision for tangata whenua involvement in

Theme	Relevant objectives and policies	Comment
		management of natural resources has been achieved for this Project through the establishment/recognition of Mana Whenua as Project Partners. The Project has ensured, through the relationship with Mana Whenua and the provision for ongoing involvement and support of Mana Whenua through the proposed creation of a Mana Whenua Steering Group prior to and during construction works, that it will facilitate the protection of the relationship of iwi with the historic, traditional, cultural and spiritual elements of Te Awa Kairangi and supporting ecosystems. This is consistent with 4.2.2, 4.2.5, 4.2.6 and 4.2.7.
Natural character and recreational amenity values	Objective 4.1.4 Objective 4.1.7 Objective 4.1.8 Policy 4.2.9 Policy 4.2.15 Policy 5.2.4	The RFP seeks to protect, or maintain (and enhance), access, recreational values, natural character and amenity of waterbodies. During the construction of the Project there will be a temporary but potentially significant effect on access, natural character and amenity. To minimise these effects to the extent practicable, the works will be staged, reducing the extent of river affected at any one time and protecting natural character (4.1.4, 4.1.8 and 4.2.15). The design and construction methodology have had regard to effects on ecosystems, habitats, species, water quality and topography (4.2.9). Following completion of construction, the Project will result in a significant improvement in river amenity and natural character, including through the provision of improved public open spaces, water quality, and riparian and landscape planting. Indigenous plants will increase natural character in contrast to the existing exotic monoculture of willows and poplars (4.1.7 and 5.2.4). In addition, the works will improve access along and to Te Awa Kairangi, including a shared path beside the river, contact recreation opportunities and three ūranga to provide access to the river and beaches (4.1.8 and 5.2.4). The Project is therefore consistent with the policy direction in the RFP regarding natural character
Natural hazards - Flooding	Objective 4.1.9 Objective 4.1.10 Policy 4.2.18 Policy 4.2.19 Policy 4.2.21 Policy 4.2.22 Objective 7.1.2 Objective 7.1.3	The RFP seeks to manage the risk of flooding to health and safety, natural values, physical resources and property to an acceptable level. New development (including infrastructure) is required to be located and designed to manage the impacts from flooding that may be experienced over their lifetime (4.1.9 and 4.1.10). The RFP allows for flood mitigation works within the river bed, including lawful maintenance and mitigation work, recontouring of river beds to avoid flood hazards, removal of sediment and development of new structures within the river bed provided that they do not contribute

Theme	Relevant objectives and policies	Comment
	Policy 7.2.7 Policy 7.2.8 Policy 7.2.13	to flood risk (4.2.19, 7.1.2, 7.1.3, 7.2.8 and 7.2.13). Proposed bridges and rock lining structures are not anticipated to have adverse effects on the structural integrity and effectiveness of flood mitigation structures and works (7.2.7). RiverLink is proposed to protect existing development from hazard risks that are deemed unacceptable due to the potential consequences of flooding on the Hutt city centre and the community. Predicted changes in climate, which are predicated to exacerbate flooding effects, have been taken into account in the flood modelling and design of the stopbanks, river corridor (including extraction) edge protection structures and bridges as consistent with 4.2.22. Best available and up-to-date hazard information across a range of probabilities was used to address the flooding risk. The Project, including its structures and earthworks activities, has been designed to improve flood protection/resilience and otherwise minimise the flood risk and adverse effects to people and property by improving and enhancing the function and capacity of existing flood protection measures (4.2.18). The Project has also included consultation and engagement which has increased community awareness and involvement in the process of flood mitigation (4.2.21). As such, the Project is consistent with the RFP.
Water quality	Objective 4.1.5 Policy 4.2.27 Objective 5.1.1 Objective 5.1.2 Policy 5.2.3 Policy 5.2.6 Policy 5.2.8 Policy 5.2.10 Policy 5.2.13 Policy 5.2.14 Policy 5.2.15	The RFP seeks to safeguard the life-supporting capacity of water and aquatic ecosystems, manage water quality for ecosystem health purposes and fish spawning purposes, and meet the needs of further generations, and it encourages discharges to land and treatment of stormwater discharges to reduce adverse effects (4.1.5, 5.1.1, 5.1.2, 5.2.3 and 5.2.6). The potential effects on water quality from the Project have been assessed in the Construction Water Quality Assessment and the Operational Stormwater Quality Assessment. The Project will utilise best practice techniques during construction to manage sediment, which is predicted to result in a minor adverse change in the downstream estuarine receiving environment, when considered in conjunction with the existing sediment/water quality within the Hutt Estuary and Wellington Harbour. As the discharges are temporary and where possible discharged to land, the provisions in Policy 5.2.8 are satisfied. The Project has been designed such that the adverse effects of operational stormwater discharges on freshwater are minimised and where practicable improved through treatment methods.

Theme	Relevant objectives and policies	Comment
		With the proposed measures in place to manage adverse effects on freshwater quality from discharges of sediment and contaminants entrained in stormwater, any potential effects on freshwater and associated ecosystems will be minimised such that they are consistent with the policy framework of the RFP (5.2.14 and 5.2.15).
Biodiversity and ecology	Objective 4.1.5 Objective 4.1.6 Policy 4.2.11 Policy 4.2.12 Policy 4.2.14 Policy 4.2.33 Policy 5.2.3 Policy 5.2.6 Policy 7.2.11 Policy 7.2.14 Policy 7.2.15	Key provisions of the RFP include objectives 4.1.5 and 4.1.6 which require that the life supporting capacity of freshwater is safeguarded and significant aquatic vegetation and habitats of freshwater fauna are protected. These objectives are given effect through Policy 4.2.11 which requires activities to avoid, remedy and mitigate adverse effects which affect aquatic ecosystems and habitats, Policy 4.2.12 which requires promotion of maintenance and enhancement of aquatic habitats and ecosystems when assessing adverse effects of development, Policy 4.2.14 which requires activities to avoid, remedy and mitigate effects on identified important trout habitat and Policy 7.2.11 which seeks to ensure that the use of river beds not covered by water does not disturb nesting birds. Policy 4.2.33 provides for activities with no more than minor effects, which includes works no significant or prolonged decreases in water quality, no adverse effects on mahinga kai or waahi tapu, and adverse effects on plants, animals and habitats will be temporary. The Project will be consistent with the relevant provisions of the RFP. A range of measures (for example a replanting programme including vegetation for flood mitigation and habitat restoration, staging of works, sediment and water quality controls, fish salvage and relocation and a standdown period from September to November for fish migration) to reduce displacement is proposed to minimise the potential effects of the Project on ecological values, nesting birds and trout habitat (5.2.3, 5.2.6 and 7.2.14). Reclamation of the river bed is occurring as there are no other practicable alternatives, and will have significant benefits to the community, fulfilling Policy 7.2.15. The Freshwater Ecology Assessment has determined that the effects of the Project on freshwater ecology values will be minor.
Activities within the bed of rivers	Objective 7.1.1 Policy 7.2.1 Policy 7.2.2 Policy 7.2.15	The RFP allows for specified uses within river beds where adverse effects are avoided, remedied or mitigated and significant adverse effects are avoided. The Project works within Te Awa Kairangi and tributaries are specified uses in the Plan – namely structures for transportation and network utility purposes; structures for activities which need to be located in, on, under, or over the beds of rivers and

Theme	Relevant objectives and policies	Comment
		lakes; and gravel extraction as enabled by 7.1.1 and 7.2.1 if adverse effects are avoided, remedied or mitigated. The effects of these works are assessed in the Freshwater Ecology Assessment. Effects will be appropriately avoided, remedied and mitigated and there are not expected to be any significant adverse effects, post mitigation and offsetting (7.2.2). Policy 7.2.15 requires that reclamation or drainage of the beds of lakes and rivers be avoided unless it meets certain exceptions. The exceptions provide for reclamation to be undertaken if the reclamation provides significant community benefit and there are no other practicable alternatives. The reclamation is associated with the SH2 and Melling Intersection upgrades, which are RSI and will therefore provide significant community benefit. As outlined in this AEE, there are no practicable alternatives as it is impractical and cost prohibitive to relocate the Melling Interchange bridge due to existing roads it needs to connect with. Other design options were discounted because of the required clearance of ecologically significant indigenous broadleaf forest, spatial and topographical constraints and additional land acquisition requirements.
Take, use and diversion of water	Objective 6.1.1 Objective 6.1.2 Objective 6.1.3 Objective 6.1.4 Policy 6.2.7 Policy 6.2.14 Policy 6.2.15 Policy 6.2.17	The RFP requires maintenance of water levels and flow regimes of water bodies to protect their natural, cultural and amenity values (6.1.1 and 6.1.2). Low flow depths will be maintained (and potentially increased) as a result of RiverLink. Policy 6.2.15 provides for the temporary damming or diversion of a river where adverse effects are avoided, remedied or mitigated. Temporary damming and diversion during construction will be undertaken within the river channel and is not likely to result in any water being diverted outside of the river system (no diversion outside of the river bed) and therefore minimum flows and water levels are not likely to be impacted, consistent with the RFP (6.2.14). Water is thus being used efficiently as consistent with 6.1.3. The RFP allows for the take of groundwater where it will not adversely affect groundwater quality or quantity or impact on takes from surrounding bores (6.2.7). Excavation and the abstraction of groundwater within shallow aquifers, which has the potential to increase groundwater turbidity, will be required for the Project. The lowering of groundwater levels and increase in turbidity has the potential to affect water takes from bores located within the zone of influence and can also cause differential settlement or subsidence effects. There is also the potential to affect the underlying aquifer. To ensure that the aquifer is appropriately

Theme	Relevant objectives and policies	Comment
		protected during construction of deeper structural requirements (foundations/bridge piles) an Artesian Aquifer Interception Management Plan that will include a Grouting Management Plan is proposed for the construction of the bridge piles. This will ensure the Project is consistent with the direction in the RFP in relation to groundwater (6.1.2 and 6.2.17). The management of flows and water levels is consistent with tangata whenua values as guided by the Kaitiaki Strategy, which fulfils Objective 6.1.4.

11.2.7 Operative Regional Plan for Discharges to Land for the Wellington Region

The Regional Plan for Discharges to Land is the operative plan in the Wellington region addressing discharges to land. This plan contains objectives and policies which are relevant to the Project, including Objectives 4.1.10 and 4.1.11, and Policies 4.2.46, 4.2.47, 4.2.48 and 4.2.49. In summary, the Regional Plan for Discharges to Land seeks to protect land and water resources through identification, management and remediation of land that is contaminated and to avoid creation of new contaminated land through management of discharges from contaminated land.

As identified in section 9.14, a risk-based PSI has been undertaken on a Project-wide basis to identify land that is or may be contaminated based on sites known to have supported contaminating land use activities in the past. From the PSI, sites which require further investigation through DSIs post consent and prior to construction commencing have been identified.

Contamination risk, once confirmed, will be appropriately managed through a Contaminated Land Management Plan which will include site-specific control measures as necessary for the construction phase. The Project is consistent with the objectives and policies in the outcomes sought in the Regional Plan for Discharges to Land.

11.2.8 Operative Regional Soil Plan for the Wellington Region

The Regional Soil Plan (RSP) is the operative plan in the Wellington region addressing soil disturbance and vegetation clearance on erosion prone land. The RSP contains several objectives and policies which are relevant to the Project, including Objectives 4.1.9, 4.1.10 and 4.1.11, and Policies 4.2.13, 4.2.14, 4.2.15 and 4.2.16. In summary, the RSP seeks to protect the life supporting capacity of soil and water resources through identification, management and remediation of land that is subject to erosion and by promoting land disturbance and management practices that minimise run-off and sedimentation of waterbodies.

Earthworks and land disturbance will be managed in accordance with the ESCP and supporting management plans to avoid, remedy or mitigate the potential effects of erosion and discharges of sediment to the receiving environment. Land disturbance will be managed to retain soil and sediment on the land by implementing best practicable options for sediment and erosion control. The ESCP and supporting management plans outline the mechanisms proposed to manage effects of sediment generation. Such measures include the use of erosion and sediment control devices, chemical treatment, management of open area limits, progressive stabilisation requirements and refining the construction sequencing and programme to minimise the risk and severity of discharges of sediment laden water.

The Project is consistent with the objectives and policies in the RSP.

11.2.9 City of Lower Hutt District Plan

The relevant objectives and policies of the District Plan are assessed Table 81 below.

Table 81 - District Plan assessment

Theme	Relevant objectives and policies	Comment
Regionally significant infrastructure	13.1.1 Objective & Policy 13.1.2 Objective & Policy 13.1.3 Objective & Policy 13.1.4 Objective & Policy	The objectives and policies of Chapter 13 of the District Plan seek to recognise and protect the local benefits of RSI and ensure that RSI and network utilities are not compromised by other activities. This includes avoiding, remedying and mitigating adverse effects on RSI and network utilities as a result of new use and development. In addition, the provisions seek to manage adverse effects on the environment as a result of the location, operation and maintenance of network utilities and recognise and provide for the sustainable, secure and efficient use, operation and development of network utilities. The direction in the District Plan for RSI is directly consistent with the direction in the RPS, which demonstrates that the Project is consistent with the policy direction for enabling new RSI and protecting existing infrastructure from reverse sensitivity effects.
Development form and function	5A1.1.1 Objective & Policy 5A 1.1.5 Objective & Policy 5A 1.2.4 Objective & Policy 5A 1.12 Objective & Policy 5A 1.13 Objective & Policy 6A 1.1.2 Objective & Policy 6A 1.1.3 Objective & Policy	Chapter 5A contains provisions seeking to promote efficient use and development and increase the diversity of activities to encourage investment and growth in the CBD while managing adverse effects on the environment, the amenity values of existing use and development and the safety of the community. In relation to the river corridor and its relationship with the CBD policies 5A 1.1.5 and 5A 1.2.4 are particularly relevant, and focus on recognising and enhancing urban design within the Central Commercial Activity Area, and enhancing the amenity, natural and recreational values of Te Awa Kairangi, through encouraging development of a promenade and increasing public access to the river, while managing building design along the river frontage. Chapter 6A includes provisions relating to enhancing main entrance routes to the city (6A 1.1.2), where they pass through the General Business Activity Area and managing the adverse effects on the amenity of the Business Areas and neighbouring areas and the environment (6A 1.1.3). RiverLink provides the opportunity for HCC to work with relevant property owners and/or future developers to carry out urban renewal and revitalisation works. These works would enable the

Theme	Relevant objectives and policies	Comment
		integration of the proposed infrastructure work with existing and future mixed-use development. The Project, through enhanced accessibility and urban spaces which provide for a variety of uses and types of occupation, is expected to increase the urban development capacity within the Central Commercial Activity Area/Hutt CBD and nearby urban environments and attract people to the river corridor for active and passive recreation pursuits. CPTED principles have been followed in the design to ensure adequate lines of sight and passive surveillance are provided. Key engineered components of the Project (such as stopbanks, river edge protection works, bridges, roads and related access connections) will contribute to the form and function of development and generate both urban and landscape outcomes, with related effects. Some of these features will also provide gateway or way-finding benefits. Overall, the Project will give effect to the objectives and policies in the District Plan relating to development form and function.
Natural character and recreation amenity values	7C 1.1.1 Objective & Policy 7C 1.2.1 Objective & Policy	Chapter 7C seeks to ensure that activities on rivers and their banks are managed to maintain and enhance their natural and ecological qualities. Following completion of construction, the natural and ecological qualities of the river will be maintained through replacement planting, and in some areas enhanced through increased native vegetation planting. The works will maintain in-stream low-flow levels and will consequently maintain the natural and ecological in-stream qualities of Te Awa Kairangi (7C 1.1.1). The District Plan also seeks to manage the external appearance and location of buildings and structures to protect open space and amenity values (7C 1.2.1). The ULDF and the designation conditions provide the opportunity for urban design consideration of the buildings for the development sites. Whilst the Project will result in a temporary decrease in access and amenity of Te Awa Kairangi during the construction period, the Project will result in a significant improvement in amenity values and open space, through the provision of new public open space, walkways, planting and a better connection between Hutt CBD and Te Awa Kairangi. River amenity will be improved with the provision of improved public open spaces, and riparian and landscape planting that integrates with the shared

Theme	Relevant objectives and policies	Comment
		pathways and pedestrian/cycle bridge. The river corridor will be integrated with the new and upgraded stopbanks and in-river works and provide improved amenity for the community and improved habitat for wildlife. Amenity features including boardwalks connecting to the wider walking and cycling network, planted areas, grassed areas, amenity wetlands, gravel beaches, play areas, a skate park, seating, and other ancillary structures will support the Project and open space amenity objectives. Steps and ramps will facilitate access and strengthen connections between the CBD and the river corridor and the use of ūranga will enhance access to the river and beaches.
Transport	14A 3.1 Objective 14A 3.2 Objective 14A 3.3 Objective 14A 4.1 Policy 14A 4.2 Policy 14A 4.3 Policy 14A 4.6 Policy 14A 4.7 Policy	The District Plan seeks to achieve the following transport outcomes: Provide for a range of transport modes Avoid, remedy or mitigate effects of transport network on surrounding land-uses Development and subdivision enables walking, cycling and public transport, and Provide for safe, resilient and well-connected transport network, facilitates urban growth and economic development and meets local and regional needs. The Project will contribute to achieving these outcomes, through providing for a range of transport modes – cycling, walking, improved road transport, and better integration with the rail network (14A 3.1). The effects of constructing and operating SH2 upgrades on the transport network will be appropriately avoided, remedied and mitigated through the design process and construction management (14A 3.2). The upgrades to the SH2 interchange will improve the safety and resilience of the State Highway and will provide for the Greater Wellington Region's transport needs (14A 4.1).
Māori relationships and cultural effects	14E 1.1 Objective & Policy	The District Plan provisions seek to identify and protect significant natural, cultural and archaeological resources in Lower Hutt from use or development that is inappropriate. The resources are identified within the District Plan Schedule. The Policy prevents damage or destruction of the resource and protects values of the resources. Two significant natural resource areas (SNR 14 and SNR 21) share boundaries with the proposed Project designation by SH2. The Project works will not

Theme	Relevant objectives and policies	Comment
		modify the resource areas or their visual amenity and natural character values, therefore are consistent with the objective and policy. One cultural resource is located in the Project area (Maraenuku pā). The resource has been assessed as having been previously destroyed, and it is unlikely that the Project will disturb or destroy any remnants or uncover Māori artefacts. The use of Accidental Discovery Protocols will prevent the further damage or destruction to the resource, as consistent with the Policy. There are no archaeological resources identified in the Schedule that are within the Project area, and thus will not be exposed to inappropriate development.
Heritage	14F 1.1 Objective & Policy 14I 1.2 Objective & Policy	The District Plan provisions seek to ensure that heritage values are not unnecessarily lost to demolition or relocation or compromised by other physical works. This requires an assessment of the need for demolition or relocation of identified heritage buildings and structures and of the available alternatives. In relation to protection of sites with historical significance, Objective 14I 1.2 seeks to ensure earthworks do not adversely affect the historical significance of an area, feature or site and Policy 14I 1.2 seeks to protect sites with historical significance from inappropriate earthworks. There are no listed heritage buildings or structures within the proposed designation boundary, either on the Heritage New Zealand Pouhere Taonga (HNZPT) list or in the District Plan. The following listed historic heritage buildings are located in close proximity to the Project: • Former Post Office (149-151 High Street, Lot 1 DP 90205) (Heritage List No. 4145) • Lower Hutt Civic Centre Historic Area (Heritage List No. 7520) • Lochaber/Prospect College (125 Western Hutt Road, Sec 1 SO 37208) (HNZPT List No 2889) • Casa Loma (760 Western Hutt Road, Lot 7 DP 54222) (Heritage List No. 1324) Whilst Melling Railway Station is not listed as a heritage building in the District Plan, nor on the HNZPT List, it has been identified as having high regional significance and potentially as national significance when considered as part of a wider group of railway stations of the same era. The RiverLink design means that the existing station

Theme	Relevant objectives and policies	Comment
		cannot remain in its current location – the railway line is being truncated some 250m to the south of its existing terminus to accommodate the new interchange, and a new station is being constructed to connect with the line in its new location and with the new pedestrian/cycle bridge to the Lower Hutt city centre. Nine archaeological sites have been identified and recorded in the Project area. A further five are located in close or related proximity to the Project area. There is also potential for unrecorded archaeological sites to be encountered during the RiverLink earthworks activities. The Archaeological and Historic Heritage Assessment concludes that effects on archaeological sites are predicted to be low due to the extent of previous disturbance and lack of physical remains. A combination of active monitoring of earthworks and adoption of an On-Call Procedure will protect any sites with historical and archaeological significance from inappropriate earthworks, thereby achieving the intent of Policy 14I 1.2. This includes for sites with cultural and spiritual values. The accompanying built heritage assessment of the effects of RiverLink on Casa Loma and Lochaber concludes there will be no effects on either of these listed buildings. The Former Post Office and Civic Centre Heritage Area are too far away from Project works to be affected. There is the potential that the former Wesleyan Cemetery at 57 Marsden Street extends further underground than currently identified. Because of the potential risk of disturbing graves, further non-invasive ground penetrating radar investigation will be undertaken prior to earthworks commencing. The Project design has been modified to avoid extensive earthworks in this location and earthworks will be actively monitored and limited to no greater than 500mm depth in areas where ground penetrating radar results indicate the likely presence of burials. This would be consistent with Objective 14I 1.2 and its related policy. The Project is consistent with the District Plan objectives and policies as there will be no effects on listed heritage buildings and structures. Although Melling Railway Station is not currently listed, it has been identified has having heritage value. A condition is proposed which requires an assessment of the feasibility of relocating the station to form part of the new Melling Station. If this is not feasible then in the first instance as much of the heritage fabric of

Theme	Relevant objectives and policies	Comment
		the existing Melling Station as is practicably feasible is reused and referenced within the new station building. If this is impracticable, the building would be demolished. It is considered that this condition would meet the requirement of Policy 14F 1.1 (b) insofar as a thorough assessment and determination of the need for demolition/relocation would be made. A built heritage specialist appointed by HNZPT would be part of the team undertaking the feasibility assessment.
Natural Hazards	4A 2.6 Objective 7C 1.1.3 Objective & Policy 7C 1.2.1 Objective & Policy 14H 1.1.1 Objective & Policy 14I 1.3 Objective & Policy 14I 1.4 Objective & Policy	The District Plan provisions seek to avoid or mitigate adverse effects of flood hazards on buildings and structures and to manage new buildings or structures in the primary and secondary river corridors. The District Plan provisions also seek to protect existing flood control structures from activities in the primary and secondary river corridor and that earthworks and gravel extraction activities are undertaken for the purpose of flood protection/control. RiverLink is required to protect existing development from hazard risks that are deemed unacceptable due to the potential consequences on the Hutt city centre and the community. Predicted changes in climate, which are predicated to exacerbate flooding effects, have been taken into account in the flood modelling and design of the stopbanks, river corridor (including extraction) edge protection structures and bridges. Best available and up-to-date hazard information across a range of probabilities was used to ensure that the flooding risk associated with the Project is reduced. The Project, including its structures and earthworks activities, has been designed to improve flood protection/resilience and otherwise minimise the flood risk and adverse effects to people and property by improving and enhancing the function and capacity of existing flood protection measures. The Project design will result in the reduction of flood depths, duration and velocity of flood flows in design events. Overall, risks from flooding to people, property and the environment have been mitigated to the extent appropriate and practicable, resulting in a significant decrease in flood risk over the Te Awa Kairangi floodplain. With regard to other natural hazards the Project straddles the Wellington fault. The Project will be designed to manage risk of seismic activity, slope stability, rock fall and settlement in accordance with the Waka Kotahi guidance. Through the alternatives assessment process, the Project design was refined

Theme	Relevant objectives and policies	Comment
		to minimise issues associated with the presence of the Wellington fault and geotechnical uncertainty. Where required, structural controls will be implemented through design to mitigate any residual land instability risks. The Project is consistent with the objectives and policies of the District Plan relating to natural hazards and flooding.
Hazardous substances	Objective 14D 1.1 Policy 14D 1.1	The District Plan seeks to protect the environment from adverse effects associated with the storage, use, disposal and transport of hazardous substances. The construction works will require the use of machinery on site and will involve the storage of diesel and other potentially hazardous substances, such as water treatment chemicals (flocculants) and heavy metals. The management of hazardous substances, including storage, handling, transport and disposal, will be subject to specific management practice and industry guidelines. These management practices will minimise potential effects on health and safety from exposure to hazardous substances and reduce potential for adverse effects on the environment. Conditions have been proposed that require all machinery to be maintained and operated in a way that ensures that spillages, particularly during refuelling and machinery servicing, are prevented in proximity to waterways. The Project is consistent with the District Plan direction regarding hazardous substances.
Notable trees	Objective 14G 3.1 Policy 14G 4.2 Policy 14G 4.3 Policy 14G 4.4	The District Plan seeks to protect notable trees, but this is unable to be achieved in all cases for this Project. In particular, Objective 14G 3.1 requires notable trees to be retained for their natural life and Policy 14G 4.2 requires notable trees to be protected for their natural life unless the tree is an immediate risk to the safety of people or property. Policy 14G 4.4 requires that activities will not damage or compromise any notable trees' health, stability, life expectancy, appearance or amenity values. The design of Project has been amended to give effect to the District Plan direction to avoid impact on notable trees as much as possible. Seven notable street trees now sit along and outside the Project boundary and will not be directly affected by the works. As discussed in section 9.15 (landscape, visual and natural character), the Project does however require the removal of three notable street

Theme	Relevant objectives and policies	Comment
		trees. Street trees will be replanted throughout the Project, which will mitigate amenity effects arising from this loss, over time.
Noise	Objective 14C 1.1 Policy 14C 1.1	The District Plan seeks to maintain or enhance amenity value in all activity areas by avoiding or mitigating the adverse effects of excessive noise. The Noise and Vibration Assessment outlines the likely noise and vibration effects of the Project during construction and operation. That report has assessed the potential effects of construction noise and vibration and concludes that daytime compliance with applicable noise and vibration criteria is likely, but there could be localised exceedances at specific locations and during specific construction activities. Effects arising from the predicted increase in noise levels will be mitigated to an appropriate level as detailed in the Noise Assessment – including minimising noise at source (where practicable) through the use of the BPO. Once constructed, the operation of the Project is expected to comply with the relevant criteria within NZS 6806. With the proposed mitigation measures, the Project will be consistent with the noise objectives and policies of the District Plan.
Residential amenity	Objective 4A2.1 Policy 4A 3.1 Policy 4A 3.5	Provisions contained in chapter 4A seek to avoid, remedy or mitigate adverse effects caused by buildings/structures and their height, scale and location on the amenity values of adjacent residential sites and the residential character of the surrounding residential area. The following Project activities are expected to affect amenity values: Earthworks during construction of the stopbanks and berms and major structures (bridges) Demolition of existing buildings and structures Changes to the physical configuration/local roads, and In-river works. Mitigation of adverse amenity effects associated with the construction of the Project is proposed through the implementation of best practice approaches such as construction management plans and will be achieved through implementation of proposed NOR and resource consent conditions.

11.3 Other matters

Section 171(1)(d) requires decision makers to have particular regard to (and Section 104(1)(c) requires that regard be had to) other matters relevant and reasonably necessary in consideration of the Application.

The Project has been shaped in accordance with key legislation and government transport policy that provides GW, Waka Kotahi and HCC with strategic direction and guidance on their respective statutory roles and responsibilities. In addition to the RMA matters, the key legislation and policies that have guided the development of the Project relate to:

- Flood protection strategy, including the Hutt River Floodplain Management Plan 2001 (HRFMP);
- The Land Transport Management Act 2003 (LTMA) and Government transport strategy;
- Spatial planning and growth strategies for the Hutt, including the Hutt City Central City Transformation Plan (CCTP) which set out principles, for the coordinated development and design of Lower Hutt's central city and immediate environs; and
- Urban design guidance including the New Zealand Urban Design Protocol and National Crime Prevention through Environmental Design Guidelines (CPTED).

11.3.1 National context

New Zealand Upgrade Programme – Transport (NZUPT)

The New Zealand Upgrade Programme was established in January 2020 and provides for significant Government investment in roads, rail, hospitals and schools throughout the country to future-proof the economy. The New Zealand Upgrade Programme for transport (NZUPT) reflects the Government's transport policy with an initial $8.7 billion being invested across road, rail, public transport and walking and cycling infrastructure. NZUPT is one of the funding programmes for RiverLink. $2.05 billion was initially allocated to be invested in Wellington from the NZUPT programme over the next decade to support growth under the Wellington Regional Growth Framework. This includes the funding for the Melling interchange component of the Project and the continuing partnership with GW and HCC on RiverLink.

Transport improvements at Melling will provide for a safer, more resilient and accessible transport system in Lower Hutt, as well as supporting flood protection and revitalisation of the Hutt Valley.

Government Policy Statement on Land Transport 2021 (GPS 2021)

The GPS 2021 sets out what the Government is seeking from land transport investment. Waka Kotahi is required under section 70 of the Land Transport Management Act 2003 to give effect to the GPS 2021 when performing certain statutory functions relating to the funding of the land transport system. While the Melling interchange component of the Project will be funded outside of those functions (i.e. through NZUPT), the GPS 2021 is nonetheless considered to be relevant as an 'other matter' in respect of this application.

The following priorities are identified in the GPS 2021:

- Safety: Developing a transport system where no-one is killed or seriously injured.
- Better Travel Options: Providing people with better transport options to access social and economic opportunities.
- Climate Change: Developing a low carbon transport system that support emissions reductions, while improving safety and inclusive access.
- Improving Freight Connections: Improving freight connections for economic development.

GPS 2021 sets out outcomes to be achieved by 2031 for each of the priorities. The relevant outcomes to the Project are summarised in Table 82 below.

Table 82 - Outcomes for strategic priorities

Priorities	Outcomes to be achieved by 2031
Safety	Reduced number of deaths and serious injuries A safer land transport network
Better travel options	Improved access to social and economic opportunities Public transport and active modes that are more available and/or accessible Increased share of travel by public transport and active modes Reduced greenhouse gas emissions, and Reduced air and noise pollution.
Climate change	Reduced greenhouse gas emissions Reduced air and noise pollution, and Improved resilience of the transport system.
Improving freight connections	Freight routes that are more reliable Freight routes that are more resilient Reduced greenhouse gas emissions, and Reduced air and noise pollution.

The Project objectives outlined in section 2.3 are strongly aligned with these outcomes.

The design of the Project will improve road safety, increasing the Melling Intersection from a 2 Star to a 4 Star KiwiRAP safety rating. The Project is thus expected to result in a reduction in the total number of deaths and serious injuries, which is consistent with the outcomes anticipated by GPS 2021 by 2031. The Project will also improve the resilience and reliability of the transport network by reducing disruption from traffic events and natural hazards.

The GPS 2021 encourages investment in walking, cycling and rail transport infrastructure, recognising its contribution to addressing two key strategic priorities: better travel options and climate change. The Government's commitment to 'net zero 2050', as reflected in the Climate Change Response (Zero Carbon) Amendment Act 2019, underscores New Zealand's ambition to transition to a low emissions economy. RiverLink will deliver safe and well-connected walking and cycling infrastructure and enhance the availability of public transport options, providing for multimodal shifts that will reduce transport emissions. The Project will also deliver improved rail transport options through a modern, connected, fit for purpose and accessible new Melling Station. In conjunction with the improvements to SH2 and active transport, the Project will support increased access to social and economic opportunities in the Lower Hutt city centre.

National Land Transport Programme (NLTP)

The Government released the National Land Transport Programme (NLTP) 2018-2021 in August 2018. The NLTP sets out how Waka Kotahi will use national land transport funding over the period of the programme. Some of the RiverLink walking, cycle and local road infrastructure is expected to be funded through the NLTP.

Transport outcomes framework

In 2018, the Government transport agencies established a Transport Outcomes Framework (refer Figure 52) to identify how the transport system supports and can improve intergenerational wellbeing and liveability outcomes. The Transport Outcomes Framework aligns with the Treasury's Living Standards Framework (The Treasury, 2019).

Many of these outcomes overlap, for example, building the Project improves safety and travel time reliability for road users but it also delivers better travel options for pedestrian and cyclists and by moving more people emissions-free it helps in addressing climate change. In addition, accelerating mode shift by partnering with local government and other agencies to shape urban form, the Project seeks to make shared and active modes more attractive, influencing private vehicle travel demand and increasing transport choice. The framework is aligned with the integrated approach adopted for the Project and illustrates well the connections across the Project as a whole.

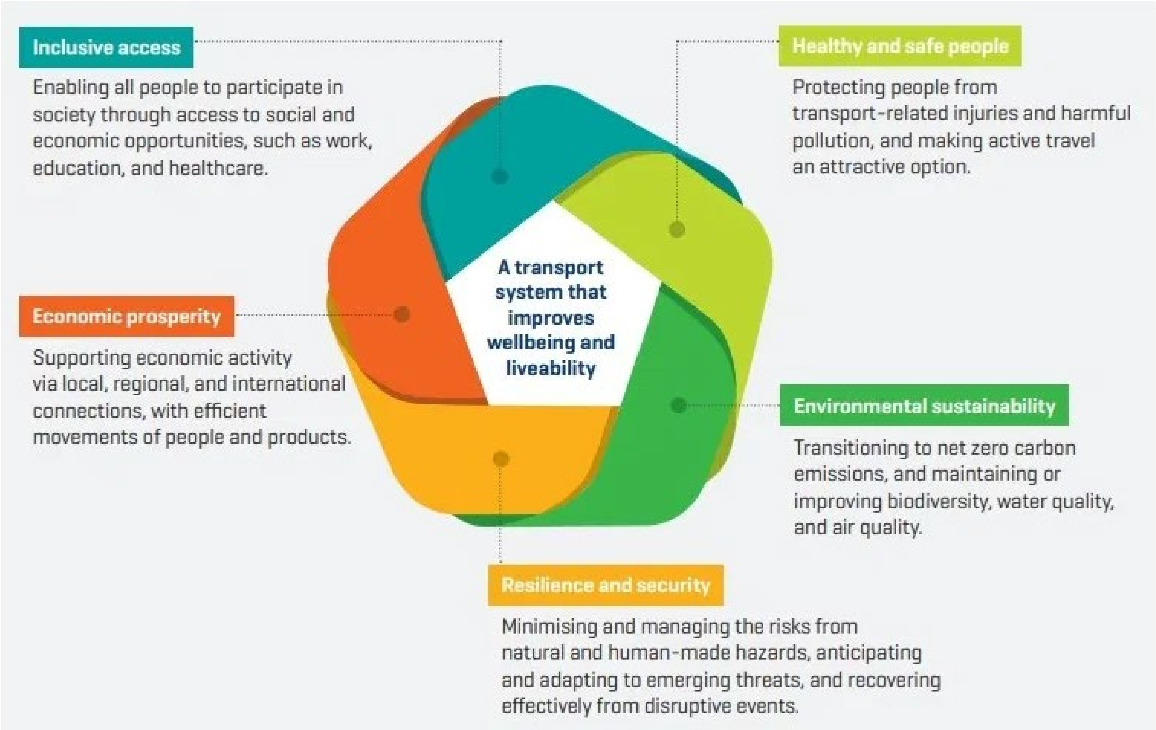


Figure 52 - Transport outcomes framework

New Zealand Urban Design Protocol (2005)

The New Zealand Urban Design Protocol is a voluntary commitment to specific urban design initiatives by signatory organisations. These include central and local government, the property sector, design professionals, professional institutes and other groups.

GW, Waka Kotahi and HCC are signatories to the Urban Design Protocol and have committed to making a significant difference to the quality and success of urban design in our towns and cities by helping them become:

- Competitive places that thrive economically and facilitate creativity and innovation
- Liveable places that provide a choice of housing, work and lifestyle options
- Healthy environments that sustain people and nature
- Inclusive places that offer opportunities for all citizens
- Distinctive places that have a strong identity and sense of place, and
- Well-governed places that have a shared vision and sense of direction.

The Project, and in particular the HCC objectives and aspects of the Project, are aligned with the direction and vision of the Urban Design Protocol and these objectives have been considered throughout the design of RiverLink through the preparation of the ULDF, the main purpose of which is to establish a framework to achieve the intended urban and landscape design outcomes for the Project. Development of the supporting strategies such as the Central City Transformation Plan (CCTP) discussed in section 11.3.3 below and guidance documents such as the District Plan's Central Area Design Guide, Bridging the Gap: the NZ Transport Agency Urban Design Guidelines (which has guided the RiverLink design) also align with the Urban Design Protocol.

National Crime Prevention Through Environmental Design Guidelines (2005)

The National Crime Prevention Through Environmental Design (CPTED) guidelines outline how urban planning, design and place management strategies can reduce the likelihood of crime and deliver numerous social and economic benefits in the long-term. Places that are safe and feel safe are vibrant – they attract people, activity and positive social interaction. Popular places are also better for business, with high pedestrian counts reflected in higher turnover, employment, profit and investment.

The CTPED guidelines introduce seven qualities of safer places, these are qualities that will improve the urban environment while reducing crime and the fear of crime.

Of particular relevance to RiverLink, CPTED guidelines encourage local authorities to adopt, develop and implement a framework to raise public awareness of crime prevention and safety and its link to the built environment. This seeks to promote the value of crime prevention as a key component of good urban design which will achieve more attractive and vibrant public places, which enhance public safety and reduce opportunities for criminal offending. Safe design also adds to the attractiveness and use of the environment. Safe popular places with high pedestrian counts are better for business, reflected in higher turnover, employment, profit, rents, capital values and rates.

The CTPED guidelines also encourage design to take into consideration long-term maintenance requirements, while ensuring quality design and encouraging use. RiverLink responds to maintenance and management through a design that seeks to minimise ongoing operational costs and the frequency of required maintenance of structures and design features.

The ULDF has been informed by, and adheres to, CPTED principles which will continue to be incorporated into the detailed design and construction of the Project.

11.3.2 Regional context

Hutt River Floodplain Management Plan (2001)

The HRFMP is a 40-year blueprint for managing and implementing programmes that will gradually reduce the effects of flooding from Te Awa Kairangi. The Plan was prepared by GW over a 10-year period with significant input from Upper Hutt City Council, HCC and Mana Whenua through the Hutt River Floodplain Management Sub-Committee, as well as community groups and organisations in the Hutt Valley. It reflects how the community believes the flood risk should be managed. The Sub-Committee (now renamed the Hutt Valley Floodplain Sub-Committee) is a joint GW sub-committee and includes councillors from GW, HCC and UHCC it meets quarterly to oversee the implementation of the HRFMP.

The HRFMP outlines a holistic approach to flood protection, combining physical protection (such as stopbanks and river realignment) with non-structural measures (such as appropriate land zoning and preparing communities for flooding). It also looks at environmental opportunities and ways to enhance the river environment.

The HRFMP's ultimate goal is to improve the community's resilience to flooding and enable Hutt City to maintain or enhance its present level of economic vitality and quality of life. The RiverLink Project is a key mechanism for achieving this outcome.

The HRFMP establishes a risk based design standard for flood protection within the Te Awa Kairangi floodplain. This design standard informs the level of protection proposed in RiverLink, including the height of the stopbanks, the height of the new Melling Bridge and pedestrian/cycle bridge above the river and the river channel works. The design standard is risk-based, which means that the level of physical works for a local area is determined by assessing the social, economic and environmental benefits and the costs of providing flood protection. The design standards are applied based on the impact of the flood event – a higher standard applies to areas such as Lower Hutt because of the potential social, economic and community loss as a result of a significant flood event.

Policy 3 from the HRFMP, the risk based 2,300 cumec design standard requires:

- *"*new or upgraded stopbanks protecting larger areas be upgraded to the 2,800 cumec standard,
- new and replaced bridges and associated waterways to pass a 2,800 cumec flow"

The design standard policy seeks to achieve a 2,800 cumec capacity (referred to as a 'rare flood' in the HRFMP) over the areas noted above and through the city, and a 2,300 cumec capacity (440-year ARI event) in other areas. There is an approximately 4% chance of a 2,800 cumec flood event or greater happening in the next 100 years, and an approximately 20% chance of a 2,300 cumec flood event (440-year ARI event) happening in the next 100 years. The existing stopbanks in the Project area are not high enough to meet the 2,800 cumec design standard.

Te Awa Kairangi / Hutt River Hutt River Environment Strategy and Action Plan (2018) (HRES)

The HRES has been prepared by GW, in collaboration with Upper Hutt City Council, HCC and Mana Whenua. It identifies opportunities to enhance Te Awa Kairangi's environment as part of HRFMP implementation, to help achieve many of the HRFMP's environmental and community outcomes. The focus of the HRES is

"on the enhancement and management of the river environment and the way it encompasses natural, social and cultural aspects or uses of the river corridor, in the widest sense, whilst providing flood protection".[62]

The HRES includes three goals related to the natural environment, community and recreation, and a number of objectives to guide the reach-specific concept plans. The strategy provides concept plans that identify ideas or opportunities for enhancing the river environment in line with the linear park vision for Te Awa Kairangi. These opportunities are either linked to capital works within each reach along Te Awa Kairangi, or exist as separate enhancement opportunities.

As it relates to RiverLink, the HRES recognises the changes that will occur as a result of this suite of projects, including changes in the intensity and types of use between Kennedy Good and Ewen bridges. There is a specific HRES objective (Objective 14) which seeks to:

"*Identify and develop enhancement opportunities for recreation through the RiverLink project"*

Specifically for the RiverLink Project reach (Ewen Bridge to Kennedy-Good Bridge), the HRES includes actions to deliver RiverLink, including acknowledging the Motutawa and Maraenuku Pā sites, and to remediate (treat) stormwater flows.

The concept plans for the Kennedy Good to Ewen bridge reach in the HRES have been taken into account in the development of the ULDF and the recreation opportunities in the RiverLink design.

Whaitua te Whanganui-a-Tara

Whaitua te Whanganui-a-Tara is a catchment-based initiative which brings together an independent committee of local people from the Hutt Valley and Wellington working in

[62] Page 5, Hutt River Environment Strategy and Action Plan 2018

partnership with Mana Whenua to develop a programme to improve the quality of the Wellington / Whanganui-a-tara streams, river and harbour.

The programme is currently under development and expected to be delivered for community feedback by August 2021. The programme will include recommendations for specific work programmes, and regulatory plan provisions

These measures will seek to provide for the integrated management of land and water resources to improve water quality. The recommendations and measures are anticipated to inform future regulatory plan changes and establish a programme of work to achieve the community's objectives for water quality and quantity in the whaitua (catchment).

RiverLink will contribute to the Whaitua te Whanganui-a-Tara's overall purpose of improving the quality of water in the whaitua through the co-ordinated programme of flood protection and stormwater improvement works which will contribute to the improvement of the water quality of Te Awa Kairangi. The Project team has met with the Whaitua te Whanganui-a-Tara committee to keep them informed about RiverLink and to respond to issues and feedback received. This consultation is detailed in section 8.5.8 of this AEE.

Regional Land Transport Plan 2015 and Mid-Term Review (2018)

The Wellington Regional Land Transport Plan 2015 (RLTP) is GW's blueprint for the growth of the transport network to meet future needs. It sets out the strategic direction for land transport in the Wellington region over the next 10-30 years.

RiverLink will help provide a high-quality public transport network through delivering on a number of the key improvement areas for public transport under the current 2015 RLTP including enhancing the quality of stations, improving pedestrian access and maintaining and enhancing park and ride facilities.

The RLTP identified Melling as an area of constrained network capacity and outlines proposed improvements to SH2 interchanges, including at Melling, to address the poor safety record of this location, improve travel times and improve access to the Lower Hutt city centre. It also notes that improvements will be timed to work alongside flood protection works and give consideration to improving access to Melling Station. The RLTP also specifically references Melling Bridge in the context of network resilience noting that a significant flood event in the vicinity of Melling Bridge would affect road and rail networks, and sever access to Lower Hutt City at that point, creating additional pressure on the surrounding network.

SH2's Wellington to Upper Hutt corridor, which includes the section through Melling, is also identified as a Priority 1 project, the highest priority allocated to significant new activities, in the 2018 mid-term update of the RLTP. SH2 Melling Efficiency and Safety Improvements was identified as a project with funding committed for 2018-2021. [63] The RLTP mid-term review noted further investigations were being undertaken to ensure improvements at Melling appropriately support the RiverLink programme.

Wellington Regional Land Transport Plan (RLTP) 2021

This is a statutory plan under the Land Transport Management Act, and is prepared by the Wellington Regional Transport Committee – comprising representatives from all local councils in the region, GW, and Waka Kotahi. It provides strategic direction, including objectives, policies and transport priorities with a 10-30 year outlook - and includes a 3 and 6 year programme of multi-modal transport activities, which is essentially a bid for funding from the NLTF.

The Wellington Regional Land Transport Plan (RLTP) 2021 sets the high level direction for the development of the region's transport network, with a long term vision seeking 'A connected region, with safe, accessible and liveable places – where people can easily, safely and

[63] Melling Efficiency and Safety Improvements was the title of the project for the upgrades at Melling Intersection. This project has since been confirmed as part of RiverLink

sustainably access the things that matter to them – and where goods are moved efficiently, sustainably and reliably'.

The Wellington RLTP 2021 includes three headline targets that provide a strong signal about the focus for developing the regional transport network over the next ten years:

- 40% reduction in deaths and serious injuries on our roads by 2030
- 35% reduction in transport generated carbon emissions by 2030
- 40% increase in active travel and public transport mode share by 2030

The region has also identified a set of ten year transport investment priorities:

1. Public transport capacity
2. Travel choice
3. Strategic access
4. Safety
5. Resilience

The RiverLink project will be a key transformational infrastructure investment that is well aligned with this strategic direction and will contribute to safety, mode shift, emissions targets – as well as other priorities like resilience and access.

Regional Public Transport Plan (2021)

The Regional Public Transport Plan (RPTP) guides the design and delivery of public transport services, information and infrastructure in the Wellington region. The RPTP has a ten year strategic focus with particular attention to the coming three-yearly operational cycle. The RPTP 2021 is due to be adopted at the end of June 2021.

The RPTP has specific goals of increasing the mode share of public transport and improving accessibility to public transport. RiverLink is a key part of this, and the RPTP lists it as a significant opportunity to increase mode shift to public transport.

Wellington Regional Growth Framework 2021

The Wellington Regional Growth Framework is a regional level spatial plan that provides a 30-year vision for how the region will grow and respond to growth and urban development challenges. The purpose of the framework is to help to guide and co-ordinate regional scale urban planning and align investment in infrastructure and services.

It is a region-wide collaborative project between GW, the city and district councils within the region, Mana Whenua, and central government (primarily Waka Kotahi and the Ministry of Housing and Urban Development). It includes existing work and plans for accommodating an additional 200,000 people and 100,000 jobs in the region. The framework has 6 objectives:

- Increase housing supply and improve housing affordability and choice
- Enable growth that protects and enhances the quality of the natural environment and accounts for a transition to a low/no carbon future
- Improve multi-modal access to and between housing, employment, education and services
- Encourage sustainable, resilient and affordable settlement patters/urban form that make efficient use of existing infrastructure and resources
- Build climate change resilience and avoid increasing the impacts and risks from natural hazards, and

- Create employment opportunities.

Submissions closed in May on the Wellington Regional Growth Framework. A key spatial initiative from the Framework is the "Lower Hutt Structure Plan" which incorporates areas of rapid transit along the rail corridor and the RiverLink area. The Project will help to implement the objectives of the Wellington Regional Growth Framework by improving access to multi-modal transportation options, delivering urban development that will connect the River and the city and encourage further growth and revitalisation of Lower Hutt. The Project will also help to build climate change resilience to the new infrastructure and revitalisation through improved flood protection.

11.3.3 Local context

Central City Transformation Plan (CCTP) (2019)

Prepared by HCC and published in March 2019, the CCTP is:

"a strategic framework to guide future development. It is aimed at creating a vibrant 24-hour city focused firmly on the river, and contributing to the growth of Lower Hutt beyond the central city".

There are nine principles within the CCTP, which relate to a number of projects. RiverLink is one of the key initiatives identified as it will act as a catalyst for future public and private development in the city centre. The CCTP includes the following principles and projects which form part of the RiverLink Project components.

- **Consolidating the city's core -** Lower Hutt's central city is too spread out. Traditional on-street shopping is spread too thinly to create the variety and intensity that characterises successful city centres. RiverLink will assist HCC plans to concentrate retail within a pedestrian-orientated area bounded by Dudley and Margaret streets, Queens Drive and Laings Road. This is intended to support the development of a network of minor streets and lanes including east-west connections that open up the core central city to the river.
- **A clear, distinct route between the bridges –** Lower Hutt city centre's street layout evolved piecemeal from several early country roads, resulting in a street pattern which is confusing to visitors. HCC's objective is that RiverLink will enable the creation of a clear route from SH2 across the relocated Melling Bridge at Queens Drive and along Queens Drive to Ewen Bridge. This will include reconfiguring the intersection of Laings Road and Queens Drive, and management of pedestrian-vehicle conflict at Margaret Street and other east-west streets and lanes.
- **Turn to face the river -** Historically, commercial development focused on High Street and Queens Drive. The mainly north-south orientation of streets and the existing stop banks have cut off the river from the city centre. RiverLink will enhance the connections between the river and city centre, with the aim of creating a more distinctive character and a more economically competitive and vibrant area. This will include a "promenade" along the stop bank between Ewen and Melling bridges with the potential to integrate, especially at the northern end of Daly Street, with high-quality medium-rise apartments or business/commercial spaces with lower levels able to accommodate cafes, restaurants, retail and commerce, and east-west, as well as public open spaces and connections linking the city centre to the river and beyond.

Lower Hutt Growth Story (LHGS) (2018)

The LHGS, prepared by Hutt City Council, Greater Wellington Regional Council and Waka Kotahi is:

"a summary of the urban growth, land use, transport and resilience goals and activities for Lower Hutt. It considers the wider regional content that Lower Hutt sites within, and describes

the outcomes and objectives being pursued within the portfolios of urban growth, land use planning, transport, and natural hazard resilience being under by the partner agencies." (Hutt City Council, 2018)[64]

The growth strategy includes a high level summary of how much, and where, growth is likely to occur, the issues and challenges and the desired outcomes and strategic responses. The RiverLink Project is identified as a high priority project in each of the transport, land use and resilience categories and described as the catalyst to change the way the Lower Hutt city centre works by taking an integrated approach, combining the Melling Interchange improvements (including the new Melling Bridge), improved flood protection and urban renewal opportunities. This includes park and ride facilities to increase access to public transport and a new Melling Train Station location that provides easy rail access to the city centre via a new pedestrian/cycle bridge over the River.

The LHGS describes investment at Melling Interchange provides an opportunity to link in with planned flood protection works and the CBD Making Places strategy to protect and then rejuvenate the Central City, supporting improved liveability of this area, and providing for new residential and employment opportunities, serviced by proximity to Melling station.

RiverLink is described as the catalyst to achieve meaningful growth and shift land use priorities by orchestrating three significant agency projects towards a common goal.

11.4 Additional statutory consideration relevant to Notice of Requirement

11.4.1 Adequate consideration of alternatives (section 171(1)(b))

Section 171(1)(b) of the RMA requires the consent authority to have particular regard to whether the requiring authority has given adequate consideration to alternative sites, routes and methods of undertaking the works where a requiring authority does not have an interest in the land sufficient for undertaking the work, or it is likely that work will have a significant adverse effect of the environment.

As has been set out in Chapter 7 of this AEE, GW, Waka Kotahi and HCC have given extensive consideration to alternative sites, routes and methods for undertaking the work. As discussed previously in this AEE, this assessment does not require an assessment of all possible alternatives, nor does it require that the 'best' option under any particular assessment system be selected.

The alternatives assessment process followed is described in Chapter 7 of this AEE and further detail is available in Appendix E. The assessment process considered options in light of the relevant Project Partner's needs, technical and environmental constraints, and the social, cultural and economic environment of the area. The process included assessment of options by relevant independent experts. The process undertaken by GW, Waka Kotahi and HCC was robust, comprehensive and iterative, before arriving at the form of the Project as described in this AEE. The assessment of alternatives undertaken by GW, Waka Kotahi and HCC accordingly meets the relevant statutory tests.

---

[64] . The Partner Agencies are Hutt City, Greater Wellington Regional Council and Waka Kotahi NZ Transport Agency

11.4.2 Reasonably necessary to achieve objectives (section 171(1)(c))

Section 171(1)(c) of the RMA provides that when considering a NoR the decision maker must have particular regard to *whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority for which the designation is sought.*

The Project objectives are set out in 2.2 of this AEE.

A discussion of why the works are reasonably necessary for achieving the Project Partner objectives, including the objectives of each of the requiring authorities and the overall objectives, is provided below.

Greater Wellington Regional Council: Te Pane Matua Taiao

The Project works are reasonably necessary for achieving the objectives of GW because:

- they will improve flood protection of Lower Hutt's city centre and adjacent residential areas through the construction of new stopbanks, upgrade of existing stopbanks, and revised river channel form along Te Awa Kairangi between Ewen Bridge and Kennedy Good Bridge, to accommodate a greater flood flow than the existing environment, and
- the stopbanks have been designed to integrate with and support the transport works and the urban renewal and revitalisation of Lower Hutt city centre, in particular through the inclusion of shared pathways and a pedestrian/cycle bridge.
- In terms of public transport, the new Melling Station designation will provide for safe, modern, connected and accessible multi-modal transport facilities.

Waka Kotahi NZ Transport Agency

The Project works are reasonably necessary for achieving the objectives of Waka Kotahi because:

- they will improve the safety and resilience of SH2 at Melling, and improve travel time reliability along SH2, and to the Lower Hutt city centre and the Western Hills, through the provision of a separated interchange
- they will enhance modal accessibility and transport connections at Melling through the provision of the new Melling Station, shared pathways and a pedestrian/cycle bridge, and
- the interchange and bridge have been designed to integrate with and support the flood protection works and the urban renewal and revitalisation of Lower Hutt city centre.

Hutt City Council

The Project works are reasonably necessary for achieving the objectives of HCC because:

- they will enhance walking and cycling connections and amenity along and across Te Awa Kairangi through the provision of shared paths, public open space and a pedestrian / cycling bridge over the river
- promote the urban renewal and revitalisation of Lower Hutt city centre by creating a connection between Hutt City's city centre and Te Awa Kairangi, and
- enable future mixed-use development.

Overall

For the reasons set out above, the Project works are also reasonably necessary for achieving the overall objectives, as specified in 2.3 above.

Reasonable necessity of the designations

The designations are considered to be reasonably necessary to achieve the objectives of all three requiring authorities, and the overall objectives, as follows:

- The designations are necessary to ensure that the Project can be constructed, operated and maintained with certainty and efficiency
- The designations will enable the Project to be undertaken in a comprehensive and integrated manner, with all relevant Project components being taken into account,
- The designations will protect the Project area from future development which may otherwise preclude the construction of the Project; and
- The proposed construction timeframe for some aspects of the Project is a number of years away, and a designation of the land will provide certainty for GW, Waka Kotahi, HCC, landowners and the community of the future intended land use.

11.5 Section 105 assessment

Some of the resource consent applications are for discharge permits, involving discharges to air, and discharges of contaminants into water and onto land. Therefore section 105 is relevant. Section 105 outlines additional matters that consent authorities must have regard to for discharge permits in addition to the matters in s104(1), namely:

- the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
- the applicant’s reasons for the proposed choice; and
- any possible alternative methods of discharge, including discharge into any other receiving environment.

11.5.1 The nature of the discharge and the sensitivity of the receiving environment

Discharge permits are being sought in respect of stormwater runoff from earthworks; stormwater runoff from impervious areas of the Project once operational; discharge of contaminants to land; and discharges of dust to air. Detailed consideration has been given to methods for addressing any potential adverse effects of these discharges, and appropriate methods have been adopted (including through design and construction methods, such as conditions requiring stormwater treatment to be designed and undertaken in accordance with relevant best practice standards, implementation of best practice erosion and sediment control measures to be set out in an ESCP and SSESCPs, and the requirement for a Construction Air Quality Management Plan) to ensure effects are appropriately managed.

The nature of the proposed discharges and sensitivity of the receiving environment in relation to the discharges during construction and operation have been outlined in sections 9.3, 9.4, 9.5, and 9.12 of this AEE.

The sensitivity of the receiving environments can be summarised as follows:

- Te Awa Kairangi is identified as a river with significant indigenous biodiversity values in the PNRP. The water quality is assessed as excellent. Te Awa Kairangi has been assessed as having high ecological value.
- The affected tributaries are assessed as having moderate ecological value.

- The Te Awa Kairangi River Mouth and Estuary and Korokoro Estuary have low marine ecological value. Wellington Harbour has moderate ecological value and Petone to Ngauranga Foreshore has high ecological value.

Sedimentation is an existing issue within the above freshwater and coastal environments, particularly following rainfall events.

There is a continuum of sensitivity of adjacent activities to air – high sensitivity residential activities located to the northwest, north and south ends of the Project; moderately sensitive commercial activities in the Lower Hutt city centre; and low sensitivity light industrial activities and open spaces located along the alignment of Te Awa Kairangi and Pharazyn Street.

11.5.2 Discharges of contaminants to land and water during construction

During construction of the Project, discharges will occur to Te Awa Kairangi and affected tributaries. Discharges will largely consist of sediment run off from earthworks and general construction activities and suspended sediment as a result of activities within the active channel. The resultant effect of construction activities being that stormwater discharges, and the river, will contain higher levels of sediment than normal during the construction period. The extent of earthworks and construction activities has been minimised to the extent practicable, and where discharges are unavoidable, best practicable options will be adopted to remedy or mitigate effects where there is no feasible alternative discharge location or method.

Key measures to minimise the effects of discharges include:

- construction activities are conducted in staged and confined manner with limited footprints and durations
- management plan procedures to avoid, minimise, treat, monitor, and adapt
- monitoring and adaptive management procedures in management plans

Specific measures for relevant areas of the Project area are summarised below:

Active channel:

- avoiding work in low flow and ecologically sensitive seasons and procedures to avoid adverse effects on sensitive biodiversity
- conducting wet extraction works and bed disturbance activities in accordance with Project specific conditions, or otherwise in accordance with the Code of Practice for River Management Activities
- progressive staging of in river activities to minimise the area of disturbance and subsequently the volumes of sediment generation
- restricting the duration of works within the active channel to protect aquatic habitat from prolonged sediment exposure

River corridor:

- avoidance of works in heavy rainfall events
- progressive stabilisation to reduce the extent of disturbed surfaces and subsequent volumes of sediment generation
- removing or capping areas of silts and clays with potential for sediment generation
- short term stabilisation (rock armour, hard fills and metals, geofabric) when rainfall events are forecast
- use of treatment devices

Outside of the river corridor:

- avoidance of works in heavy rainfall events
- separating sources of clean water from active construction areas
- use of sediment treatment devices to treat sediment laden water before discharging to the river (via existing stormwater network or land)
- chemical treatment to maximise performance of devices where reasonably practicable

Contaminated land:

- ESC measures to reduce erosion and detain contaminated sediments on site
- contaminant testing and chemical treatment of any dewatering and stormwater runoff prior to discharge

Industry best practice site management and the proposed construction methodology will minimise effects on people and the environment to the extent practicable, particularly given works are required within and adjacent to areas with significant indigenous biodiversity values.

The Project also has the potential to result in discharges of other construction related contaminants to surface water (i.e. cementitious products and fuels and oils). These contaminants will be managed in accordance with industry best practice. Disposal of contaminated land and any water which is unsuitable for site treatment will be to trade waste or to off-site disposal (landfill) as an alternative to discharging into the natural environment.

The Construction Water Quality Assessment concludes that the effects of discharges of sediment during the construction phase of the Project will be minor.

11.5.3 Discharges to water during operation

A detailed description of the nature and quality of stormwater discharges from the operational phase of the Project is provided in the Stormwater and Operational Water Quality Assessment. Due to topography, Te Awa Kairangi is the only feasible discharge location for stormwater. The design has endeavoured to provide treatment where spatial constraints and access restrictions allow. There will be a significant reduction in the contaminant load being discharged to Te Awa Kairangi as a result of reductions in developed catchment areas as a result of the stopbank realignment, reduction in carpark areas and inclusion of treatment of runoff from the local roads where possible, newly developed carparks, along with treatment of discharges from the upgraded section of highway and the new bridge. The proposed approach to stormwater from the operational phase is considered to be the best practicable option.

11.5.4 Discharges to air

During the construction of the Project, discharges of dust will take place as a result of construction activities. These discharges are an unavoidable part of the construction process and cannot practicably be discharged to another receiving environment due to their geographic location. There are a range of methods proposed for dust control and best practice site management methods will be used during the construction phase to minimise effects on people and the environment, as set out in the CAQMP required to be prepared.

11.6 Section 107 assessment

The Project is to be considered under Section 107 of the RMA. Section 107(1) sets out restrictions on granting discharge permits if, after reasonable mixing, the contaminant or water discharged is likely to give rise to certain effects in the receiving waters (as listed in s107(1)(c)-(g)).

The Project involves discharges to water during both the construction and operational phases. The discharges meet the tests of Section 107, allowing the grant of discharge permits for the following reasons:

1. The potential for effects associated with odours, conspicuous oils, floatable or suspended materials on receiving waters from construction and operational discharges is assessed in sections 9.3, 9.4, 9.7, and 9.9 of this AEE, and potential effects are assessed as minor (s107(1)(c) and (e)).
2. The Construction Water Quality Assessment concludes that there will be minor effects on the colour and visual clarity of Te Awa Kairangi post mitigation as a result of suspended sediment. Any effects will be of localised extent and temporary duration, as they are limited to construction activities and the construction period. After reasonable mixing these discharges are not expected to be conspicuous (s107(1)(d)).
3. The Marine Ecology and Coastal Avifauna and Freshwater Ecology assessments conclude that there will be no significant adverse effects from the discharge of contaminants on aquatic life during construction and operation of the Project (s107(1)(g)).

11.7 Part 2 analysis

Section 104(1)(b) of the RMA sets out the matters that decision-makers are required to have regard to when considering an application for resource consent and any submissions received. Similarly, section 171(1)(a) of the RMA sets out the matters that decision-makers must have particular regard to when considering a NoR and any submissions received.

Any such consideration, however, is subject to Part 2 of the RMA which sets out the purpose and principles of the RMA. The purpose of the RMA as stated in section 5 is to promote the sustainable management of natural and physical resources. The Court of Appeal in *RJ Davidson Family Trust v Marlborough District Council*[65] has confirmed that decision-makers in resource consenting matters must have regard to Part 2 where *"it is appropriate to do so"*[66] however, where the relevant plan provisions have clearly given effect to Part 2 there may not be a need to do so as it *"would not add anything to the evaluative exercise."*[67] Nonetheless, it is a requirement of Clause 2(1)(f) of Schedule 4 to the RMA that an application for a resource consent includes an assessment of the activity against the matters set out in Part 2.

Part 2 of the RMA provides further direction on the matters of national importance (section 6), other matters (section 7) and the principles of the Treaty of Waitangi (section 8) which require different levels of response ("recognise and provide for," "have particular regard to," and "take into account," respectively).

When the benefits of the Project are considered alongside measures to avoid, remedy and mitigate adverse effects, it is considered the Project promotes the sustainable management of natural and physical resources and is consistent with the purpose and principles of the RMA. The purpose of the RMA will be achieved by confirming the NoRs and granting the resource consents sought, subject to the proposed designation and consent conditions set out in this AEE.

---

[65] *RJ Davidson Family Trust v Marlborough District Council* [2018] NZCA 316, [2018] 3 NZLR 283.
[66] *RJ Davidson Family Trust v Marlborough District Council* [2018] NZCA 316, [2018] 3 NZLR 283 at [47] and [75].
[67] *RJ Davidson Family Trust v Marlborough District Council* [2018] NZCA 316, [2018] 3 NZLR 283 at [75].

11.7.1 Section 5 - Purpose

The Project will enable people and communities to provide for their social, economic and cultural wellbeing and for their health and safety through:

a. Supporting the economic growth of Lower Hutt city centre, through urban development and by pivoting the city centre to face Te Awa Kairangi

b. Providing significant community social and transport benefits by improving transport access and safety between SH 2 and central Lower Hutt, and

c. Increased health and safety through increased protection against natural hazards resulting from an improved flood protection system.

d. The construction, operation and maintenance of the Project is necessary for the Project Partners to meet their objectives, as set out in section 2.2 of this AEE.

In balancing these considerations with the matters in section 5(2) of the RMA, the following conclusions are derived from the assessment in the preceding chapters of the AEE:

a. The Project will help meet the future transportation, population and commercial growth and flood protection needs, and does not preclude future opportunities for other transport, flood mitigation or urban development improvements

b. The Project will help safeguard the life supporting capacity of natural resources, specifically:

c. Air - by reducing traffic congestion on SH2 and local road network

d. Water – stormwater discharges will be treated and there will be overall long-term benefits arising from re-vegetation and planting, and

e. Ecosystems – by avoiding, remedying, mitigating, and offsetting effects on ecological values.

f. The Project includes a suite of measures appropriate to the scale and significance of the potential effects that may arise during the construction and operation of the Project to avoid, remedy or mitigate those adverse effects.

For these reasons, the Project will achieve the RMA's purpose of sustainable management of natural and physical resources.

11.7.2 Section 6 – Matters of national importance

The section 6 matters of national importance that must be recognised and provided for are addressed below:

> *(a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development*

The proposed full reshaping of the riverbed to set the channel shape will establish a new natural meander pattern suitable for a widened channel. The re-shaping will result in a more natural channel form and as such will enhance the natural character of the river. During the reshaping works, there will be a significant but temporary effect on natural character, in the area of the river which is being worked. These works will be staged to minimise the effects to the extent practicable. Once the works are complete, the Project will increase the natural character of Te Awa Kairangi, compared to the existing moderate values.

Overall, the Project recognises and provides for the natural character of Te Awa Kairangi.

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna

Project works will avoid to the extent practicable areas of significant vegetation and significant habitats of indigenous fauna. Mitigation measures are proposed to address unavoidable effects, including replacement planting which is intended to replace lost vegetation and restore habitats as quickly as possible. Positive effects will arise through the mitigation proposed in the river corridor, i.e. through the planting of native forest species that would have been the predominant vegetation in the floodplain historically, this represents a trade-up in comparison to the existing willow and flood protection plantings. The construction methodology and conditions of consent will protect significant habitats of indigenous fauna (Te Awa Kairangi) during construction with freshwater habitat expected to recover, to the point where aquatic habitat will be enhanced, post-construction. An offset has also been proposed in respect of the permanent aquatic habitat lost in Harbour View Stream, and terrestrial ecology removal from the hillside above SH2. Overall, it is expected that proposed mitigation and offsetting measures proposed will appropriately protect significant indigenous vegetation and significant habitats of indigenous fauna.

(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers

The Project will enhance public access to and along Te Awa Kairangi through the provision of a new walking promenade atop of the stopbank, with access steps and ramps providing access to the promenade from Lower Hutt city centre; a new pedestrian / cycle bridge across the river; and up to six ūranga (large concrete stepped terraces to provide access to the river and beaches of Te Awa Kairangi).

(e) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga

The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga was taken into account in the development of the Project and through the preparation of the CIA. The MWSG will provide ongoing opportunities for Mana Whenua to incorporate cultural values into the Project through the Urban and Landscape Master Plan during detailed design, including through interpretive signage, input into the development of management plans, development and implementation of cultural protocols and observation and input into construction monitoring processes. The MWSG and these opportunities are secured by conditions of consent.

(f) the protection of historic heritage from inappropriate subdivision, use, and development

The archaeology and historic heritage assessment generally concludes that overall there will be low to low-moderate potential adverse effects as a result of undertaking earthworks on the archaeology and historic heritage values present within the Project area. Conditions are proposed to protect historic heritage values including effects relating to the existing Melling Station building, which although not formally identified, has heritage value. The proposed mitigation also includes adopting an On Call Procedure for areas where archaeological values have not yet been identified in conjunction with an Archaeological Authority to be implemented during construction. Visual and virtual records of representative examples of the buildings scheduled for demolition will also be undertaken as part of this Project. Other mitigation relates to managing effects of construction in proximity to high values such as the historic Methodist cemetery located on Bridge Street and heritage buildings listed in the District Plan which are adjacent to the Project area, but not directly affected by the works.

(h) the management of significant risks from natural hazards

The flood protection works will reduce risks of flooding for Lower Hutt city centre and as such contribute to the management of significant risks from natural hazards. The Natural Hazards and Geotechnical Assessment (Technical Report #15) has identified several natural hazards that could have effects on Project elements. Design and construction measures will be used to mitigate these risks to the extent possible. Overall, the risks to Project elements from natural hazards have been assessed as tolerable, and so significant risks are considered to be appropriately managed.

11.7.3 Section 7

The following matters in Section 7 of the RMA have been given particular regard to:

- Kaitiakitanga and the ethic of stewardship (s.7(a) and 7(aa)) have been recognised and actively incorporated into the Project design and proposed effects management approach including the preparation of the Kaitiaki Strategy for the Project, and involvement of Mana Whenua in the development of particular management plans. Kaitiakitanga and stewardship will continue to be recognised through the detailed design and construction of the Project, secured by the MWSG framework and conditions of consent.
- The efficient use and development of natural and physical resources (s.7(b)), whereby the Project will improve flood protection and improve protection of existing investments in Lower Hutt city centre, while improving efficiency of SH2 and the local roading network
- The maintenance and enhancement of amenity values (s.7(c)) has been recognised, through the provision of improved public open spaces, and riparian and landscape planting that integrates with the shared pathways and pedestrian/cycle bridge. The Project’s effects on amenity values during construction, especially those related to water quality, noise and air quality, will be managed through implementation of construction management plans, adopting best practice techniques and site management measures. The Urban and Landscape Master Plan and supporting consent conditions will appropriately manage, and are expected to enhance in the longer term, visual and natural character amenity effects on residents and users of the river corridor.
- The Project will avoid any material adverse effects on the intrinsic values of Te Awa Kairangi’s ecosystems (s.7(d). with adverse effects on freshwater and the natural environment being limited in both spatial extent and duration (temporary) and appropriately managed in a manner which maintains, and where possible enhances, the intrinsic values of ecosystems.
- The maintenance and enhancement of the environment (s.7(e)), protection of ecosystems and the quality of the environment (both natural and physical) were key considerations during the alternatives assessment process and development of the construction conditions which sought to avoid adverse effects to the greatest practicable extent. Where adverse effects could not be avoided, mitigation and offsetting has been proposed to ensure that the quality of the environment is maintained and where possible enhanced. The Project is expected to result in overall positive effects on the Te Awa Kairangi catchment and positive effects on the built environment.
- Te Awa Kairangi provides habitat to trout, and this has been considered in the Project design and construction conditions and proposed monitoring. Any effects on trout are expected to be temporary and limited in extent, with relatively rapid recovery of trout populations.
- The effects of climate change (s.7(i)) have been considered through the design of the flood mitigation works and operational stormwater and bridge design, with predicted changes in rainfall rates and intensity informing the design standards for the Project.

11.7.4 Section 8

GW, Waka Kotahi and HCC recognise their role in taking into account the principles of the Treaty of Waitangi through their partnership with local iwi. Principles of the Treaty of the Waitangi have been taken into account through consultation with the relevant iwi early in the development of the Project. In developing the Project, recognition has been given to both the relationship of Mana Whenua to their lands, culture and traditions in this area and the commitment to partnership between Mana Whenua and GW, Waka Kotahi and HCC. In particular, Taranaki Whānui and Ngāti Toa have provided cultural input and advice to inform the Project design, and have prepared the Kaitiaki Strategy for the Project, which provides a holistic guide all stages of the Project to enhance the mana and mauri of Te Awa Kairangi. This partnership and relationship will be maintained in the subsequent phases of the Project through the MWSG framework, secured by proposed designation and resource consent conditions.

12. References

Abley, S., Durdin, P., & Douglass, M. (2010). *Integrated transport assessment guidelines: NZ Transport Agency research report 422.* Wellington: NZ Transport Agency.

Atapattu, D. (2015a). *Hutt City Centre Upgrade Project Options for Consultation.*

Atapattu, D. (2015b). *Hutt River City Centre Upgrade Project: Community Feedback on Integrated Concept Design options - September 2015.*

Beca Limited. (2017). *Riverlink Daly St Interface Structures Design Statement (TR/14).*

Boffa Miskell. (2015). *Hutt River City Centre Upgrade Project - Options Evaluation Report.*

Boffa Miskell Limited. (2018). *Riverlink Landscape Architecture, Urban Design and Ecological Design Technical Report (TR17/16).*

Cameron, D. (2016). *Ecological Effects of Flood Protection Activities in the Hutt River - 2016 ADDENDUM.*

Cameron, D. (2016). *Effects of Flood Protection Activities on Aquatic and Riparian Ecology in the Hutt River.*

Cameron, D. (2018). *Baseline Monitoring of Aquatic Habitat Quality and Fish Communities: 2017/2018.*

Cameron, D. (2019). *Gibbons Street Works, Hutt River: Ecological monitoring.*

Damwatch Engineering Limited. (2018). *Riverlink Riverworks Preliminary Design Technical Report (GW/RiverLink-T-17/09).*

DHI Limited. (2017a). *RiverLink, Riverworks Preliminary Design, Modelling Bed Level Changes of the Hutt River.*

DHI Limited. (2017b). *RiverLink, Riverworks Preliminary Design, Hydraulic Modelling.*

Earth in Mind Limited. (2014). *Lower Hutt Aquifer Model Revision (HAM3): Sustainable management of the Waiwhetu aquifer.*

Fuller, I. C., Death, R. G., & Death, A. M. (2015). Developing an index of natural character to monitor change in river condition in response to river engineering. *B1 - Hydromorphologie Regionale / Regional Hydromorphology*, 1-3.

G & E Williams Consultants and Christensen Consulting Limited. (2018). *The River Channel Design Assessment of Options and Preliminary Design Report.*

gazette.govt.nz. (2015). *Resource Management (Approval of NZ Transport Agency as a Requiring Authority) Notice 2015*. Retrieved from https://gazette.govt.nz/notice/id/2015-go6742

GHD Limited. (2014). *Melling Gateway Strategic Case.*

GHD Limited. (2015). *Melling Gateway Programme Business Case.*

GHD Limited. (2017). *Riverlink Project and Hutt City Council Stormwater.*

GHD Limited. (2018). *Preliminary Concept Design Technical Report Transport Assessment (TR17/12).*

GHD Limited. (2020a). *Assessment of Alternatives 1-6 Assessment Report.*

GHD Limited. (2020b). *SH2 Pedestrian Overbridge.*

GHD Limited. (2021a). *RiverLink City Edge Multi Criteria Analysis Report.*

GHD Limited. (2021b). *City Edge MCA Analysis Addendum.*

Greater Wellington Regional Council. (2001). *Hutt River Floodplain Management Plan.*

Greater Wellington Regional Council. (2019). *Significance and Engagement Policy*. Retrieved from http://www.gw.govt.nz/assets/Uploads/Councils-Significance-and-Engagement-Policy-August-2019.pdf

Greater Wellington Regional Council. (2021). *GWRC Web Map Viewer*. Retrieved from https://mapping.gw.govt.nz/GW/GWpublicMap_Mobile/?webmap=d4e8a3b2241045e68fd8fc9f91973b10

Greater Wellington Regional Council. (2021). *Hutt groundwater diagram*. Retrieved from http://www.gw.govt.nz/assets/Our-Environment/Water-Supply/PDFs/Hutt-groundwater-diagram.jpg

Heath, M., & Greenfield, S. (2016). *Benthic cyanobacteria blooms in rivers in the Wellington Region: Findings from a decade of monitoring and research.* Wellington: Greater Wellington Regional Council.

Hutt City Council. (2009). *CBD Making Places Report*. Retrieved from http://www.huttcity.govt.nz/Your-Council/Projects/riverside-promenade---riverlink/Making-places/CBD-Making-Places-Report/

Hutt City Council. (2018). *Lower Hutt Growth Story*. Retrieved from http://iportal.huttcity.govt.nz/Record/ReadOnly?Tab=3&Uri=5055959

Hutt City Council. (2018). *Significance and Engagement Policy*. Retrieved from http://iportal.huttcity.govt.nz/Record/ReadOnly?Query=container:%5Buri:3677911%5D&Tab=31&Uri=3677410&Page=3

Hutt City Council. (2019). *Central City Transformation Plan sections*. Retrieved from http://www.huttcity.govt.nz/Your-Council/Projects/central-city-transformation-plan/central-city-transformation-plan-sections/

Hutt City Council. (2020). *RiverLink Strategic Communications, Marketing and Engagement Plan.*

Hutt City Council. (2020). *Riverside Promenade Business Case – Building the Future.*

Infometrics & PS Consulting. (2015). *Flood Protection: Option flexibility and its value.*

Isthmus. (2021). *Te Awa Kairangi RiverLink Urban and Landscape Design Framework.*

Isthmus Limited. (2019). *RiverLink Te Awa Kairangi - Pedestrian and Cycle Bridge Concept Design Report.*

New Zealand Government. (2018). *Government Policy Statement on Land Transport 2018/19 - 2027/28*. Retrieved from https://www.transport.govt.nz//assets/Uploads/Report/Government-Policy-Statement-on-land-transport-2018.pdf

NIWA. (2017). *Hutt River Flood Frequency Update.*

NIWA. (2018). *New Zealand Fish Passage Guidelines: For structures up to 4 metres.* Hamilton: NIWA.

NZ Transport Agency. (2016). *Draft State highway public engagement guidelines.* Wellington: NZ Transport Agency.

NZ Transport Agency. (2016). *Environment and Social Responsibility Policy*. Retrieved from https://www.nzta.govt.nz/assets/resources/environmental-and-social-responsibility-manual/docs/environmental-and-social-responsibility-policy.pdf

NZ Transport Agency. (2016). *Guide to assessing road-traffic using NZS 6806 for state highway asset improvement projects.* Wellington: NZ Transport Agency.

NZ Transport Agency. (2016). *Social impact guide.* Wellington: NZ Transport Agency. Retrieved from https://www.nzta.govt.nz/assets/resources/guide-to-assessing-social-impacts-for-state-highway-projects/16-243-People-and-place-state-highway-social-impact-guide-2017-FINAL.pdf

NZ Transport Agency. (2017). *Draft Melling Intersection Improvements Indicative Business Case.*

NZ Transport Agency. (2018). *NZ Transport Agency Statement of Intent*. Retrieved from https://www.nzta.govt.nz/assets/resources/statement-of-intent/2018-2022/soi-2018-2022.pdf

Opus Limited. (2018). *Riverlink Preliminary Design Report for Stopbanks (TR17/10).*

Paul, B., & Wallace, P. (2015). *Hutt City Centre Upgrade Project - River Corridor Options.*

Polvere, R. (2018). *RiverLink River Channel Design Channel Alignment: Options 1 and 2 Selection Process.*

Saunders, W. S., Beban, J. G., & Kilvington, M. (2013). Risk-based approach to land use planning. *GNS Science Miscellaneous Series*, 97.

Saunders, W. S., Mathieson, J. E., Lawrence, J., Dissen, R. J., Dellow, G. D., Power, W. L., . . . Townsend, D. B. (2016). *Review of hazard information for Hutt City: GNS Science Consultancy Report 2016/74.* Lower Hutt: GNS Science.

Stantec. (2018). *Melling Link - Further Options Report.*

Stantec. (2019a). *Melling Intersection Improvements MCA Workshop (June 2018) Report.*

Stantec. (2019b). *Melling Transport Improvements SSBC.*

Stark, J. D., & Maxted, J. R. (2007). *A User Guide for the Macroinvertebrate Community Index.* Wellington: Ministry for the Environment.

Stats NZ. (2021). *Business demography statistics*. Retrieved from NZ.Stat: http://nzdotstat.stats.govt.nz/wbos/Index.aspx?_ga=2.159427901.1263296918.1621546628-744988959.1613602543

The Treasury. (2019). *Our living standards framework*. Retrieved from https://www.treasury.govt.nz/information-and-services/nz-economy/higher-living-standards/our-living-standards-framework

Waka Kotahi. (2020). *Te Whanganui A Tara Wellington*. Retrieved from Waka Kotahi Arataki Version 2 - Wellington: https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/regional-summary-wellington-august-2020.pdf

Wellington Regional Council. (2001). *Hutt River Floodplain Management Plan - for the Hutt River and its Environment*. Retrieved from https://www.gw.govt.nz/assets/Our-Services/Flood-Protection/Hutt/FP-Hutt-River-FMP.pdf

Appendices

Please see separate documents for the AEE appendices