Summary of the Christchurch Multi-Hazards Study

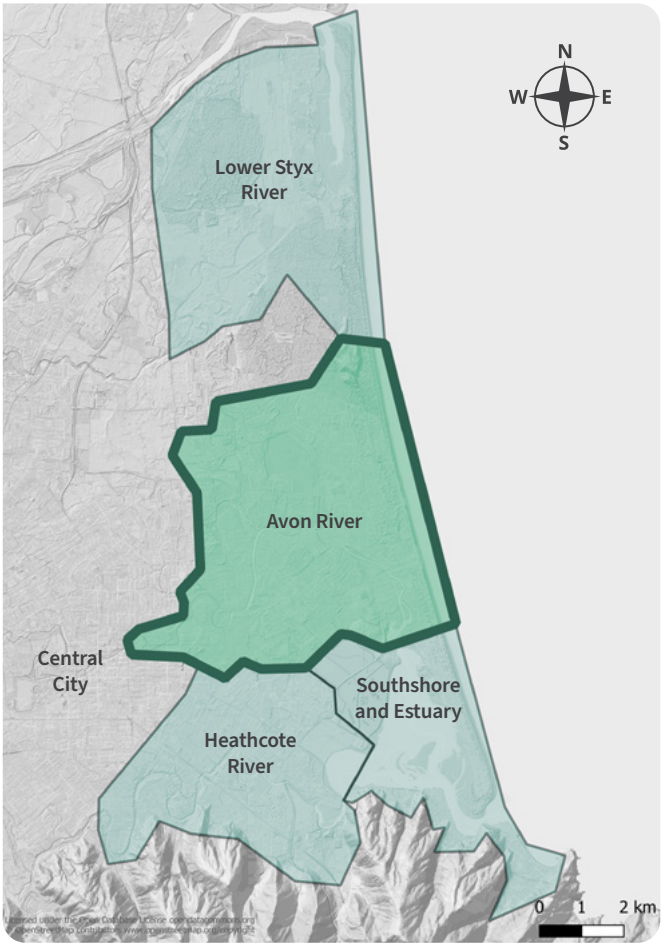
Stage 3

June 2026

Why this study was done and the area it covers

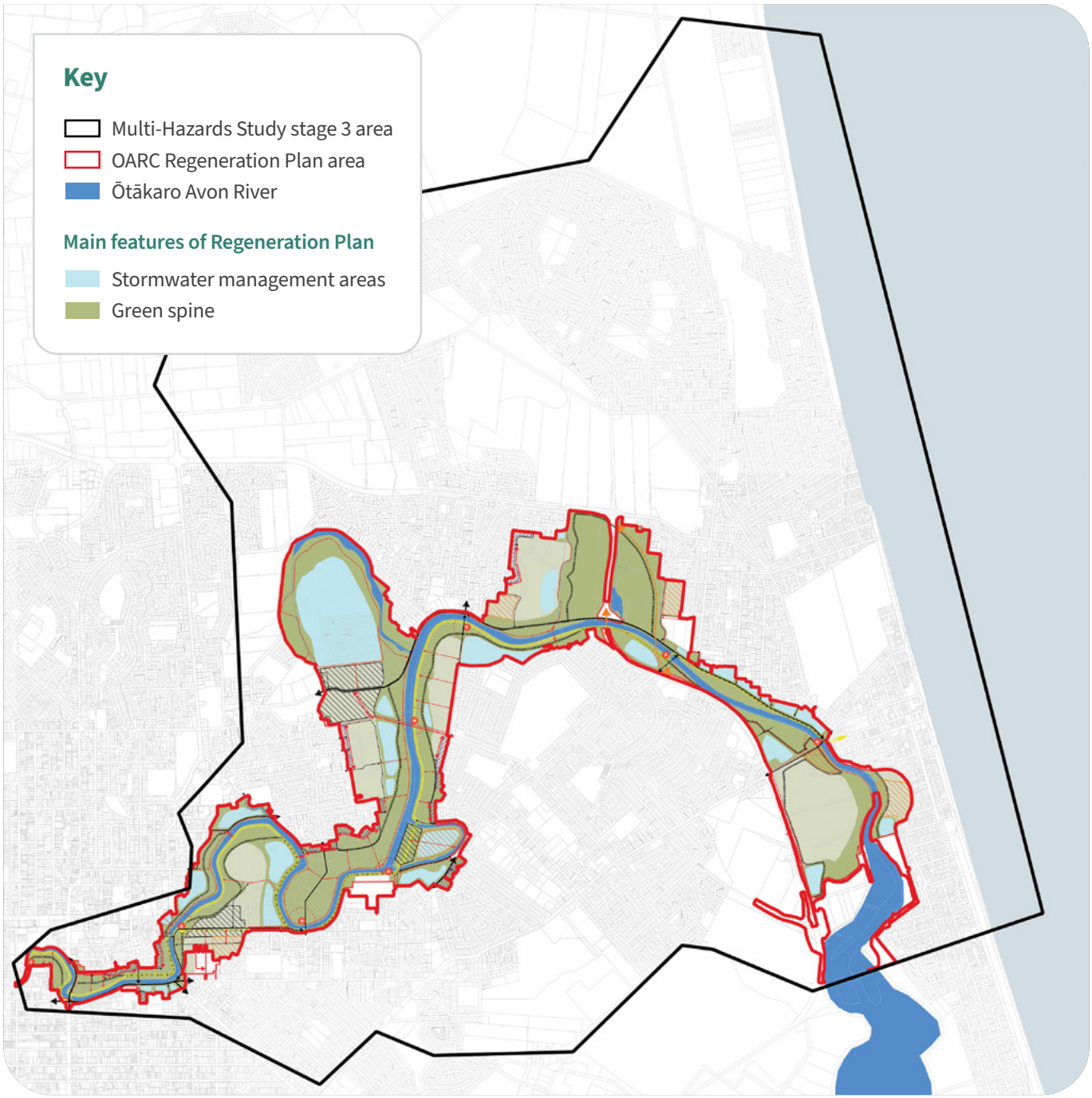
Christchurch is low-lying and mostly flat, and faces flooding risks from storms, waterways, and the sea. Since the Canterbury earthquakes of 2010 and 2011, the city has also been exposed to ongoing land settlement (vertical land movement). This has lowered ground levels, increasing flood risk in some places.

In 2017, we started the Multi-Hazards Study to understand how different natural hazards combine to affect flooding risk and what it might mean for our flood defences. These hazards include river flooding, heavy rainfall, rising groundwater, earthquakes, vertical land movement, coastal flooding, coastal erosion, and tsunami.



What is the Ōtākaro Avon River Corridor?

This 600-hectare area flanks the Ōtākaro Avon River and is the former Residential Red Zone, now under Council ownership. There is a regeneration plan for future use of the area that includes large areas of ecological restoration, flood defences, stormwater management areas, and a wide range of other activities.



Stage 3 of the study focuses on the lower Ōtākaro Avon River catchment, including the Ōtākaro Avon River Corridor (OARC).

As a catchment study, it takes a broad approach without drilling down to details, such as risks to individual properties, but provides general information about hazards across the wider area.

This area is low lying and already experiences flooding from the river and heavy rainfall. In some places, groundwater levels are high. Flood risk in this area is expected to increase over time.

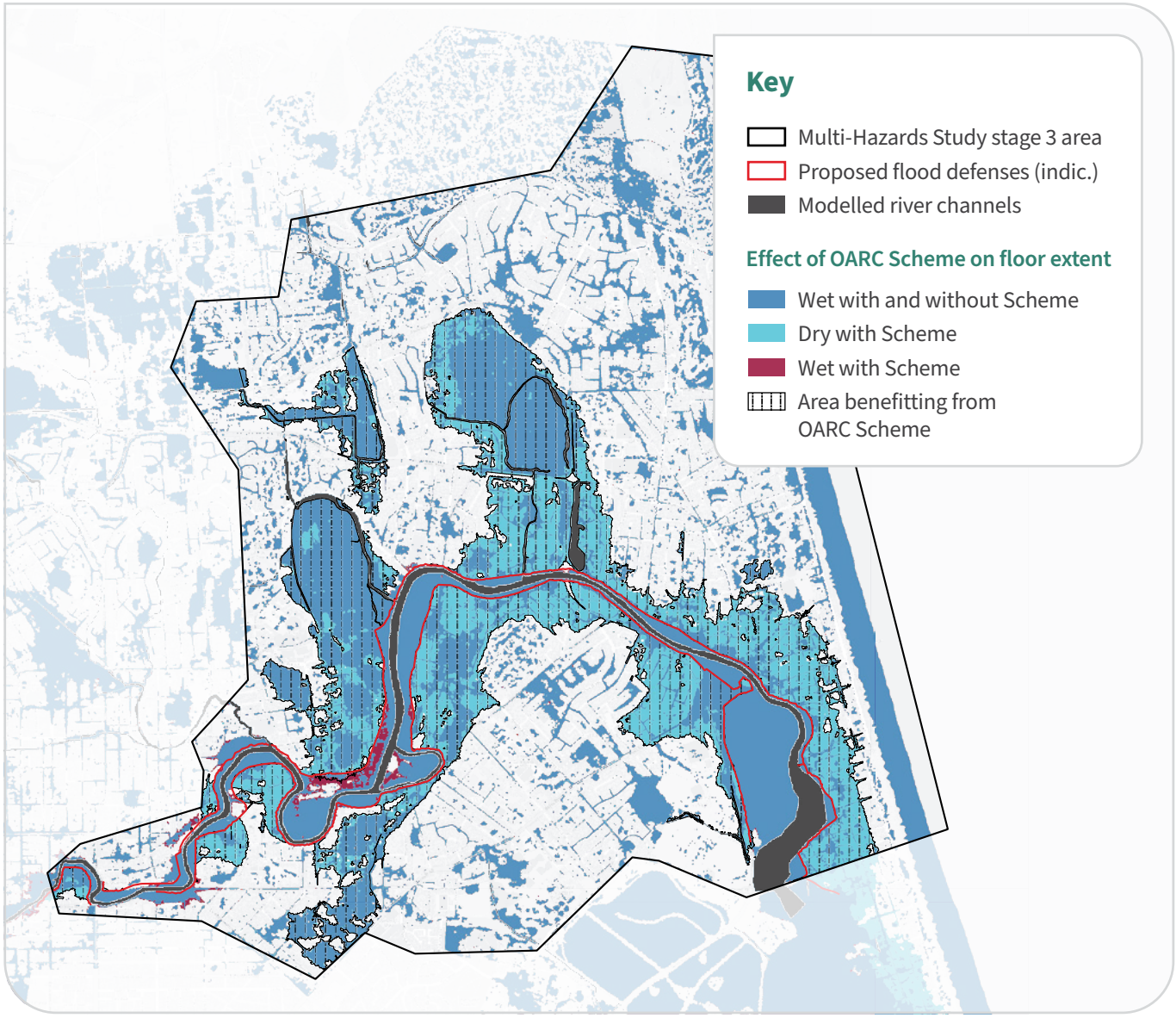
The findings of this study will help us plan, design, and build flood management in the OARC to last the next 30 years. They will also help us plan longer term flood defence infrastructure in the area through the Coastal Hazards Adaptation Planning (CHAP) programme, which will work with the community to consider future responses to coastal hazards and flooding.

What defences are already in place and what's proposed?

We already have stopbanks along the banks of the Ōtākaro Avon River. These were built decades ago and have had several repairs and upgrades since the earthquakes. They are suitable for today's sea and flood levels but will become less effective over time and were designed to last only another eight to 13 years.

The plan over the next 10 years or so is to build new flood defences and stormwater pump stations within the OARC, set back from the river's edge. The defences are intended to manage flooding from the river, rainfall and tides over the next 30 years, while allowing more space for nature and for floods.

The new defences will be designed so they could be raised in the future to respond to sea level rise and land movement. Decisions about longer term flood protection beyond this period will be considered through the CHAP programme.



Effect of OARC Scheme on 0.5% AEP (or a 1-in-200 year) flood extent in approximately 2060 (0.45m sea level rise from 2020).

What happens if flood risk isn't managed?

Modelling shows that the flood risk in the lower Ōtākaro Avon River catchment will increase significantly if no new flood management work is done.

By around 2060, about 3500 buildings within the study area could be exposed to above-floor flooding during an extreme flood event, about twice today's level of risk. By 2100, this could increase to around 5600 buildings. This is mainly driven by sea level rise, more rainfall, and ongoing land settlement. (These estimates are based on assumed building floor levels, are uncertain and could be an overestimate.)

The increase in flood risk also has significant financial consequences. If no additional flood management work is carried out, flood damage is estimated to total around $1 billion by 2060 and around $3 billion by 2100. Most of this damage would be to private property.

How effective are the proposed OARC flood defences?

The study found that the proposed new higher OARC flood defence scheme would significantly reduce river flooding risk within the protected area.

By around 2060, the scheme could significantly reduce the number of buildings exposed to above-floor flooding by about 2200 buildings. If the proposed new flood defences were raised by 2100, they could reduce risk for an additional 1500 buildings.

In economic terms, the scheme could avoid about $630 million in flood damage by 2060 and around $2.2 billion by 2100 (if the new flood defences were raised). The estimated cost of building defences is lower than the damage costs avoided, meaning the scheme is considered economically justified for managing river flooding. However, this does not address all flood-related risks.

Key

- Multi-Hazards Study stage 3 area
- OARC Regeneration Plan area
- Approx. limit of area benefiting from OARC Scheme in 2060
- New stopbanks
- New pumps

Change in depth with OARC Scheme

- < -0.5 m
- -0.5 to -0.25 m
- -0.25 to -0.1 m
- -0.1 to -0.01 m
- No change
- > +0.01 m

Change in flood depth with OARC Scheme for 0.5% AEP for 0.45 m SLR (~2060) and approximate extent of the area benefiting from the OARC Scheme.

What risks remain, even with flood defences?

Earthquakes

Earthquakes could damage flood defences and underground services, and ongoing land movement could increase flood risk over time. If another large earthquake occurred, there could be very high costs to repair flood defences and restore services. No engineered structure is completely risk-free.

If flood defences fail, particularly during an earthquake, flash flooding could occur, which would be difficult to predict and manage.

Groundwater

Groundwater is a significant ongoing risk. By around 2060, rising groundwater could affect about 25% of buildings within the area protected by the proposed OARC scheme, increasing to around 42% by 2100.

Managing groundwater could be very costly, and the effectiveness of groundwater management is unknown. High groundwater can cause issues including access difficulties from sustained ponding, damp homes and outbuildings, affect vegetation and limit how land is used.

Stormwater

Stormwater flooding may still occur in some areas when the stormwater network of pipes, drains and streams is overwhelmed during heavy rainfall. The proposed flood defence scheme does not address flooding in the stormwater network away from the OARC.

The map on the previous page shows these areas and also some areas where stormwater ponding could be made worse by the scheme, which will need to be addressed as the scheme design develops. Other programmes and projects listed in our long-term plan aim to reduce stormwater network flooding.

Tsunami

The flood defences are not designed to protect against a tsunami. Large tsunami events could flood the area, with seawater flowing over the coast or upriver. Stopbanks could trap the seawater and make the flooding more severe. Evacuation and emergency planning remain essential to managing tsunami risk.

Why are development controls still important?

Not all risks can be removed, so flood defences alone are not enough. Managing risk also requires planning controls, such as restrictions on land use and minimum building floor levels. These controls help reduce exposure to flooding and prevent future development from increasing risk. Such controls work alongside flood defences to manage overall risk. Plan Change 12 aims to manage land development in areas affected by coastal hazards.

What does this mean for future decisions?

There is significant uncertainty in how hazards will change over the long-term. This study shows that flood defences provide important benefits over the next few decades but have limits. Future decisions will need a combination of approaches, such as; flood protection, planning controls, and service withdrawal and retreat. Community involvement will be key, and will be arranged through programmes of work such as CHAP.

What were the findings of the peer review?

The study was peer reviewed by a panel of experts to ensure its technical quality and robustness.

Download the peer review findings and full report at the link below, under **Learn more** > **Technical reports**:

ccc.govt.nz/environment/coast/adapting-to-coastal-hazards/coastal-hazards

Overall conclusion

If no action is taken, flood risk in the Ōtākaro Avon River Catchment will gradually increase as sea levels rise, rainfall intensifies, and the existing stopbanks reach the end of their life.

Interim flood defences are under way and will provide significant benefits over the next 30 years by reducing river flooding. However, they don't remove all the risk. Groundwater, surface flooding from stormwater, earthquakes, and tsunami remain important concerns even once the flood defences are in place.

Managing flood risk will continue to require a combination of infrastructure, planning controls – such as minimum floor levels – and adaptation. Longer-term decision-making will be achieved through the Coastal Hazards Adaptation Planning (CHAP) programme.

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Christchurch City Council