Head of Lake Whakatipu Natural Hazards Adaptation Strategy Overview

Version 1 | May 2025

COVER ARTWORK: CONNIE ANDERSON

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> *It's definitely a unique community and it values its environment. I think underpinning all of this is this understanding that the environment is bigger than us.*

Otago Regional Council

QUEENSTOWN LAKES DISTRICT COUNCIL

Emergency Management Otago
Te Rākau Whakamarumaru Ōtākou

1. What is this Strategy?

Preface

The Head of Lake Whakatipu Natural Hazards Adaptation Strategy (the Strategy) is a partnership between Otago Regional Council, Queenstown Lakes District Council, Civil Defence Emergency Management Otago and the community.

It provides a common direction for our natural hazards management and adaptation planning and decisions at Head of Lake Whakatipu / Whakatipu Waimāori. It also supports everyday decision making by individuals and the community.

The Strategy has been developed over five years and is the result of collective effort. A range of organisations, subject matter experts and individuals have contributed.

Natural hazard resilience at the Head of Lake Whakatipu is reliant on a strong foundation of existing responses. Our **Action Plan** aims to build and improve upon our foundation.

As the landscape and climate change, we may need to consider big questions — do we do the same? Do things better? Do things differently? Our **Future Toolbox** contains possible responses that may help us adapt further as we face future changes.

Possible future responses are high-level concepts at this stage (not commitments). More information about detailed costs, benefits and risks would be required to inform future decision making.

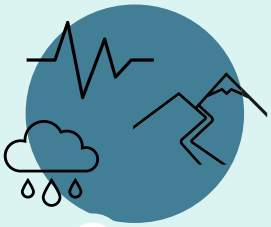
Over time we will review, adjust, and improve this first version of the Strategy. We will also track progress on our actions and check in with the community.

Mana whenua, key stakeholders, and the community are encouraged to continue their involvement in implementation and future versions.

The Strategy is a non-statutory plan. It does not carry decision-making power or create any legal obligations. Other statutory processes, such as long-term plans, also offer opportunities for public participation and alignment. This highlights the shared responsibility in managing natural hazards in the area, now and in the future.

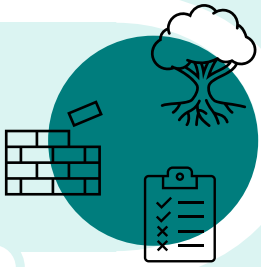
Our adaptation journey

The Strategy has been developed using the Dynamic Adaptive Pathways Planning approach, which includes the following steps:

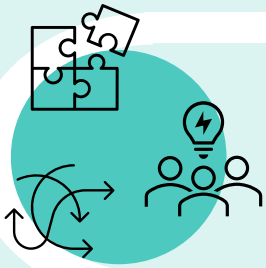


What is happening? Study our changing weather and environment. Assess the hazards and risks facing the Head of Lake Whakatipu. Gain a shared understanding of the science and local knowledge.

What matters most? Work with the community and mana whenua to understand what they value most about the Head of Lake Whakatipu area — including places, things, and other taoka (treasures).



What can we do? Identify a long list of possible responses for managing risk and adapting to change. Evaluate the high-level pros and cons.



Make it happen. Combine the existing responses that we rely on into a strong foundation and identify possible future pathways (covering different areas and time frames). Agree on signals, triggers and events that mean it's time to put different parts of the plan into action.

Create a plan. Capture everything in an Adaptation Strategy. Action what we can within current constraints. Keep the plan moving forward.

We are here

Is it working? Our environment and climate keep changing, and we do too. Keep monitoring for success and for signals that it's time to shift pathways.

Improve things bit by bit. Check in with the community, review and update the Strategy regularly. Take advantage of new opportunities.

How can we support the community to adapt, live and thrive into the future?

> *People come from all walks of life and the community is a lot more diverse than it used to be — community still comes together when it needs to.*

'The Head of the Lake' has a strong community spirit and self-organises to meet community aspirations.

We are facing natural hazard challenges and future uncertainties. The area at the Head of Lake Whakatipu is exposed to multiple natural hazard risks, and this risk setting is compounded by landscape-scale changes and a changing climate. There are no simple solutions.

We need to plan for the long term — to work together to build our adaptative capacity — to cope, adjust, respond and transform over time.

This Strategy will help us take advantage of opportunities and to better cope with the consequences now and in the future at the Head of Lake Whakatipu.

Vision and goals

'Our vision is a resilient and sustainable Head of Lake Whakatipu, where proactive natural hazard and climate adaptation enhance community wellbeing and safety and contribute to a flourishing environment.'

Goal 1 Adaptation is woven into our everyday work

Goal 2 Lay a robust foundation for decision-making

Goal 3 Healthy and resilient communities

Goal 4 Resilient built places, infrastructure, and systems

Goal 5 A flourishing environment

Development and implementation of the Strategy is guided by key principles.

- Take a **holistic and long-term view** to natural hazards risk management and adaptation efforts.
- **Partner and collaborate** with mana whenua, partner agencies, communities and stakeholders.
- Make **robust decisions** using the best available evidence.
- **Be community-centered.**
- **Be flexible** and adjust as we go.
- Consider **co-benefits** for adaptation efforts to achieve complementary goals.
- Promote **fairness and equity** for and between communities and across generations.
- **Uphold te Tiriti o Waitangi.**
- **Align with national-level direction and policies.**
- Adaptation efforts should **work with nature** as much as possible.
- Be **open and accountable.** Ensure progress is transparently communicated.
- Consider **cost-effectiveness and practicality** to ensure that resources are used efficiently and that they reduce risks to what is reasonable, practicable, and acceptable to partners and the community.

2. What matters most to the community and mana whenua? This is what we heard . . .

Community outcome statements

People provided many insights into what matters most to them at the Head of the Lake. Together, these values make up a set of community outcome statements that provide guidance for decision making now and into the future.

1. **A community that feels supported and safe from the impacts of natural hazards**
2. **Residents feel at home, connected to their environment and supported by the experience of community**
3. **A beautiful environment and a feeling of connection with nature**
4. **Sustainable, functioning ecosystems**
5. **The opportunity to make a living**
6. **Be resilient and self-determining**
7. **Functional, resilient and accessible infrastructure, support services and emergency response**
8. **Heritage is safeguarded and accessible**
9. **A healthy community that promotes the wellbeing of all**

Some overarching community values emerged from all the feedback and engagement activities over five years:

Lifestyle and wellbeing — people feel safe to do their day-to-day activities. A sustainable, self-sufficient and resilient community.

Environment — sense of stewardship and connection to nature — mountains, rivers, lakes. A place for wildlife and biodiversity to thrive.

Belonging — a feeling of home. A strong sense of community where people support and take care of each other.

Recreation — being able to enjoy recreation and links to the broader environment. A place for residents and visitors to enjoy together.

The community vision for the area (Sharing our Future 2016):

"A unique, inclusive community that fosters and embraces individuality, diversity and innovation, encourages resilience and promotes community vitality and collaboration.

The Glenorchy community has a collective strong voice that advocates for positive change. Glenorchy has the infrastructure to support a thriving boutique local economy in keeping with the rural landscape, actively respects and enhances the natural environment, collectively works towards providing their own resources (self-sufficiency)."

In the 2001 Community Plan, core resident values included being safe, caring, self-reliant, welcoming, working together, and respecting the environment (Blakely Wallace Associates, 2001).

Residents also valued the history of the area, the rural atmosphere, peacefulness, landscapes, and having the wilderness at their doorstep.

Mana whenua values

The Head of the Lake area is immensely significant to mana whenua.

To uphold the mana of kā rūnaka, it is crucial that mana whenua have authority over how their manawa (aspirations) for the future are portrayed and represented in this Strategy and in future actions.

Aukaha, as mana whenua representative, identified key values that offer a glimpse into a mana whenua worldview with respect to the area and the programme of work.

Ka Uara — core cultural values:

- **Mana —** mana whenua are leaders, influencers and partners.
- **Mauri —** protect and enhance the mauri (life force) of the Head of Lake Whakatipu, now and well into the future.
- **Whakapapa —** the traditional authority of mana whenua at the Head of the Lake is grounded in recognised ancestral rights which give mana whenua the mana and kaitiaki responsibilities.

Additional Kāi Tahu values include:

- **Ki uta ki tai —** interconnectedness of the whole environment, commonly translates to 'from the mountains to the sea'.
- **Kaitiakitaka —** intergenerational and inherited responsibility and stewardship on behalf of future generations.
- **Manaakitaka —** expressing aroha, hospitality, generosity and mutual respect. Processes and decisions that enable positive social outcomes and support wellbeing.
- **Mahika kai —** ability to, and access to, gather or harvest resources. Ensure a healthy functioning ecosystem and sustainable harvesting practices.
- **Wai Māori and Wai Ora —** importance of protecting and enhancing the wellbeing of all bodies, as water is a sacred entity in te ao Māori and is the source of all life.
- **Maumaharataka —** acknowledging and upholding memories of the past and Kāi Tahu pūrākau (stories).
- **Whakawhanaukataka —** relationship and community building, working together for the benefit of the community.

> *There's something about it. I can't put my finger on it. It feels like home. Everybody does become like your extended family. That's the thing — it's the community and the people for me. Despite the amazing stuff and mountains, it's the people that have kept me here. It's small but it's not constrained either. It's close to so much that I love — the outdoors.*

3. Why do we need to adapt?

History of adaptation

The land and waters of Aotearoa New Zealand are alive and always changing. Natural hazards are everywhere. People have adapted to landscape-scale changes in the past and are currently adapting to and living with natural hazard challenges in the present. We will continue to adapt to the dynamic natural environment into the future.

The challenges at the Head of Lake Whakatipu / Whakatipu Waimāori exist because of its location, history, what the land is made of, and the ways the land has been used in the past and present.

Adaptation to the growth of the **Dart–Rees delta** has meant that people have moved the location of the Glenorchy jetty so boats could continue to access Head of the Lake communities.

The current Glenorchy jetty is the third constructed over the township history. We can tell this from old photos, maps and street names.

Kinloch wharf illustrates a current challenge. In the 1890s Kinloch wharf had sufficient depth of water to service the paddle steamer *S.S. Mountaineer;* then the bay at Kinloch was rapidly infilled from the early 2000s; and now the Kinloch wharf is unusable due to sedimentation.

The **Glenorchy School** was moved to its present site in 1939 because the old site was exposed to Buckler Burn hazards.

The *S.S. Mountaineer* at Kinloch wharf, pictured in the 1890s

Image by Valentine and Sons Ltd, 1892-1893. Hocken collections reference number P2008-073-013.

> *Everyone helps each other out like family because if your car broke down on the road, you would hope people stopped for you, and you would stop for people.*

The Kinloch wharf, pictured in October 2019

Mana whenua history

The landscapes of the Head of Whakatipu Waimāori (Lake Whakatipu) tell generations of Kāi Tahu stories and histories.

The arrival of Waitaha and Rākaihautu:

According to Kāi Tahu tradition, the Waitaha were the first people to arrive in Te Waipounamu (the South Island).

It is written that the Waitaha arrived in Te Waipounamu on a great canoe called Uruao, which was captained by Rākaihautū.

It is said that Rākaihautū used his famous kō (Polynesian digging tool) to form the major lakes of Te Waipounamu, which included Whakatipu Waimāori.

The genealogies of the Waitaha people can be traced from Rākaihautū through to his living descendants, the modern day Kāi Tahu.

"Ko Rākaihautū te takata nāna i timata te ahi ki tenei motu." (It was Rākaihautū who lit the first fires on this island.)

Kāi Tahu taoka (treasures) cover the landscape; from the ancestral mauka (mountains), large flowing awa (rivers), tūpuna roto (great inland lakes), pounamu, and ara tawhito (traditional travel routes/trails), which connected kāika (settlements) and nohoaka (seasonal settlements) and mahika kai resources.

These all make the area immensely significant to mana whenua.

European history

The Head of the Lake community has a long history of resilience.

Scheelite mining, gold mining, sawmilling, farming and tourism have all in some way supported the small, close-knit townships of Glenorchy and Kinloch.

While many people are attracted to the area because of its natural beauty, the relative remoteness of the area shaped both the economy and the types of people who lived there.

Community members have long been characterised by a 'number 8 wire mentality' and self-sufficiency. The community have a strong sense of identity, cohesion and shares aspirations for the future.

Present day community and challenges

The Head of the Lake population has doubled over the last 20 years, with increased land-use and development pressures, and growth in the number of residents who rely on the road to Queenstown for their day-to-day lives.

Some residents may be less aware of the challenges that natural hazards pose in the area. Today, tourism is the dominant industry.

There are further challenges to support tourists and day visitors in the face of potential natural hazard events.

Natural hazards at the Head of Lake Whakatipu

This area has a dynamic landscape with a wide range of potential natural hazard impacts, including a high potential for cascading hazard scenarios, where one hazard triggers another (e.g. landslides triggered by earthquake shaking). Landscape and climate changes contribute to future uncertainties.

Terrain/slope hazards

Landslides are a common occurrence in the Dart and Rees catchments, due in part to unstable geology. Rainfall, earthquakes and changes in land use can also trigger landslides.

Tributary hazards

Side streams that feed into the rivers and lake have local hazards, such as erosion, flooding and sediment deposition. Some streams also have the potential for debris floods, which are a fast-moving mix of loose sediment, rock and water, and can be a very dangerous and destructive form of flooding.

Climate change

By 2090, winter and spring rainfall are projected to increase in the catchments, with more intense storms and additional heavy rainfall days. Flood flows are also projected to increase in magnitude due to climate change.

Floodplain hazards

The Dart and Rees catchments naturally supply huge amounts of sediment into the rivers. Active river channels and the delta are always changing in response.

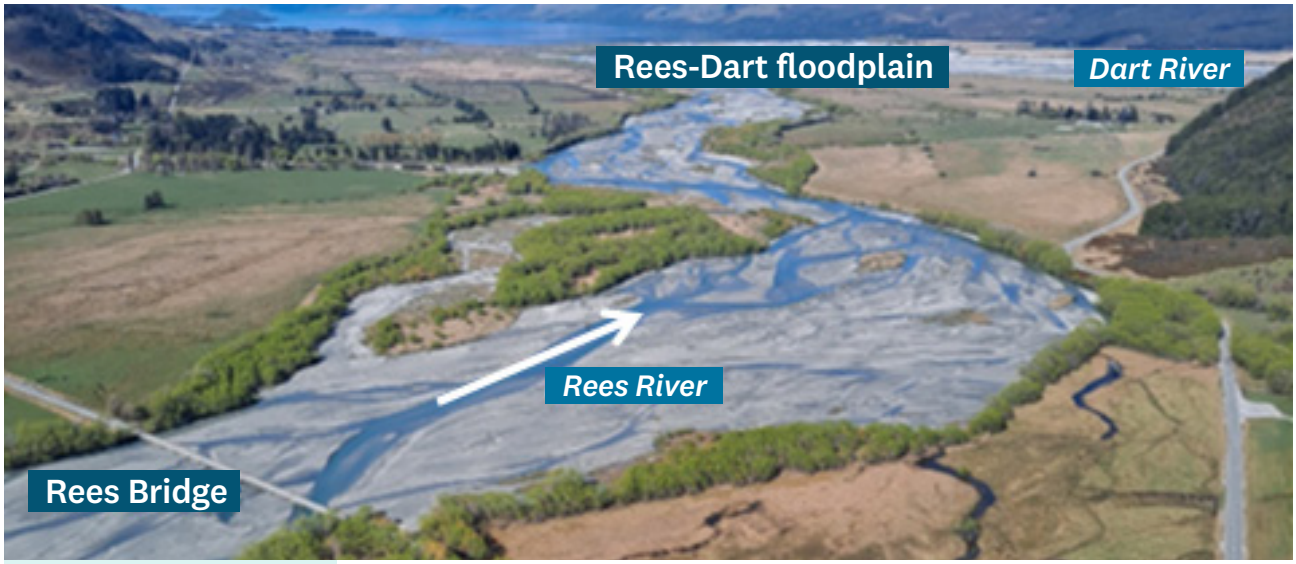
Low-lying land adjacent to the Rees and Dart rivers is subject to flooding. Floodwaters can damage land, property and infrastructure, and interrupt local road access. Damage can occur due to erosion, inundation, and sediment left behind by floodwater.

Bank erosion is currently a threat to Kinloch Road, due to the ongoing westwards migration of the Dart River active channel.

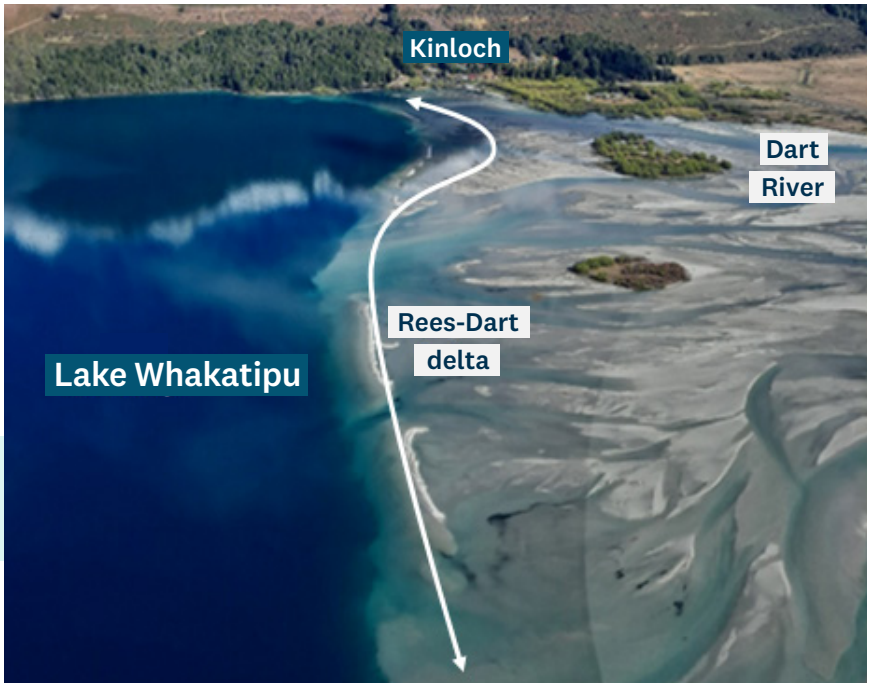
Build-up of sediment in the bed of the active channels will continue. Future landscape changes are likely when the rivers break out of current paths, seeking new channels on lower parts of the floodplain.

River delta growth will continue. Areas of higher growth depend on where the main channels are discharging sediment and are likely to vary with future channel movements.

The effectiveness of current Kinloch wharf, Glenorchy jetty, Rees River bridge and floodbanks are all affected by sediment build-up.



Lower Rees River valley (looking downstream towards Lake Whakatipu)



Rees–Dart delta (looking west towards Kinloch)

Glenorchy township with the Buckler Burn shown on the right

Earthquake hazards

Earthquakes cause ground shaking in response to rapid release of built-up strain along fault lines.

Numerous mapped fault systems are present in the wider area. Nearby possible active faults include the West Whakatipu Fault, located approximately 2 km west of Kinloch, and the Moonlight Fault, approximately 15 km east of Glenorchy.

The most notable fault in the area is the Alpine Fault, some 55 km to the nearest point from Glenorchy. The likelihood of an earthquake triggering at some point along the 800-km-long Alpine Fault over the next 50 years is 75%, with an 82% chance that the earthquake event would exceed magnitude 8.

Earthquake shaking can cause damage directly. Strong shaking can also trigger additional cascading hazards in some areas, such as landslides, and liquefaction and lateral spreading.

Liquefaction and lateral spreading hazards can occur when strong ground shaking during an earthquake disturbs ground sediments, causing them to behave as fluid. This can deform the surface of the ground, damaging buildings, roads and underground infrastructure.

An earthquake shaking hazard at Kinloch and Glenorchy is expected to pose the greatest risk to buildings and lifelines infrastructure through structural damage, compared to relatively few injuries or deaths.

All the lower-lying areas of Glenorchy township in the north and west are vulnerable to liquefaction, and significant and widespread land damage may occur from strong earthquake shaking. The potential for lateral spreading damage, such as land cracking, is highest near the lake edge and decreases with an increasing distance from the lake.

Potential 'Alpine Fault Magnitude 8 (AF8)'

A credible science-based hazard scenario developed by AF8 to help us plan and prepare for an Alpine Fault earthquake:

'Central Otago will likely experience 2-3 minutes of strong shaking in this South to North rupture scenario. The shaking will likely trigger snow/ice avalanches, landslides and rockfalls on mountain and hill slopes, making some roads impassable and potentially isolating communities in the area.

Central Otago lakes could be affected by landslide-triggered tsunami, making it important for communities to know the 'Long or Strong, Get Gone' messaging.

Thousands of tourists may be stranded in the area, unable to get home and will need to be looked after for days due to damage to roads. Some areas may lose power and telecommunication services.

Emergency Management Otago has information to help you plan and prepare for emergency events in your region.'

www.af8.org.nz

Hazards along the Queenstown–Glenorchy Road

The Queenstown–Glenorchy Road provides the only road access in and out of the Head of the Lake area for residents and visitors.

The community relies heavily on the road to access goods, services, employment, education, recreation, and health care outside the area. The road traverses many locations exposed to debris flow, flooding or landslide/rockfall hazards.

One example is Shepherds Hut Creek, where a debris flow event disrupted road access in 2022.

> *You can see climate change if you are connected to nature … you can't live here and not be aware of it … you need to be attuned to it.*

Buckler Burn hazards

The Buckler Burn is very dynamic, with unstable terrain, a high sediment supply, and channel movement.

Over a very long time, Buckler Burn has deposited sediments directly into the lake, forming an alluvial fan landform and delta. The land under most of Glenorchy township consists of old deposits from Buckler Burn and Rees River.

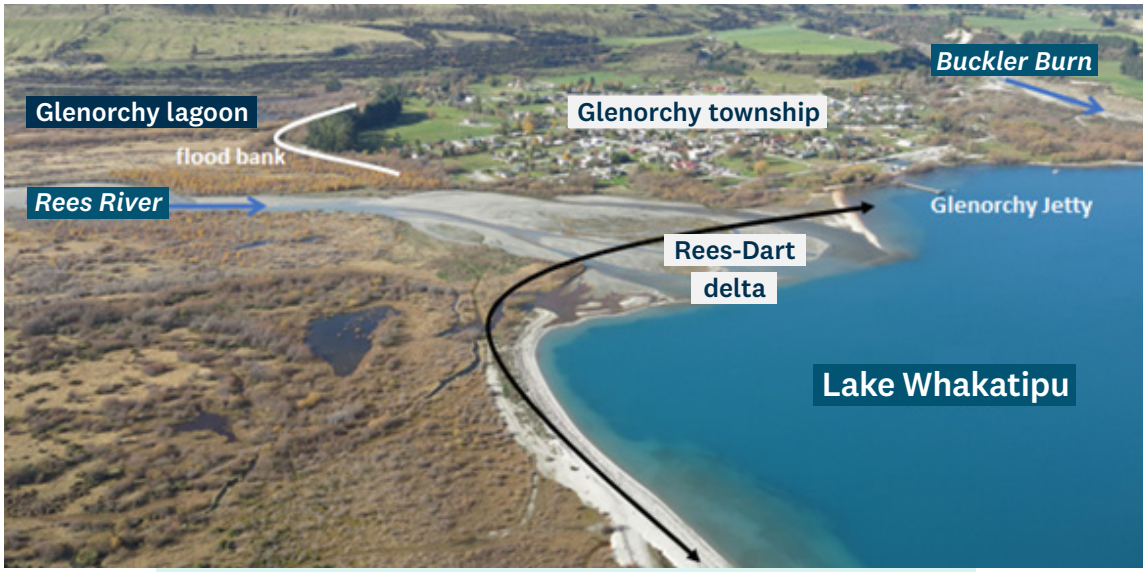
In large floods, Buckler Burn may break out along Oban Street and cause minor flooding in the township area. Bank erosion is also a threat to a section of Queenstown–Glenorchy Road, which is near the current active channel. However, Buckler Burn debris flows are considered unlikely to be a threat to Glenorchy.

The present-day alignment of the active channel and area of delta growth is along the most southern limit of the fan. The fan surface may build up in the future and northwards migration towards the township should be anticipated.

Dart and Rees river hazards

The Dart and Rees rivers are very dynamic, with a high sediment supply, active channel movement and continued delta growth into the lake.

Glenorchy Lagoon and the existing Rees–Glenorchy floodbank provide some protection from smaller, more frequent Dart–Rees flood events. In larger Dart–Rees floods (20-year average recurrence interval and above), the floodbank is overtopped and flooding occurs in northern parts of Glenorchy township.



Rees–Dart delta and Glenorchy township (looking southeast towards Richardson Mountains)

Lake Whakatipu hazards

High lake levels can cause flooding of low-lying areas adjacent to Lake Whakatipu, including parts of Kinloch and Glenorchy (alongside the lake and floodbank).

Lake floods are often associated with a series of rainfall events close together, and the lake may remain at high levels for days to weeks.

Lake levels typically rise relatively slowly, with more time to respond than other sources of flooding.

I think what you have is an enormous wealth of understanding; people who are very closely connected with the landscape … People who are going out after every flood, as they're watching during every flood and they're keeping a very close track on what's happening.

You are dealing with a community who are pretty well aware of their landscape and engage with it in so many different facets.

They're not just around the lagoon; these people are riding up the hillsides, they're tramping everywhere, they're fishing, they're boating, and they're doing the whole gambit of ways of engaging with the natural environment.

They're acutely aware of that.

4. What do we rely on for natural hazard management now?

Natural hazard resilience at the Head of Lake Whakatipu is reliant on a strong foundation of existing responses.

2. Emergency readiness and response

1. Hazard awareness (societal, behavioural, and institutional)

3. Flood mitigation and protection

- Flood monitoring network (rainfall and water level stations) and flood data
- Flood monitoring, forecasting and warning
- Existing low-level Rees River flood protection by Glenorchy floodbank
- Existing river management (vegetation and gravel)

7. Policy and planning — existing land use zoning, rules and building controls

4. Road access — existing maintenance, reactive repair and planned works

- Glenorchy–Queenstown Road
- Kinloch and Glenorchy–Paradise local road system

6. Private property resilience

- Household emergency planning
- Property and business insurance (adjust coverage as needed)
- Consider local risk and hazard information when property decisions are required (e.g. buying/selling)

5. Existing boat access at Kinloch and Glenorchy

How are we planning to enhance and improve?

Existing responses are an important part of the picture and go partway towards addressing the needs of the area. Our Action Plan will build and improve upon this base to increase resilience.

Glenorchy has a strong and deep community network that is easily called upon in emergencies.

5. What might the future look like?

Do the same? Do better? Do things differently?

Existing and planned responses are reviewed periodically to assess if they are still working for us.

Over time we might choose to improve, adjust or expand our current approaches. In the future we might reach a point where our current approaches no longer work well for changed conditions and we will need to consider 'doing things differently'.

Future challenges might require a different set of responses. That is why the **'Future Toolbox'** includes both standard ways to manage hazards and innovative ideas.

Possible responses in the **Future Toolbox** are not commitments at this stage. Some possible responses fall outside the current roles and responsibilities of partner agencies.

There should be no expectation that the Strategy partners will or will not undertake any particular mitigation works.

> *Some are good at leading and mobilising others, and others are good at getting stuff done ...*

> *As long as there are still people here, and two thirds of the dwellings are still habitable, I would say we would probably stay put.*

> *"In our existing places, people can work together to reduce risk through social networks, nature-based and hard-engineering solutions, through upgrades to existing buildings and infrastructure to withstand more extreme climatic conditions, and by being better prepared.*
>
> *Councils and communities should consider the full range of adaptation options for areas under threat."*
>
> ***— National Adaptation Plan 2022***

EXISTING RESPONSES AND IMPROVEMENTS IN OUR ACTION PLAN	POSSIBLE FUTURE RESPONSES IN THE FUTURE TOOLBOX
Existing hazard awareness Societal, behavioural, and institutional changes (improve over time) when considering natural hazards and changes to the physical environment	**Hazard awareness (possible future responses)** Review and accept residual risk for existing development
ACTIONS TO IMPROVE: **Governance and collaboration** 1. Otago Regional Council (ORC) and Queenstown Lakes District Council (QLDC) collaborate to develop a governance framework or memorandum of understanding (MoU) for addressing adaptation issues at the Head of the Lake and/or across the district, including the implementation of adaptation actions to improve resilience. 2. Partner with mana whenua to ensure mana whenua values and aspirations and mātauraka Kāi Tahu are embedded into decision making and implementation of the Strategy, following the lead of Aukaha and Te Ao Mārama (ORC). 3. ORC, QLDC, Civil Defence Emergency Management Otago (CDEM), mana whenua and local community work together to ensure a coordinated and consistent approach to implementation of actions aligning with this Strategy. 4. Work together to mainstream adaptation across ORC work programmes and ensure our work aligns with this Strategy and towards achieving each goal.	
ACTIONS TO IMPROVE: **Advice, information and education (ORC)** 1. Ensure the ORC Natural Hazards Portal includes up-to-date information on natural hazards and the impacts of climate change. 2. Maintain ORC Head of Lake Whakatipu adaptation web pages with relevant and up-to-date information. 3. Provide newsletter updates about programme milestones and/or progress towards actions. 4. ORC to attend Glenorchy Community Association (GCA) meetings as required, at least annually, to provide progress updates and check in with the community. 5. Ensure that ORC's messaging about natural hazards adaptation and adaptation workstreams is communicated in a way that is understood by a wide audience. 6. Monitor the headofthelake@orc.govt.nz inbox for public enquiries and information relating to the programme. Consider other methods and tools for capturing community feedback.	

EXISTING RESPONSES AND IMPROVEMENTS IN OUR ACTION PLAN

Existing hazard mitigation

- Emergency readiness and response (improve over time)

Existing flood mitigation and protection

- Maintain the flood monitoring network (rainfall and water level stations) and flood data history
- Flood monitoring, forecasting and warning (improve over time)

ACTIONS TO IMPROVE:
Information gathering and monitoring

1. Investigate hazards and risks as part of usual business (ORC).
2. Geomorphic change monitoring and assessment — maintain an awareness of locations and scale of geomorphic changes (e.g. active river channel position, bed levels and rates of change) which may have direct impacts or exacerbate natural hazard characteristics (ORC).
3. Data collection to document major flooding (or other hazard) events — improve the recording and understanding of hazard event characteristics and the impacts of those events (ORC).
4. Monitoring and analysis of signals/triggers/thresholds (ORC/QLDC).
5. Communication and reporting of physical environment monitoring — data collection and analysis findings will be communicated to key project partners and stakeholders (ORC).

ACTIONS TO IMPROVE:
Emergency Management

1. Develop a long-term recovery plan for a potential major hazard event (ORC/CDEM/QLDC).
2. Operate a network of near real-time rainfall and water level stations across the region to support flood forecasting and emergency response with a 24/7 duty roster to support forecasting duties and any necessary response (ORC/CDEM).
3. Monitor and ensure ORC's network of environmental monitoring stations remains fit for purpose; providing information for flood response, for documentation of flood events, and for public awareness of river flow, lake and lagoon levels. Review of performance of the flood forecasting systems (lake level and lagoon level forecasting).
4. Capability development and awareness raising — public and internal education, share lessons learned from other emergencies (CDEM).
5. Engagement with communities and stakeholders (before, during and after an emergency) (CDEM / Community Response Group).

EXISTING RESPONSES AND IMPROVEMENTS IN OUR ACTION PLAN

Existing flood mitigation and protection

- Existing low-level Rees River flood protection by Glenorchy floodbank (maintenance and reactive repair)
- Existing river management (vegetation and gravel)

Existing road access

- Maintenance, reactive repair and planned works for the Glenorchy–Queenstown Road
- Maintenance, reactive repair and planned works for the Kinloch and Glenorchy–Paradise local road system

Existing boat access

- Existing boat access at Kinloch and Glenorchy (limited by existing and ongoing sediment accumulation)

ACTIONS TO IMPROVE:
Addressing impacts of natural hazards and climate change

1. Routine maintenance of QLDC transport network, including roading assets, Glenorchy jetty and marina.
2. Glenorchy Area Bridge Resilience (QLDC 24–34 LTP) — non-routine work required to protect the serviceability of the Glenorchy, Paradise and Rees River bridge assets following damage and to minimise threat of road closure due to natural phenomena.
3. Raising Kinloch Road (QLDC 24–34 LTP) — raising Kinloch Road in conjunction with two-yearly gravel extraction under the Rees River bridge.
4. Develop Operational River Management Plans, including the Dart and Rees floodplains (ORC).
5. Develop a gravel management plan for the Buckler Burn (ORC).
6. Annual vegetation management, rock armouring and gravel management (ORC) — ongoing river management activities (such as regular vegetation control in Lagoon Creek / lagoon area).
7. Maintenance of Rees River floodbanks (ORC) — maintain (not renew or increase) the existing banks (*Rees River floodbanks are not owned by ORC).
8. Floodplain and rivers (ORC) — create/trial NBS groynes.

POSSIBLE FUTURE RESPONSES IN THE FUTURE TOOLBOX

Flood mitigation and protection (possible future responses)

- Small-scale improvements to Glenorchy floodbank to maintain/reduce flood risk
- Major works to increase level of service of Glenorchy floodbank
- Redesign Rees flood protection for changed conditions (e.g. post event)
- River management and nature-based interventions (e.g. targeted planting)
- Redesign nature-based interventions for changed conditions
- Small-scale works to reduce Buckler Burn erosion and/or flood risk

Road access (possible future responses)

- Small-scale improvement to existing Kinloch and Glenorchy–Paradise local road system (as well as maintenance and reactive repair)
- Reduced level of service of existing Kinloch and Glenorchy–Paradise local road system (e.g. some parts 4WD only)
- Major works to increase resilience of Kinloch and Glenorchy–Paradise local road system (e.g. protect, raise, realign)
- Reactive redesign Kinloch and Glenorchy–Paradise local road system for changed conditions (e.g. post event)

Boat access (possible future responses)

- Short-term improvements to existing boat access (e.g. dredging)
- Upgrade boat access with resilient solution (e.g. relocatable wharfs)
- Relocate wharfs periodically to maintain future access

EXISTING RESPONSES AND IMPROVEMENTS IN OUR ACTION PLAN	POSSIBLE FUTURE RESPONSES IN THE FUTURE TOOLBOX
Existing public asset resilience • Existing low-level Rees River flood protection by Glenorchy floodbank (maintenance and reactive repair) • Existing river management (vegetation and gravel) **ACTIONS TO IMPROVE:** **Addressing impacts of natural hazards and climate change** 1. Glenorchy Adaptation Pathways (QLDC 30 Year Infrastructure Strategy) — work on social infrastructure required to address selected adaptation pathways. 2. Head of the Lake Adaptation (QLDC 24–34 LTP) — use Strategy to inform responses to identified hazards, providing scoped and costed solutions for input to the next QLDC LTP (27–37) and other key planning documents.	**Public asset resilience (possible future responses)** • Improve resilience of critical assets in higher hazard areas (such as floodproofing, floor raising, ground or structure strengthening, retrofit, move elsewhere) **Community-wide resilience (possible future responses)** • Community-wide improvement works for liquefaction hazard (such as ground improvement and strengthening existing buildings)
Existing private property resilience • Household emergency planning • Property and business insurance (adjust coverage as needed) • Consider local risk and hazard information when property decisions are required (e.g. buying/selling) **ACTIONS TO IMPROVE:** **Addressing impacts of natural hazards and climate change** 1. Provide information and support property owners to undertake property-level interventions to improve their resilience to natural hazards risks (ORC).	**Private property resilience (possible future responses)** • Improve property and land resilience (such as floodproofing, floor raising, ground or structure strengthening)
Existing policy and planning • Policy — existing land use zoning, rules and building consents **ACTIONS TO IMPROVE:** **Policy and planning processes** 1. Consider natural hazard property information for resource and building consents (QLDC). 2. ORC and QLDC to collaborate to ensure common adaptation priorities, information and actions identified in this Strategy inform and input into the next ORC and QLDC long-term plan, spatial plan, district plan and other relevant policies and plans. 3. Natural hazard information included on LIM reports (QLDC). 4. ORC and QLDC to collaborate on path forward for assessing risk tolerance with the community (once the proposed RPS is operative).	**Policy and planning (possible future responses)** • Policy and planning (possible future responses) • Policy — review hazard and risk information and set appropriate requirements for new development • Policy — strengthen land use controls in higher hazard areas to avoid additional exposure • Policy and services — identify and make available lower hazard land for new building and/or relocation • Recovery plan improvement • Proactive relocation plan • Voluntary proactive relocation from higher hazard areas • Voluntary reactive post-event retreat from higher hazard areas

6. How will we know when future decisions are needed?

The Strategy uses an adaptive management approach, which aims to try to avoid unacceptable conditions by monitoring signals and triggers and using these to guide the timing of future decision making.

Adaptation thresholds for the Head of the Lake are based on what we have heard along the way. The selected signals and triggers weave adaptation into our everyday work and build on existing monitoring. Other signals and triggers may be selected during implementation of the Strategy and development of operational plans.

Adaptation thresholds

An ***'adaptation threshold'*** is ***'what people do not want to happen'*** (unacceptable conditions).

- Extended disruption to road access from Queenstown
- Frequent or severe damaging or disruptive events
- Loss of amenity and cultural values
- Lengthy displacement of people following extreme events
- Withdrawal of maintenance, decline in levels of service and increasing cost of repairs
- Unaffordable or high-excess insurance premiums or withdrawal of insurance and bank finance

> *A lot of it is about the physical environment. It is a really beautiful place, it's a spectacular place to live in. We have a huge amount of opportunities for awesome outdoors stuff. The other part of the equation is the community.*

Signals

An advanced ***'signal'*** is something we can monitor. Signals help us get ready to move to new pathways with enough time for decision making and implementation. However, surprise situations can still occur, and so signals are not a guarantee that an adaptation threshold will be avoided.

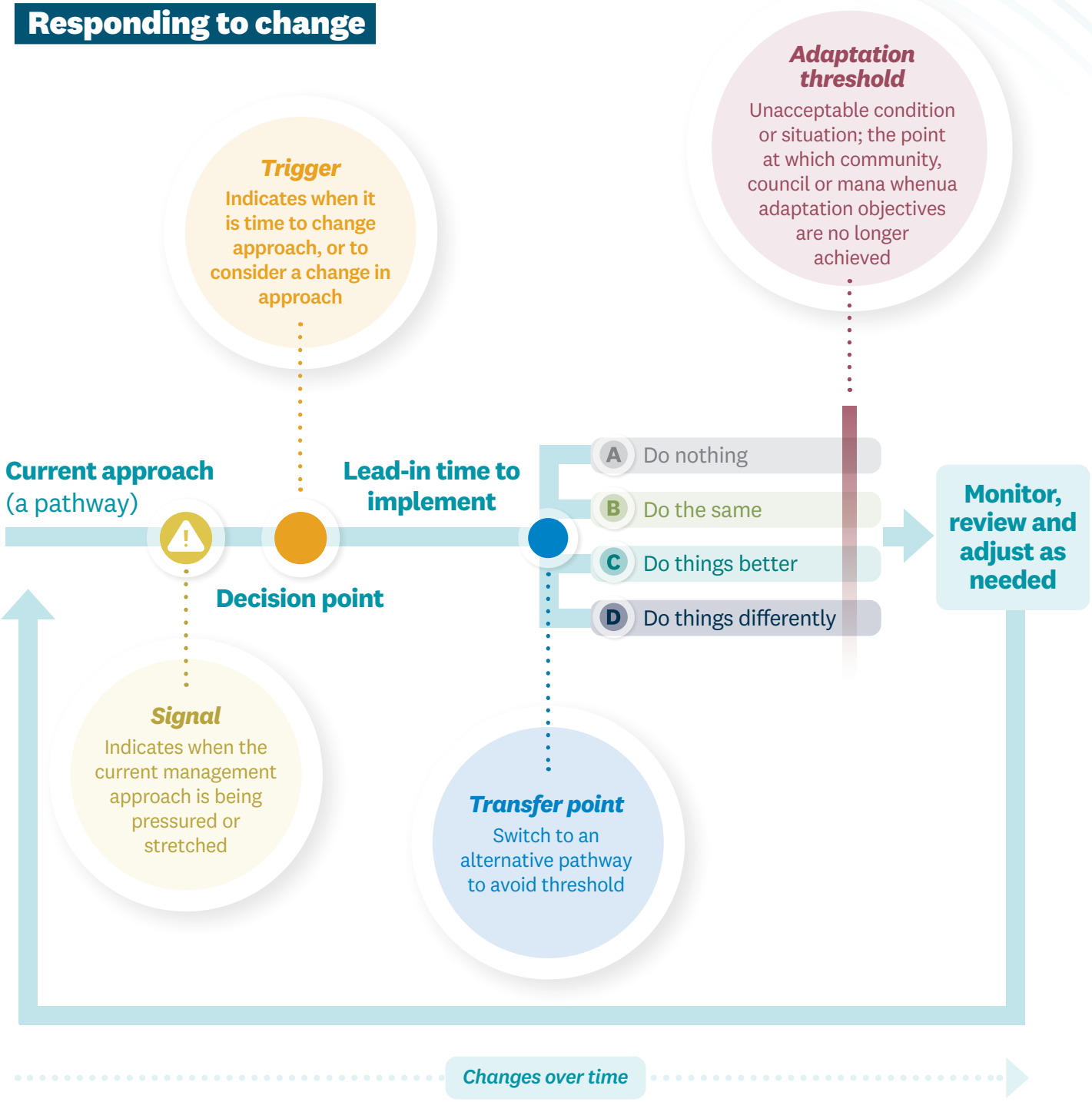
1. Growth in costs to maintain and repair assets
2. Lower level of service (e.g. due to delta growth, river bed aggradation)
3. Frequency, number or impacts of flooding events reaching nuisance level (includes residential areas, roads and agricultural land)
4. Movement of active river channel towards high value areas and assets
5. Negative impacts on community wellbeing
6. Insurance affordability or coverage

Triggers

A ***'trigger'*** is a point to review and make decisions whether to change responses or pathways. Triggers that occur ahead of an adaptation threshold are the most useful for forward planning.

1. Decision-making cycles (3-year, 10-year, 30-year) — the usual timing to consider partner agencies priorities, level of investment and business cases for changes. Public consultation is also required. These timelines are suitable for staying ahead of gradual changes. It is important that up-to-date analysis and reporting of signals feed into and inform the decision-making process. Signals can be considered both individually and in combination.
2. Opportunities — keeping adaptation goals front of mind, looking out for opportunities to take action and make progress.
3. Significant natural hazard event with unacceptable outcomes — an integrated, multi-agency approach will be required for effective recovery.

Responding to change



7. How will we work together to implement the Strategy?

The current responses are implemented by agencies through well-established planning processes, such as long-term plans and District Plan.

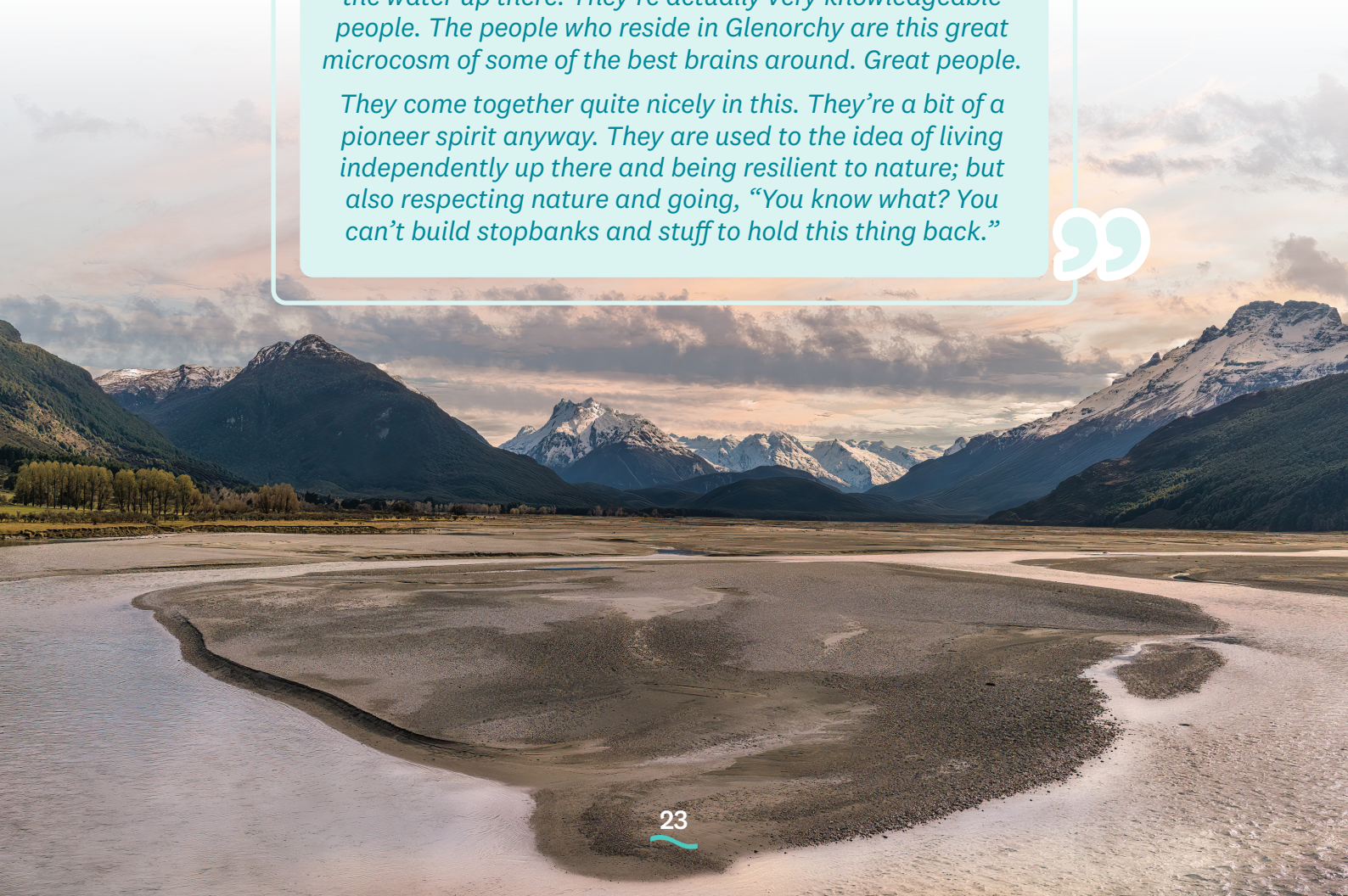
Many of the possible future responses are also standard ways of managing natural hazards. Decisions on continuing and future investment are made by the agencies during regular update cycles for their plans.

Council plans typically have three-year cycles and cover 10-year (e.g. council long-term plans) to 30-year (e.g. council infrastructure strategies) periods.

Some possible future responses are **out of the ordinary.** Implementation of uncommon responses would require one-off, specialised planning, funding and governance arrangements.

If there is severe damage as a result of a natural hazard event, then it is likely that a tailored recovery plan would be put in place.

> *The Glenorchy-ites are a special breed. They are a very tight-knit community. There is something quite special in the water up there. They're actually very knowledgeable people. The people who reside in Glenorchy are this great microcosm of some of the best brains around. Great people.*
>
> *They come together quite nicely in this. They're a bit of a pioneer spirit anyway. They are used to the idea of living independently up there and being resilient to nature; but also respecting nature and going, "You know what? You can't build stopbanks and stuff to hold this thing back."*



How will the adaptation strategy be implemented?

Community, individuals, private asset and business owners

QUEENSTOWN LAKES DISTRICT COUNCIL

Otago Regional Council

Emergency Management Otago
Te Rākau Whakamarumaru Ōtākou

Existing and planned responses

Property owners and businesses
- Emergency planning
- Property and business insurance
- Consider local risk and hazard info when making property decisions

Long-term plan
- Existing and planned activities for assets: roads, Glenorchy floodbank and wharfs
- Emergency and recovery planning

Spatial plan
Vision and framework for how and where the communities of the wider Wakatipu and Upper Clutha can grow well and develop to ensure our social, cultural, environmental and economic prosperity

District plan
- Land use zoning
- Development rules and building controls

Long-term plan
- Existing and planned activities including: river management, monitoring, flood forecasting and warning
- Emergency planning

Otago Regional Policy Statement
Overarching policy framework that identifies and drives progress on significant resource management issues facing the region

Otago group plan
- 4Rs (reduction, readiness, response and recovery)
- Support for community response

Decisions by individuals

Decision-making process

Possible future responses

Property owners and businesses
- Ongoing responses
- Improve awareness
- Change behaviour
- Improve property and land resilience
- Adjust insurance

Future long-term plan
- Ongoing responses
- Future investment in assets (roads, wharfs, Glenorchy floodbank)
  - small-scale works
  - major works
  - redesign
  - change level of service

Future spatial plan
- Future plan revisions are informed by up-to-date natural hazard information
- Identify and make available lower hazard land

Future district plan
- Review risk info
  - accept residual risk for existing development
  - set requirements for new developments
- Strengthen controls in higher hazard areas

Future long-term plan
- Ongoing responses
- Additional investment:
  - nature-based solutions
  - new protection
  - redesign
- Redesign for changed conditions

Future Otago Regional Policy Statement
- Future revisions are informed by up-to-date natural hazard information

Future Otago group plan
- Ongoing responses
- Recovery plan improvement
- Future investment in improvements

These future responses are out of the ordinary and would require tailored implementation processes

Responsibility not defined at this stage
- Community-wide improvement works for liquefaction hazard
- Proactive relocation plan
- Voluntary proactive relocation from higher hazard areas

Tailored post-event recovery plan
- How can we adapt to the post-event conditions? Rebuild? Build back better? Do things differently?
- Voluntary reactive post-event retreat from higher hazard areas

8. How will we review and adjust?

This is the first version of the Strategy. Over time we will review and adjust to keep up with future challenges.

We already collect information on social, economic, institutional and environmental conditions, as part of our existing business practices. We will use this information to track changes and monitor how the Strategy is working.

Every six years (or earlier if there is an urgent need), Otago Regional Council will conduct a comprehensive review and work with partners and community to ensure the Strategy is updated appropriately in light of new information.

Between updates, we will track progress on **Actions** and report back through a variety of channels, such as our website.

> *We can see what's happening with the delta advancing. But, to hear the explanation of why that's happening, how it's going to change in the future, how it's only limited by the amount of water that comes down the river, and we know we will get more frequent heavy rain events, which will accelerate that. Then of course, as the land builds up behind it, it's just going to carry on doing that.*

PHOTO: MATT GARDNER

Artwork competition category runners-up

THOMAS GREEN
AGED 5 AND UNDER

JACK WATTS
AGED 6-8

MACKENZIE JONES
AGED 9+

Acknowledgments

ORC and the Strategy's partners gratefully acknowledge the many community members who shared their experiences, perspectives and aspirations throughout the development of this Strategy.

The quotes included in this document reflect insights shared during our studies and community engagement events.

We thank everyone who took the time to engage with us and help shape this work.

ARTWORK FROM THE 2024 HEAD OF THE LAKE YOUTH ART COMPETITION