

Why consider elevation of buildings as an option?

Throughout the world, there are examples of homes that have been built to better manage the potential hazards of the surrounding landscape and so, support human occupation – for example:

- historic swamp paa in Aotearoa (elevated for flood protection)
- fale in the South Pacific (elevated along shorelines)
- Queenslander houses in Australia (elevated for heat circulation)
- bayou houses in Mississippi (elevated and over water)
- the City of Venice (built over water)
- and, more recently, retrofitting homes in Hampton in Virginia, USA (elevated for flood protection).

We wanted to see if it was feasible to consider elevation of houses in areas subject to coast inundation and/or flooding in Aotearoa New Zealand. This forms part of a wider set of investigations into options for Te Puuaha o Waikato in particular but may have relevance to other coastal and flood plain communities.

What we did

On behalf of NIWA, construction cost experts WT Partnership were contracted to estimate the cost to raise existing residential and non-residential properties by up to 2 m above their current platform levels:

- residential dwellings (single and 2/3 storey)
- non-residential properties, including wharehau and businesses.

For each of these structures, WT Partnership (with advice from Auckland House Lifting) estimated the cost to elevate the above dwellings according to the following construction types based on a 'typical' structure:

- piled timber frame
- concrete pad with steel and timber framing
- brick/concrete construction.

What we learned from the study

Residential options cost matrix*

Residential buildings: e.g., single storey ground floor area = 106 m² (average of 1–3 bedroom house excluding garage (p.4 of report))

Typology	Single storey with a ground floor 106m ²	Cost/m ² footprint area	2/3 storey with a ground floor of 52m ²	Cost/m ² footprint area
Timber framed dwelling	\$172,129	\$1,624	\$131,874	\$2,536
Concrete pad/steel/timber framed dwelling	\$352,591	\$3,326	\$220,402	\$4,239
Brick/concrete dwelling	\$357,453	\$3,372	\$228,556	\$4,395

*Does not include the costs of residential facades over raised portion (i.e., the raised areas are left open).



Non-residential options cost matrix

Non-residential buildings: e.g., single storey ground floor area = 500 m² (p.7 of report)

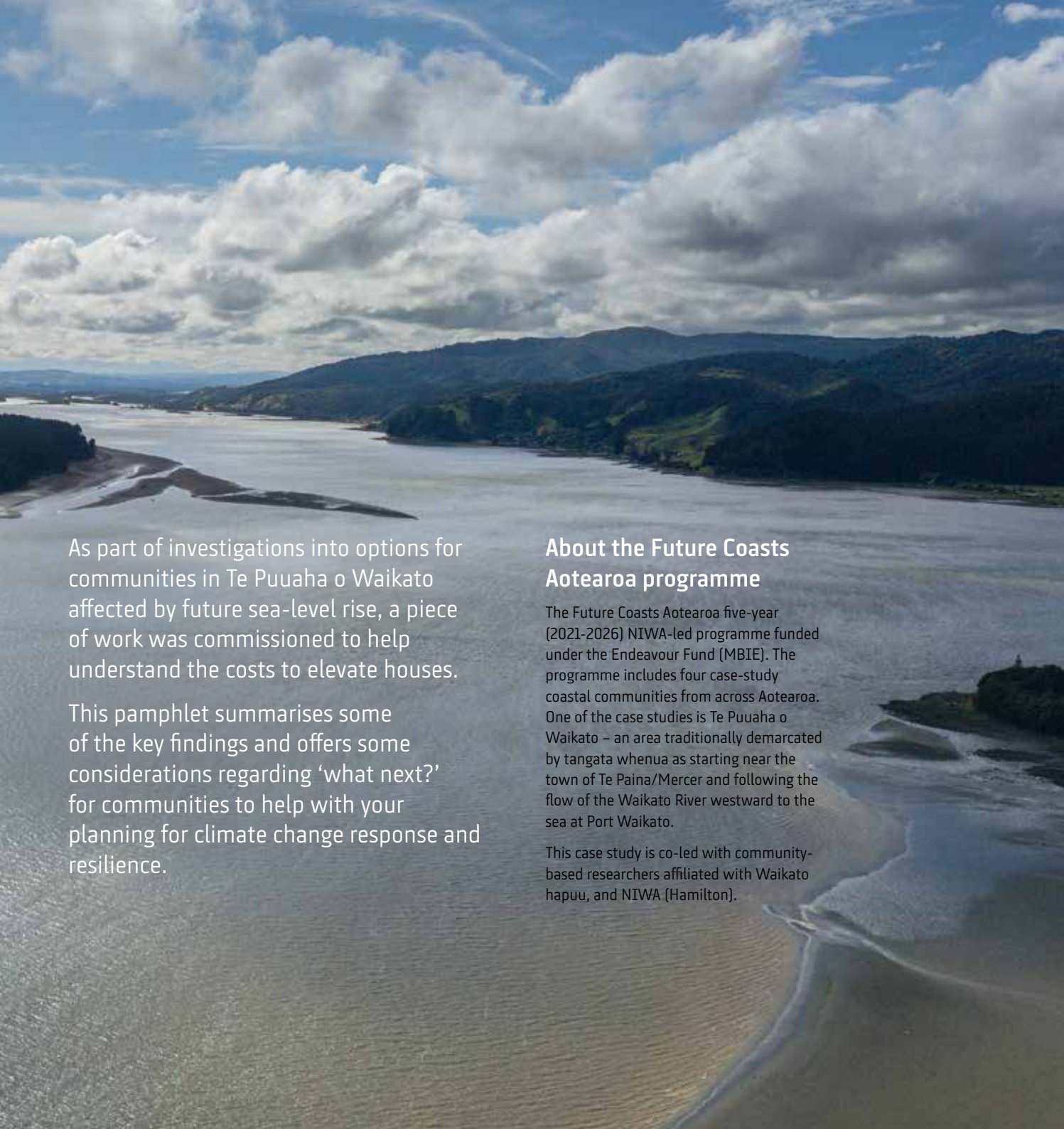
Typology	Single storey with a ground floor of 500m ²	Cost/m ² footprint area	2/3 storey with a ground floor of 250m ²	Cost/m ² footprint area
Timber framed dwelling	\$939,169	\$1,878	\$631,952	\$2,528
Concrete pad steel/timber framed dwelling	\$1,549,710	\$3,099	\$935,925	\$3,744
Brick/concrete dwelling	\$1,719,052	\$3,438	\$1,058,227	\$4,233

We note that there are range of other costs that are not factored into this assessment (see pp. 5 & 7 of the full report). These will need to be investigated and confirmed by those who are interested in looking into this further.

WT Partnership considered that for buildings of timber and pile construction, lifting them by 2 metres might be more cost effective than constructing new builds. However, this method might not be financially viable for buildings of concrete construction.

Other considerations

- Affordability
- Extreme flood events
- Elevation will not guarantee that a building will not flood
- Climate change increasing the frequency of extreme events
- How do families stay safe over time?
 - Keep elevating?
 - Raise building higher than required to be prepared for future floods?
- Raising a building can potentially buy time to develop options but will not solve the challenges in the long term
 - Roads and infrastructure still get damaged
 - Families could end up without utilities/ being cut off
 - Upgrading infrastructure can be complex and expensive
- Communities in raised buildings remain in flood risk areas so, while homes remain dry, properties will remain in the path of floods, and can continue to be harmed and still need remediation resulting in repeated costs
- Who pays to elevate homes and infrastructure?



As part of investigations into options for communities in Te Puuaha o Waikato affected by future sea-level rise, a piece of work was commissioned to help understand the costs to elevate houses.

This pamphlet summarises some of the key findings and offers some considerations regarding ‘what next?’ for communities to help with your planning for climate change response and resilience.

About the Future Coasts Aotearoa programme

The Future Coasts Aotearoa five-year (2021-2026) NIWA-led programme funded under the Endeavour Fund (MBIE). The programme includes four case-study coastal communities from across Aotearoa. One of the case studies is Te Puuaha o Waikato – an area traditionally demarcated by tangata whenua as starting near the town of Te Paina/Mercer and following the flow of the Waikato River westward to the sea at Port Waikato.

This case study is co-led with community-based researchers affiliated with Waikato hapuu, and NIWA (Hamilton).

What next?

If you are considering elevation of a building as an option, we recommend you build a plan for what elevation might need to look like for you.

Read the report to get a better understanding about the extra costs that may also need to be factored in, including considerations for any upgrades for the systems connected to your home (water, power, wastewater).

It is also important to consider what it might mean for you if roading infrastructure is impacted in the future. Could you still access your property? What are the options (if any) available to you for access?

Want to learn more?

The following may be helpful for informing next steps:

- Expertise in house lifting: **Auckland House Lifting**
- House lifting protocol (NZ): <https://www.sitesafe.org.nz/globalassets/guides-and-resources/best-practice-guides/house-lifting-protocol.pdf>
- FEMA guidance for house lifting in the US: https://www.fema.gov/sites/default/files/documents/fema_elevating-your-house-chapter-5.pdf

For further information about the programme and to view the report visit:

niwa.co.nz/future-coasts

Programme contact:

christo.rautenbach@niwa.co.nz



August 2023

Maaku anoo e hanga toohu nei whare

ELEVATING BUILDINGS

An option for communities affected by sea-level rise and flooding?

Research from the NIWA-led Future Coasts Aotearoa programme

