Tangoio Climate Change Adaptation Decision Model

A process for exploring adaptation pathways for Tangoio Marae

Prepared for Maungaharuru-Tangitū Trust and Deep South National Science Challenge

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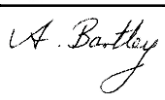	Formatting checked by:	Alison Bartley
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Executive summary

Measures to adapt to climate change are likely to raise important social and cultural issues for Māori. It is imperative these issues be understood and acknowledged so that responses to the potential impacts of climate change on critical services for Māori communities such as infrastructure, water management and public health, are aligned with the values of the people they are intended to help. Further work is needed to provide critical information that will assist Māori communities and businesses to make informed decisions about future needs, allocation, and adaptation measures for marae/whānau/hapū/iwi. In many instances, adaptation to these new climatic conditions will require additional financial resources and technological capacity that many Māori communities and businesses do not currently possess (King et al. 2011).

Adaptation requires a focus on the societal context of decision processes (Gorddard et al. 2016) and is especially true for Māori communities who have a variety of governance and decision-making structures and processes. In collaboration with the Tangoio Marae community this project developed and tested the eight step adaptation decision model Te Huringa ki te Rangi – He Rautaki Tāwariwari to help facilitate the critical conversations required to better understand the impacts, experiences and risks associated with flooding. Mātauranga Māori, the experiences of the community, and the latest hydrological modelling were brought together and presented back to the community using a variety of formats (e.g., flooding history timelines, videos, visualisations of hydrological modelling outputs). The variety of formats used enabled the wider community, some of whom may have not experienced extreme flooding events in their lifetime, to better understand the potential implications of different future climate change scenarios over a range of timeframes. These formats enabled all generations (i.e., not only the generation who have directly experienced extreme flooding) of the Tangoio Marae community to better understand how flooding has impacted Tangoio Marae previously, and therefore participate in the exploration of potential options for the future of the marae.

The Tangoio community have a clear understanding of the vision and aspirations that they have for themselves, the marae and their local environment (Step 1). The Tangoio community have developed a shared understanding of the past and of what the future could bring (Step 2) and identified a range of potential options for assessment (Step 3). The serious game, Marae-opoly gave the Tangoio Marae community the opportunity to work through climate change futures and adaptation options and experiment with different scenarios and decisions (Step 4). This is the first time a serious game has been developed to support climate change adaptation decision making for a Māori community. As a process, it enabled in-depth kōrero between players about what adaptation options could be appropriate to them according to cultural values, their aspirations for the marae and the resources available. In the words of whānau:

> *"We learnt a lot, we realise now that this is a complex project, and understanding the mahi involved it is not as simple as go or stay and that is what we thought, easy done, so realised that a lot to think about. We had a lot of fun, a lot of kōrero doing it. We are leaving here with our eyes wide open.* (Spokesperson Group 6)

The project team used all of the information gained in Steps 1–4 to provide an example of how the knowledge and aspirations of the community could be used to develop adaptation pathway maps for Tangoio Marae. We understand that the Tangoio Marae community are in the process of considering the adaptation options proposed in more detail, including building stop banks, lifting building floor levels, waterproofing buildings, improving site drainage, riparian restoration works, and developing a response plan and preparedness kit for large storm events.

In collaboration with Maungaharuru-Tangitū Trust (MTT) and the Tangoio Marae community this project developed and tested a variety of new approaches that have not been drawn together previously for the benefit of a Māori-driven research need. These transferrable approaches could support other Māori communities around Aotearoa-New Zealand to plan for, and respond to, climate change-related risks and impacts.

1 Introduction

Greenhouse gas emissions from human activity has already affected the global climate (IPCC 2014). Aotearoa-New Zealand is no exception, with many changes in climate already detected and projected to continue over time (Reisinger et al. 2013; Ministry for the Environment 2016; Royal Society of New Zealand 2016; Climate Change Adaptation Technical Working Group 2017; Ministry for the Environment and Stats NZ 2017).

Key trends and projections for Aotearoa-New Zealand (Ministry for the Environment 2016; Bell et al. 2017; Climate Change Adaptation Technical Working Group 2017; Ministry for the Environment and Stats NZ 2017) include:

- Higher air temperatures, with a higher proportion of days over 25°C, and a decrease in frost days. To date, an average temperature increase of 0.9°C has already been measured.
- Rising sea-level along coastal margins causing increased coastal erosion and coastal inundation risk. Between 1915 and 2015, a sea-level increase of around 180 mm has been measured.
- Changing rainfall patterns with respect to where (geographic location) and when (season) rain falls. More frequent weather extremes with higher rainfall intensity, potentially elevating flood risk in already flood prone catchments and an increased risk of drought.

These changes are expected to continue in an unpredictable way and will have implications for the way we live and the things important to us (i.e., marae, housing, farms, public infrastructure, recreational spaces). The extent and speed of change is dependent on the success of collective international efforts to mitigate greenhouse gas emissions. Greater mitigation means less need for individuals, whānau, hapū, communities and business to adapt, but less mitigation will mean more adaptation will be required (Royal Society of New Zealand 2016). Even if emissions were reduced immediately, some degree of change is already likely to occur due to historical greenhouse gas emissions, this is especially true for sea-level rise (Rouse et al. 2016). Consequently, adapting our communities to a changing climate will be required.

What is adaptation?

Adaptation to climate change is the process of adjustment to the actual or expected effects of a changing climate on human systems (IPCC 2014). Adjustments can mean many things including accommodating change, protecting assets, retreating or avoiding existing and new risks (Bell et al. 2017). The overall aim of adaptation is to help individuals, whānau, hapū, communities and businesses, moderate or avoid any risks, and to utilise any potential benefits from the changing climate. Most importantly, adaptation helps people to retain things (objects or practices) of value and importance into the future as the climate changes (Barnett et al. 2015; Rouse et al. 2016; Tschakert et al. 2017).

Adaptation could entail tweaks and small changes to existing practices and/or systems (i.e., incremental adaptation), or fundamental changes and re-design (i.e., transformational adaptation) (IPCC 2014). It is important to note that adaptation is unlikely to be an “on-off” activity, but rather the implementation of a sequence of adaptations and actions over time as the impacts and implications of climate change become more apparent. Sequencing adaptations over time is a

concept known as adaptation pathways, a conceptual and analytical framework for enabling adaptation planning and decision-making in response to long-term change[1] (e.g., Barnett et al. 2015; Bell et al. 2017; Lawrence and Haasnoot 2017). Pathways are constructed to maintain a flexibility between options and to avoid investment in expensive changes until they are required.

Why do we need to adapt?

The argument for adaptation is that by thinking about, and planning ahead to cope with, the impacts and implications of a changing climate we have a far better chance of retaining the things that we value and our respective livelihoods (Tschakert et al. 2017). Essentially, because we have taken the time to think about options and alternatives carefully, rather than just reacting to changes as they unfold, the risk of making poor choices (often called maladaptation) is reduced.

How do we adapt?

Adaptation requires careful consideration for many reasons, including, it is hard to know what will change, when it could change, and precisely how it might change. There is no silver bullet, no single solution. Every community's situation will be different and require different responses. Any decision or strategy on how to adapt to the challenges created by a changing climate and changing hazards requires a conversation involving many parties based on multiple types of information and knowledge.

There are many ways to adapt and each option has advantages and disadvantages, and certain options may only work for certain periods of time (lifespans). Furthermore, these options may be costly to maintain or have an intolerable impact elsewhere. To further complicate matters, these choices will need to be made about what to protect, for how long, and for whom? Disagreements over what should occur are very possible (Barnett et al. 2015).

1.1 Adaptation for marae communities: Tangoio case study

The effects of climate change will be observed the length of Aotearoa-New Zealand. This means that marae and other Māori-owned assets will be affected, especially if they are situated near the coast or on flood plains (e.g., King et al. 2011, 2012 and 2013). Simply waiting and reacting to an event or problems as they arise puts important cultural assets and land at risk, and jeopardises what is possible for future generations.

Adaptation requires a focus on the societal context of decision processes (Gorddard et al. 2016) and is especially true for Māori communities who have their own decision-making structures and processes (e.g., whakapapa and tikanga). Tangoio Marae have committed to a process to not only support more informed decision-making around the future for Tangoio Marae, but to also provide a roadmap to help other marae/hapū/iwi facing similar challenges of seeking sustainable long-term development, whilst managing natural hazards and climate change-related risks.

Tangoio Marae is located at Tangoio in the Te Ngarue Stream catchment, one of Hawke's Bay's worst flood zones. The Te Ngarue catchment has been subjected to regular flood events with records dating back to before 1924 (HBRC 2005). Despite these flood events, the hapū persisted in occupying Tangoio and erected the first wharenui in the current marae location in the 1920's and a wharekai in 1955. However, by the 1960's many whānau were forced to move away from Tangoio due to a series of devastating floods.

[1] For example, see https://coastadapt.com.au/pathways-approach

Today the Tangoio marae complex remains the centre of the universe for the hapū. The complex is still used, albeit by fewer whānau and less frequently. Looking forward, the hapū (Marangatūhetaua/Ngati Tū, Ngāti Whakaari, Ngāi Tauira, Ngāti Kurumōkihi, Ngāi Te Ruruku, and Ngāi Tahu) and Maungaharuru-Tangitū Trust (MTT) aspire to build a proud, vibrant and modern marae for present and future generations. In association with their recent Treaty of Waitangi settlement, MTT in consultation with the hapū developed a strategic plan to assist in "Building a proud, vibrant and modern Marae" (Figure 1).

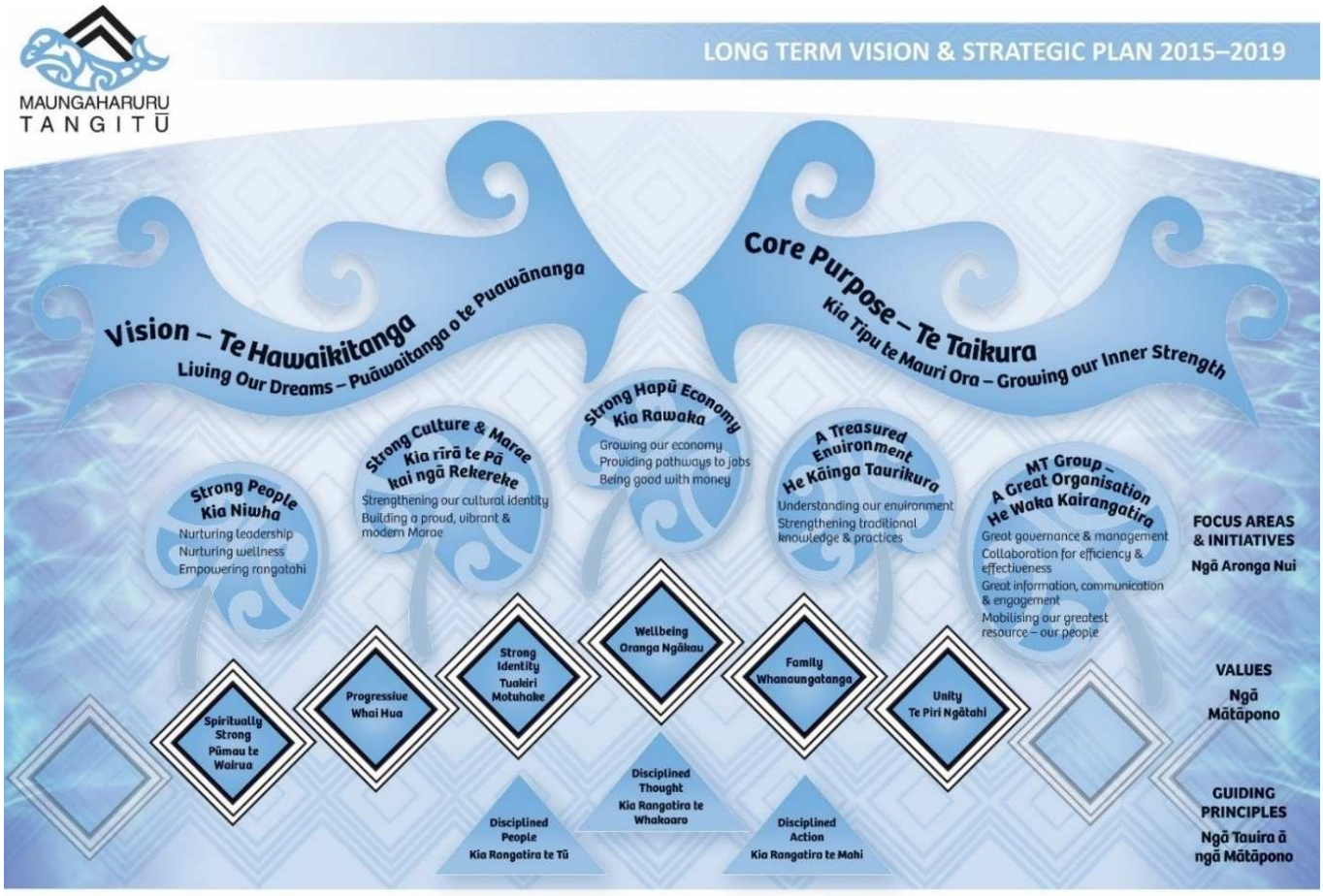

Figure 1: Maungaharuru-Tangitū Trust's long-term vision and strategic plan 2015-2019. (Source: http://tangoio.223.165.77.199.sth.nz/wp-content/uploads/2015/12/Strategic-Plan-2015-2019).

The first action the strategic plan identifies is to "confirm a decision regarding the future location and design of the marae". To move forward with this decision, the people of Tangoio Marae have had the foresight and courage to discuss and consider the current natural hazard risks the marae is exposed to and the potential impacts that climate change could have on the marae in its current location. While under pressure to do something quickly, the Tangoio Marae community are taking a measured approach to their decision-making. The decision-making process being worked through is one of many steps they are taking to ensure that their Treaty settlement funds are invested wisely and will be used to create a legacy that will serve their future generations well.

2 Project scope and report structure

The “Exploring Coastal adaptation pathways for Tangoio Marae” project was a collaboration between the people and hapū of Tangoio Marae, MTT and NIWA. The overarching aim of the project was to develop an indigenous climate change adaptation decision model in the form of a simple flow-diagram that captures the key processes and stages involved for the benefit of Aotearoa-New Zealand communities facing uncertain and complex climate change impacts. This study was funded by the Deep South National Science Challenge.

The objective of the project is to “develop a decision-making model using a real-world example of a community grappling with the challenges and uncertainty of climate change impacts for others to learn from, adapt, improve and use for their unique situations.” In collaboration with MTT and the Tangoio Marae community this project responds to the challenges ahead for many Māori communities facing climate change risks and impacts. The detailed aims of the research were to:

- share knowledge and build shared understanding about climate change and risk management
- identify and appraise ways for marae to adapt to climate change which is similar in content and intent to other recent guidance (e.g., Bell et al. 2017)
- help other marae/hapū/iwi facing similar challenges of sustainable development and managing natural hazards and climate change risks
- assist the people of Tangoio Marae in identifying, evaluating and reaching an agreed strategy for their future, and
- provide a real-world example for other communities to learn from and adopt as appropriate.

This report details the process that MTT, NIWA and the Tangoio community used to develop and test an adaptation decision-making model called Te Huringa ki Te Rangi - He Rautaki Tāwariwari (Section 3). The Tangoio community were asked to evaluate the approaches used in this project and this is summarised in Section 4. A glossary of the Te Reo, and technical terms and abbreviations, used in this report are provided in Sections 7 and 8 respectively. Supplementary information to inform and support each step of the decision-making model is provided in the appendices.

This report is an extension of the material contained in the “Te Huringa ki Te Rangi - He Rautaki Tāwariwari Information Folder” that was distributed to the Tangoio marae community in February 2018. Overall, the content and style of this report has been constructed to support on the ground adaptation through provision of information and examples, rather than as a technical document. This approach follows leading international practice regarding adaptation pathways (Barnett et al. 2014; Bosomworth et al. 2015; Bell et al. 2017).

3 Developing and testing a decision-making model

Any decisions on how to adapt to the challenges created by a changing climate and changing hazards requires staged conversations that are informed by multiple information and knowledge sources, and draw on a variety of specialist expertise (including mātauranga Māori, social science, hydrology, environmental engineering, strategic planning).

Various processes have been developed by different disciplines around the world to help facilitate staged conversations and the input of multiple information sources. **Multi-step adaptive management cycles** designed to guide structured and iterative decision-making in the face of uncertainty are commonly used across different natural resource management contexts (e.g., freshwater, conservation, fisheries). **Adaptation pathways** is strategic planning approach that is increasingly being used in climate and hazards-related decision-making processes. It encourages participants to consider multiple futures. This means you can see what your options are, how long these might be effective for and when you might need to change tact. The approach is focussed on achieving an agreed vision and objectives, through proactive planning that acknowledges that there are many ways to achieve it. Adaptation pathways also support staged decision-making and investment. It allows people to plan and know what they can expect to happen when a pre-determined trigger arrives (Barnett et al. 2015; Bell et al. 2017; Lawrence and Haasnoot 2017).

In this research the project team drew on the key steps typically involved in adaptive management cycles and adaptation pathways to propose a decision-making model that could be tested with the Tangoio Marae community. It is similar to the 10 step decision cycle presented in Bell (2017) for coastal adaptation to climate change. The model entails eight steps: (1) Clarify vision and objectives; (2) Understand past, present and future; (3) Identify options; (4) Develop potential pathways; (5) Evaluate pathways; (6) Choose pathway; (7) Implement; (8) Monitor and review. This section describes each step of the decision model called **Te Huringa ki te Rangi – He Rautaki Tāwariwari** (Figure 2) in greater detail.

At the centre of all thinking and decision-making is a clear understanding of the vision and aspirations that the community have for themselves and their environment (Step 1). The visioning stage is followed with developing a shared understanding of the past and of what the future could bring (Step 2). Once an agreed understanding is reached, options to address any current or potential issues can be identified and assessed (Step 3). These elements enable possible strategies to be developed, evaluated and for some decisions to be made, implemented, monitored and reviewed (Steps 4–8).

Naming the model

The project team would like to acknowledge Sam Toka (Waikato, Ngāti Mahuta) for the name ‘Te Huringa ki te Rangi’.

Te Huringa ki te Rangi – literally translated is “The Changes within the Heavens”. This title reflects the eternal battle between Tāwhirimātea (god of wind and storms) and Tūmatauenga (the god of war and of mankind) which followed the separation of Papatūānuku and Ranginui. In the creation story, the children of Ranginui (the sky father) and Papatūānuku (the earth mother) wished to separate their parents so that light could come into the world. The only brother who did not agree to this was Tāwhirimātea who plotted revenge against the other brothers. After defeating Tane-nui-a-rangi (also known as Tāne Mahuta), Tangaroa, Rongomātāne and Haumia-tiketike, Tāwhirimātea then turned his wrath towards Tūmatauenga, the one who suggested killing their parents.

Tūmatauenga stood firm and endured the fierce onslaught of gale force winds, lightning, thunder, driving rain and hail sent by his brother. Tū cast incantations known as tūā to cause the raging tempest of the heavens to calm down. His endurance against Tāwhirimātea's eternal need to seek revenge is a symbol of mankind's resilience when faced with extreme adversity. However, this is a battle that can never be truly won by Tāwhiri or Tū. Tāwhirimātea continues to attack people in storms and hurricanes, trying to destroy us on sea and land. In return, we must resist, plan, strategise, and adapt to survive the attacks served us.

He Rautaki Tāwariwari – literally translated is "A Flexible Strategy" and reflects the need for our planning to be strategic and proactive whilst also having the flexibility to be adjusted to meet changing circumstances and needs.

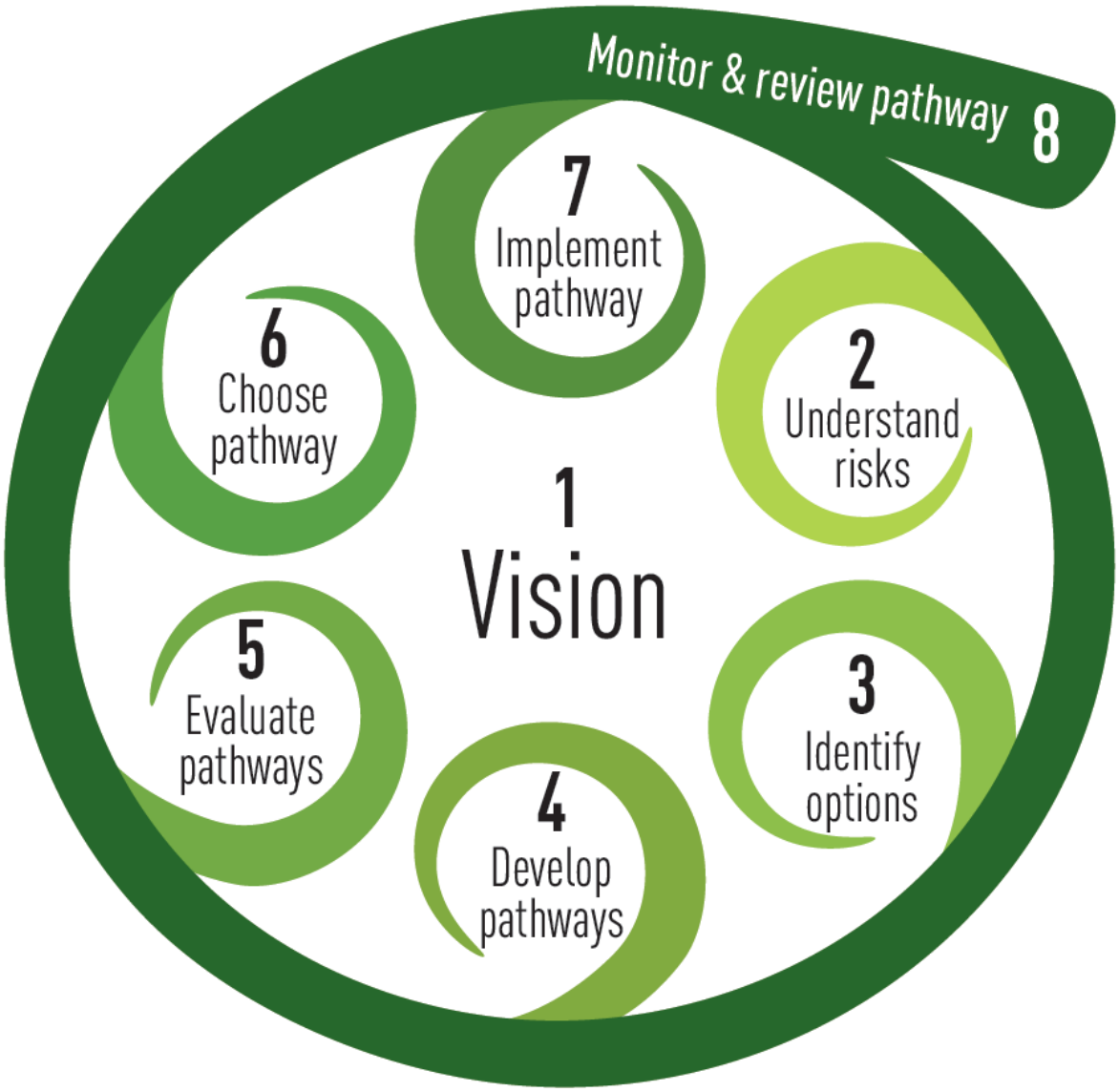

Figure 2: The eight steps of the decision model Te Huringa ki te Rangi – He Rautaki Tāwariwari. (Graphic: Jackie Colliar, Aarti Wadhwa). The model is relevant to any complex decision-making process involving competing objectives, uncertainty and the need to adapt to changing circumstances and knowledge.

Step 1: Clarify vision and objectives

3.1 Decision-making processes and participants

Fundamental to any decision-making process is defining who will make what decisions, and what process will be followed to reach decisions (Bell et al. 2017). This needs to be decided and agreed upon before proceeding with subsequent steps. Doing this upfront sets clear expectations for all involved and allows for a robust and inclusive plan to be developed. Questions to consider include:

- Who will need to be involved? Who are the key people and organisations that need to play a role?
- Who will decide? Is everyone eligible to participate in the decision, or will an elected or self-selected group be mandated with making choices?
- How will the decisions be made? Will it be by vote? Who can vote? Will a majority or a consensus be required? At what stage in the process will a vote occur – once or several times?
- How will decisions be communicated to marae/whānau/hapū/iwi?

The most appropriate decision-makers and methods will vary between marae/hapū/iwi, and in many cases will be guided by their constitution, trust deeds, charters and the like. Some of the more common methods include decisions by consensus or by majority vote of the delegated decision makers. The delegated decision-makers could be elected representatives including tribal governance representatives, elders, responsible trustees, executive committee, beneficiaries and/or shareholders.

Some early thinking about how long the process will take and who might manage the different steps is also needed (Bell et al. 2017). Questions to consider include:

- Who will run/manage the process and co-ordinate the various elements?
- How long will the process take?
- How will the marae/whānau/hapū/iwi be included and updated?
- Who will ensure that everyone is heard?
- What skills and knowledge is needed to complete the process – where and when might these be accessed?

3.2 Articulating the vision and objectives

The purpose of this step is to articulate a shared marae/whānau/hapū/iwi vision, collective goals and aspirations, in this case for Tangoio Marae and the supporting community. Establishing a vision is a helpful way to think about what is of value today and what could be achieved in the future. Once described, this can then inform discussions regarding how to manage the risks presented by climate change to a tolerable level (Tschakert et al. 2017).

To ensure that there is no repetition, all previous material should be reviewed to establish what vision statements have already been described. Once existing information is reviewed, it is critical that the interpretation and relevance of the existing information is confirmed with the community and an agreed vision or set of vision statements and aspirations are agreed by all. The most appropriate methods of engagement will depend on the community, but could include hui, social media, surveys, and interviews.

When previous information about marae/whānau/hapū/iwi visions and aspirations do not exist, it will need to be generated before proceeding with the other steps. Articulating a shared vision can be achieved through a combination of hui, interviews and online surveys asking questions like:

- Describe (or draw) your vision for the marae in the future.
- What does the marae need to flourish?
- What makes a functioning marae?
- What activities are important?
- What legacy do we want to leave our mokopuna?

3.2.1 Tangoio Marae approach

The people of Tangoio Marae formulated a shared vision and collective aspirations. This process involved a number of activities, including reviewing existing documentation, interactive group discussions and online surveys. A previous vision established by the people of Tangoio Marae was identified as part of the review of existing documentation. The previous vision comprised three components:

1. Aspirations – dreams or hopes for the marae.
2. Activities – behaviours and things the people wanted to do at the marae to achieve their aspirations.
3. Built-form – spaces, structures, physical things and design features that support activities and aspirations.

Interactive group-based discussions facilitated during a series of hui was undertaken to confirm the continued relevance of the vision and aspirations and collated additional new information (Figure 3) in early 2016. In order to be as inclusive as possible a follow-up online survey was constructed for those who could not attend the hui in mid-2016. The online survey had two parts, first a marae vision component (see Appendix A: Marae vision and feedback survey), and second a marae facility component, which included questions regarding tolerance to flooding and loss of services (see Appendix B: Marae facilities and tolerance to flood survey). The surveys remained open for several

weeks. All the information gathered through these activities were combined to establish the top priorities and aspirations for the Tangoio Marae community.

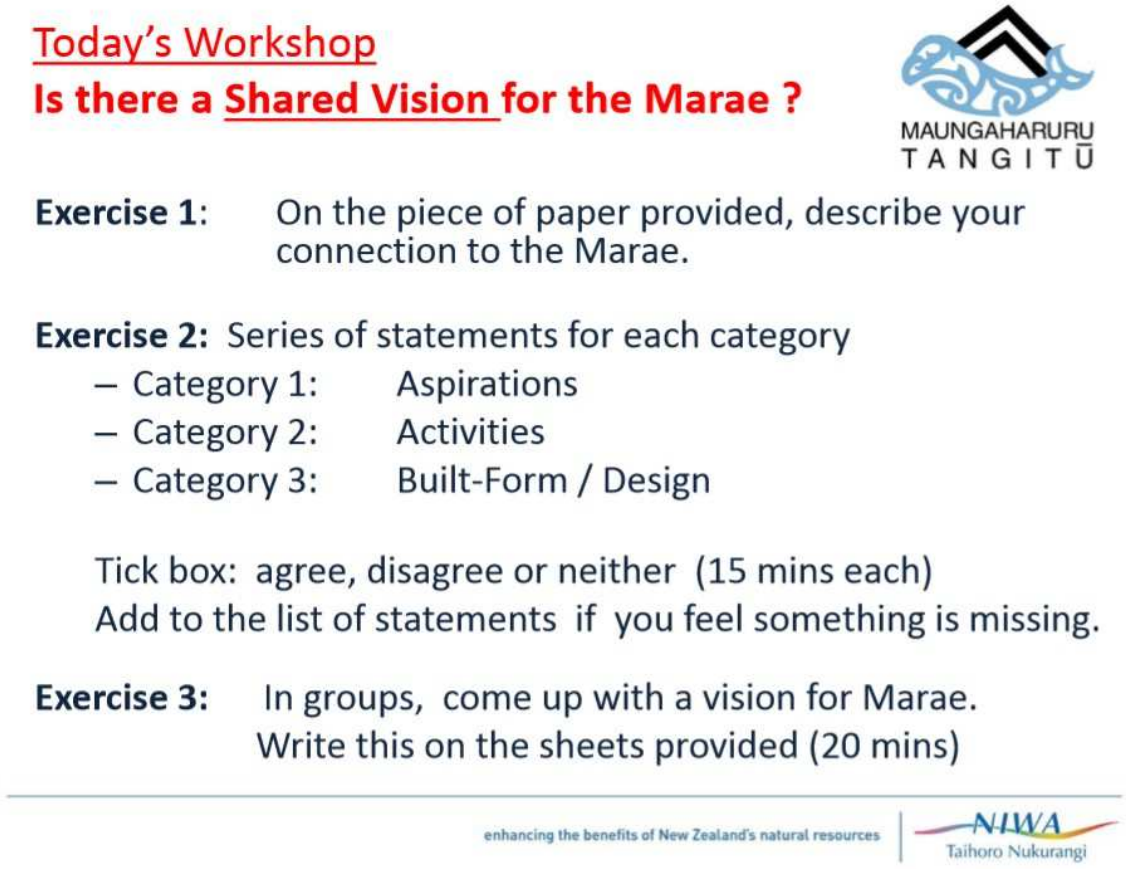

Figure 3: Exercises used to stimulate interactive group-based discussions during a series of hui (March 2016) to confirm the vision and aspirations of the community for Tangoio Marae.

3.2.2 Tangoio Marae results

The combined results from the hui and subsequent online survey demonstrated that the vision and aspirations previously developed by the people of Tangoio Marae has altered little from the those established through their most recent visioning exercise. The combined results also re-affirmed several key aspects of importance to the people of the marae that centred around a well-functioning built environment, which supports a flourishing culture and services key activities necessary for whānau well-being and connectivity to the marae. Importantly, there was a high level of agreement among the hapū on what is important. The top five priorities in each component of the overarching vision (i.e., aspirations, activities, built-form) are shown in Figure 4.

The top built-form environment priorities were further explored to better understand the areas that were considered for the marae to be: (1) essential, (2) nice to have, and (3) not essential (Figure 5). Once again, there was a high degree of agreement between those who responded to the survey. This information was presented back at the hui and again during Step 4 (Develop strategies) to allow for continual reflection on previously stated priorities and aspirations.

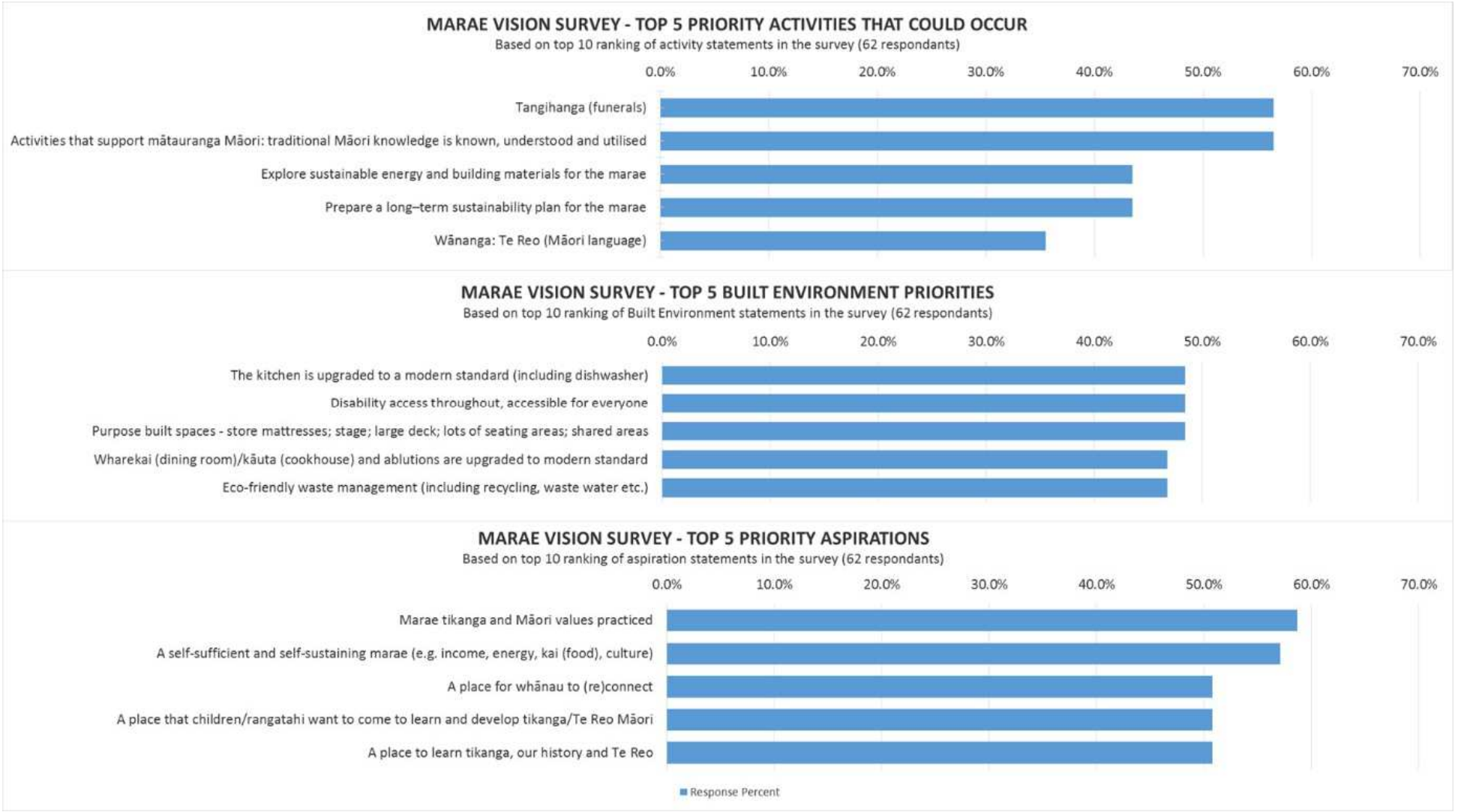

Figure 4: Top five priorities and aspirations for Tangoio marae collated under each component of the overarching vision (i.e., activities, built-form, aspirations) as determined by the community (N = 62 respondents) via online surveys.

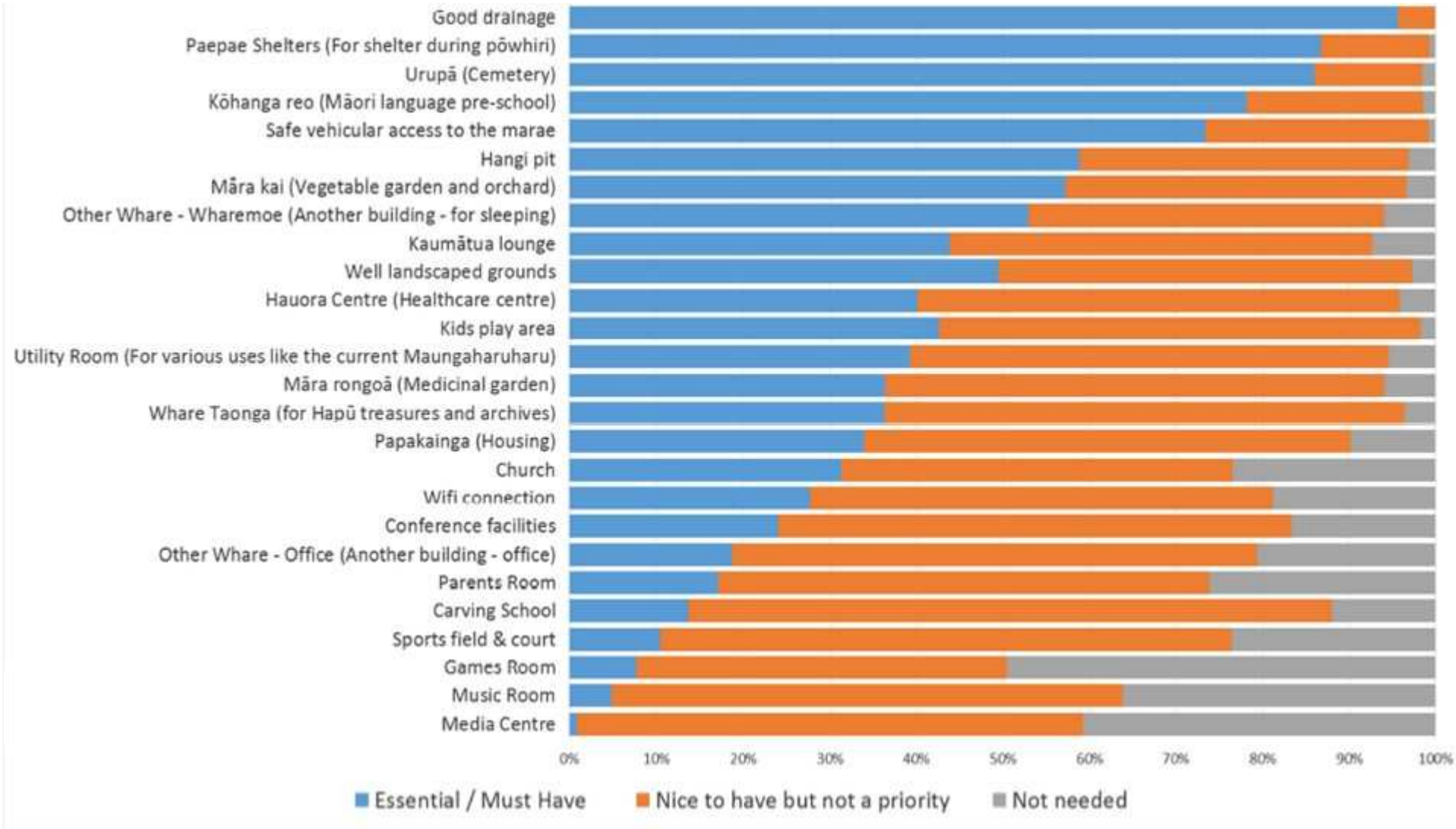

Figure 5: Top priorities and aspirations for Tangoio marae relevant to the "built-form environment" as determined by the community (N = 62 respondents) via online surveys. The bars show the percentage of respondents who felt the action, activity or facility was essential (blue), nice to have (orange) or not needed (grey).

Step 2: Understand past, present and future risks

This step is about developing a shared understanding of the past, present and possible future issues. Furthermore, this step recognises that the past is a very important reference for Māori, for example, as expressed in the whakataukī – *"Kia whakatōmuri te haere whakamua" (My past is my present is my future, I walk backwards into the future with my eyes fixed on my past).*

Reaching a shared understanding of the past and current situation provides an agreed platform/foundation from which to consider and analyse possible futures and identify and develop adaptation options and pathways. This step is critical in the adaptation pathways process, irrespective of the challenges being faced by the community.

3.3 Understanding the past, present and future

3.3.1 Tangoio Marae approach

In the case of Tangoio Marae this step revolved around the impacts, experiences and risks associated with flooding. The first stage (2a) focussed on historic flooding in the catchment and the impacts it has had on the marae and local community. The second stage (2b) focussed on the potential implications of different future climate change scenarios over a range of timeframes. Our investigations aimed to contribute toward a shared understanding of the nature of the current risk through:

- collating, sharing and verifying data and records from historic flooding events
- weaving historical records with experienced based information and observations together
- using computational modelling to assess the potential flooding impacts associated with different climate change scenarios, and
- communicating the information in different ways to support learning within the hapū.

Understanding the past

The process toward understanding the past and present flood hazard at Tangoio Marae comprised two intertwined and complementary knowledge sources: (1) technical information, and (2) lived experience-based information. Details of the specific methods used to support a shared understanding of the past, present and current risks are described below.

While technical and historic flooding information is useful, it can sometimes fail to communicate the social impacts on individuals, whānau and community, particularly to those who have not experienced them. Consequently, collection and collation of stories and experience of historical flooding in the valley was needed to help those who have never experienced such an event to begin to grasp the potential impacts and implications. To this end, kaumātua and others with a long history of life in the area and some experience of flooding were approached to participate in semi-structured interviews (Kitchin and Tate 2000; Flick 2009).

The interviews explored what floods the interviewees had experienced, what happened, what it was like to be in a flood, how it affected them and their surroundings, what the damage was and how the clean-up proceeded (see Appendix C: Semi-structured interview questions). With the permission of the participants, the interviews were videoed, transcribed and formed the base for the creation of a flood timeline and a short video on experiences of the 1968 flood and 1988 Cyclone Bola. The 1963 and 1988 events were selected because they were the largest events which were vividly recalled.

In order to benefit from the learnings gained of previous technical/scientific studies and the latest hydrological modelling approaches that are able to draw on historical datasets the project team:

- collected, collated and shared available flooding records, including photos, written accounts, technical reports and rainfall data, and sought to facilitate two-way information transfer with the marae community
- met with and interviewed members of the marae community to verify the picture of historic flooding, built up using the available records and to fill gaps in the information
- used hydrological and hydrodynamic modelling to assist with recognising and understanding past coastal-river reach processes, hazards and risks. The hydrodynamic modelling of Cyclone Bola was calibrated against peak water levels obtained from photographs (during and after the event) and information supplied by individuals who witnessed the flooding and resulting damage, and
- used the calibrated coupled hydrological-hydro-dynamic model to assess and illustrate the potential impacts if sea-level rise and river flooding on Tangoio Marae and surrounding land, across a range of timeframes and climate change scenarios.

Understanding the future

Future climates and climate-related weather patterns and their impacts are commonly examined through the analysis of various climate scenarios. The approach taken at Tangoio Marae was no different. To help define and improve understanding of future risks we:

- used a range of methods to demonstrate the concept of probability with respect to extreme rainfall events
- introduced some of the science around climate change
- acknowledged the uncertainty around climate change projections, extent and impacts
- selected several potential climate change futures (Representative Concentration Pathways, RCPs[2]) and timeframes to test
- used the calibrated coupled hydrological-hydrodynamic model to assess the future risks and issues arising from climate change, and

[2] Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the Intergovernmental Panel on Climate Change for its 5th Assessment Report (AR5) in 2014. The pathways are used for climate modeling and research. They describe four possible climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. The four RCPs, RCP2.6, RCP4.5, RCP6, and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values.

- focused on the clear trends emerging from the climate change science subject area, rather than the detailed technical concepts or the results of modelling.

The calibrated coupled hydrological-hydrodynamic model was developed as part of understanding the past flood risks, but was also used to assess and illustrate (1) projected sea-level rise impacts across a range of timeframes, and (2) future river flooding coupled with increases in sea-level across different climate change scenarios. It was recommended that if we are only looking at one *reasonably likely* RCP scenario for river flooding, that we look at either RCP 4.5 or RCP 6.0 as they are more likely at this stage than RCP 8.5, which is akin to no effective control on global emissions and is now considered less likely in the wake of the 2015 Paris Agreement.

Three scenarios were modelled in this project to investigate the potential impacts that climate change could have on the peak flood water level in the valley and around the marae (Table 1). The timeframes investigated were selected to cover short, medium and long-term periods. In accordance with the climate change scenarios selected for this investigation, increases of 0.2 m, 0.5 m and 1.36 m in sea-level were used[3] (Table 1).

The coupled hydrologic-hydrodynamic modelling undertaken as part of this project was not meant to provide a comprehensive climate change impact assessment. The modelling data provided a point from which to start a conversation around the key concepts associated with climate change, potential impacts of climate change on Tangoio Marae and surrounding areas, and the uncertainty regarding the when and to what extent the impacts may be.

Table 1: Climate change scenarios used to investigate potential peak flood water levels in the valley and around Tangoio Marae.

Scenario	Year	Climate change scenario	Assumed sea-level rise (m)	Peak discharge (at marae) (m^3/s)	Elevation model	Assumptions
Bola	Present	None	None	146	No stopbank[a]	Bridge blocked[b]
Bola + Climate Change Scenario 1	2040	RCP 6.0	0.2	154	With existing stopbank	Bridge blocked
Bola + Climate Change Scenario 2	2090	RCP 6.0	0.5	164	With existing stopbank	Bridge blocked
Bola + Climate Change Scenario 3	2120	RCP8.5	1.36	160	With existing stopbank	Bridge blocked

[a], The Bola modelling simulation assumed that the existing stop-bank constructed around the marae site was not in place. Future model scenarios retain the existing stop-bank around the marae site.

[b], The modelling assumes the main Te Ngarue Stream channel is blocked at the Tangoio Settlement Road bridge crossing. Stream channel blockage was observed at the crossing during the Cyclone Bola event and following smaller flood events as a result of forestry slash, logs and debris conveyed by runoff, erosion and flood waters from the catchment.

[3] For sea-level rise, the added compounding factor is the strong potential for increasing polar ice sheet melting, for which higher sea-level rise scenarios should be used to stress-test adaptation plans (as per the Ministry for the Environment coastal guidance for local government).

3.3.2 Tangoio Marae results

Understanding the past

The intelligence obtained through the process of understanding the past and present issues formed the basis for assessing future risks and exploring potential options for the future. The collation of historic flood records and photographs coupled with first-hand accounts spotlighted the frequency, severity and impacts of flooding in the valley. Digital productions (e.g., animated modelling simulations) and high resolution static outputs are available on the NIWA website.

The experiences of flood shared through the interviews were emotional and vivid. The first lived experience of flooding was the most memorable and considered to have the greatest impact on the individuals interviewed. The information obtained through this stage allowed those who have experienced flooding at the marae first-hand to share those experiences, and allowed those who have not experienced flooding the opportunity to do so through the eyes and memories of their whānau. Several key themes emerged through the interviews, including:

- impact of flooding on the community, marae and whānau
- consistency in recollections
- resilience and strength of the people following repeated impacts of flooding, and
- what the recovery process involved.

The interviews delivered more than memories or discussions around flooding. They provided a glimpse into the history and people in the Tangoio Valley, their whakapapa, resilience, humour, experiences, dreams and aspirations. Recordings of the interviews provide taonga for the whānau of those interviewed along with the wider hapū. Invaluable information with which to calibrate the hydrological-hydrodynamic models was obtained through the interviews and background investigations.

Modelling of a known event extreme event, Cyclone Bola, provided a better understanding of extent and depth of flooding in the Tangoio Valley (Bind et al. 2018). The modelled peak water depths were calibarated using photographs in the Tangoio Valley during and after Cyclone Bola and compared with observations from whānau present at the marae either during Cyclone Bola or soon after the flood waters receeded. A good level of calibration was achieved between the modelled water levels and the observations and records available (Table 2). Further details of the hydrological-hydrodynamic modelling are provided in Bind et al. (2018).

Table 2: Comparison between observed water levels based on participants recollection and evidence of water damage to buildings and modelled water levels for Cyclone Bola.

Location	Modelled Water Level (m)	Observed Water Level (m)
Front of Tangoio wharenui	20.89	20.82–21.14
Taurima whare[a]	20.90–21.00	21.14

[a], The Taurima whare neighbours the marae and was the closest building to the stream that had clear evidence of water damage directly attributable to Cyclone Bola. The water level was visually confirmed by three interview participants.

Throughout this step we sought to weave the technical and experienced-based information together to communicate the breadth of knowledge obtained. Calibrating the modelled peak flood levels against observations improved the levels of confidence in the computational models of the Te Ngarue Stream and provided a sound base line from which to test different climate change scenarios (i.e., test the effects of changes to rainfall and increased sea-levels). The understanding obtained from weaving the complementary technical and experience-based information provided a fuller picture of the impacts that flooding has had on the community. The knowledge gained through this process was shared through:

- hui, wānanga, presentations, papers, posters and plans
- animated modelling simulations
- production of mural timeline (Figure 6) to communicate frequency and impacts of historic flooding in the Te Ngarue Valley and share stories obtained through interviews
- production of two video vignettes to communicate experiences and impacts of the 1963 flood and the 1988 Cyclone Bola event, and
- making all the information (including recordings of the hui) available online through social media sites.

Understanding the future

The modelling results for the different climate change scenarios (including sea-level rise) were not overly compelling for the existing marae site. The modelling predicted increased peak water levels further down the catchment, but little change at the marae. Communicating the potential flood risks associated with the potential climate change futures assessed was achieved through focussing on the key concepts rather than specific modelling results, i.e., climate change will result in more extremes in the weather, which amongst many things, means increased risk of flooding in the future.

The information, data, stories, scenarios and models were brought together at a single hui to provide a seamless and integrated overview of the past and potential future flood events in the valley. This hui was structured to:

1. Present the information on past flood events and show the timeline and videos telling stories and experiences relating to major floods in 1963 and 1988 (Cyclone Bola).
2. Introduce ideas of risk and changing risk using short relatable examples. For example, a large jar of ping pong balls with set number of white balls and a few coloured ones, drawn at random to show the probability of an event occurring at any time.
3. Overview of climate change science and how it is thought to be occurring and to begin a discussion over what Aotearoa-New Zealand could look like in the future.
4. Present the future climate change scenario modelling to demonstrate possible future flood risk in the valley.

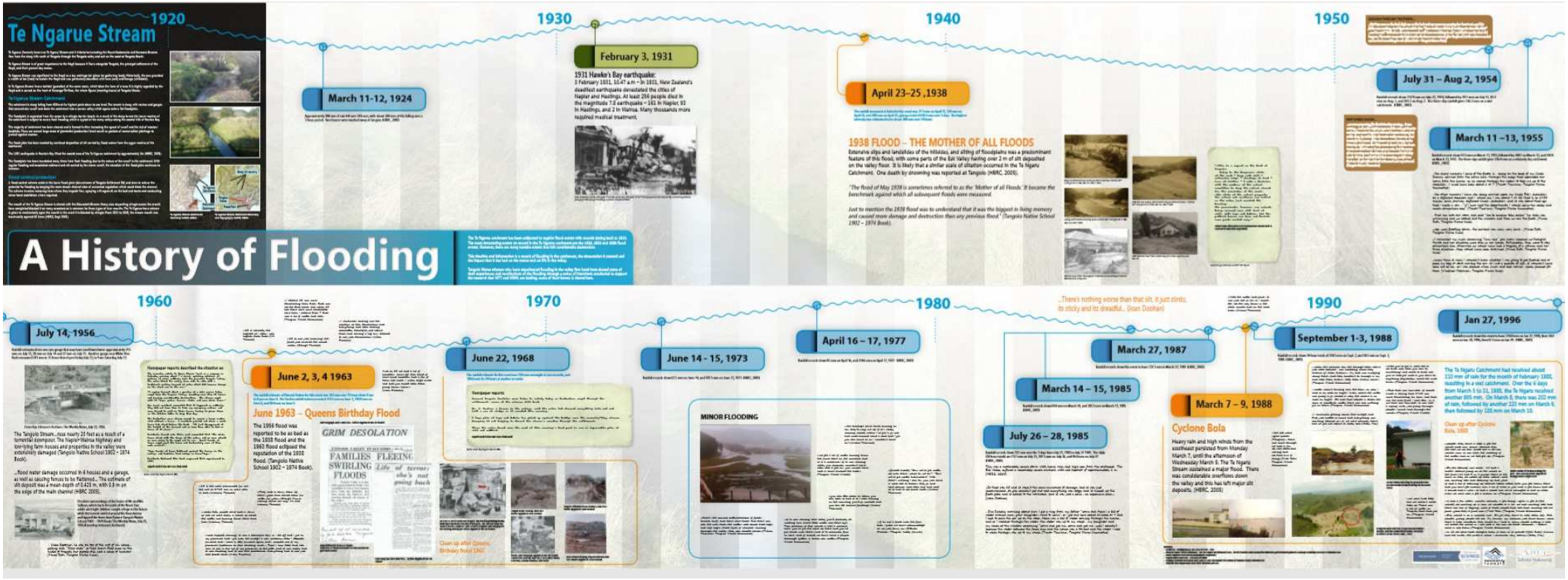

Figure 6: A history of flooding timeline to help communicate frequency and impacts of historic flooding in the Te Ngarue Valley and share stories obtained during hui and interviews with the Tangoio Marae community. (Graphic: Jackie Colliar, Erika Mackay, Aarti Wadhwa).

Step 3: Identify options

The purpose of this step is to prompt the community to identify options that achieve their aspirations which include options to mitigate or avoid flood risks, as well as options to upgrade existing facilities or build new ones. In the case of the Tangoio community, not all of the options presented sought to solve or reduce the existing flood risk or exposure. At this stage it is important to consider as many options as possible, even if they seem irrelevant to addressing the risk or hazard because they may become relevant later in the process.

3.4 Identifying options

3.4.1 Tangoio Marae approach

Through establishing a shared understanding of community aspirations and the existing and future flood risks, the marae community identified a range of potential options for their marae. The approaches used to **identify potential options** included:

- brain-storming with the community to establish the full suite of options (completed in the hui for Step 2)
- site visits and a walk-over with key individuals
- physical assessment of the area including survey of ground and building levels
- talking to locals and independent experts, and
- giving people time to contemplate options, talk to others and provide input.

In order to maintain hapū ownership of the suite of solutions, all the suggested options were retained throughout the process irrespective of the technical feasibility or practicality for that location. It is important to note that facility upgrade options, new buildings and purchase of land were all included as options

Once options were identified, we then sought input to better **define the scope of the options**. For example, where facility upgrades were identified as an option to be considered to achieve the marae aspirations we sought to define the scale and quality of the upgrade to assist with developing concept design details. Where a new facility or a new marae location was identified as an option, we sought to define how much land might be needed (or may need to be protected) for the marae. Input into to defining each option was obtained through an online survey (see Appendix B: Marae facilities and tolerance to flooding survey) and included questions regarding preferences for size and type of building upgrades and new facilities. Respondents were also asked to rate the importance of different options/sizes.

Once the options were identified and some indication of scale obtained, **concept details were developed**. These details included an indicative building footprint and high-level costs estimates. The concept details were used to prepare the "Options menu" (see Appendices D and E) which is a key resource for considering the range of pathways in Step 4. Presenting the options in a table form provided whānau members with easy-to-understand information. It was important to present all the options identified and to present them in a consistent way (to avoid the perception of bias) and in a logical order. The level of investigation, methods used and assumptions made to develop options were highlighted so that people understood the level of uncertainty associated with the information provided for each option.

3.4.2 Tangoio Marae results

A full suite of options for the future of Tangoio Marae were identified through facilitated discussions and included engineered solutions for flood protection, marae re-location options, and improvement of existing marae facilities and infrastructure. The detailed suite of options with indicative cost estimates, estimated maintenance costs, assumptions, anticipated benefits, and the level of flood protection provided is presented in Appendix D: Suite of options considered for the future of Tangoio Marae. The options put forward included (see Appendix D):

- investing money tagged for the marae for a financial return
- riparian restoration works
- lifting building floor levels, or constructing new buildings with elevated floor levels
- building stop banks
- developing a response plan and preparedness kit for large storm events
- waterproofing buildings
- investing in an Earth Ark, i.e., "Build an ark to carry the marae and all of the whānau"
- improving site drainage
- upgrading the existing kitchen, and
- upgrading marae access.

The investigations completed for this step provided a key input into Step 4 and a starting point for investigating and developing the options further as part of the decision-making process (Step 5). Specific options associated with different solutions (e.g., stop banks or new sites) form part of Steps 5, 6 and 7.

Step 4: Develop potential pathways: Marae-opoly

3.5 Assessing options

The purpose of this stage is assembling a range of adaptation options and strategies through a process that can be intuitively understood by all participants. Many adaptation discussions struggle during these final stages of the process due to the complex and contested nature of the decisions and the array of possible alternative options. In order to decide how to adapt to the potential future impacts of flooding at Tangoio Marae, it is necessary to consider:

- to what degree the different choices will achieve (or not achieve) the vision and aspirations of the marae/whānau/hapū/iwi (Step 1)
- all the reasonable and possible alternatives (Step 3)
- the robustness of each of these options/strategies given the uncertainty surrounding future flooding and its impacts (Step 2), and
- the impacts and implications for the marae/whānau/hapū/iwi for each possible option/strategy, including doing nothing (elements of Step 2).

The primary method used to facilitate these difficult conversations was a "**serious game**[4]" developed as part of the project. Serious games have been used before to enable discussion and decisions regarding possible adaptations and sequences of adaptations over time (i.e., adaptation pathways) (Rijcken et al. 2012; Hill et al. 2014; van Pelt et al. 2015; Lawrence and Haasnoot 2017). In particular, the Deltares' Sustainable Delta Game[5] was tested with decision-makers seeking to adaptively manage flood risk the Hutt River Catchment, in Wellington (Lawrence and Haasnoot 2017). Such games help participants to think through and learn about the complexity of the problem, the benefits and consequences of different choices over the long-term. In addition, games prepare the initial groundwork for the development of adaptation pathways through player experimentation with different decisions and outcomes (Lawrence and Haasnoot 2017).

3.5.1 Tangoio Marae approach

Marae-opoly is a serious game that was designed specifically for Tangoio, to encapsulate the complex adaptation challenge in a manner which could be understood and played by all participants. It sought to reflect reality where ever possible and rely on reasonable assumptions were necessary. The principle aim of the game was to maintain a functioning marae that meets the needs, vision and aspiration of the whānau/hapū/iwi through making adaptation decisions over a 100-year time frame

[4] **Serious games** are games designed for a purpose beyond pure entertainment. They use the motivation levers of game design – such as competition, curiosity, collaboration, individual challenge – and game media, including board games through physical representation or video games, through avatars and 3D immersion, to enhance the motivation of participants to engage in complex or boring tasks. Serious games are used in a variety of professional situations such as education, training, assessment, recruitment, knowledge management, innovation and scientific research (Source: http://lexicon.ft.com/Term?term=serious-games).

[5] https://www.deltares.nl/en/software/sustainable-delta-game/

on a set budget. The game was tested and refined with MTT staff and trustees, Tangoio Marae Trustees and marae members ahead of game play with the wider marae community.

Whānau were invited to a day-long hui on Saturday 11 March to play Marae-opoly. The players were organised into six small groups and presented with the game material (Table 3, Appendix D, Figure 7). This included a range of options, including: flood mitigation/protection, purchasing new land, upgrading existing facilities, or developing new facilities either at the existing marae location or on a new site (Appendix D). Many flood protection options have on-going maintenance costs associated with them (identified in Step 3). Players were provided with $4 million in play money with which to pay for their choices and could opt to invest their money (for a fixed return) and insurance could be purchased if desired. Any choices could be made, provided they were reached by consensus and the group had the money to pay for choice and afford on-going maintenance costs. The amount of money provided was based on how much Tangoio Marae could reasonably expect to receive to assist with flood adaptation.

The game pieces of Marae-opoly are presented in Table 3 and detailed game instructions are provided in Appendix E. Players were given an hour to familiarise themselves with the material and make the first set of decisions. Each subsequent decision round took between 20 min and 30 mins.

Decisions were made by the groups over six rounds, in 10-year blocks (between 0–10-yrs and 51–100-yrs) while a "rainmaker[6]" was running in the background. Six different rainmakers were generated based on possible future scenarios, each represented a different possible future based on the general trends of increased frequency of extreme events. At the end of each 10-year block the groups were asked to rate their strategy given the flood events of the preceding decade and against the vision and aspirations of the hapū.

The game was a facilitated process and each group's decisions were recorded on a large notice board for other groups (Figure 7) to see and present back to the other participants. The game was played repeatedly using several different scenarios (rainmakers) to represent different potential and unknown multiple futures.

Table 3: Marae-opoly game pieces.

Game piece	Description
GAME BOARD	A map of the marae and surrounds.
CASH	$4,000,000 in pretend money to invest over the next 100 years.
OPTIONS MENU	A menu of options to choose from including flood protection improvements, to upgrade the marae and options and costs associated with moving the marae to a new location. The menu describes the options, pros and cons, the upfront costs, and ongoing maintenance costs.
DECISION & BALANCE SHEET	To track and record your decisions, and cash balance.

[6] In Marae-opoly a "rainmaker" is a simulated record of flooding frequency based on local rainfall records, with an allowance for increased rainfall intensity and flood frequency. The rainfall series for the game played at Tangoio Marae were randomly selected. At the end of each 10-yr block the game facilitator told the groups how many floods had occurred over the time period and then asked the groups to assess the state of their investments to improve the marae using the emoji lollipops.

Game piece	Description
EMOJI LOLLIPOPS	To rate how you felt your decisions performed throughout the game. Each group member will have a set of these.
WHĀNAU WISH LIST 'GREEN' CARD	Summary of whānau priorities and aspirations to consider when making your decisions.
OPERATING & MAINTENANCE 'ORANGE' CARD	Details of how operating and maintenance costs will be accounted for.
INSURANCE INFORMATION 'BLUE' CARD	Details the cost of insurance and the implications if you chose not to insure the marae.
FLOOD RELATED MAINTENANCE COST TABLE	Reference to help you assess flood related maintenance costs associated with the available options.

3.5.2 Tangoio Marae results

Playing Marae-opoly (Figure 7) enabled key conversations necessary for (hypothetical) adaptation to occur within each group in a non-confrontational and experimental way. Key questions participants asked included: What should be done? Why should we do that? When should we act? What order should we do things? What will whānau think of these decisions? Do we have enough money? What can the whānau live with?

The game was close enough to reality to reflect the crucial but necessary choices. Each group approached the simulation differently, some invested, other spent, but they all experimented. Player's reflections included:

> *"Because we weren't investing any money into the kete, and so our strategy sort of went a bit hori, spending, spending, spending, then deficit, whoops. For 30 years a whole generation we went without, but we were still here, we had our land just like our old people"* (Group 1)

> *"At the beginning we had lots of spending, we got land and infrastructure and a new marae. We wanted to also protect the current marae, while we had big dreams and aspirations we wanted to ensure that we could continue as a whānau here and protect it from what ever happened. We think our strategy did work. However, we could have done it better and saved ourselves 20 years if we made better decision. We got to many big dreams up here, and spent too much money and therefore we had a lot of down time when we only could pay our costs and insurances, so we would definitely change that"* (Group 4)

> *"Our strategy was to use short term and long-term goals. We looked at investments, we kept our focus and we considered what we had to work with and the needs of our people. The short term long term approach gave us time to think about what direction and having a set budget helped us to realise what we could spend and what we couldn't"* (Group 2)

Each group applied a different strategy over the 100-year timeframe and could clearly describe the reason for the choices, the successes and the mistakes they made. Overall the players expressed that they enjoyed the game and the key messages regrading adaptation were learnt in a memorable way, for example:

"*It was an awesome way of seeing the bigger picture and what that would look like*".

Figure 7: Playing Marae-opoly with the Tangoio community. (Clockwise from top left): Marae-opoly game pieces; Marae-opoly players with emoji sticks; Marae-opoly strategy decision board for six groups (numbered 1-6); and Group of players working through the game.

Step 5: Evaluate pathways

The purpose of this step is to narrow down which adaptation strategy or pathway best meets the visions and aspirations of the marae/whānau/hapū/iwi given the uncertainty surrounding how a changing climate could, in the case of Tangoio Marae, affect the intensity and frequency of flooding in the valley. Once a long-list of options and strategies are identified, it is likely that further investigation will be needed to evaluate them properly and reduce the options being considered. The types of further investigation needed will depend on the options and could include: (a) Concept or preliminary design investigations; (b) Discussions with key stakeholders including Territorial Local Authorities (TLAs); (c) Seeking property advice; and (d) Discussions with external funders.

3.6 Evaluating options and pathways

3.6.1 Tangoio Marae approach

There are several crucial questions to be considered in order to narrow down the multitude of pathways and options produced during Marae-opoly (Step 4) to a manageable shortlist:

1. What strategies and pathways meet the vision and aspiration of the hapū?
    - 1.1 What aspirations could be achieved – what could not?
    - 1.2 What are the benefits of each pathway, for whom and when (in what timeframe)?
    - 1.3 What at the disadvantages of each pathway for whom and when (in what timeframe)?
    - 1.4 Is one group within the hapū disproportionately affected?
2. Technical – what pathways are feasible from a technical perspective?
    - 2.1 What are the most appropriate technical solutions?
    - 2.2 What are the costs of each pathway?
    - 2.3 What is the impact of the option on other values (i.e., aesthetics)?
    - 2.4 Under what conditions would the option fail?
    - 2.5 What is the residual (remaining) risk?

3. How flexible are the options?

    3.1 Do any of the pathways lock the hapū into a particular option?

    3.2 Does the pathway allow the hapū to change their plans as needed?

    3.3 Does the pathway disadvantage future generations or restrict their choices in the future?

4. How will the pathways be funded?

    4.1 How will the pathways be funded over the timeframe?

    4.2 Is there still money for other foreseen or unforeseen events or needs (e.g., replacement kitchen)?

The process of evaluating each pathway against the set of critical questions might result in some changes to the short-listed pathways or new pathway options. As part of the evaluation it is important to decide if you:

- need to gather extra information (e.g., the cost and location of land to help inform the decision), and
- have enough information now to choose one adaptation pathway and move to the next step in the decision-making process.

Once you have enough information and have firmed up your short-list of potential strategies you can evaluate them further. The most appropriate evaluation method will depend on several factors including:

- the target audience and purpose of engagement
- who is making the decisions on the strategy, and
- the risks and financial implications of the decisions.

There are many established methods available to evaluate different options, including pros/cons, cost/benefit analysis and Multi-Criteria Analysis (MCA). For further information on the range of methods refer to Bell et al. (2017). Irrespective of the method used, it is important that the overall strategy is evaluated, rather than the individual options that make up the strategy.

3.6.2 Tangoio Marae results

Initial rounds of Marae-opoly (Step 4) identified several common elements to the strategies being formed by the Tangoio community as well as several key differences (Table 4). The Tangoio Marae community are in the process of further investigation to evaluate options and pathways. We understand that all the options identified in Step 3, except Earth Ark, are being considered in more detail.

To demonstrate the adaptation pathway approach, we have developed a “short list” of options that draws on the common features of the strategies formulated through Marae-opoly game play. These options are provided for demonstration purposes only and have not been developed or agreed by the Tangoio Marae community. Four possible pathways are shown in Figure 8.

Table 4: Common elements and differences across the strategies employed by the groups of Marae-opoly players from the Tangoio community.

Timeframe	Commonalities	Differences
Short-term	Options to protect the existing marae complex.	Sequence of interventions.
	Investment in cash and/or land.	$4,000,000 in pretend money to invest over the next 100 years.
	Upgrading the existing marae.	a) Level of investment in the existing marae. b) Level of investment in cash and/or land.
Long-term	Maintaining insurance to protect existing marae complex.	To track and record decisions, and cash balance.
	Maintaining insurance to protect assets.	Tolerance to adverse impacts of flooding.

Figure 8 has the different possible flood adaptation options on the vertical axis while the horizontal axis represents the increasing impacts of flooding associated with a changing climate. The horizontal axis can be loosely linked with time as the frequency, magnitude and impacts of flooding will likely increase over time as the climate changes. However, there are no actual time frames on the axis as the rate of change cannot be predicted. When reading Figure 8, begin from the existing situation. This situation will continue until a point where the goals and aspirations can no longer be met, once this occurs a decision must be made as to what happens next. This decision point is represented on the diagram by a circle. At the decision point it is time to switch to another option. It is very important to note that many options have finite lifespans. This means that the adaptation option will only be effective in meeting goals and aspirations while the floods frequency and magnitude remain below a certain number. For example, raising floor levels will work until the flood water can overtop the new floor, or the flood waters damage essential services and access ways and it becomes too expensive to keep fixing. Some options will not be effective indefinitely. The value of using pathway maps is that the different options are mapped out, which helps to think through how adaptation can be staged in response to changing flood frequency and magnitude. It then becomes clear that options do not have to be applied until they are needed.

In reality, each of the options include investing a portion of the available funds, and some upgrades of the existing marae facilities – but to keep things simple, these elements are not included in the hypothetical adaptation pathway map.

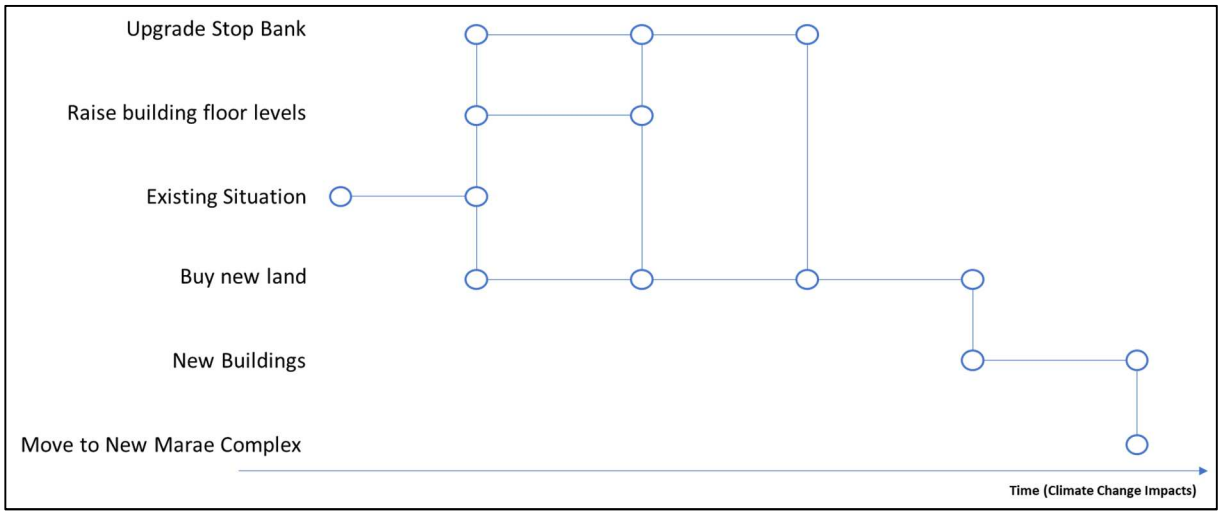

Figure 8: Example of a hypothetical adaptation pathways map for Tangoio Marae illustrating a short list of six options, including the existing situation. In the map, starting from the existing situation, the blue lines represent all of the potential pathways possible and the circles represent the point where a switch to another option is required. We further explain and build on this adaptation pathway in Figure 9.

Step 6: Choose pathway

This step involves choosing the preferred adaptation pathway and beginning to define how it will be enacted over time. This step includes agreeing on trigger points that specify what actions will be taken and when. While we did not reach this step with the Tangoio Marae community, we have provided some guidance on Steps 6–8 based on other relevant research (e.g., Bell et al. 2017).

Knowing when to move from one option to another is not easy to define. It is unlikely to follow prescribed timeframes due to the uncertainty associated with climate change timing, scale and impact. It is therefore more appropriate to identify triggers on when to act rather than absolute timeframes. Identifying these triggers requires conversations around what impacts/situations are acceptable and at what point an agreed action(s) is required.

3.7 Choosing a preferred pathway

As noted in Step 1, defining who the decision-makers are and how the decision will be made is critical. The most appropriate decision-makers and methods will vary between marae/whānau/hapū/iwi. Decisions could be made by consensus or by majority vote of the delegated decision-makers. The delegated decision-makers could be elected representatives including tribal governance representatives, elders, responsible trustees, executive committee, beneficiaries or shareholders.

The level of information needed to support the decision-making process and appropriate methods of evaluating short listed options will depend on the scale of decision to be made and the implications of those decisions. These factors must be considered on a case by case basis. Common methods used to **identify a preferred pathway** for consideration by the decision-makers include: Assessing the results of the serious game play and community engagement; Cost-Benefit Analysis (CBA); and MCA. Where an MCA is used, the criteria and their relative importance should be agreed by the community and sensitivity assessments completed. Typical criteria used in MCA include economic, environmental, social and cultural matters.

After the preferred pathway is decided, **thresholds** and **trigger points** need to be defined. Thresholds are “events” that should not occur because they affect the values and aspirations in a way that is considered to be unacceptable. Triggers are the points when it is time to move onto the next step of the pathway or strategy. For example, it could be when the cost of insurance increases above an agreed number, or the cost of flood repairs exceed a certain value, or the frequency of flooding exceeds an agreed number. Trigger points should be set at a level that leaves enough time to take an action to avoid a threshold. For example, once the trigger value is exceeded there is still enough time to plan and implement the next step in the pathway/strategy (Bell et. al 2017). How to define appropriate and relevant trigger points is the subject of on-going research both nationally and internationally.

There are the things that can and must be **measured and monitored** so that trends are picked up early enough for the marae/whānau/hapū/iwi to decide or take an action to move onto the next part of the pathway. For example, keeping track of insurance costs, keeping a record of flooding impacts, etc.

The adaptation pathway needs be **clear and well documented** and the outcomes integrated into other marae/hapū/iwi documents, plans and processes. The documentation should describe the sequence of options that are available to the community to respond to climate change impacts linked with the agreed trigger points and a monitoring plan.

3.7.1 Tangoio Marae results

To further explain the adaptation pathway approach and the role of triggers, we have developed an adaptation pathway map (Figures 8 and 9) for **demonstration purposes only**. This has not been developed with, or agreed on by the Tangoio Marae community. The example provided in Figure 9 demonstrates how trigger points (Table 5) are represented in the adaptation pathway presented earlier in Figure 8. This adaptation pathway illustrated in Figure 9 assumes that Option 1 (upgrade stop bank) from Step 5 is selected as the preferred approach.

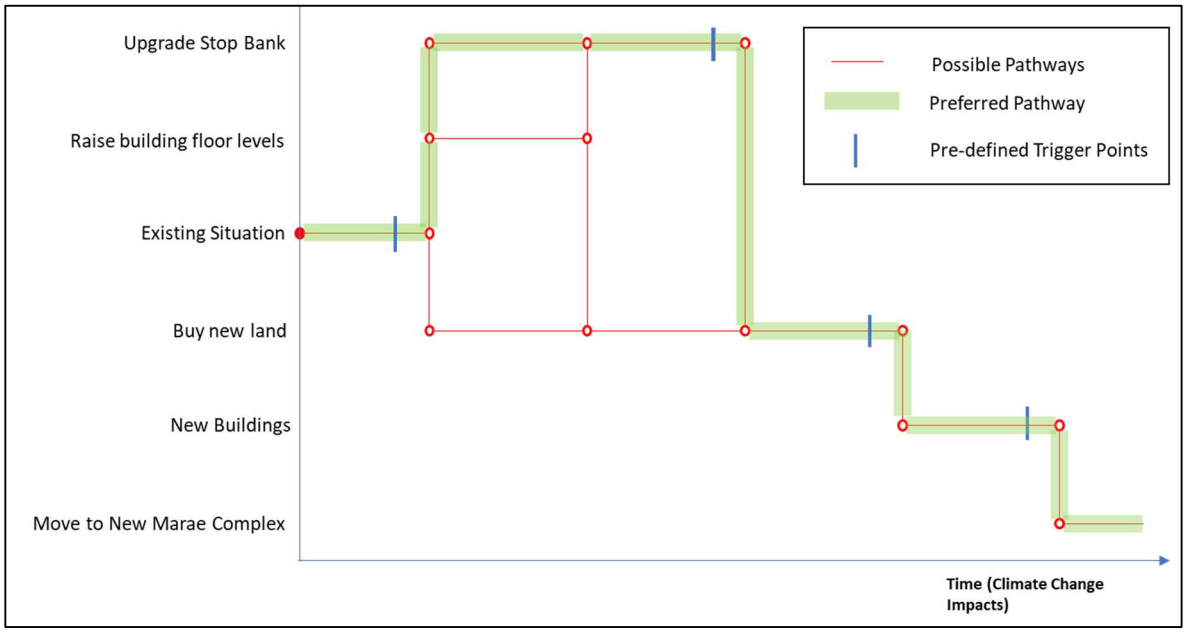

Figure 9: Example of a hypothetical adaptation pathways map for Tangoio Marae illustrating a preferred pathway from the existing situation to a new marae complex. This adaptation pathway, shown in green, assumes that option 1 (upgrade stop bank) is selected as the preferred approach, leading over time to the purchase of new land and buildings and finally to marae relocation. The blue lines are the trigger points where actions are taken to avoid breaching thresholds. The red circles are the points at which change occurs from one option in the pathway to another.

In Figure 9, the existing situation might continue until a trigger point is reached, which is indicated by the blue line. This trigger would be pre-determined and could be could be a flood event, or a near miss, which affects critical buildings (see Table 5). Once the trigger is reached, actions will be taken to facilitate a move to the next option, in this case upgrading the stop bank. The trigger point needs to be set so that there is enough time to complete all the investigations and actions necessary to implement the action before the threshold is breached, in this case costing and construction of the stop bank. In Figure 9, this is shown conceptually as the space between the blue line and the red

circle, where the red circle is the decision point when it is time to move to the next option. The stop bank will be an effective adaptation option until the flood magnitude increases so that the risk of overtopping is high or the maintenance costs become difficult to manage reaching a further trigger point (blue line). At this time other investigations and actions will need to occur to move towards purchasing new land and buildings.

Table 5: Some of the potential trigger points along a hypothetical adaptation pathways map for Tangoio Marae.

Options in adaptation pathway	Trigger point to move to the next step	Implementation actions
Existing situation	• marae access and use affected more than five times in 12 months due to flooding, or • marae building(s) are flooded above floor level.	• detailed design and construction of stop bank to provide more than 1% Annual Exceedance Probability (AEP) flood protection, or • upgrade stop banks.
	• land suitable for new marae development or for investment becomes available.	• consider purchasing land for investment (i.e., land banking) or future development.
Upgrade stop banks	• stop bank overtopped more than twice, or • marae buildings are flooded above flood level, or • cost of insurance exceeds $50k/annum, or • sufficient finances available to fund purchase of new land.	• identify potential land for marae relocation, or • continue to maintain stop bank and marae, • confirm availability of funds, • buy new land.
New buildings	• decisions made on future of existing marae, • new marae complex completed.	• move to new marae complex.
Move to new marae complex	NA. Assume new marae is located outside of flood hazard area.	NA. Assume new marae is located outside of flood hazard area.

Steps 7 and 8: Implement, monitor and review pathway

3.8 Implementing a preferred pathway

This step is all about implementing the decisions on the preferred pathway and associated trigger points made in Step 6. Several critical actions are required to ensure that the adaptation pathway is implemented, as agreed, including:

- deciding who will take overall responsibility for implementation of the pathway
- communicating the pathway, triggers and monitoring needs and results
- integrating the pathway into all relevant marae/hapū/iwi plans, processes and decision-making
- confirming the indicators that need to be monitored and recorded to determine if a trigger point is approaching or has been reached. In defining the trigger points, most of the indicators that need to be monitored and recorded over time will have been identified
- defining who will be responsible for monitoring and recording different indicators and who will act on the monitoring information, and
- embedding the pathway into all relevant decision-making processes (including plans and policies).

3.9 Monitoring and review

Adaptation pathways approaches support long-term planning under uncertainty. The use of adaptation pathways implies a systematic monitoring effort to inform future adaptation decisions. This monitoring should feed into a long-term collaborative learning processes between multiple actors at various levels (Hermans et al. 2016).

Monitoring and review of the adaptation pathways are critical to maintain its currency and relevance. This process is on-going and fundamental to responding to changing needs and circumstances of the community, as well as new knowledge and experiences as they come to hand. The decisions made in Steps 7 and 8 also need to be incorporated into an adaptation pathways document which records the process and decisions made (see Section 3.7).

3.9.1 Tangoio Marae results

Playing Marae-opoly laid the ground work for understanding what thresholds the Tangoio Marae community had for the frequency and impact of flood events (see Appendix F). This kind of information can be used to start informing the design of a monitoring programme and the selection of indicators (Table 6).

It is important to note that these reported tolerances may change if more frequent flooding does occur. Principally, as many of the respondents had not experienced such an event and have little experience to base their response on. This is where monitoring and review becomes necessary to pick up any changes as people experience real events. Table 7 presents a range of possible indicators which could be monitored to assist in deciding when to move between the various alternative options. These options are provided for **demonstration purposes only** and have not been developed or agreed by the whānau of Tangoio Marae.

Table 6: Average reported tolerances to the frequency of flooding impacts by the Tangoio community as indicated in online surveys (N=138 respondents).

Impacts of flooding	Average frequency that was tolerable to respondents
Water logged carpark	Once every 2-5 years
Flooded marae grounds	Once every 2-5 years
Flooded and water damaged wharekai	Once every 2-5 years
Flooded and water damaged wharenui	Once every 2-5 years
Flooded and water damaged ablutions	Once every 2-5 years
Asked to help clean up buildings/marae grounds post flood	Once a year
Asked to contribute pūtea (money) to help clean up buildings/marae grounds post flood	Once a year
Unable to use facilities due to damage/clean up	Once every 2-5 years
Loss of access to the marae due to flooding	Once every 2-5 years
Damaged marae grounds (i.e., landscaping)	Once every 2-5 years
Cancelled events due to flood damage, waterlogging	Once every 2-5 years
Impact on the urupā (cemetery)	Once every 2-5 years
Kōhanga Reo closed due to waterlogged carpark	Once every 2-5 years

Table 7: Examples of some of the indicators and associated monitoring that could give effect to the example adaptation pathway described in Step 6. This information is provided for illustrative purposes only and has not been developed or agreed by the whānau of Tangoio Marae or MTT.

Indicator	Relevance	Frequency	Monitor	Recording methods
Investment performance.	Monitor availability of funding to implement pathway.	On-going	MTT Board	Hui-a-hapū, annual report.
Hapū vision and objectives.	Is pathway still relevant?	3–5 years	MTT Board	Updated hapū strategic plan.
Progress towards hapū priorities.	Is pathway giving effect to hapū priorities? Does it need to change? Do triggers need to change?	Annual	MTT Board	Hui-a-hapū, annual report.
Climate science predictions/developments.	Has the risk of climate change impacts on the marae changed? Does the pathway need to be updated?	3–5 years	MTT Environmental Manager	Hui-a-hapū, special report to MTT Board.
Flooding frequency/ duration/impact (e.g., damage, inconvenience, recovery costs).	Have triggers been reached, are they approaching? Are the triggers still appropriate?	On-going	Marae Committee	Quarterly monitoring reports and annual pathway report to MTT Board.
Insurance premiums and cover.	Have triggers been reached, are they approaching? Are the triggers still appropriate?	Annual	Marae Committee	Annual adaptation pathway report to MTT Board.
Surrounding land-use changes.	Have the risks to the marae changed?	Annual	MTT Environmental Manager	Annual adaptation pathway to MTT Board.
Overall pathway.	Is pathway still relevant? Does documentation need to be updated to reflect actions already made?	3–5 years	MTT Board	Hui-a-hapū, special report to MTT Board.

4 Evaluation of the approaches used in this project

An evaluation of the approaches used to deliver this project was undertaken at two key points in the process:

- firstly, at the end of the hui designed to discuss historical experience with flooding and present potential future flood modelling, and
- secondly after the flood adaptation simulation game (Marae-opoly) hui.

4.1 Historical experiences: Past and future floods (Steps 2 and 3)

This hui aimed to provide a forum to explore past experiences with flooding at Tangoio and discuss possible future risk due to a changing climate (to achieve Steps 2 and 3). The participant evaluation provided insights into how successful the methods were in terms of conveying the past information and experiences, and presenting potential future flood risk (Figure 10). Each attendee was provided with the opportunity to complete an evaluation form (Appendix G) which sought to **gauge their understanding of the research's purpose**, if they felt included and heard, if the methods used had increased their understanding of the flood risks faced, if the video and data presented contributed towards this understanding, and their self-efficacy (i.e., belief that their actions can affect a desirable outcome). The evaluation form comprised both open and closed questions, the latter were ranked on a six-point Likert scale from 1 (agree) to 6 (disagree).

In general, evaluation form respondents (N=32) understood the purpose of the joint research project (greater than 85% reported a 3 or less) and were supportive of the decision-making process (greater than 90% reported a 3 or less). More than 75% of participants felt their ideas and knowledge were valued (reported a 3 or less). More than 75% of participants felt video had increased their understanding of what a flood could be like (reported a 3 or less), with more than 80% agreeing that the video was a good way to help those who had not experienced a flood understand what it could be like (Figure 10). For example, in the words of whānau:

"*Shows the affect it had on people at the time that lived in effected area"*

"It (the video) *gives a good indication of what happened and what could happen"*

"From this presentation/hui we are better able to make informed decisions"

Most hui attendants (more than 85% reported a 3 or less) believed there were things they could to reduce the effect of floods on the marae and would take part in further hui to prepare. The more negative responses were from a very small number of participants who consistently disagreed with the activities on the day.

This evaluation reveals several key details; first the approach applied to complete Steps 2 and 3 achieved the desired outcome regarding effective communication of past and potential future flood risk. Second that the hui participants felt their ideas were valued and heard, which is a critical element of any decision-making process. Finally, the participants felt empowered to act to reduce their expose to flood in the future. In short, the aims of the hui designed to discuss historical experiences with flooding and present potential future flood modelling were achieved, and the ground work for the next stage (Step 4) was established.

4.2 Flood adaptation simulation game (Marae-opoly) hui (Step 4)

A second evaluation form was designed to provide insights into how successful the **flood adaptation simulation game (Marae-opoly)** was in establishing a place to jointly discuss adaptation issues. Critical issues for evaluation included, how can the suite of adaptation options enable the vision and aspirations for Tangoio Marae, what are the benefits and costs associated with each option, and how can long-term planning occur with existing resources.

The evaluation data suggests the Marae-opoly was very successful with at least 90% of respondents reporting a 3 or less for each of the questions asked (Figure 11). This clearly demonstrates the value of developing a fit-for-purpose serious game to create a learning environment where key discussions occur and experimentation is possible with different options. Most importantly the simulation game was fun. For example, in the words of whānau:

> *"I enjoyed the game, I think we leave here with more knowledge, and look forward to seeing whatever happens"* (Spokesperson Group 2)

> *"We learnt a lot, we realise now that this is a complex project, and understanding the mahi involved it is not as simple as go or stay and that is what we thought, easy done, so realised that a lot to think about. We had a lot of fun, a lot of korero doing it. We are leaving here with our eyes wide open.* (Spokesperson Group 6)

The game can (and should) be played repeatedly by the marae community until several clear strategies or pathways emerge that are robust in multiple possible futures and meet the aspirations and vision of the iwi/hapū/whānau. As Group 3 pointed out is it very important that the game is played by many people:

> *"Different generations can be heard on this kaupapa as well, it is them (rangatahi) who will be dealing with this, they are important to this process".* (Spokesperson Group 3)

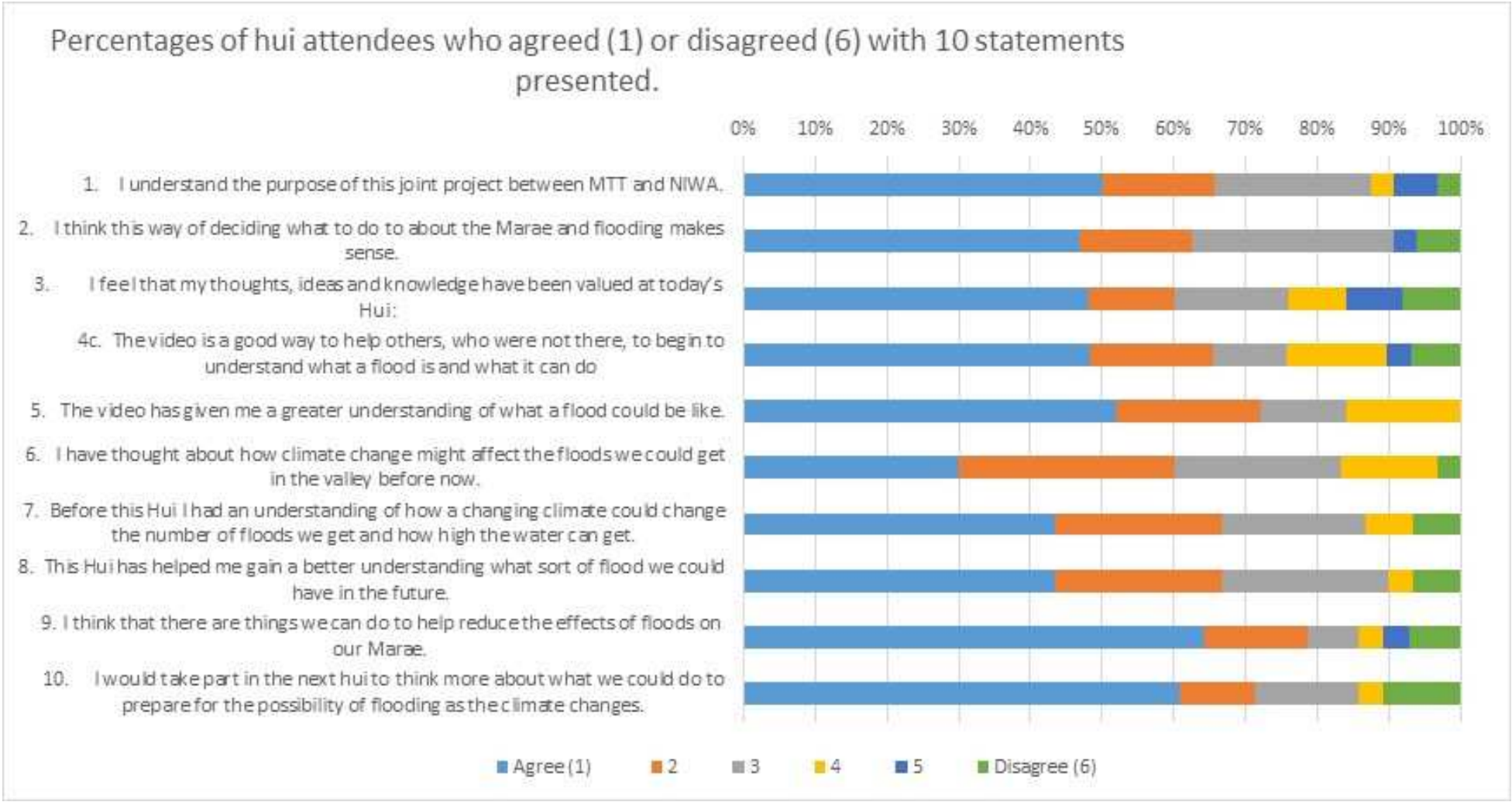

Figure 10: Percentage of the past and future floods hui attendants who agree or disagreed with the 10 statements presented in the post-hui evaluation form.

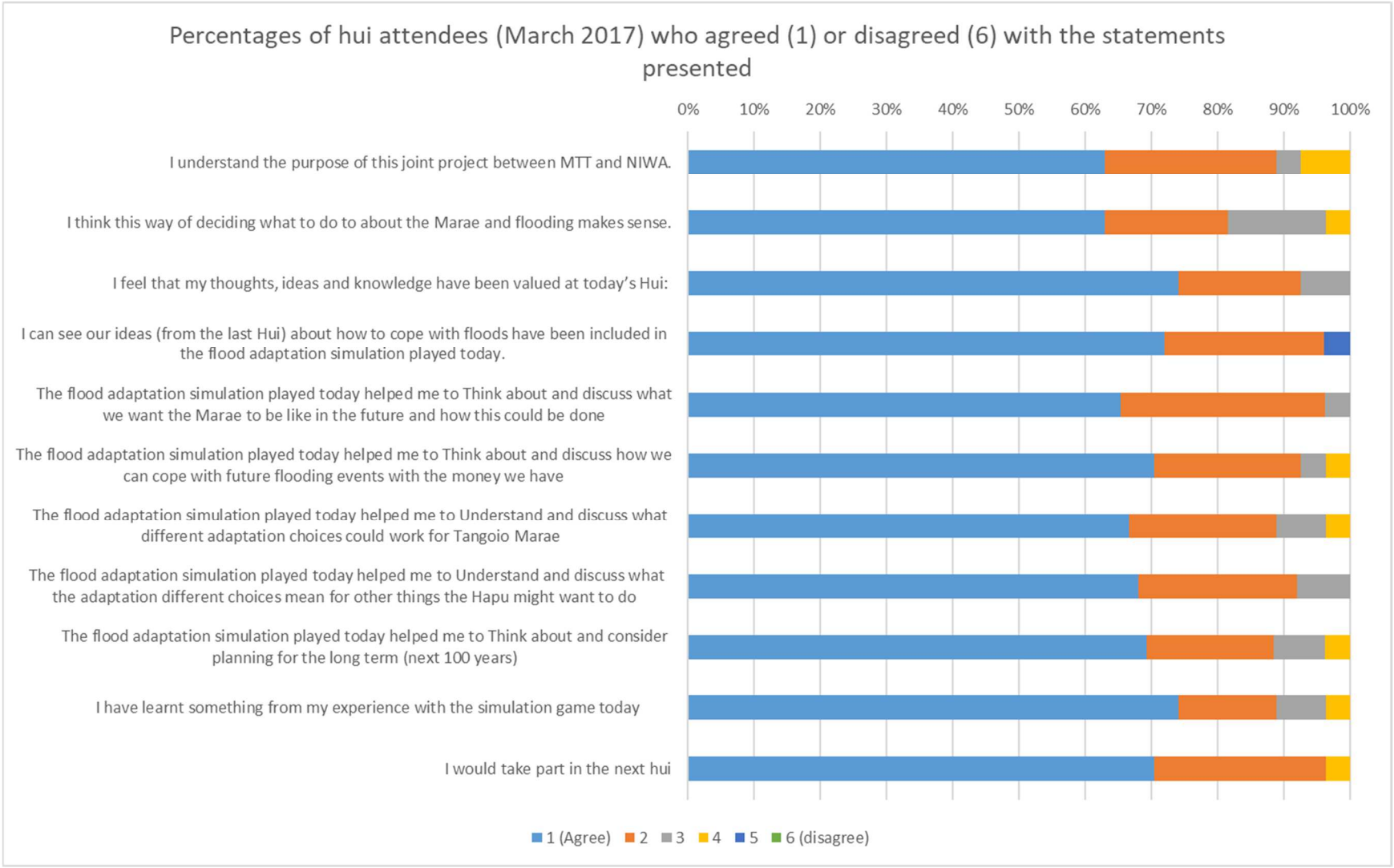

Figure 11: Percentage of the Marae-oploy hui attendants who agree or disagreed with the 10 statements presented in the post hui evaluation sheet.

5 Conclusions

Aotearoa-New Zealand is subject to a changing climate. These changes in climate are already detected and projected to continue over time and in an unpredictable way. A changing climate will have implications for the way we live and the things important to us. Consequently, our communities will be required to adapt to a changing climate. Māori-owned assets (e.g., marae, land, businesses, waterways) will be affected by climate change, especially if situated near the coast or on flood plains.

The 'Exploring coastal adaptation pathways for Tangoio Marae' research project developed and tested a decision-making model called Te Huringa ki te Rangi – He Rautaki Tāwariwari with the Tangoio Marae community. This report details the eight steps of Te Huringa ki te Rangi – He Rautaki Tāwariwari and discusses the results and effectiveness of each step. Embedded in this process is the serious game, Marae-opoly. The game allows players to work through climate change futures and adaptation options to test different scenarios and inform their decision-making process.

This report is presented as an illustration of how Te Huringa ki te Rangi – He Rautaki Tāwariwari was applied at Tangoio Marae. This project provides a real-world example of an indigenous community-driven adaptation pathway which other Māori and indigenous communities can learn from, adapt, develop and apply as appropriate. Te Huringa ki te Rangi – He Rautaki Tāwariwari has been developed in a way which allows other communities to tailor the process to their given context/needs/aspirations. This report also provides a detailed repository for communities who would like more information on the serious game developed in this project, Marae-opoly.

The Tangoio Marae community has been grappling with the issues of flooding for decades and have actively driven and sought to bring in researchers with specialist expertise to help them realise their strategic goal of a "Building a proud, vibrant and modern Marae" (Figure 1). We recognise that not all indigenous communities will be starting from this same place, and so we provide some learnings and reflections below that may assist other groups in the future:

- If the climate change or natural hazard risks and issues are not clearly defined, start the journey by scoping the relevant matters with the individuals/groups/organisations who initiated the discussion.
- Do your homework, find out who the key stakeholders are and how the community has been affected historically. Pull together all the relevant technical information you can find. Find out who has lived in the area for generations, and try to find them and talk to them about their experiences of the hazards. Talk to your local authorities, Civil Defence, and other government authorities.
- Where limited technical information is available, start scoping the work that may be required to inform the decision-making processes. Talk to others who have worked through or are working through a similar situation. Find out what they did, what technical expertise they may have brought in to assist. Talk to local authorities, Crown Research Institutes, Tertiary Institutions, and find out what relevant work they have done or are doing in the area. Look at opportunities to use and build on existing work and the learnings of others.

- After all the ground work is done and you have some understanding of the past and current risks and issues, communicate them through stories or narratives. Where possible let those people who have experienced the hazard or the impact first hand tell the story. If no-one locally has experienced the hazard, draw on the stories of others in similar situations.
- Draw rich pictures of the experiences. Information with which to tell the narrative could be obtained through existing records (e.g., literature, stories, video, songs etc.,) interviews, wānanga or through conversations at the kitchen table.
- The elected or self-selected group driving the adaptation discussions could under take the initial brainstorm and present to the wider community for confirmation and additions.
- A tailor-made serious game is not the only way to develop different adaptation pathway options:
  - Other approaches can be used provided they: Allow for a future focus; Provide for a flexible sequencing of actions/decisions over time; Recognise the benefits and disadvantages of each alternative; and discuss and consider the inherent trade-offs between different goals and aspirations across different generations.
  - Other approaches could include: Playing other different serious games - Although many of them are more abstract and general, they are effective in conveying the key adaptation principles; Holding wānanga to discuss the possible adaptation pathways; or Engaging consultants to form the different adaptation pathway options.

Every climate change adaptation process and pathway will be slightly different to suit the local context. However, this report has provided a starting point and preliminary resources for those at the beginning of their own journey. The area of climate change adaptation continues to grow in prominence in development practice and scholarship internationally. For example, there is a growing amount of literature being generated on the limits, thresholds, constraints, barriers and frontiers of adaptation, that are social, cultural, economic and political, as well as biophysical (Webber 2016). The lessons and guidance available for communities is increasing so taking the time to review the latest literature and current best practises from around the world before starting a new climate change adaptation project is advisable.

6 Acknowledgements

'Ka pūwaha te tai nei, hoea ngātahi tātou!'

Kei ngā tōtara pū, kei ngā uru kahika o te marae o Tangoio, te Poari o Maungaharuru-Tangitū (Ngāti Marangatūhetaua, Ngāti Whakaari, Ngāi Tauira, Ngāti Kurumōkihi, Ngāi Te Ruruku ki Tangoio me Ngāi Tahu), tatū atu ki te whānau a Doohan, Te Kaunihera ā Rohe o Te Matua-a-Māui, otirā Te Kōmata-o-te-tonga hoki, nā koutou i utu ai ngā nama mō tā mātou mahi rangahau, tēnei te mihi kau atu a NIWA ki a koutou katoa e aku rangatira. Mei kore ake ō koutou pūmau ki te kaupapa, ka kore, kore rawa atu tēnei kaupapa e ora ai. Nō reira tēnā hoki koutou katoa. E hiahia ana hoki te rōpū o NIWA ki te whakanui i a Sam Toka nō Waikato me Ngāti Mahuta, nāna i homai te ingoa, `*Te Huringa ki te Rangi*'.

'When there is a break in the waves, we paddle together!'

To the esteemed ones, the leaders of Tangoio Marae, the Maungaharuru-Tangitū Trust (Ngāti Marangatūhetaua, Ngāti Whakaari, Ngāi Tauira, Ngāti Kurumōkihi, Ngāi Te Ruruku ki Tangoio me Ngāi Tahu), to the Doohan family, the Hawkes Bay Regional Council, and also the Deep South National Science Challenge, who funded our research programme, the project team would like to take this opportunity to acknowledge you all. If it wasn't for your commitment and support, this programme would not have been successful. For that reason salutations to you all. The project team would also like to acknowledge Sam Toka (Waikato, Ngāti Mahuta) for the name '*Te Huringa ki te Rangi'.*

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6.1 Further information

Further information about this project and additional resources are available online from:

- www.niwa.co.nz/te-kuwaha/tools-and-resources, and
- www.deepsouthchallenge.co.nz

Available resources include:

- marae-opoly game material and instructions
- video productions on the impacts of Cyclone Bola and 1968 Flood events on Tangoio Marae
- project presentations, surveys, evaluation forms and feedback, and
- modelling results and animations.

7 Glossary: Te Reo Māori used in this report

Hapū	Is a tribal grouping that consists of whānau who typically share descent from a common ancestor.
Haumia-tiketike	God of fernroot and uncultivated food.
Hauora	Health.
He Rautaki Tāwariwari	Literally translated is "A Flexible Strategy" and reflects the need for our planning to be strategic and proactive whilst also having the flexibility to be adjusted to meet changing circumstances and needs.
Hori	Falsely, mistake, misjudge.
Hui	Meetings, gatherings.
Iwi	Is an extended tribal grouping that consists of hapū or whānau who typically share descent from a common ancestor and associate with a distinct territory.
Kaumātua	Elders.
Kaupapa	Topic.
Kāuta	Cookhouse.
Kete	Kit, basket.
Kōhanga Reo	Māori language pre-school.
Kōrero	Speech/speak, narrative, story, news, account, discussion, conversation, discourse, statement, information.
Māori	Indigenous people of Āotearoa-New Zealand.
Māra kai	Vegetable garden and orchards.
Māra rongoā	Medicinal garden.
Marae	Typically refers to the complex of facilities, including the marae ātea, wharenui and wharekai.
Marae ātea	Courtyard, open area in front of the wharenui where formal welcome to visitors takes place and issues are debated.
Mātauranga Māori	Is a holistic perspective encompassing all aspects of knowledge and seeks to understand the relationships between all component parts and their interconnections to gain an understanding of the whole system. It is based on its own principles, frameworks, classification systems, explanations and terminology. Mātauranga Māori is a dynamic and evolving knowledge system and has both qualitative and quantitative aspects.
Mokopuna	Grandchildren.
Ngā Aronga Nui	"Focus areas and initiatives" (Source: http://tangoio.223.165.77.199.sth.nz/wp-content/uploads/2015/12/Strategic-Plan-2015-2019.pdf)
Paepae	Orator's bench.
Papakainga	Form of housing/habitation development which occurs on multiply-owned Māori land.
Papatūānuku	The earth mother.
Pōwhiri	Welcome ceremony on a marae.
Puāwaitanga o te Puawānanga	"Living our Dreams" (Source: http://tangoio.223.165.77.199.sth.nz/wp-content/uploads/2015/12/Strategic-Plan-2015-2019.pdf)
Pūtea	Money.
Rangatahi	Youth.

Ranginui	The sky father.
Rongomātāne	God of the kūmara and cultivated foods.
Tamariki	Children.
Tane-nui-a-rangi (also known as Tāne Mahuta)	God of the forests and birds.
Tangaroa	God of the sea.
Tangihanga	Funeral.
Taonga	An object or natural resource which is highly prized.
Tāwhirimātea	God of wind and storms.
Te Huringa ki te Rangi	Literally translated is "The Changes within the Heavens". This title reflects the eternal battle between Tāwhirimātea (god of wind and storms) and Tūmatauenga (the god of war and of mankind) which followed the separation of Papatūānuku and Ranginui. In the creation story, the children of Ranginui (the sky father) and Papatūānuku (the earth mother) wished to separate their parents so that light could come into the world. The only brother who did not agree to this was Tāwhirimātea who plotted revenge against the other brothers. After defeating Tane-nui-a-rangi (also known as Tāne Mahuta), Tangaroa, Rongomātāne and Haumia-tiketike, Tāwhirimātea then turned his wrath towards Tūmatauenga, the one who suggested killing their parents. Tūmatauenga stood firm and endured the fierce onslaught of gale force winds, lightning, thunder, driving rain and hail sent by his brother. Tū cast incantations known as tūā to cause the raging tempest of the heavens to calm down. His endurance against Tāwhirimātea's eternal need to seek revenge is a symbol of mankind's resilience when faced with extreme adversity. However, this is a battle that can never be truly won by Tāwhiri or Tū. Tāwhirimātea continues to attack people in storms and hurricanes, trying to destroy us on sea and land. In return, we must resist, plan, strategise, and adapt to survive the attacks served us.
Te Reo Māori	Māori language.
Tikanga	Correct procedure, custom, habit, lore, method, manner, rule, way, code, meaning, plan, practice, convention.
Tūmatauenga	The god of war and of mankind.
Urupā	Cemetery.
Wānanga	Learning, workshop.
Whakapapa	Genealogy, lineage, descent, ancestry.
Whakataukī	Proverb.
Whānau	A family group that consists of individuals who typically share a common whakapapa and identify with a common living or recent ancestor.
Whare	House.
Whare taonga	A building/room for hapū treasures and archives.
Wharekai	Dining room.
Wharemoe	Building for sleeping.
Wharenui	Meeting house.
Wharepaku	Toilets, ablutions.

8 Glossary: Abbreviations and scientific terminology used in this report

Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
Adaptations to climate change	Undertaking actions to minimise threats or to maximise opportunities resulting from climate change and its effects.
Adaptation pathways	A conceptual and analytical framework for enabling adaptation planning and decision-making in response to long-term change.
Annual Exceedance Probability (AEP)	The probability of a given event (e.g., flood or sea level or wave height) being equalled or exceeded in elevation, in any given calendar year. AEP can be specified as a fraction (e.g., 0.01) or a percentage (e.g., 1%). For example a 1% AEP flood has a 1 in 100 chance of being exceeded in any one year. A 10% AEP flood has a 1 in 10 chance of being exceeded in any one year.
AR5	5th Assessment Report of IPCC – published in 2013/14 covering three Working Group Reports and a Synthesis Report.
Average Recurrence Interval (ARI)	Is the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. ARI is also known as Return Period and is equal to the inverse of probability. A so-called 100-year flood does not mean that there is exactly one flood of this size every 100 years. It means that there is a 1 in 100 chance in any given year that a flood of this size or bigger will happen; it is therefore more correctly called a 1% AEP flood.
Climate change	Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. (For more information see: https://www.mfe.govt.nz/climate-change).
Climate change scenario	A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as the observed current climate. A climate change scenario is the difference between a climate scenario and the current climate.
Coastal inundation	Is the flooding of coastal lands by raised ocean waters and can be compounded by flooding in adjacent lowland rivers. Most coastal inundation problems have arisen from coastal development located in low-lying coastal areas, or areas located too close to the shoreline to accommodate existing natural changes in shoreline position. (Source: Ministry of Civil Defence & Emergency Management 2010).
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/ radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.

Cost Benefit Analysis (CBA)	A systematic process for calculating and comparing benefits and costs of a decision, policy (with particular regard to government policy) or (in general) project (Source: Wikipedia).
Flood risk	Flooding is a natural process which occurs when river levels or lake levels are higher than the surrounding land, or when stormwater cannot drain away and builds up. Flood risk is the size of the flood and the damage that occurs from a flood, for instance to homes or businesses, crops or pasture. Flood risks are different around the country, depending on the local circumstances. In some areas rainfall is greater, such as the West Coast of the South Island. In other areas towns and cities have been established on floodplains. Flooding can have significant consequences for communities and individuals. These include community trauma and disruption, damage to property and infrastructure, business losses and economic hardship. (Source: http://www.mfe.govt.nz/more/natural-hazard-management/flood-risk-management/managing-flood-risk)
Greenhouse gases	Greenhouse gases, such as carbon dioxide and methane, act like a blanket around the Earth. They trap warmth from the sun and make life on Earth possible. Without them, too much heat would escape and the surface of the planet would freeze. (Source: https://www.mfe.govt.nz/node/16597)
ha	Hectare.
Hazard	A source of potential harm to people or property. Examples are erosion or inundation.
HBRC	Hawkes Bay Regional Council.
Intergovernmental Panel on Climate Change (IPCC)	This body was established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) to objectively assess scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human induced climate change, its potential impacts and options for adaptation and mitigation. Its latest reports (the Fifth Assessment) were published in 2013/14.
Impacts (Consequences, Outcomes)	Effects on natural and human systems. In this report, the term impacts is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts.
Likert scale	A scale used to represent people's attitudes to a topic.
m	Metres.
M	Million.
m^2	Square metres.
m^3/s	Cubic metre per second.
Marae-opoly	Is a serious game that was designed in this project to encapsulate the complex adaptation challenge in a manner which could be understood and played by all participants. It sought to reflect reality where ever possible and rely on reasonable assumptions were necessary. The principle aim of the game was to maintain a functioning marae that meets the needs, vision and aspiration of the whānau/hapū/iwi through making adaptation decisions over a 100-year time frame on a set budget.
MfE	Ministry for the Environment.

Mitigation (of climate change)	A human intervention to reduce the sources or enhance the sinks of greenhouse gases.
MTT	Maungaharuru-Tangitū Trust.
Multi-Criteria Analysis (MCA)	An approach that evaluates multiple conflicting criteria in decision making (Source: Wikipedia).
NIWA	National Institute of Water & Atmospheric Research.
Projection	A numerical simulation (representation) of future conditions. Differs from a forecast; whereas a forecast aims to predict the exact time-dependent conditions in the immediate future, such as a weather forecast a future cast aims to simulate a time-series of conditions that would be typical of the future (from which statistical properties can be calculated) but does not predict future individual events.
RCPs	Representative concentration pathways. They describe four possible climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. The four RCPs, RCP2.6, RCP4.5, RCP6, and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+2.6, +4.5, +6.0, and +8.5 W/m^2, respectively).
Risk	The chance of an 'event' being induced or significantly exacerbated by climate change, that event having an impact on something of value to the present and/or future community. Risk is measured in terms of consequence and likelihood.
Scenario	In common English parlance, a 'scenario' is an imagined sequence of future events. The IPCC Fifth Assessment describes a 'climate scenario' as: A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. The word 'scenario' is often given other qualifications, such as 'emission scenario' or 'socio-economic scenario'. For the purpose of forcing a global climate model, the primary information needed is the time variation of greenhouse gas and aerosol concentrations in the atmosphere.
Sea level change	Sea level can change, both globally and locally due to (1) changes in the shape of the ocean basins, (2) a change in ocean volume as a result of a change in the mass of water in the ocean, and (3) changes in ocean volume as a result of changes in ocean water density.
Serious games	Are games designed for a purpose beyond pure entertainment. They use the motivation levers of game design – such as competition, curiosity, collaboration, individual challenge – and game media, including board games through physical representation or video games, through avatars and 3D immersion, to enhance the motivation of participants to engage in complex or boring tasks. Serious games are used in a variety of professional situations such as education, training, assessment, recruitment, knowledge management, innovation and scientific research (Source: http://lexicon.ft.com/Term?term=serious-games).
SLR	Sea-level rise.
TLAs	Territorial Local Authorities.
Tolerable levels, tolerable risks	Three categories of risks relevant to climate adaptation can be defined (Dow et al. 2013): (1) Acceptable risks are risks deemed so low that additional risk reduction efforts are not seen as necessary; (2) Tolerable risks relate to activities seen as worth pursuing for their benefits, but where additional efforts (adaptations) are required for risk reduction within reasonable levels; and (3) Intolerable risks are those which exceed a socially negotiated norm or a value.
W/m^2	Watts per square meter (a measure of radiation intensity).

9 References

Barnett, J., Graham, S., Mortreux, C., Fincher, R., Waters, E., Hurlimann, A. (2014) A local coastal adaptation pathway. *Nature Climate Change,* (28 September 2014): DOI: 10.1038/NCLIMATE2383

Bell, R., Lawrence, J., Allan, S., Blackett**,** P., Stephens, S. (2017) *Coastal Hazards and Climate Change: Guidance for Local Government*. Ministry for the Environment, Wellington.

Bind, J., Zammit, C., Yang, J., Goodier, C., Colliar, J. (2018) Exploring Coastal Adaptation Pathways for Tangoio Marae: Modelling Assessment of Climate Change Impacts on Flood Extent and Level. *NIWA Client Report*. July 2018: 56.

Bosomworth, K., Harwood, A., Leith, P., Wallis, P. (2015) Adaptation Pathways Planning Playbook: a guide to developing options for climate change adaptation in NRM. *Southern Slopes Climate Change Adaptation Research Partnership (SCARP): RMIT University*, *University of Tasmania, and Monash University.*

Climate Change Adaptation Technical Working Group (2017) Adapting to climate change in New Zealand*. Stocktake Report from the Climate Change Adaptation Technical Working Group.* Retrieved from www.mfe.govt.nz.

Dow, K., Berkhout, F., Preston, B.L. (2013) Limits to adaptation to climate change: a risk approach. *Current Opinion in Environmental Sustainability,* 5: 384-391.

Flick, U. (2009) *Introduction to Quantitative Research* (4th Edition ed.). London: Sage.

Gorddard, R., Colloff, M.J., Wise, R.M., Ware, D., Dunlop, M. (2016) Values, rules and knowledge: Adaptation as change in the decision context. *Environmental Science & Policy*, 57: 60-69.

Hawke's Bay Regional Council (2005) *Te Ngaru Catchment Flood Hazard Study Asset Management Group Technical Report*, Napier.

Hermans, L.M., Haasnoot, M., ter Maat, J., Kwakel, J.H. (2017) Designing monitoring arrangements for collaborative learning about adaptation pathways. *Environmental Science & Policy*, 69: 29-38.

Hill, H., Hadarits, M., Rieger, R. (2014) The Invitational Drought Tournament: What is it and why is it a useful tool for drought preparedness and adaptation? *Weather and Climate Extremes*, 3: 107-116

King, D.N., Dalton, W., Home, M., Duncan, M., Srinivasan, M.S., Bind, J., Zammit, C., McKerchar, A., Ashford-Hosking, D., Skipper, A. (2011) Maori community adaptation to climate variability and change: Examining risk, vulnerability and adaptive strategies with Ngāti Huirapa at Arowhenua Pā, Te Umu Kaha (Temuka), New Zealand. *NIWA Client Report:* AKL2011-015: 133

King, D.N., Dalton, W., Bind, J., Srinivasan, M.S., Duncan, M., Skipper, A., Ashford-Hosking, D., Williams, B., Renata, H., Baker, M. (2012) Coastal adaptation to climate variability and change: examining community risk, vulnerability and endurance at Manaia Settlement, Hauraki-Waikato, Aotearoa-New Zealand. *NIWA report* AKL2012-029: 142

King, D.N., Dalton, W., Bind, J., Srinivasan, M.S., Hicks, D.M., Iti, W., Skipper, A., Home, M., Ashford-Hosking, D. (2013) Coastal adaptation to climate variability and change: examining community risk, vulnerability and endurance at Mitimiti-Hokianga, Aotearoa-New Zealand. *NIWA Client Report*: AKL2013-022: 140

Kitchin, R., Tate, N.J. (2000) *Conducting research into human geography: Theory, methodology and Practice*. Harlow, England: Prentice Hall.

IPCC (2014) Annex II: Glossary [Agard, J., E.L.F. Schipper, J. Birkmann, M. Campos, C. Dubeux, Y. Nojiri, L. Olsson, B. Osman-Elasha, M. Pelling, M.J. Prather, M.G. Rivera-Ferre, O.C. Ruppel, A. Sallenger, K.R. Smith, A.L. St. Clair, K.J. Mach, M.D. Mastrandrea, and T.E. Bilir (eds.)]. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA: 1757-1776.

Lawrence, J., Haasnoot, M. (2017) What it took to catalyse uptake of dynamic adaptive pathways planning to address climate change uncertainty. *Environmental Science & Policy,* 68: 47-57. doi:https://doi.org/10.1016/j.envsci.2016.12.003

Ministry for the Environment & Stats NZ (2017) *New Zealand's Environmental Reporting Series: Our atmosphere and climate 2017*. Retrieved from www.mfe.govt.nz and www.stats.govt.nz.

Ministry for the Environment (2016) *Climate Change Projections for New Zealand: Atmosphere Projections Based on Simulations from the IPCC Fifth Assessment*. Wellington: Ministry for the Environment.

Ministry of Civil Defence & Emergency Management (2010) *Working from the same page consistent messages for CDEM*. Part B: Hazard-specific information. Coastal-storm Inundation. April 2010: 18. https://www.civildefence.govt.nz/assets/Uploads/publications/consistent-messages-part-B-coastal-inundation.pdf

Reisinger, A., Kitching, R., Chiew, F., Hughes, L., Newton, P., Schuster, S., Webb, L. (2014) Australasia. In: V.R. Barros, C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, & L.L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA. Cambridge University Press.

Rijcken, T., Stijnen, J., Slootjes, N. (2012) "SimDelta"—Inquiry into an Internet-Based Interactive Model for Water Infrastructure Development in The Netherlands. *Water,* 4: 295-320.

Rouse, H.L., Bell, R.G., Lundquist, C.J., Blackett, P.E., Hicks, D.M., King, D.N. (2016) Coastal adaptation to climate change in Aotearoa-New Zealand. *New Zealand Journal of Marine & Freshwater Research,* 51: 183-222.

Royal Society of New Zealand (RSNZ) (2016) Climate change implications for New Zealand. The Royal Society of New Zealand, New Zealand.

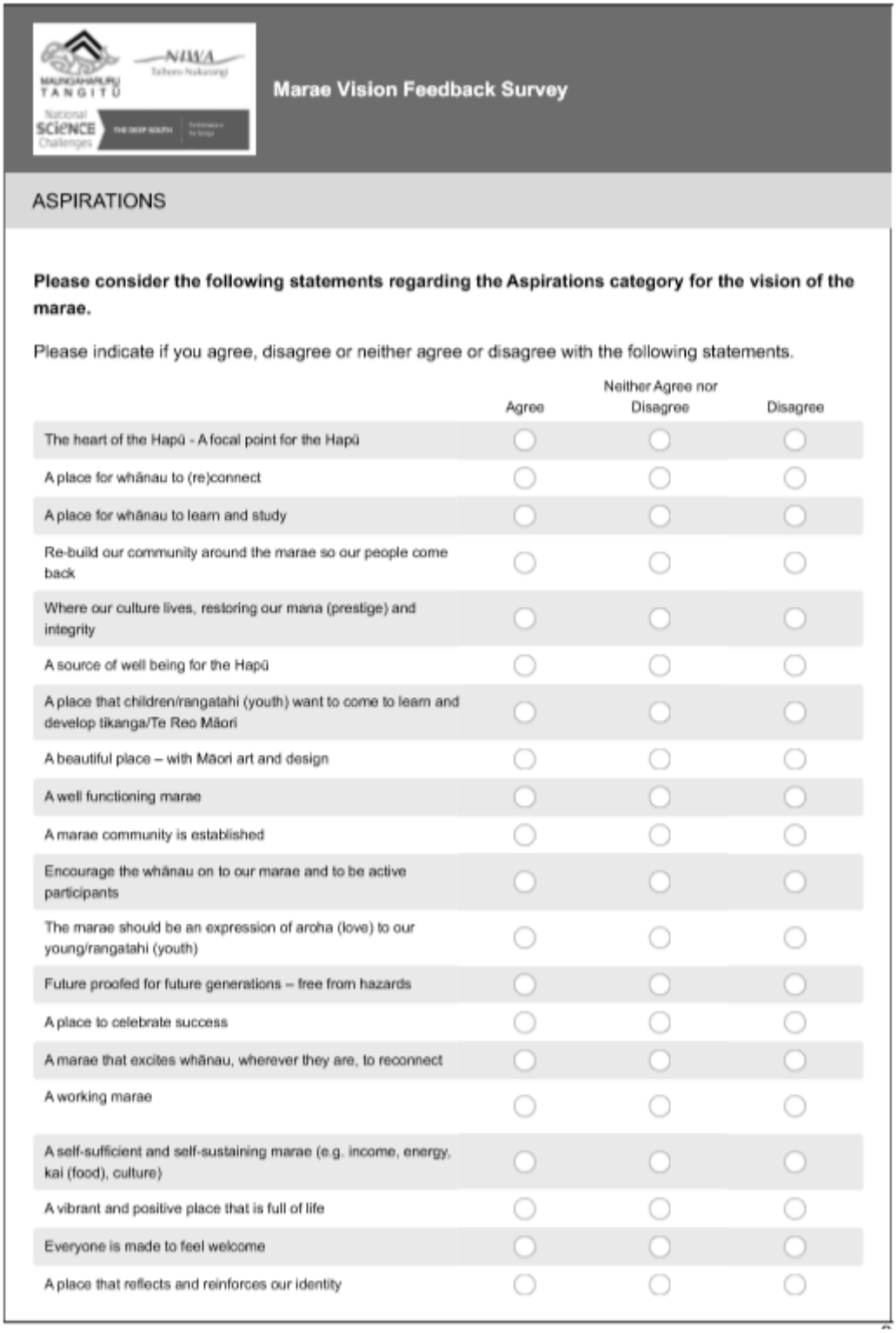
Tschakert, P., Barnett, J., Ellis, N., Lawrence, C., Tuana, N., New, M., Elrick-Barr, C., Pandit, R., Pannell, D. (2017) Climate change and loss, as if people mattered: values, places, and experiences. *Wiley Interdisciplinary Reviews: Climate Change 2017:* 1-19.

Valkering, P., Brugge, van der, R., Offermans, A. (2013) A Perspective-Based Simulation Game to Explore Future Pathways of a Water-Society System Under Climate Change. *Simulation Gaming,* 44: 366-390.

van Pelt, S.C., Haasnoot, M., Arts, B. (2015) Communicating climate (change) uncertainties: Simulation games as boundary objects. *Environmental Science & Policy,* 45: 41-52.

Webber, S. (2016) Climate Change Adaptation as a Growing Development Priority: Towards Critical Adaptation Scholarship. *Geography Compass,* 10: 401-413.

Appendix A Marae vision feedback survey



Marae Vision Feedback Survey

ASPIRATIONS

Please consider the following statements regarding the Aspirations category for the vision of the marae.

Please indicate if you agree, disagree or neither agree or disagree with the following statements.

	Agree	Neither Agree nor Disagree	Disagree
The heart of the Hapū - A focal point for the Hapū	○	○	○
A place for whānau to (re)connect	○	○	○
A place for whānau to learn and study	○	○	○
Re-build our community around the marae so our people come back	○	○	○
Where our culture lives, restoring our mana (prestige) and integrity	○	○	○
A source of well being for the Hapū	○	○	○
A place that children/rangatahi (youth) want to come to learn and develop tikanga/Te Reo Māori	○	○	○
A beautiful place – with Māori art and design	○	○	○
A well functioning marae	○	○	○
A marae community is established	○	○	○
Encourage the whānau on to our marae and to be active participants	○	○	○
The marae should be an expression of aroha (love) to our young/rangatahi (youth)	○	○	○
Future proofed for future generations – free from hazards	○	○	○
A place to celebrate success	○	○	○
A marae that excites whānau, wherever they are, to reconnect	○	○	○
A working marae	○	○	○
A self-sufficient and self-sustaining marae (e.g. income, energy, kai (food), culture)	○	○	○
A vibrant and positive place that is full of life	○	○	○
Everyone is made to feel welcome	○	○	○
A place that reflects and reinforces our identity	○	○	○

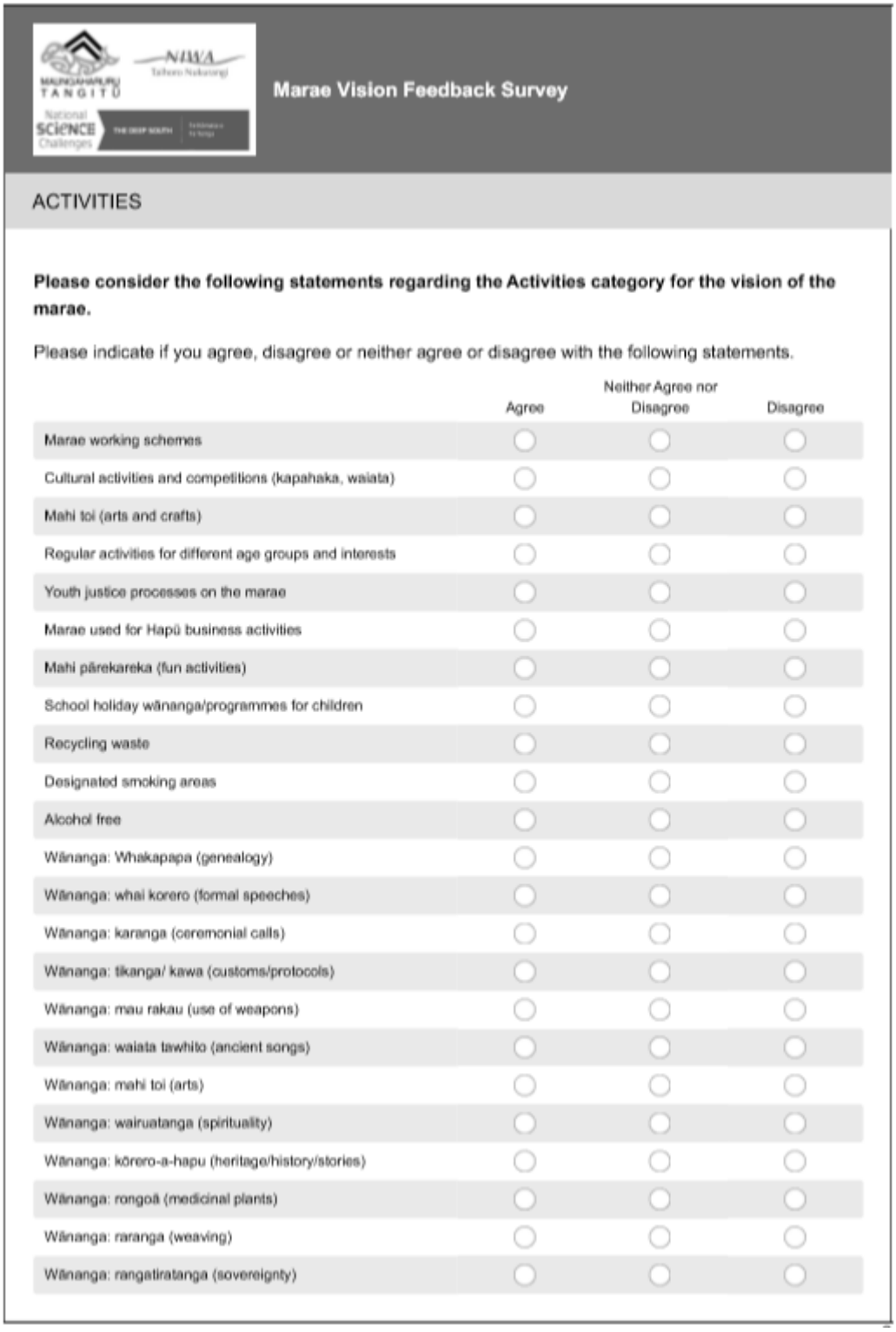
	Agree	Neither Agree nor Disagree	Disagree
Our marae is a state of the art complex	◯	◯	◯
A place to learn tikanga, our history and Te Reo	◯	◯	◯
The marae is active and healthy	◯	◯	◯
Marae tikanga and Māori values practised	◯	◯	◯
Actively participating in marae activities will support strong, thriving whānau units	◯	◯	◯
The centre point of Hapū life	◯	◯	◯
Our marae advances the well-being of our people and wider community	◯	◯	◯
Our marae can help us be all as one	◯	◯	◯
Our Marae is recognised, known and respected in the community	◯	◯	◯
Safe - prepared for global warming	◯	◯	◯
Large enough for all and for future expansion	◯	◯	◯
Fully functioning, safe and comfortable	◯	◯	◯
A source of confidence, strength and pride	◯	◯	◯
Whakapapa (genealogical ties) and traditions are all around and upheld	◯	◯	◯
Our marae expresses Māori models of health e.g. Te Whare Tapa Whā: Te Taha Tinana/Te Taha Hinengaro/Te Taha Whānau/Te Taha Wairua	◯	◯	◯

Are there any other aspirations you hold for the marae? (please specify)

* Please check your top 10 statements with regards to the Aspirations category for the vision of the marae.

(Please select up to 10 statements only)

- [ ] The heart of the Hapū - A focal point for the Hapū
- [ ] A place for whānau to (re)connect
- [ ] A place for whānau to learn and study
- [ ] Re-build our community around the marae so our people come back
- [ ] Where our culture lives, restoring our mana (prestige) and integrity
- [ ] A source of well being for the Hapū
- [ ] A place that children/rangatahi want to come to learn and develop tikanga/Te Reo Māori
- [ ] A beautiful place – with Maori art and design
- [ ] A well functioning marae
- [ ] A marae community is established
- [ ] Encourage the whānau on to our marae and to be active participants
- [ ] The marae should be an expression of aroha (love) to our young/rangatahi (youth)
- [ ] Future proofed for future generations – free from hazards
- [ ] A place to celebrate success
- [ ] A marae that excites whānau, wherever they are, to reconnect
- [ ] A working marae
- [ ] A self-sufficient and self-sustaining marae (e.g. income, energy, kai (food), culture)
- [ ] A vibrant and positive place that is full of life
- [ ] Everyone is made to feel welcome
- [ ] A place that reflects and reinforces our identity
- [ ] Our marae is a state of the art complex
- [ ] A place to learn tikanga, our history and Te Reo
- [ ] The marae is active and healthy
- [ ] Marae tikanga and Māori values practiced
- [ ] Actively participating in marae activities will support strong, thriving whānau units
- [ ] The centre point of Hapū life
- [ ] Our marae advances the well-being of our people and wider community
- [ ] Our marae can help us be all as one
- [ ] Our Marae is recognised, known and respected in the community
- [ ] Safe - prepared for global warming
- [ ] Large enough for all and for future expansion
- [ ] Fully functioning, safe and comfortable
- [ ] A source of confidence, strength and pride
- [ ] Whakapapa (genealogical ties) and traditions are all around and upheld
- [ ] Our marae expresses Māori models of health e.g. Te Whare Tapa Whā: Te Taha Tinana/Te Taha Hinengaro/Te Taha Whānau/Te Taha Wairua



Marae Vision Feedback Survey

ACTIVITIES

Please consider the following statements regarding the Activities category for the vision of the marae.

Please indicate if you agree, disagree or neither agree or disagree with the following statements.

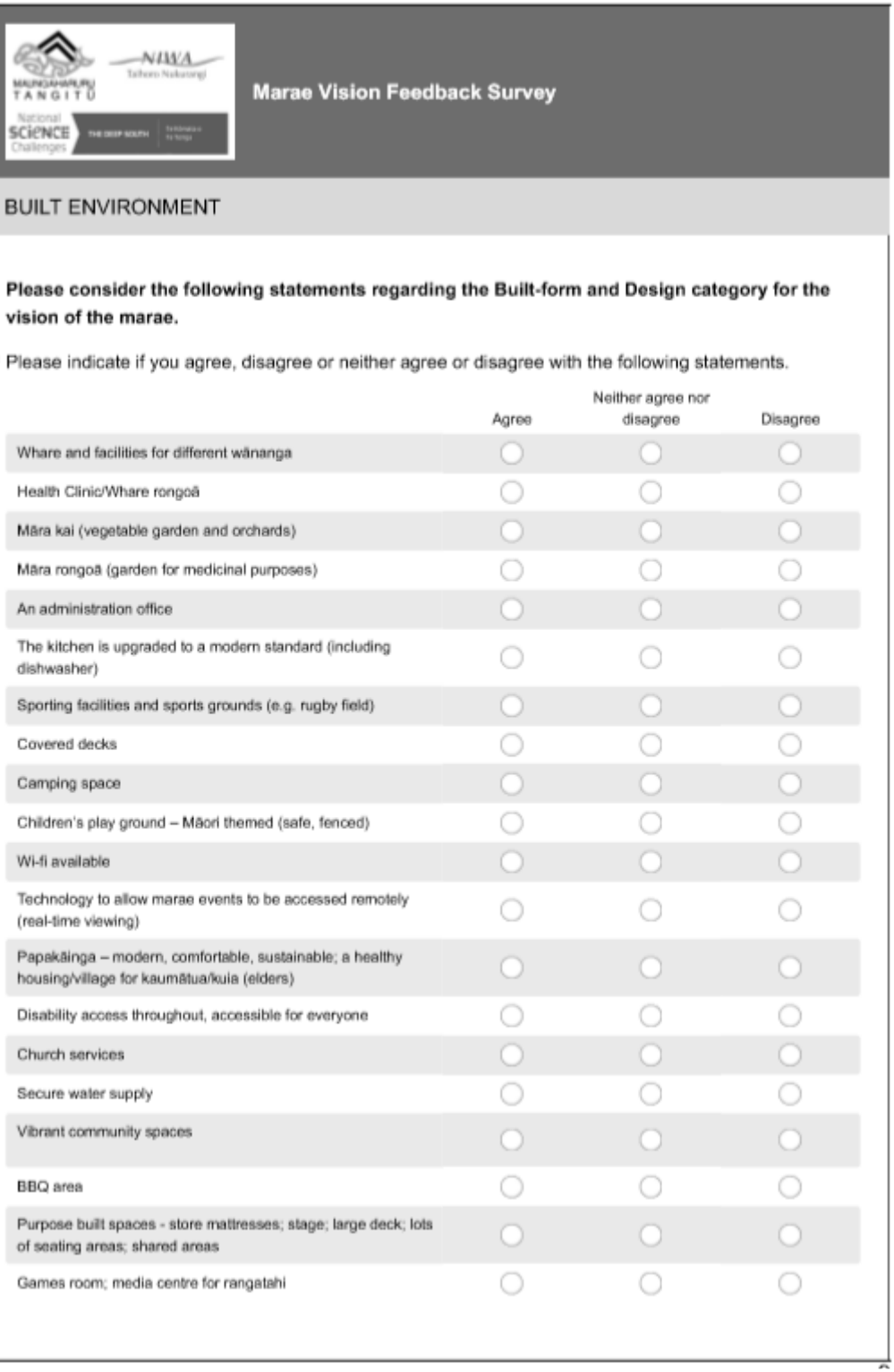
	Agree	Neither Agree nor Disagree	Disagree
Marae working schemes	○	○	○
Cultural activities and competitions (kapahaka, waiata)	○	○	○
Mahi toi (arts and crafts)	○	○	○
Regular activities for different age groups and interests	○	○	○
Youth justice processes on the marae	○	○	○
Marae used for Hapū business activities	○	○	○
Mahi pārekareka (fun activities)	○	○	○
School holiday wānanga/programmes for children	○	○	○
Recycling waste	○	○	○
Designated smoking areas	○	○	○
Alcohol free	○	○	○
Wānanga: Whakapapa (genealogy)	○	○	○
Wānanga: whai korero (formal speeches)	○	○	○
Wānanga: karanga (ceremonial calls)	○	○	○
Wānanga: tikanga/ kawa (customs/protocols)	○	○	○
Wānanga: mau rakau (use of weapons)	○	○	○
Wānanga: waiata tawhito (ancient songs)	○	○	○
Wānanga: mahi toi (arts)	○	○	○
Wānanga: wairuatanga (spirituality)	○	○	○
Wānanga: kōrero-a-hapu (heritage/history/stories)	○	○	○
Wānanga: rongoā (medicinal plants)	○	○	○
Wānanga: raranga (weaving)	○	○	○
Wānanga: rangatiratanga (sovereignty)	○	○	○

	Agree	Neither Agree nor Disagree	Disagree
Wānanga: Inoi/karakia/hīmene (Christian and Māori prayer/hymns)	○	○	○
Wānanga: kōrero tuku iho (Hapū history)	○	○	○
Wānanga: Te Reo (Māori language)	○	○	○
Wānanga: tito waiata (composing songs)	○	○	○
Wānanga: haka/kapa haka (cultural group)	○	○	○
Wānanga: whakairo (carving)	○	○	○
Wānanga: tikanga tā moko (traditional tattooing)	○	○	○
Marae based tourism	○	○	○
Explore sustainable energy and building materials for the marae	○	○	○
Prepare a long – term sustainability plan for the marae	○	○	○
Mara kai (vegetable gardens/orchards) at the marae	○	○	○
Activities for kōhungahunga (0-5 year olds)	○	○	○
Mara rongoā (garden for medicinal purpose) at the marae	○	○	○
Restore our whare-nui (meeting house)	○	○	○
Tangihanga (funerals)	○	○	○
Teach our mokopuna (grandchildren) fishing, diving, swimming, growing veggies on our land	○	○	○
Planning hui	○	○	○
Smoke free	○	○	○
Sports days/events	○	○	○
Place to practice religion	○	○	○
Performing arts and a culture group	○	○	○
Activities that support mātauranga Māori: traditional Māori knowledge is known, understood and utilised	○	○	○
Share knowledge and skills between generations	○	○	○

Are there any other activities you would like to occur at the marae? (please specify)

* Please check your top 10 statements with regards to the Activities category for the vision of the marae.
(Please only select 10 statements)

- [ ] Marae working schemes
- [ ] Cultural activities and competitions (kapahaka, waiata)
- [ ] Mahi toi (arts and crafts)
- [ ] Regular activities for different age groups and interests
- [ ] Youth justice processes on the marae
- [ ] Marae used for Hapū business activities
- [ ] Mahi pārekareka (fun activities)
- [ ] School holiday wānanga/programmes for children
- [ ] Recycling waste
- [ ] Designated smoking areas
- [ ] Alcohol free
- [ ] Wānanga: Whakapapa (genealogy)
- [ ] Wānanga: whai korero (formal speeches)
- [ ] Wānanga: karanga (ceremonial calls)
- [ ] Wānanga: tikanga/kawa (customs/protocols)
- [ ] Wānanga: mau rakau (use of weapons)
- [ ] Wānanga: waiata tawhito (ancient songs)
- [ ] Wānanga: mahi toi (arts)
- [ ] Wānanga: wairuatanga (spirituality)
- [ ] Wānanga: kōrero-a-hapu (heritage/history/stories)
- [ ] Wānanga: rongoā (medicinal plants)
- [ ] Wānanga: raranga (weaving)
- [ ] Wānanga: rangatiratanga (sovereignty)
- [ ] Wānanga: īnoi/karakia/hīmene (Christian and Māori prayer/hymns)
- [ ] Wānanga: kōrero tuku iho (Hapū history)
- [ ] Wānanga: Te Reo (Māori language)
- [ ] Wānanga: tito waiata (composing songs)
- [ ] Wānanga: haka/kapa haka (cultural group)
- [ ] Wānanga: whakairo (carving)
- [ ] Wānanga: tikanga tā moko (traditional tattooing)
- [ ] Marae based tourism
- [ ] Explore sustainable energy and building materials for the marae
- [ ] Prepare a long–term sustainability plan for the marae
- [ ] Mara kai (vegetable gardens/orchards) at the marae
- [ ] Activities for kōhungahunga (0-5 year olds)
- [ ] Mara rongoā (garden for medicinal purpose) at the marae
- [ ] Restore our whare-nui (meeting house)
- [ ] Tangihanga (funerals)
- [ ] Teach our mokopuna (grandchildren) fishing, diving, swimming, growing veggies on our land
- [ ] Planning hui
- [ ] Smoke free
- [ ] Sports days/events
- [ ] Place to practice religion
- [ ] Performing arts and a culture group
- [ ] Activities that support mātauranga Māori: traditional Māori knowledge is known, understood and utilised
- [ ] Share knowledge and skills between generations



Marae Vision Feedback Survey

BUILT ENVIRONMENT

Please consider the following statements regarding the Built-form and Design category for the vision of the marae.

* Please indicate if you agree, disagree or neither agree or disagree with the following statements.

	Agree	Neither agree nor disagree	Disagree
Whare and facilities for different wānanga	○	○	○
Health Clinic/Whare rongoā	○	○	○
Māra kai (vegetable garden and orchards)	○	○	○
Māra rongoā (garden for medicinal purposes)	○	○	○
An administration office	○	○	○
The kitchen is upgraded to a modern standard (including dishwasher)	○	○	○
Sporting facilities and sports grounds (e.g. rugby field)	○	○	○
Covered decks	○	○	○
Camping space	○	○	○
Children's play ground – Māori themed (safe, fenced)	○	○	○
Wi-fi available	○	○	○
Technology to allow marae events to be accessed remotely (real-time viewing)	○	○	○
Papakāinga – modern, comfortable, sustainable; a healthy housing/village for kaumātua/kuia (elders)	○	○	○
Disability access throughout, accessible for everyone	○	○	○
Church services	○	○	○
Secure water supply	○	○	○
Vibrant community spaces	○	○	○
BBQ area	○	○	○
Purpose built spaces - store mattresses; stage; large deck; lots of seating areas; shared areas	○	○	○
Games room; media centre for rangatahi	○	○	○

	Agree	Neither agree nor disagree	Disagree
Environmentally sound practices/sustainable products and services	○	○	○
Recycling facilities	○	○	○
Rain tanks	○	○	○
Renewable energy	○	○	○
Equipped for emergencies and hazards - safe place for the wider community in natural disasters	○	○	○
Beautiful artwork and designs	○	○	○
Functional facilities to ensure marae operations run smoothly	○	○	○
Music room	○	○	○
Carving School – new carvings and restoration of old and existing carvings	○	○	○
Place/space to repair, restore, create tukutuku/kōwhaiwhai (woven and painted panels)	○	○	○
Wharekai (dining room)/kāuta (cookhouse) and ablutions are upgraded to modern standard	○	○	○
Properly landscaped and maintained grounds	○	○	○
Whare taonga and whare pukapuka (archived resources, photos, books, cds and taonga)	○	○	○
Our marae is positioned proudly within our takiwā high, away from environmental hazards	○	○	○
Safe access from road	○	○	○
Close to native bush and awa (rivers)	○	○	○
Kāuta (cookhouse); hangi area	○	○	○
Eco-friendly waste management (including recycling, waste water etc.)	○	○	○
Office(s) and/or other spaces and facilities for hapū based businesses	○	○	○

Are there any other aspects of the built environment you would like to see at the marae? (please specify)

* Please check your top 10 statements with regards to the Built-form and Design category of the vision for the marae.

(Please select up to 10 statements only)

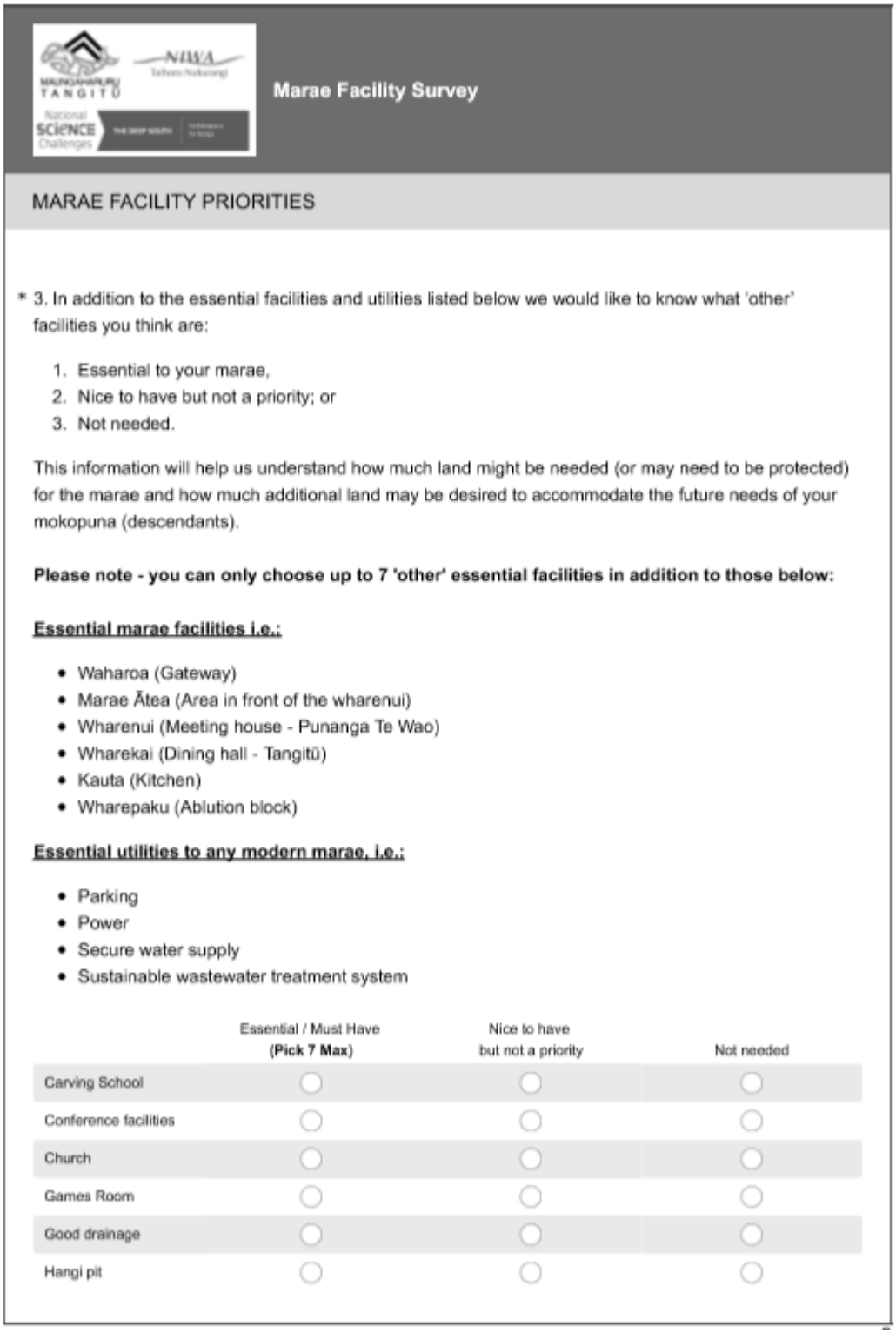
- ☐ Whare and facilities for different wānanga
- ☐ Health Clinic/Whare rongoā
- ☐ Māra kai (vegetable garden and orchards)
- ☐ Māra rongoā (garden for medicinal purposes)
- ☐ An administration office
- ☐ The kitchen is upgraded to a modern standard (including dishwasher)
- ☐ Sporting facilities and sports grounds (e.g. rugby field)
- ☐ Covered decks
- ☐ Camping space
- ☐ Children's play ground – Māori themed (safe, fenced)
- ☐ Wi-fi available
- ☐ Technology to allow marae events to be accessed remotely (real-time viewing)
- ☐ Papakāinga – modern, comfortable, sustainable; a healthy housing/village for kaumātua/kuia (elders)
- ☐ Disability access throughout, accessible for everyone
- ☐ Church services
- ☐ Secure water supply
- ☐ Vibrant community spaces
- ☐ BBQ area
- ☐ Purpose built spaces - store mattresses; stage; large deck; lots of seating areas; shared areas
- ☐ Games room; media centre for rangatahi
- ☐ Environmentally sound practices / Sustainable products and services
- ☐ Recycling facilities
- ☐ Rain tanks
- ☐ Renewable energy
- ☐ Equipped for emergencies and hazards - safe place for the wider community in natural disasters
- ☐ Beautiful artwork and designs
- ☐ Functional facilities to ensure marae operations run smoothly
- ☐ Music room
- ☐ Carving School – new carvings and restoration of old and existing carvings
- ☐ Place / space to repair, restore, create tukutuku / kōwhaiwhai (woven and painted panels)
- ☐ Wharekai (dining room)/kāuta (cookhouse) and ablutions are upgraded to modern standard
- ☐ Properly landscaped and maintained grounds
- ☐ Whare taonga and whare pukapuka (archived resources, photos, books, cds and taonga)
- ☐ Our marae is positioned proudly within our takiwā high, away from environmental hazards
- ☐ Safe access from road
- ☐ Close to native bush and awa (rivers)
- ☐ Kāuta (cookhouse); hangi area
- ☐ Eco-friendly waste management (including recycling, waste water etc.)
- ☐ Office(s) and/or other spaces and facilities for hapū based businesses

Marae Vision Feedback Survey

ANY FURTHER FEEDBACK

Please provide any further feedback on the three categories and consider whether these capture your vision for the marae? Do you have any other thoughts about the vision for the marae?

Appendix B Marae facilities and tolerance to floods survey



Marae Facility Survey

MARAE FACILITY PRIORITIES

* 3. In addition to the essential facilities and utilities listed below we would like to know what 'other' facilities you think are:

1. Essential to your marae,
2. Nice to have but not a priority; or
3. Not needed.

This information will help us understand how much land might be needed (or may need to be protected) for the marae and how much additional land may be desired to accommodate the future needs of your mokopuna (descendants).

Please note - you can only choose up to 7 'other' essential facilities in addition to those below:

Essential marae facilities i.e.:

- Waharoa (Gateway)
- Marae Ātea (Area in front of the wharenui)
- Wharenui (Meeting house - Punanga Te Wao)
- Wharekai (Dining hall - Tangitū)
- Kauta (Kitchen)
- Wharepaku (Ablution block)

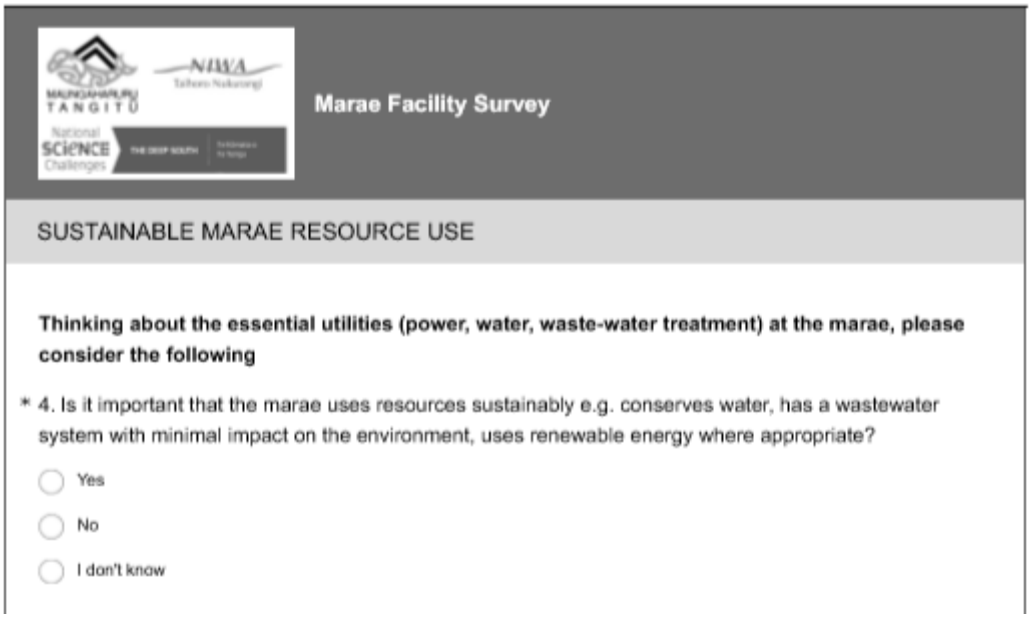
Essential utilities to any modern marae, i.e.:

- Parking
- Power
- Secure water supply
- Sustainable wastewater treatment system

	Essential / Must Have **(Pick 7 Max)**	Nice to have but not a priority	Not needed
Carving School	○	○	○
Conference facilities	○	○	○
Church	○	○	○
Games Room	○	○	○
Good drainage	○	○	○
Hangi pit	○	○	○

	Essential / Must Have **(Pick 7 Max)**	Nice to have but not a priority	Not needed
Kids play area	○	○	○
Kōhanga reo (Māori language pre-school)	○	○	○
Māra kai (Vegetable garden and orchard)	○	○	○
Māra rongoā (Medicinal garden)	○	○	○
Parents Room	○	○	○
Media Centre	○	○	○
Music Room	○	○	○
Other Whare - Office (Another building - office)	○	○	○
Other Whare - Wharemoe (Another building - for sleeping)	○	○	○
Paepae Shelters (For shelter during pōwhiri)	○	○	○
Papakainga (Housing)	○	○	○
Safe vehicular access to the marae	○	○	○
Sports field & court	○	○	○
Urupā (Cemetery)	○	○	○
Well landscaped grounds	○	○	○
Whare Taonga (for Hapū treasures and archives)	○	○	○
Wifi connection	○	○	○
Hauora Centre (Healthcare centre)	○	○	○
Kaumātua lounge	○	○	○
Utility Room (For various uses like the current Maungaharuharu)	○	○	○

Please list any others not outlined above



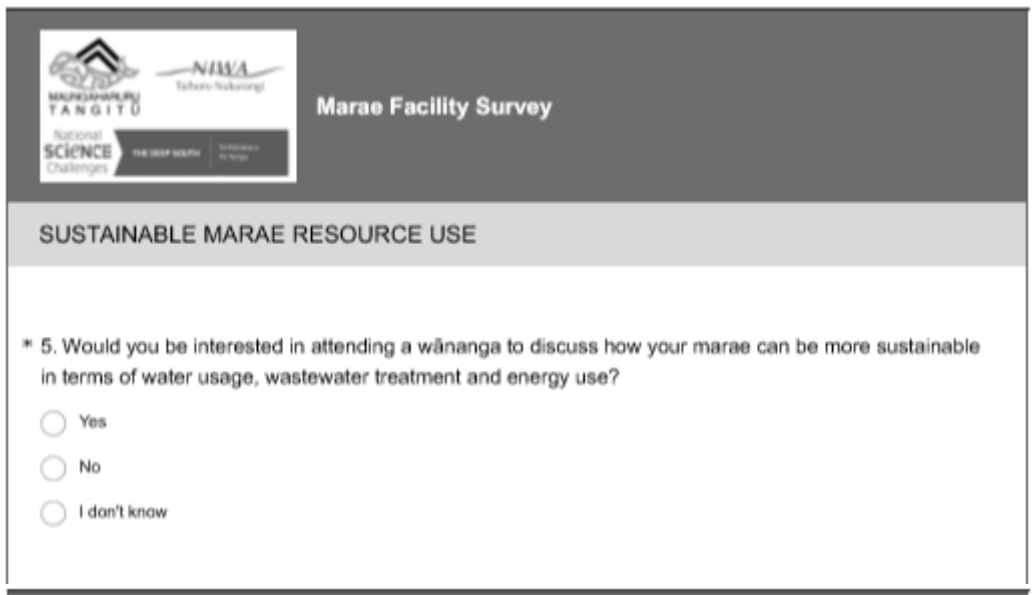
Marae Facility Survey

SUSTAINABLE MARAE RESOURCE USE

Thinking about the essential utilities (power, water, waste-water treatment) at the marae, please consider the following

* 4. Is it important that the marae uses resources sustainably e.g. conserves water, has a wastewater system with minimal impact on the environment, uses renewable energy where appropriate?

- Yes
- No
- I don't know

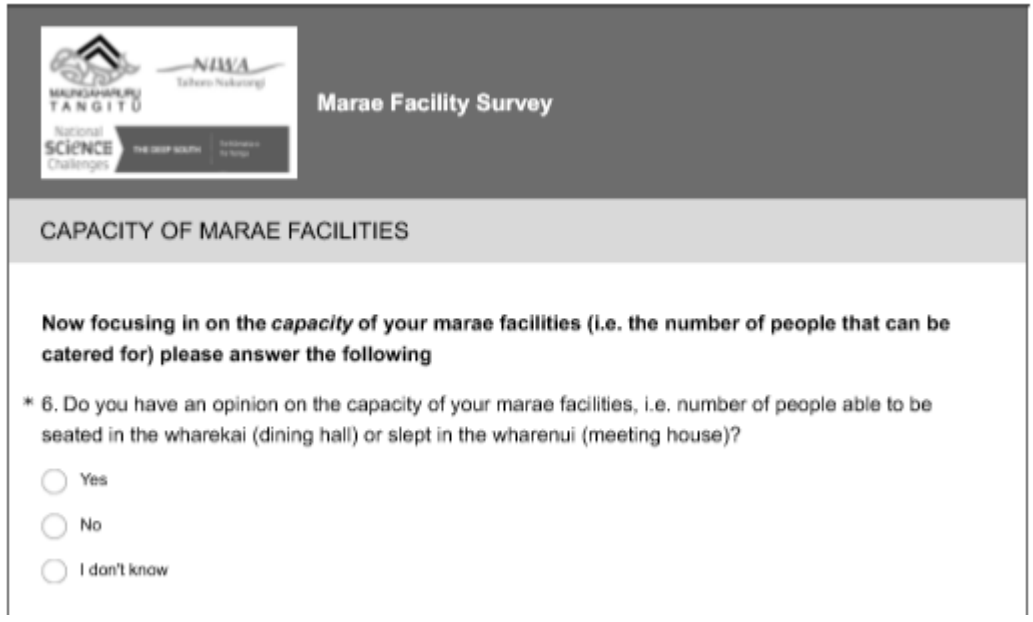


Marae Facility Survey

SUSTAINABLE MARAE RESOURCE USE

* 5. Would you be interested in attending a wānanga to discuss how your marae can be more sustainable in terms of water usage, wastewater treatment and energy use?

- Yes
- No
- I don't know



Marae Facility Survey

CAPACITY OF MARAE FACILITIES

Now focusing in on the *capacity* of your marae facilities (i.e. the number of people that can be catered for) please answer the following

* 6. Do you have an opinion on the capacity of your marae facilities, i.e. number of people able to be seated in the wharekai (dining hall) or slept in the wharenui (meeting house)?

- Yes
- No
- I don't know

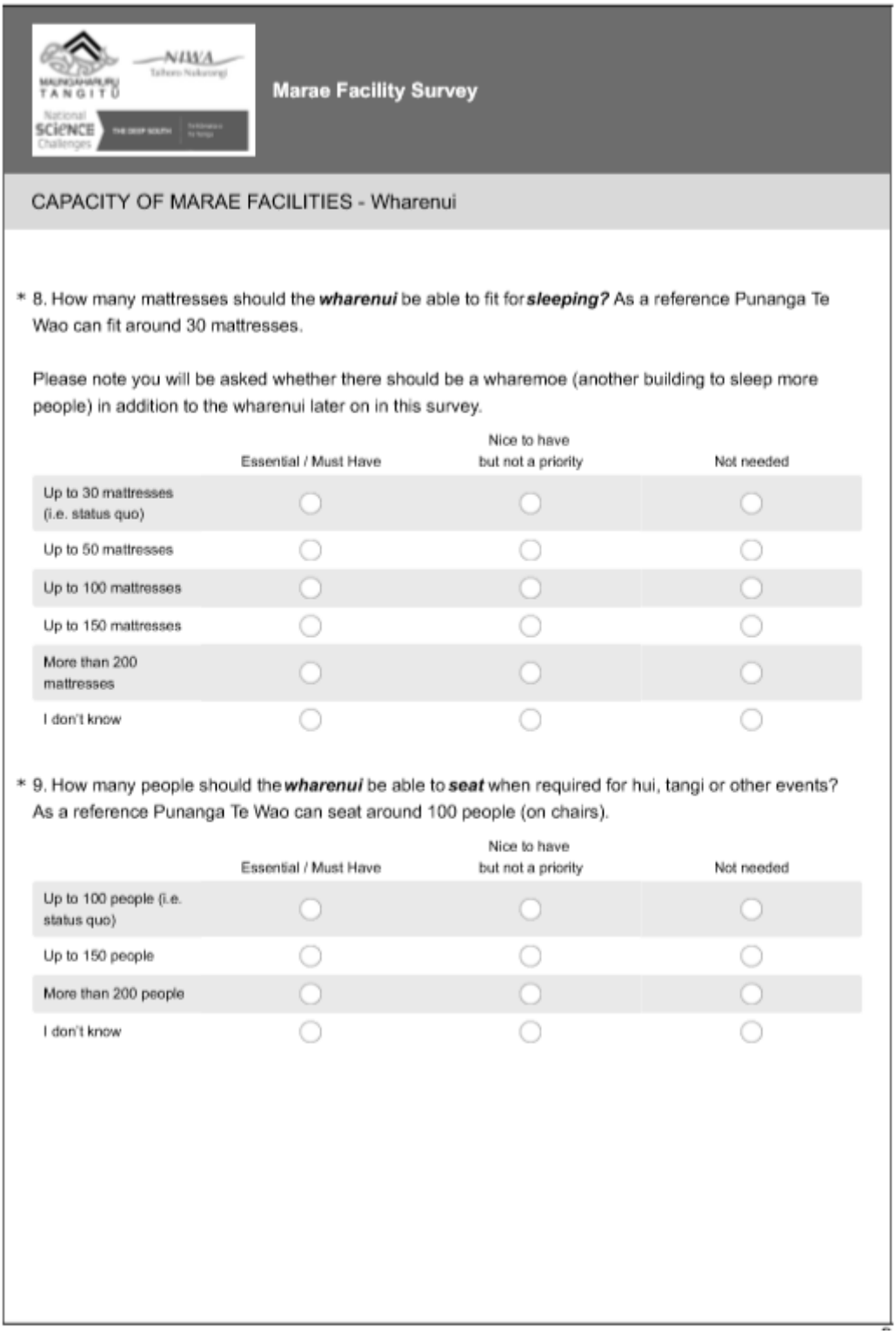
Marae Facility Survey

CAPACITY OF MARAE FACILITIES - Wharekai

* 7. How many people should the ***wharekai*** (dining hall) be able to ***seat***? As a reference, the existing wharekai - Tangitū can seat 220 people.

Consider what you think is absolutely essential, what is a nice to have but not essential and what may be too big.

	Essential / Must Have	Nice to have but not a priority	Not needed
Up to 200 people	○	○	○
Up to 300 people	○	○	○
Up to 400 people	○	○	○
More than 400 people	○	○	○
I don't know	○	○	○



Marae Facility Survey

CAPACITY OF MARAE FACILITIES - Wharenui

* 8. How many mattresses should the ***wharenui*** be able to fit for ***sleeping?*** As a reference Punanga Te Wao can fit around 30 mattresses.

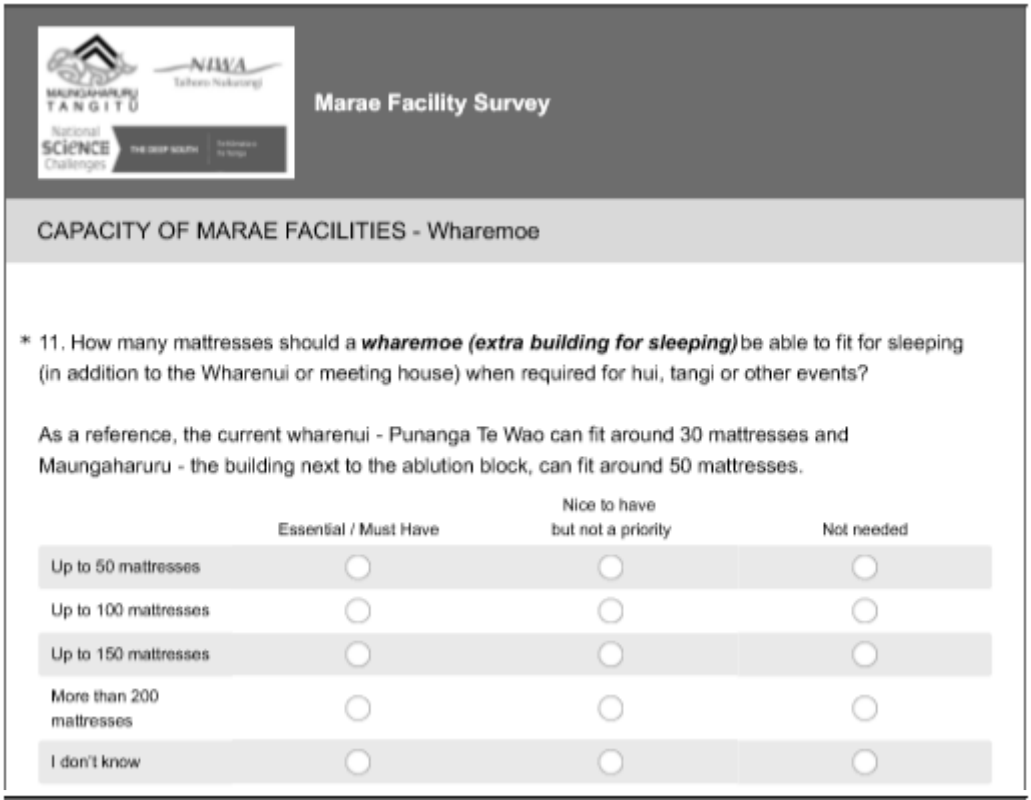
Please note you will be asked whether there should be a wharemoe (another building to sleep more people) in addition to the wharenui later on in this survey.

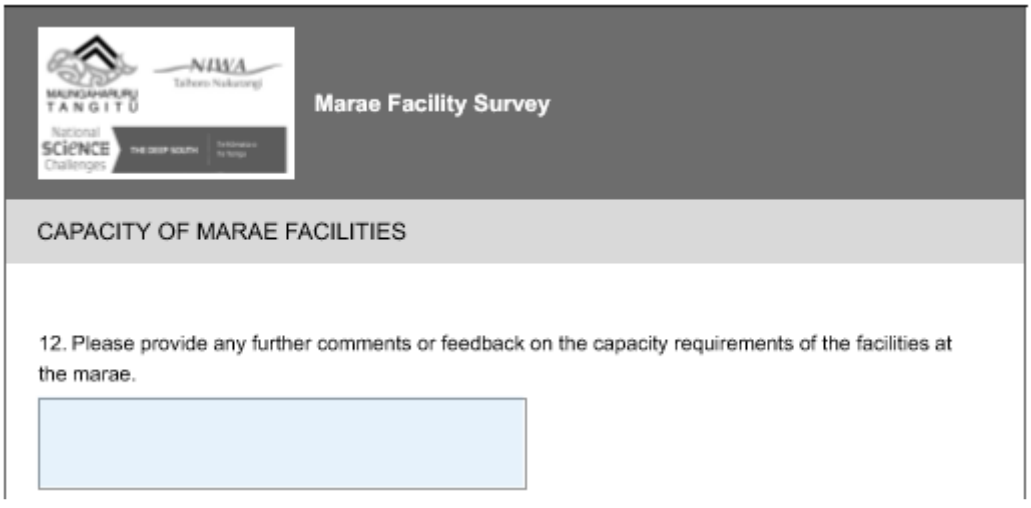
	Essential / Must Have	Nice to have but not a priority	Not needed
Up to 30 mattresses (i.e. status quo)	○	○	○
Up to 50 mattresses	○	○	○
Up to 100 mattresses	○	○	○
Up to 150 mattresses	○	○	○
More than 200 mattresses	○	○	○
I don't know	○	○	○

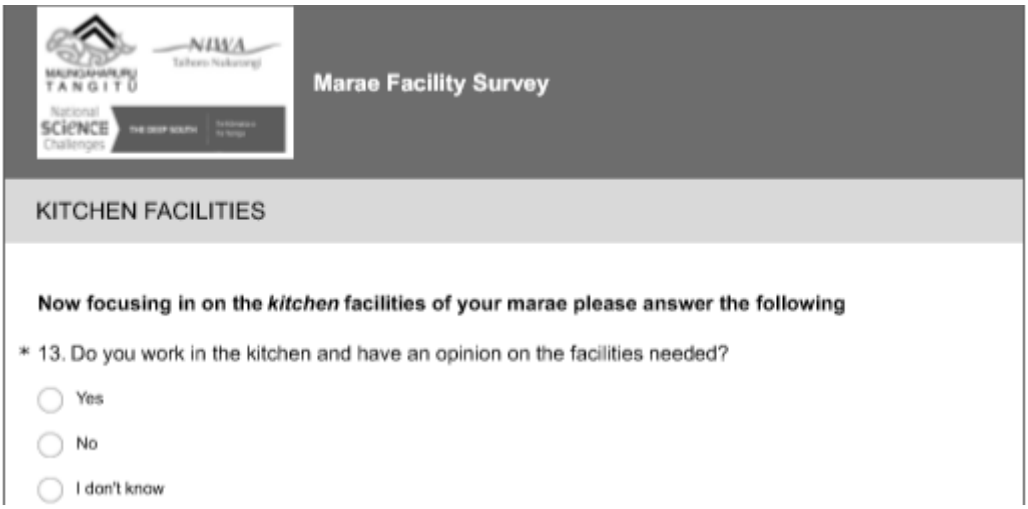
* 9. How many people should the ***wharenui*** be able to ***seat*** when required for hui, tangi or other events? As a reference Punanga Te Wao can seat around 100 people (on chairs).

	Essential / Must Have	Nice to have but not a priority	Not needed
Up to 100 people (i.e. status quo)	○	○	○
Up to 150 people	○	○	○
More than 200 people	○	○	○
I don't know	○	○	○


Marae Facility Survey
CAPACITY OF MARAE FACILITIES - Wharemoe
* 10. Do you think a ***wharemoe (extra building for sleeping)*** is needed to provide extra sleeping capacity in addition to the wharenui (meeting house)?
Yes
No
I don't know


Marae Facility Survey
CAPACITY OF MARAE FACILITIES - Wharemoe
* 11. How many mattresses should a ***wharemoe (extra building for sleeping)*** be able to fit for sleeping (in addition to the Wharenui or meeting house) when required for hui, tangi or other events?
As a reference, the current wharenui - Punanga Te Wao can fit around 30 mattresses and Maungaharuru - the building next to the ablution block, can fit around 50 mattresses.
Essential / Must Have
Nice to have but not a priority
Not needed
Up to 50 mattresses
Up to 100 mattresses
Up to 150 mattresses
More than 200 mattresses
I don't know


Marae Facility Survey
CAPACITY OF MARAE FACILITIES
12. Please provide any further comments or feedback on the capacity requirements of the facilities at the marae.



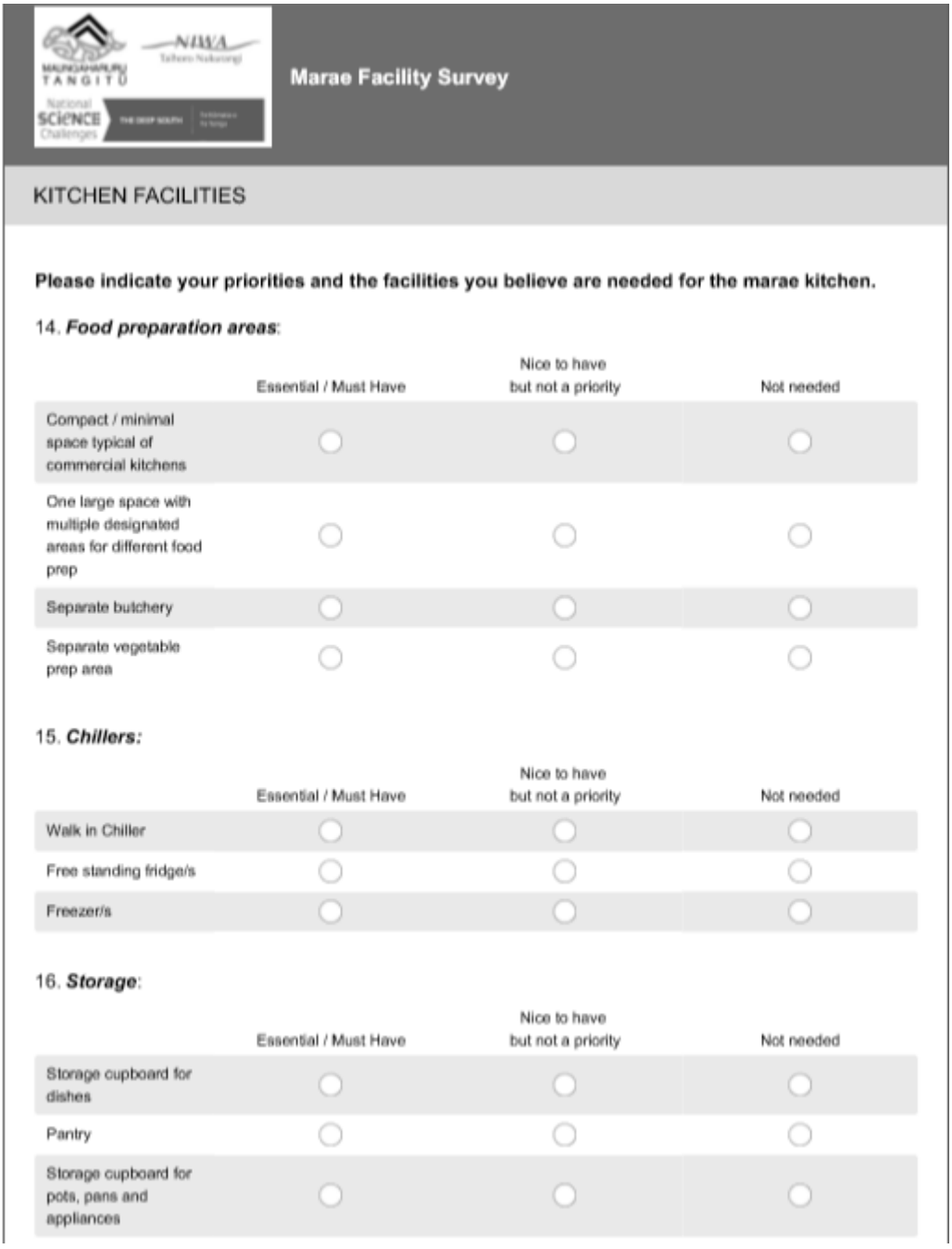
Marae Facility Survey

KITCHEN FACILITIES

Now focusing in on the *kitchen* facilities of your marae please answer the following

* 13. Do you work in the kitchen and have an opinion on the facilities needed?

- Yes
- No
- I don't know



Marae Facility Survey

KITCHEN FACILITIES

Please indicate your priorities and the facilities you believe are needed for the marae kitchen.

14. ***Food preparation areas***:

	Essential / Must Have	Nice to have but not a priority	Not needed
Compact / minimal space typical of commercial kitchens	○	○	○
One large space with multiple designated areas for different food prep	○	○	○
Separate butchery	○	○	○
Separate vegetable prep area	○	○	○

15. ***Chillers:***

	Essential / Must Have	Nice to have but not a priority	Not needed
Walk in Chiller	○	○	○
Free standing fridge/s	○	○	○
Freezer/s	○	○	○

16. ***Storage***:

	Essential / Must Have	Nice to have but not a priority	Not needed
Storage cupboard for dishes	○	○	○
Pantry	○	○	○
Storage cupboard for pots, pans and appliances	○	○	○

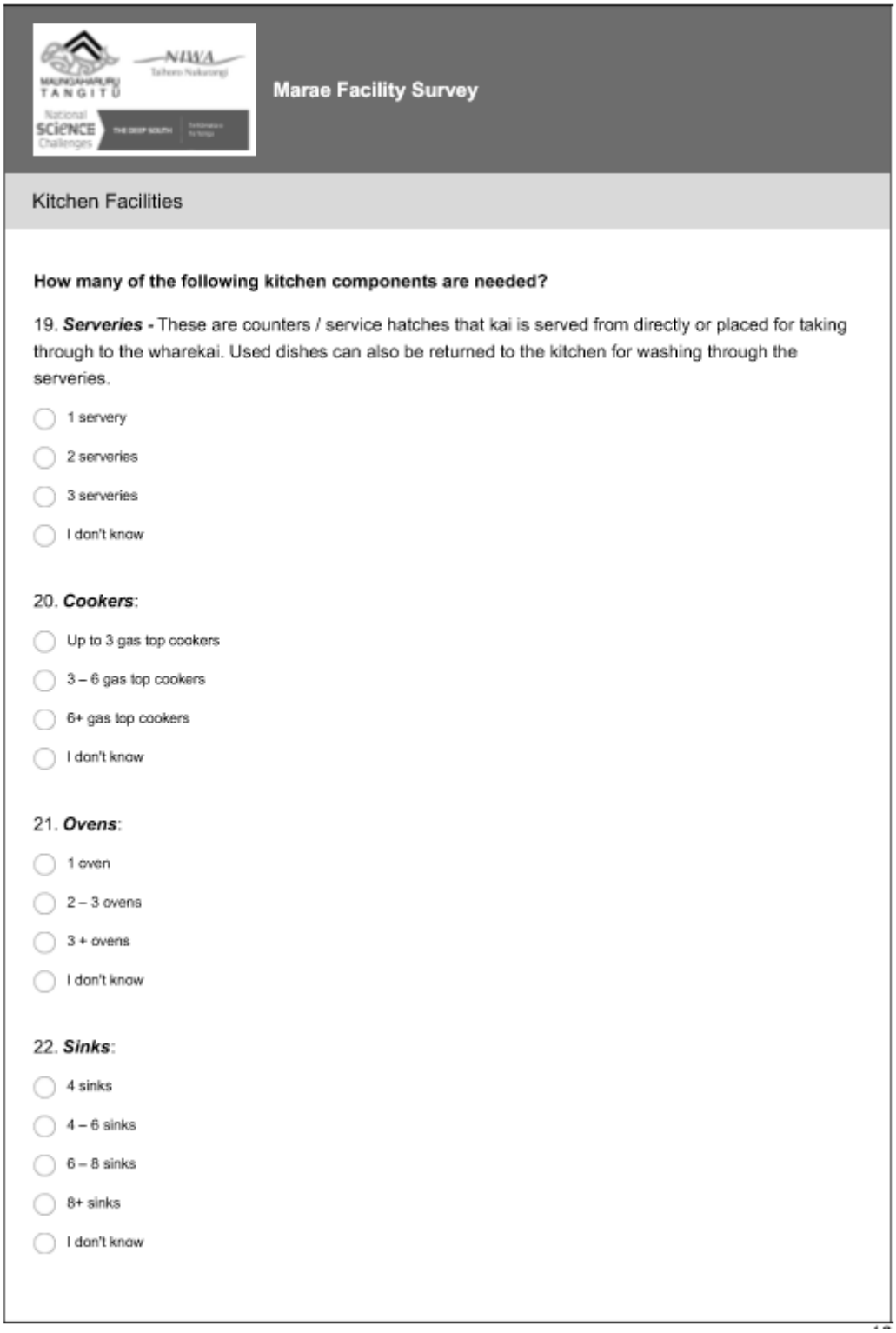
17. ***Dishwashing facilities***:

	Essential / Must Have	Nice to have but not a priority	Not needed
Commercial dishwashing area	○	○	○
Multiple dishwashing areas	○	○	○
Enough space for up to 10 people to help with dishwashing at any single time	○	○	○
Enough space for up to 20 people to help with dishwashing at any single time	○	○	○

18. ***Other facilities***:

	Essential / Must Have	Nice to have but not a priority	Not needed
Separate Laundry	○	○	○
Separate wharepaku (toilets), showers and rest area for ringawera (cooks)	○	○	○

Please list any other kitchen facilities that you consider essential.


Marae Facility Survey
Kitchen Facilities
How many of the following kitchen components are needed?
19. Serveries - These are counters / service hatches that kai is served from directly or placed for taking through to the wharekai. Used dishes can also be returned to the kitchen for washing through the serveries.
1 servery
2 serveries
3 serveries
I don't know
20. Cookers:
Up to 3 gas top cookers
3 – 6 gas top cookers
6+ gas top cookers
I don't know
21. Ovens:
1 oven
2 – 3 ovens
3 + ovens
I don't know
22. Sinks:
4 sinks
4 – 6 sinks
6 – 8 sinks
8+ sinks
I don't know

Marae Facility Survey

FLOOD IMPACTS ON THE MARAE

This part of the survey focuses on how you feel about living with the impacts of flooding

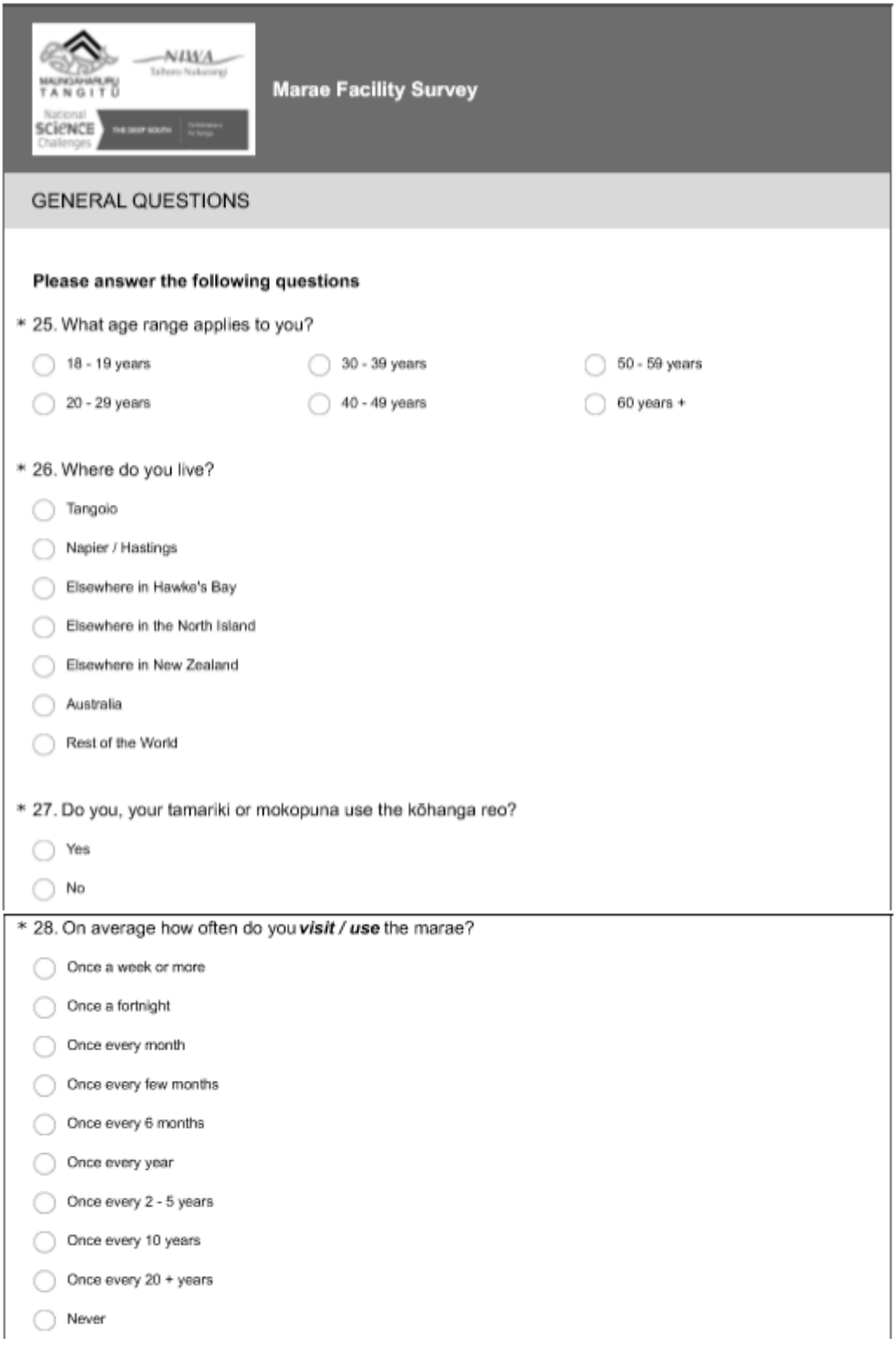
* 23. How often could you live with each of the impacts listed below?

	Once every month	Once every 1 - 3 months	Once every year	Once every 2-5 years	Once every 10 years	Once every 50 years	Once every 100 years
Water logged carpark	○	○	○	○	○	○	○
Kōhanga Reo closed due to waterlogged carpark	○	○	○	○	○	○	○
Flooded marae grounds	○	○	○	○	○	○	○
Flooded and water damaged wharekai (dining hall)	○	○	○	○	○	○	○
Flooded and water damaged wharenui (meeting house)	○	○	○	○	○	○	○
Flooded and water damaged ablutions	○	○	○	○	○	○	○
Asked to help clean up buildings / marae grounds post flood	○	○	○	○	○	○	○
Asked to contribute pūtea (money) to help clean up buildings / marae grounds post flood	○	○	○	○	○	○	○
Unable to use facilities due to damage/clean up	○	○	○	○	○	○	○
Loss of access to the marae due to flooding	○	○	○	○	○	○	○
Damaged marae grounds (i.e. landscaping)	○	○	○	○	○	○	○
Cancelled events due to flood damage, water logging	○	○	○	○	○	○	○
Impact on the urupā (cemetary)	○	○	○	○	○	○	○

Please list any other flood impacts on the marae and how often you have experienced them.

* 24. How often could you live with the loss of the following ***utility services*** at the marae?

	Once every month	Once every 1 - 3 months	Once every year	Once every 2-5 years	Once every 10 years	Once every 50 years	Once every 100 years
Power cut	○	○	○	○	○	○	○
Loss of water supply	○	○	○	○	○	○	○
Loss of sewer system	○	○	○	○	○	○	○
Phone outage	○	○	○	○	○	○	○



Marae Facility Survey

GENERAL QUESTIONS

Please answer the following questions

* 25. What age range applies to you?

- ◯ 18 - 19 years
- ◯ 20 - 29 years
- ◯ 30 - 39 years
- ◯ 40 - 49 years
- ◯ 50 - 59 years
- ◯ 60 years +

* 26. Where do you live?

- ◯ Tangoio
- ◯ Napier / Hastings
- ◯ Elsewhere in Hawke's Bay
- ◯ Elsewhere in the North Island
- ◯ Elsewhere in New Zealand
- ◯ Australia
- ◯ Rest of the World

* 27. Do you, your tamariki or mokopuna use the kōhanga reo?

- ◯ Yes
- ◯ No

* 28. On average how often do you ***visit / use*** the marae?

- ◯ Once a week or more
- ◯ Once a fortnight
- ◯ Once every month
- ◯ Once every few months
- ◯ Once every 6 months
- ◯ Once every year
- ◯ Once every 2 - 5 years
- ◯ Once every 10 years
- ◯ Once every 20 + years
- ◯ Never

* 29. Please state how many times you have attended the following types of events at the marae in the last 2 years? (Note: your response must be a number)

Tangi

Unveiling

Wedding

Birthday

Reunion

Wānanga

Marae Trustees / Committee hui

Maungaharuru-Tangitū Trust hui

Noho-ā-Rangatahi (Te Ara Kairangi)

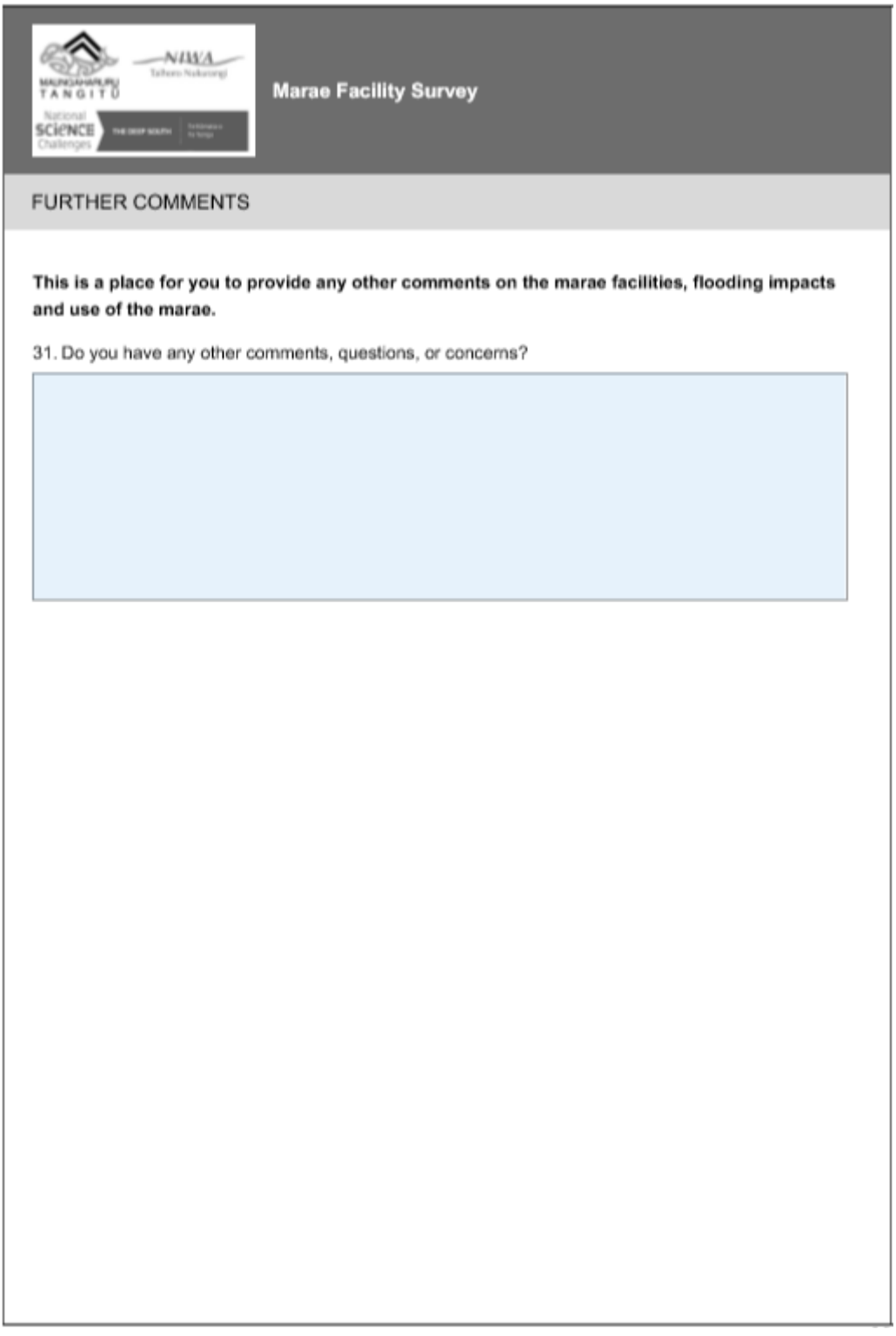
Whakamoemiti (Church service)

External organisation hui

Working bee

* 30. Have you hosted any of the events listed above at a location besides the marae? If yes please indicate what kind of event it was and why it wasn't held at the marae.

- ◯ No
- ◯ Yes


Marae Facility Survey
FURTHER COMMENTS
This is a place for you to provide any other comments on the marae facilities, flooding impacts and use of the marae.
31. Do you have any other comments, questions, or concerns?

Appendix C Semi-structured interview questions

To begin:

- Can you see Tangoio Marae and your house on the map?
- How long have you lived there?
- Can you tell me a bit about your life here?

Floods Timeline:

- Draw a timeline (on blank sheet) and mark what floods you can remember and the ones others told you about.

Two options – talk about each flood if the participant wishes or ask about the most memorable flood/biggest flood and Cyclone Bola

Option 1: Ask a few questions about each flood:

- What was it like?
- What happened?
- How big was it? (Where did the water get to physical marker if possible … i.e., use map and/or door frame, tree)
- What was affected (prompts homes land services (power water supply) foods supply stock? (map where possible)
- What did you do, how did you cope? (where did you shelter, how did you get around, get water.
- Did anything change afterwards? (prompts move, banks)
- Who made the decision(s)?
- How did it change? why did it change?
- How did it work out?
- How long did it take to get things back to normal (recovery)?
- What couldn't you do for a while?
- Any pictures?
- What happened – how long did the water stay around for?

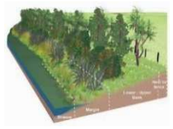
Option 2: Reference specific events:

- What was the most memorable flood – why was that? What happened? *(Cover questions from option 1).*
- What was the biggest flood you can remember? *(Cover questions from option 1).*
- Did you experience cyclone Bola? What happened? *Get physical markers for Bola at minimum (Cover questions from option 1).*

Finish up

- What advice/knowledge would you like to pass to others about flooding?
- Is there anything else around floods that you feel is important enough to talk about?

Appendix D Suite of options considered for the future of Tangoio Marae.

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Insure Marae.	Insure the marae.	• That insurance will continue to be available even if marae impacted by numerous floods. • Refer to Insurance "Blue" card for details.	Refer to Insurance "Blue" card.	Refer to Insurance "Blue" card.	No change.	Refer to Insurance "Blue" card.	Offers protection against natural disasters, fires etc.	Significant expense.
Invest Money. 	Return of $500k for every $1,000,000 invested over 10-year period.	• Simple 5% annualized return. • Minimum investment of $1,000,000 for 10 years.	Min $1,000,000 ($1 Million)	$0	No change.	Refer to Insurance "Blue" card.	• Investment earns a return. • Investment can be withdrawn at the beginning of any 10-year period.	No improved flood protection.
Do Nothing.	No change from current situation.	• Buildings can tolerate repeated flood damage. • Whānau will pitch in to clean up following flood events.	$0	$0	No change.	Refer to Insurance "Blue" card.	No upfront investment allowing money to be used for other things.	• No improved flood protection. • Increased insurance costs if marae impacted by flooding. • Costs and effort to clean up marae after flood events.
Te Ngarue Riparian Planting. 	Riparian planting and restoration of lower reaches of stream by the marae.	• Planting in collaboration with land owners and HBRC. • Stream planting fenced to exclude stock. • Co-funded work with in-kind services from marae whanāu and others. • 50% plant survival for 50-yr ARI events. • 0% survival for 100-yr ARI events. • Whānau will pitch in to clean up following flood events.	$200k	$50k/10-yr Plus costs following floods: 20-yr ARI = MINOR = $20K 50-yr ARI = FLOOD = $50K 100-yr ARI= MAJOR =$100k > 100-yr ARI = CATASTROPHIC =$200k	No change.	Refer to Insurance "Blue" card.	• Improved stream habitat & ecological value. • Potential to reduce stream bank erosion. • Improved appearance. • Whanāu reconnection with stream.	No improved flood protection.
Stream Maintenance.	As is – keeping the stream free flowing by removing pest plants (e.g., willows) and stabilising banks.	HBRC will continue with existing scheme.	$0	$0	No Change	Refer to Insurance "Blue" card.	Reduced risk of blockage.	Needed in combination with other options to improve flood protection.

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Lift building floors above 2% AEP (50-year ARI) flood level. 	Lift Punanga Te Wao (wharenui), Tangitū (wharekai) and Maungaharuru (utility building) floors to above the 2% AEP / 50-year ARI flood level.	• Building floor levels can be elevated – either through re-piling or pouring a new concrete floor. • Includes an allowance for replumbing the ablution facilities in order to lift the floor level and installing new door ways. • Whānau will pitch in to clean up the marae grounds following flood events. • Buildings can tolerate repeated flood damage. • Buildings and site can be restored following flood damage.	$1.2M	$0 Plus additional costs following floods: 100-yr ARI = MAJOR = $50k > 100-yr ARI = CATASTROPHIC = $200k	50-yr ARI (2% AEP) for lifted buildings only.	20-yr ARI = MINOR FLOOD= $20k 50-yr ARI = FLOOD = $50k 100-yr ARI = MAJOR FLOOD = $500k >100-yr ARI = CATASTROPHIC FLOOD = $1.5M	Increased level of protection for lifted buildings.	• Only protects lifted buildings. • Clean up will still be required for site and buildings that aren't lifted. • Level of protection will reduce over time as the flood plain and surrounding land levels increase (as a result of sedimentation).
Lift building floors above 1%AEP (100-year ARI) flood level. 	Lift Punanga Te Wao (wharenui), Tangitū (wharekai) and Maungaharuru (utility building) floors to above the 1% AEP / 100-year ARI flood level.	• Building floor levels can be elevated through re-piling or pouring a new concrete floor. • Ablution facilities replumbed to lift the floor level and new doors installed. • Whānau will pitch in to clean up the marae grounds and site following flood events. • Buildings can tolerate repeated flood damage. • Buildings and site can be restored following flood damage.	$1.7M	$0 Plus additional costs following floods: > 100-yr ARI = CATASTROPHIC = $200k	100-yr ARI (1% AEP) for lifted buildings only.	20-yr ARI = MINOR= $20k 50-yr ARI = FLOOD = $50k 100-yr ARI = MAJOR = $300k >100-yr ARI = CATASTROPHIC = $1M	Increased level of protection for lifted building.	• Only protects lifted buildings. • Clean up will still be required for site and buildings that aren't lifted. • Level of protection will reduce over time as the flood plain and surrounding land levels increase (as a result of sedimentation).

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Build flood bank to protect site in 2% AEP (50-year ARI) flood event. 	Build flood bank around entire site (marae, Taurima whare, carpark, kōhanga reo) to provide 2% AEP (50-year ARI) flood level of protection.	• Flood bank (or stop bank) will protect entire site (marae, carpark, kōhanga) and surrounding land and tie into the high points in the state highway. • Alternatively, the level of the state highway could be raised to reduce the length of flood bank required. • Transit (NZTA) and Regional Council will not oppose the proposal. • Land access and resource consents to build the flood banks are obtained. • Some sections of the existing flood bank can be built up to provide part of the new flood bank. • Space is available to increase flood bank level and footprint. • Ignores continued sedimentation of flood plain and need to increase level in future. • Marae responsible for ongoing maintenance. • Buildings can tolerate repeated flood damage. • Buildings and site can be restored following flood damage.	$700k	$100k/10-yr Plus additional costs following floods: 100-yr ARI= MAJOR =$50k > 100-yr ARI = CATASTROPHIC = $200k	50-yr ARI (2% AEP)	50-yr ARI = FLOOD = $20k 100-yr ARI = MAJOR = $500k >100-yr ARI = CATASTROPHIC = $2.5M	• Increased level of protection to entire site including kōhanga reo, carpark, Taurima whare. • Potential to protect lands and residents surrounding the marae.	• Level of protection will decrease over time as flood plain level builds. • Larger impacts when more extreme events occur. • Requires ongoing maintenance for continued protection. • Higher stop bank will require increased footprint. • Requires resource consent and land owner approval. • Stock excluded from stop banks (i.e., loss of productive land).
Preparedness response kit. 	Response plan and equipment to protect wharenui in up to 2% AEP (1 in 50-yr) flood events.	• Whānau will respond and lay out sand bags when needed. • Clean up costs include restocking the kit and cleaning the site after each event. • Preparedness kit will only be effective in events up to 50-yr ARI.	$100k	$50k/10-yr Plus additional costs to replenish kit following events: 20-yr = $20K 50-yr = $40K	50-yr ARI (2% AEP)	20-yr ARI = MINOR = $20k 50-yr ARI = FLOOD = $50k Refer to Insurance "Blue" card for: 100-yr ARI = MAJOR, >100-yr ARI = CATASTROPHIC	• Relatively low cost . • Will be useful for small to medium events. • Can be implemented easily if people are available and respond quickly enough.	• Requires people to maintain the kit. • Needs people to implement. • Needs fast response by able bodied people to implement. • Needs to be fast enough to be effective. • Ineffective and potentially dangerous if people respond to late or there are not enough people to implement.

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Build flood bank to protect site in 1% AEP (100-year ARI) flood event. 	Build flood bank around entire site (marae, Taurima whare, carpark, kōhanga) to provide 1% AEP (100-yr ARI) flood level of protection.	• Flood bank (or stop bank) will protect entire site (marae, carpark, kōhanga) and surrounding land and tie into the high points in the state highway. • Alternatively, the level of the state highway could be raised to reduce the length of flood bank required.. • NZTA and HBRC will not oppose the proposal. • Land access and resource consents to build the flood banks are obtained. • Some sections of the existing flood bank can be built up to provide part of the new flood bank. • Space is available to increase flood bank level and footprint. • Ignores continued sedimentation of flood plain and need to increase level in future. • Marae responsible for on-going maintenance. • Buildings can tolerate repeated flood damage. • Buildings and site can be restored following flood damage.	$1M	$100k/1-0yr Plus additional costs following floods: > 100-yr ARI = CATASTROPHIC = $200k	100-yr ARI (1% AEP)	100-yr ARI = MAJOR = $20k >100-yr ARI = CATASTROPHIC = $2.5M	• Increased level of protection to entire site including kōhanga reo, carpark, Taurima whare. • Potential to protect lands and residents surrounding the marae.	• Level of protection will decrease over time as flood plain level builds. • Larger impacts when more extreme events occur. • Requires ongoing maintenance for continued protection. • Higher stop bank will require increased footprint. • Requires resource consent and land owner approval. • Stock excluded from stop banks (i.e., loss of productive land).
Waterproof the buildings. 	Engineered water proofing of wharenui, ablutions and Maungaharuru whare. Tangitū cannot be water proofed.	• Punanga Te Wao (wharenui), Tangitū wharekai) and Maungaharuru (utility building) can be waterproofed. • Waterproofing via sprayed liquid membrane (BEP Blue Barrier), flood gates for door openings and sealed vents. • Buildings can tolerate repeated flood damage. • Buildings and site can be restored following flood damage.	$1.5M	$300k/10-yr Plus additional costs to reinstate following events: 50-yr ARI = $10k 100-yrARI = $20k >100-yrARI = $250k	100-yr ARI (1% AEP) for waterproofed buildings only	20-yr ARI = MINOR = $20k 50-yr ARI = FLOOD = $50k 100-yr ARI = MAJOR = $300k >100-yr ARI = CATASTROPHIC = $1M	Increased level of protection for some buildings.	• Only benefits buildings that have been waterproofed. • Relatively new technology in NZ.
Earth Ark. 	Build an ark to carry the marae and all of the whānau.	Ark can be built for $20M.	$20M	$500k/10-yr	500-yr ARI (0.2% AEP)	N/A	Remove flood risk.	• High cost. • Impractical. • Will require people to board the Ark. • Will need to be fully stocked, ready to go at all times and may not provide the functionality a marae can.

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Drainage Improvement works. 	Improving site drainage to reduce frequency of nuisance flooding that currently occurs on a regular basis.	• Flood waters stay within the banks of the stream in 10% AEP (10-yr ARI) flood events or smaller. • Drainage can be installed to provide 10% AEP level of service.	$200k	Costs to reinstate drainage following events. 50-yr ARI = $10k 100-yrARI = $20k >100-yr ARI= $100k	10-yr ARI (10% AEP)	Refer to Insurance "Blue" card.	• Immediate benefit. • Will reduce frequency of nuisance flooding.	Will not provide protection for events larger than 10% AEP (1 in 10-year flood).
Upgrade the Marae - New kitchen fit out.	Upgrade the kitchen with complete refurbishment and appliances.	No changes to existing building structure or utilities (i.e., power, gas, water, wastewater).	$350k	$0	No change.	Refer to Insurance "Blue" card.	Improve function of marae.	No increase in flood protection.
Upgrade the Marae – Access.	Improve the safety of the vehicle access into the marae.	NZTA will support improvements to access safety and contribute toward costs.	$100k	$0	No change.	Refer to Insurance "Blue" card.	Improve safety of access to the marae from the State Highway.	No increase in flood protection.
Upgrade the Marae - New paepae shelters.	Construct new paepae shelters.		$40k	$0	No change.	Refer to Insurance "Blue" card.	Improve function of marae.	No increase in flood protection.
Upgrade the Marae - Kids Playground.	Construct new playground for tamariki.		$20k	$0	No change.	Refer to Insurance "Blue" card.		No increase in flood protection.
New Marae – Buy Land.	Buy 3 ha of land in a location outside of flood hazard areas.	• 3 ha of suitable land is readily available at $200k/ha. • New site can be found and consented to meet the needs of the whānau.	$600k	$0	N/A – located outside of flood hazard area.	$0	• Provides opportunity to develop a marae complex outside of flood hazard area. • Land could be used for different purposes. • Could be land banked and on-sold if not required.	• Need to decide what to do with existing Tangoio Marae site and facilities. • May not be large enough to cater for all whānau aspirations.
Land for urupā.	Purchase 1 ha land for urupā, fence and create access.	• 1 ha of suitable land is readily available at $200k/ha. • New site can be found and consented to meet the needs of the whānau.	$300k	$0	N/A – located outside of flood hazard area.	$0	Provides more space for whānau.	No increase in flood protection.
New Marae – Build Infrastructure.	Build essential infrastructure at a new site out of the flood risk area: - Power - Water - Wastewater - Vehicular access & car park - Drainage	• Land out of flood risk area has been purchased. • Infrastructure has been built at new site. • Power is available at the building site, includes new transformer, 150 m cable to main distribution board. • 3 x 30ML water tanks and new bore. • Basic septic tank and dispersal field, free draining soil with deep water table. • 150 m long x 3 m wide access road. • 20 m x 40 m carpark area. • Good drainage at the new site.	$550k	$0	N/A – located outside of flood hazard area.	N/A – New facilities must be insured. Refer to Insurance "Blue" card.	• Provides options for the future. • Opportunity to increase size and improve function of facilities.	Need to decide what to do with existing Tangoio Marae site and facilities.

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
New Ablution Facilities.	Build new 16 m x 6 m ablution facilities.	• Land out of flood risk area has been purchased and infrastructure has been built at new site OR space is available at existing site. • Slightly larger facilities than existing (100 m² v 80 m²). • Assumes 20% higher cost to build at existing site due to need to build above flood level.	$420k if at new site $600k if at existing	$0	•N/A – located outside of flood hazard area. •If at existing site assume floor will be built above 100-yr ARI flood level.	• N/A – New facilities must be insured. • Refer to Insurance "Blue" card.	• Remove flood risk. • Reduce insurance costs. • Provides modern facilities. • Opportunity to increase size and improve function of facilities .	Need to decide what to do with existing Tangoio Marae site and facilities.
New Wharekai/Kāuta.	Build new 20m x 30m building with commercial kitchen fit out.	• Land out of flood risk area has been purchased and infrastructure has been built at new site OR space is available at existing site. • Significantly larger building than existing facilities (600 m² v 400 m²). • Includes dining hall and commercial kitchen. • Commercial kitchen appliance fit out. • Assumes 20% higher cost to build at existing site due to need to build above flood level.	$2.45M if at new site $2.95M if at existing	$0	•N/A – located outside of flood hazard area. •If at existing site assume floor will be built above 100-yr ARI flood level.	• N/A – New facilities must be insured. • Refer to Insurance "Blue" card.	• Remove flood risk. • Reduce insurance costs. • Provides modern facilities. • Opportunity to increase size and improve function of facilities.	Need to decide what to do with existing Tangoio Marae site and facilities.
New Wharenui.	Build new whare 20 m x 10 m (slightly larger than existing).	• Land out of flood risk area has been purchased and infrastructure has been built at new site OR space is available at existing site. • Larger shell than existing wharenui (200 m² v 130 m²). • Interior fit out costs assumed to be $120k. • Assumes 20% higher cost to build at existing site due to need to build above flood level.	$950k if at new site $1.15M if at existing site	$0	•N/A – located outside of flood hazard area. •If at existing site assume floor will be built above 100-yr ARI flood level.	• N/A – New facilities must be insured. • Refer to Insurance "Blue" card.	• Remove flood risk. • Reduce insurance costs. • Provides modern facilities. • Opportunity to increase size and improve function of facilities.	Need to decide what to do with existing Tangoio Marae site and facilities.
New Utility Building.	Build new wharemoe 15 m x 10 m.	• Land out of flood risk area has been purchased and Infrastructure has been built at new site OR space is available at existing site. • Smaller than existing utility building (150 m² v 260 m²). • Assumes 20% higher cost to build at existing site due to need to build above flood level.	$520k if at new site $620k if at existing site	$0	•N/A – located outside of flood hazard area. •If at existing site assume floor will be built above 100-yr ARI flood level.	• N/A – New facilities must be insured. • Refer to Insurance "Blue" card.	• Remove flood risk. • Reduce insurance costs. • Provides modern facilities. • Opportunity to increase size and improve function of facilities.	Need to decide what to do with existing Tangoio Marae site and facilities.

Appendix D: Continued

OPTION	DESCRIPTION	ASSUMPTIONS	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED	PROS	CONS
Landscape new marae complex.	Landscape new complex at a new site out of the flood risk area.	• Land out of flood risk area has been purchased. • Infrastructure has been built at new site. • Fencing, plantings & gardens, flag pole; paepae shelters; waharoa; paving.	$250k	$0	N/A – located outside of flood hazard area.	• N/A – New facilities must be insured. • Refer to Insurance "Blue" card.		Need to decide what to do with existing Tangoio Marae site and facilities.
Small Papakainga.	3 x 2 Bedroom (80 m²) and 3 x 3 Bedroom (110 m²) Papakainga.	• Development can be sited on marae land. • No allowance for land purchase included in costs. • Land development costs, roading, water, wastewater drainage, carport, chattels included in costs. • Assumes power is available at the site.	$3M	Assumed to be self-sustaining/funding.	If at existing site assume floor will be built above 100-year ARI flood level.	N/A – located outside of flood hazard area if associated with new marae. For >100-yr ARI at existing site additional recovery cost of $1.5M.	Could contribute to recreating a vibrant marae community.	

Appendix E Marae-opoly instructions and game pieces

Introduction

MARAE-OPOLY INSTRUCTIONS

INTRODUCTION:

This Serious Game has been developed to help test a range of possible adaptation options for the marae. You'll be forced make some decisions about what you may or may not invest in, and what risks you might be willing to take and what trade-offs you're willing to make.

You'll play in groups and will have a set amount of money to work with. You'll have a range of things that you can do with the money you have. In your groups you can choose what to do with the money you have and see how your choices perform over time against future floods. What your group chooses to do with the money you have is entirely up to you, so long as you agree and can pay for it.

By experimenting and deciding what to do as a group you will need to have important conversations about what is possible and what could or should be done and why.

Most of the options available to you have been identified by the people of Tangoio Marae. We have put ball-park costs together for the options for the purpose of this game. Please note that the cost estimates are indicative only and have not been thoroughly costed out.

Remember, this is a game. It's a way to try out different things. Some of your choices might work as you intended, and some might not. But that's OK. No decisions will be made as a result of playing this game.

We hope that playing the game will help identify possible strategies that could be taken to achieve the goals and aspirations of the marae whanau.

Your participation in playing this game will help us all understand what the different choices might mean for the future, and also help narrow down the options the Marae Options Committee should look at further as part of the work they are doing.

Game brief

MARAE-OPOLY INSTRUCTIONS

THE BRIEF:

You have some big decisions to make about the future of the marae. What it will look like, how exposed it will be to flood hazards and what facilities it will have are all important considerations.

You have Four Million Dollars ($4,000,000) to invest over the next 100 years. You will work in groups to decide how to invest your money on 10-yearly intervals. A range of options with varying costs and benefits are available.

What your group chooses to do with the money you have is entirely up to you but you'll need to consider the priorities in the whanau wish list and explain how they have influenced your decision making.

The performance of your investment decisions against floods will be tested on 10-yearly time periods. After each test, you will be asked to rate how your investment performed before deciding what you might do for the next 10-years.

Game pieces

MARAE-OPOLY INSTRUCTIONS

GAME PIECES:

Each group has the following game pieces. Check you have all of the listed items.

GAME BOARD	A map of the marae and surrounds
CASH	$4,000,000 (=4 million dollars =$4,000k) in pretend money to invest as you wish over the next 100 years. Min denomination is $10,000.
OPTIONS MENU	A menu of options that you can choose from. The menu describes the options, pros and cons, the upfront costs, and ongoing maintenance costs. The menu includes options to improve flood protection as well as options to upgrade the marae. Options and costs associated with moving the marae to a new location are also provided.
DECISION & BALANCE SHEET	To track and record your decisions, and cash balance.
CALCULATOR	To help you keep track of spending and costs.
EMOJI LOLLIPOPS	To rate how you felt your decisions performed throughout the game. Each group member will have a set of these.
WHANAU WISH LIST 'GREEN' CARD	Summary of whanau priorities and aspirations to consider when making your decisions.
OPERATING & MAINTENANCE 'ORANGE' CARD	Details of how operating and maintenance costs will be accounted for.
INSURANCE INFORMATION 'BLUE' CARD	Details the cost of insurance and the implications if you chose not to insure the marae.
FLOOD RELATED MAINTENANCE COST TABLE	Reference to help you assess flood related maintenance costs associated with the available options.

Gaming elements

MARAE-OPOLY INSTRUCTIONS

OTHER GAMING ELEMENTS:

GROUP FACILITATOR	Each group will be assigned a facilitator to help you get into the game and facilitate discussion where needed.
BANK	This is where you go to purchase options, pay maintenance and restoration costs, pay insurance and collect returns on investment. The Bank will send around debt collectors to collect maintenance and restoration costs.
OPTIONS OVERLAYS & STICKERS	These will be given to each group in exchange for purchasing options from the Bank. Clip the overlay to your board, and place the sticker in the appropriate cell on the strategy display board.
STRATEGY TRACKING BOARD	When you make an investment or purchase an option from the Bank, you will be given a sticker to put on the board in the relevant time period. This will allow other groups to see what decisions you have made and also to allow the Bank to track your ongoing costs. Insurance and maintenance cost payments for each period will also be recorded, along with a record of any investments made (that are either cashed in in the case of cash investments, or defaulted on in the case of options where maintenance lapses).
LAPSED MAINTENANCE STICKER	Marker to highlight if maintenance costs have not been paid for more than 30years and that the asset is no longer functional. The sticker will be displayed on the Strategy Tracking Board.
CONDEMNED BUILDING STICKER	Marker to highlight if recovery costs have not been paid following flood events and to indicate that the marae would not be fit for use. The sticker will be displayed on the Strategy Tracking Board.
RAINMAKER	A simulated record of flooding frequency based on local rainfall records, with an allowance for increased rainfall intensity and flood frequency. The rainfall series used for the game will be randomly selected from several different rainfall series. At the end of each 10-year block we will pause and tell you how many floods occurred and ask you to assess how your investments have performed using the Emoji Lollipops.

Forming groups and assigning roles

MARAE-OPOLY INSTRUCTIONS

BEFORE WE START

1. FORM GROUPS & ASSIGN ROLES

Each group will need to assign someone to each of the following roles:

Role	Purpose
Spokesperson	Share the decisions made by the group for each 10 year block and reasons for the decisions including how the whanau wish list has been considered.
Record keeper	Record investment decisions, reasons for decisions on the Strategy and Balance sheet.
Financial Officer	Manage the money, keep track of funds, pay capital and ongoing costs, and put investment stickers up on board for public record.

2. CHECK YOUR MATERIALS

Check you have all the game pieces listed.

3. REVIEW THE BRIEF

Make sure you understand the aim of the game

4. REVIEW THE 'WHANAU WISH LIST 'GREEN' CARD

Have a look at the top priorities and aspirations identified by the whanau as important. Discuss how they will influence your decisions. Your group will need to explain how you have accounted for these priorities in your decision making and why. If you chose not to consider them you'll need to give explain why.

5. REVIEW THE OPTIONS MENU

Check out the options available, their pros and cons and upfront and ongoing maintenance costs.

There are many options including options for flood protection, investments, environmental enhancement, marae upgrade options, and options to develop a marae at a location out of the flood hazard zone.

6. REVIEW THE INSURANCE INFORMATION 'BLUE' CARD

7. REVIEW THE OPERATING & MAINTENANCE 'ORANGE' CARD

How to play

MARAE-OPOLY INSTRUCTIONS

LETS PLAY!!!

We will play in 10 year blocks – at the start of every time block your group has chance to make some investments decisions.

You can choose to do whatever you like - As long as the group agrees and you have the money. You'll need to consider the priorities in the whanau wish list and record how they have influenced your decision making.

Review your Options Menu. Be aware that some options have ongoing maintenance and operational costs.

You can choose to purchase insurance or not. For details refer to the Insurance Information Blue Card.

ROUND 1

DELIBERATION & DECISION MAKING

Discuss and consider the options available, their upfront and ongoing costs and what they will deliver.

Consider the Whanau wish list in making your decisions.

Decide what you want to do and why you want to do it. Will you purchase insurance? Will you invest with the bank or purchase flood protection options? Will you upgrade parts of the marae? Will you move? Will you do a combination of all of the above?

Record you choices on the decision sheet aswell as your reasons including how the priorities on the Whanau Wish List has been considered.

Make your purchases from the Bank. You can choose as many or as few options in 10 years as you wish and can pay for.

Place the Options Overlays you have purchased onto your game board and post the associated sticker onto the Strategy Tracking Board.

MARAE-OPOLY INSTRUCTIONS

SHARING THE DECISIONS MADE

Once all the groups have made their decisions, the spokesperson from each group will have 2 minutes max to describe the groups' choices and reasons for them.

RAIN GENERATOR

After each group has decided what they want to do, the rain generator will be run to test your decisions.

PERFORMANCE ASSESSMENT

Each group will be asked to assess how well their decisions performed using your emoji lollipop. Did your decisions work as planned? Were you flooded? Will you change your strategy going forward?

You will also need to work through the recovery and maintenance costs to feed into the next round of decisions. The bank will come and collect any payments due.

ROUND 2 – 6

This steps followed in round 1 will repeated for the following time blocks:

- Year 11 – 20
- Year 21 – 30
- Year 31 – 40
- Year 41 - 50
- Year 51 -100

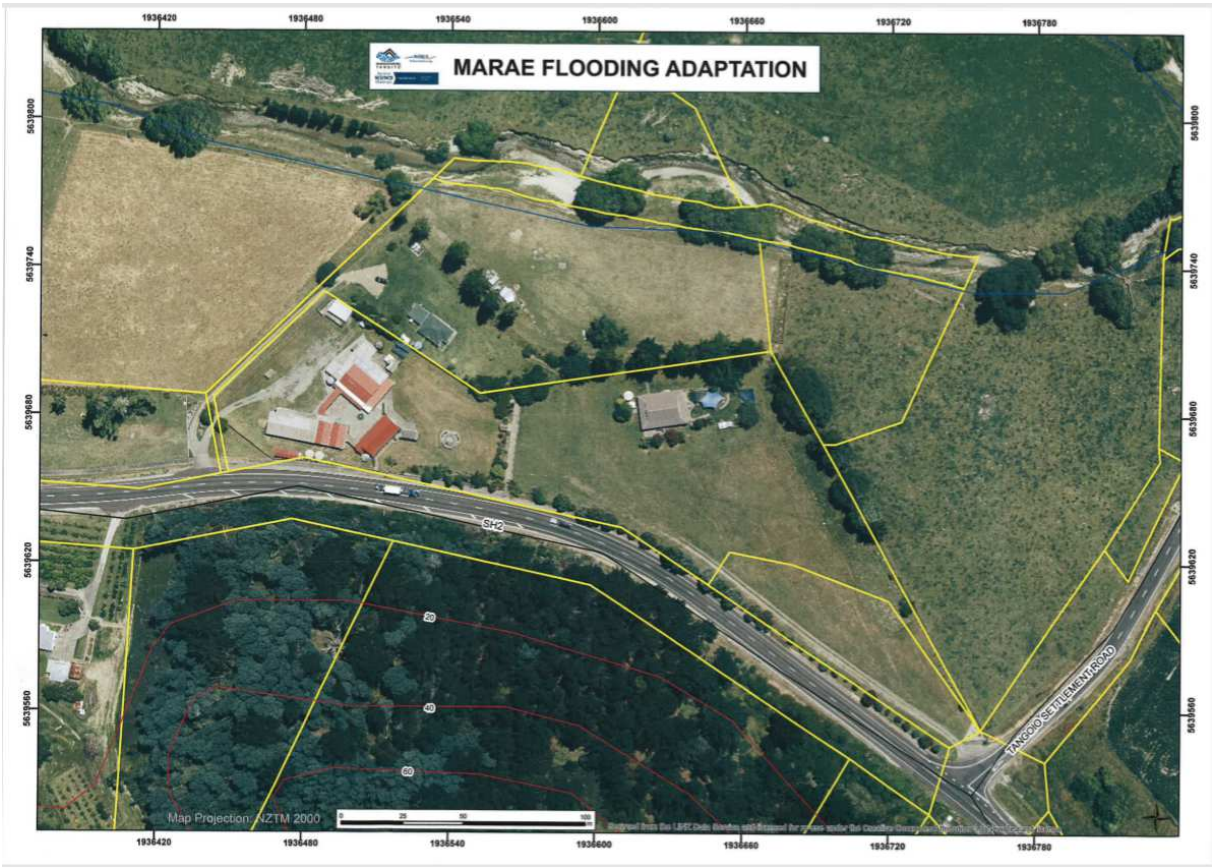
WRAP UP

After all 6 rounds are completed, you'll have 5 minutes to discuss how your overall strategy performed.

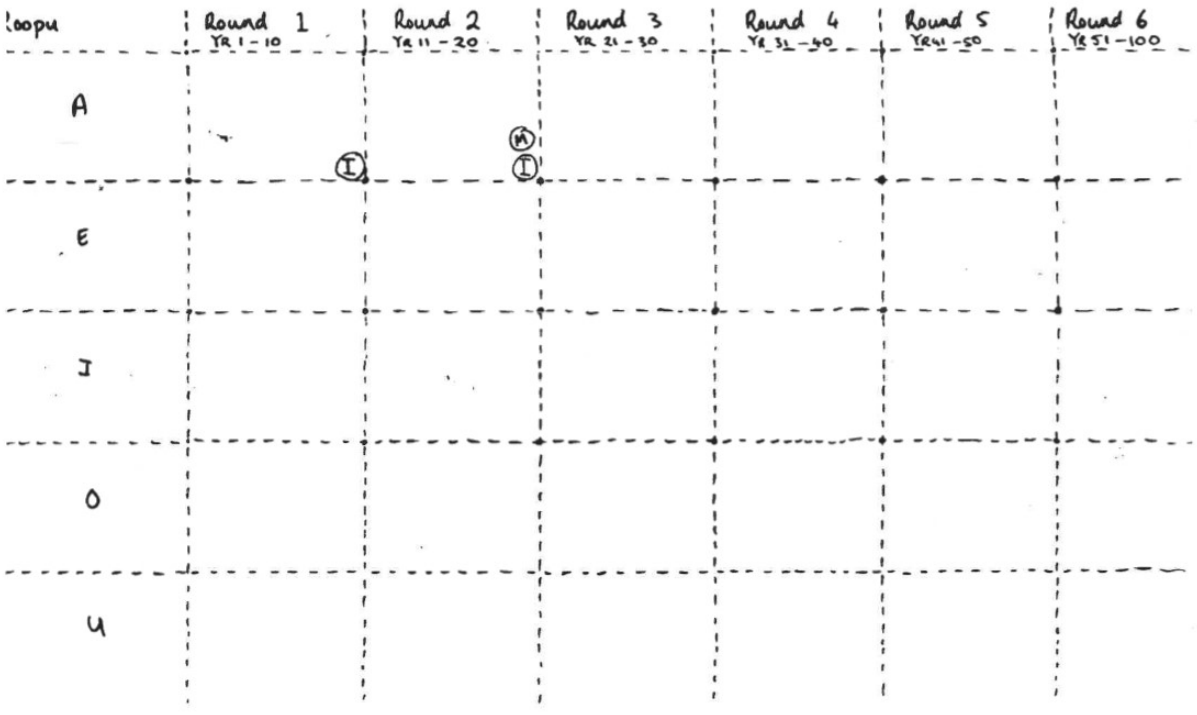
- Did your strategy work? Why? Why not?
- Did your strategy deliver the priorities identified on the Whanau wish list?
- What went well? What would you take forward?
- What would you do differently?
- What have you learnt?

Each group will have up to 2 min to share your summary with everyone.

Game board



Strategy tracking board



Quick reference menu: Options for the future of Tangoio Marae

MARAE-OPOLY

QUICK REFERENCE OPTIONS MENU

OPTION	DESCRIPTION	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED
Insure Marae	Insure the marae	Refer to Insurance "Blue" card	Refer to Insurance "Blue" card	No change	Refer to Insurance "Blue" card
Invest Money 	Return of $500k for every $1,000,000 invested over 10 year period	Min $1,000,000 ($1 Million)	$0	No change	Refer to Insurance "Blue" card
Do Nothing	No change from current situation	$0	$0	No change	Refer to Insurance "Blue" card
Te Ngarue Riparian Planting 	Riparian planting and restoration of lower reaches of stream by the marae.	$200k	$50k/ 10 yr Plus additional costs following floods 20yr ARI = MINOR = $20K 50yr ARI = FLOOD = $50K 100yr ARI= MAJOR =$100k > 100yr ARI = CATASTROPHIC =$200k	No change	Refer to Insurance "Blue" card
Stream Maintenance	As is – keeping the stream free flowing by removing pest plants (e.g. willows) and stabilising banks	$0	$0	No Change	n/a
Lift building floors above 2% AEP (50 year ARI) flood level 	Lift Punanga Te Wao (wharenui), Tangitū (whārekai) and Maungaharuru (utility building) floors to above the 2% AEP / 50 year ARI flood level	$1.2M	$0 Plus additional costs following floods 100yr ARI= MAJOR =$50k > 100yr ARI = CATASTROPHIC =$200k	50 yr ARI (2% AEP) for lifted buildings only	20yr ARI = MINOR FLOOD= $20k 50yr ARI = FLOOD = $50k 100yr ARI = MAJOR FLOOD= $500k >100yr ARI = CATASTROPHIC FLOOD= $1,500k

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The information provided here is for illustrative purposes only. Costs provided are indicative only and can not be relied upon for budgetting purposes. No feasibility assessments or investigations into the specific options described have been completed. The marae options committee will be investigating and evaluating specific options further to feed in to the decision making process.

MARAE-OPOLY

QUICK REFERENCE OPTIONS MENU

OPTION	DESCRIPTION	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED
Lift building floors above 1%AEP (100 year ARI) flood level 	Lift Punanga Te Wao (wharenui), Tangitū (whārekai) and Maungaharuru (utility building) floors to above the 1% AEP / 100 year ARI flood level	$1.7 M	$0 Plus additional costs following floods > 100yr ARI = CATASTROPHIC =$200k	100 yr ARI (1% AEP) for lifted buildings only	20yr ARI = MINOR= $20k 50yr ARI = FLOOD = $50k 100yr ARI = MAJOR = $300k >100yr ARI = CATASTROPHIC = $1,000k
Build floodbank to protect site in 2%AEP (50 year ARI) flood event 	Build floodbank around entire site (marae, Taurima whare, carpark, kohanga) to provide 2% AEP (50 year ARI) flood level of protection.	$700k	$100k/ 10yr Plus additional costs following floods 100yr ARI= MAJOR =$50k > 100yr ARI = CATASTROPHIC =$200k	50 yr ARI (2% AEP)	50yr ARI = FLOOD = $20k 100yr ARI = MAJOR = $500k >100yr ARI = CATASTROPHIC = $2,500k
Build floodbank to protect site in 1%AEP (100 year ARI) flood event 	Build floodbank around entire site (marae, Taurima whare, carpark, kohanga) to provide 1% AEP (100 yr ARI) flood level of protection.	$1M	$100k/ 10yr Plus additional costs following floods > 100yr ARI = CATASTROPHIC =$200k	100 yr ARI (1% AEP)	100yr ARI = MAJOR = $20k >100yr ARI = CATASTROPHIC = $2,500k
Preparedness response kit 	Response plan and equipment to protect wharenui in up to 2% AEP (1 in 50 yr) flood events	$100k	$50k/ 10yr Plus Costs additional to replenish kit following events. 20yr = $20K 50yr = $40K	50 yr ARI (2% AEP)	20yr ARI = MINOR = $20k 50yr ARI = FLOOD = $50k Refer to Insurance "Blue" card for 100yr ARI = MAJOR and >100yr ARI = CATASTROPHIC

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MARAE-OPOLY

QUICK REFERENCE OPTIONS MENU

OPTION	DESCRIPTION	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED
Waterproof the buildings 	Engineered water proofing of Wharenui, ablutions and Maungaharuru whare. Tangitū can not be water proofed.	$1.5M	$300k/ 10yr PLUS Additional costs to reinstate following events. 20yr ARI = $5k 50yr ARI = $10k 100yr ARI = $20k >100yr ARI = $250k	100 yr ARI (1% AEP) For waterproofed buildings only	20yr ARI = MINOR = $20k 50yr ARI = FLOOD = $50k 100yr ARI = MAJOR = $300k >100yr ARI = CATASTROPHIC = $1,000k
Earth Ark 	Build an ark to carry the marae and all of the Whānau.	$20M	$500k/10 yr	500yr ARI (0.2% AEP)	N/A
Drainage Improvement works 	Improving site drainage to reduce frequency of nuisance flooding that currently occurs on a regular basis.	$200k	Costs to reinstate drainage following events. 50yr = $10k 100yr = $20k >100yr = $100k	10 yr ARI (10% AEP)	Refer to Insurance "Blue" card
Upgrade the marae – New Kitchen Fit Out	Upgrade the kitchen with complete refurbishment and appliances	$350k	$0	No change	Refer to Insurance "Blue" card
Upgrade the Marae - Access	Improve the safety of the vehicular accesway into the marae	$100k	$0	No change	Refer to Insurance "Blue" card
Upgrade the Marae - New paepae shelters	Construct new paepae shelters	$40k	$0	No change	Refer to Insurance "Blue" card
Upgrade the Marae - Kids Playground	Construct new playground for tamariki	$20k	$0	No change	Refer to Insurance "Blue" card
New Marae – Buy Land	Buy 3ha of land in a location outside of flood hazard areas	$600k	$0	n/a – located outside of flood hazard area	$0

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MARAE-OPOLY

QUICK REFERENCE OPTIONS MENU

OPTION	DESCRIPTION	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED
Land for Urupa	Purchase 1ha land for Urupa, fence and create access	$300k	$0	No change	$0
New Marae – Build Infrastructure	Build essential infrastructure at a new site out of the flood risk area: - Power - Water - Wastewater - Vehicular Access & car park - Drainage	$550k	$0	n/a – located outside of flood hazard area	N/A – New facilities must be insured Refer to Insurance "Blue" card
New Ablution Facilities	Build new 16m x 6m ablution facilities	$420k if at new site $600k if at existing site	$0	n/a – located outside of flood hazard area or if at existing site assume floor will be built above 100 year ARI flood level	N/A – New facilities must be insured Refer to Insurance "Blue" card
New Wharekai/Kauta	Build new 20m x 30m building with commercial kitchen fit out	$2.45M if at new site $2.95M if at existing site	$0	n/a – located outside of flood hazard area or if at existing site assume floor will be built above 100 year ARI flood level	N/A – New facilities must be insured Refer to Insurance "Blue" card
New Wharenui	Build new whare 20m x 10m (slightly larger than existing)	$950k if at new site $1.15M if at existing site	$0	n/a – located outside of flood hazard area or if at existing site assume floor will be built above 100 year ARI flood level	N/A – New facilities must be insured Refer to Insurance "Blue" card
New Utility Building	Build new wharemoe 15m x 10m	$520k if at new site $620k if at existing stie	$0	n/a – located outside of flood hazard area or if at existing site assume floor will be built above 100 year ARI flood level	N/A – New facilities must be insured Refer to Insurance "Blue" card
Landscape new marae complex	Landscape new complex at an new	$250k	$0	n/a – located outside of flood hazard area	N/A – New facilities must be insured

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MARAE-OPOLY

QUICK REFERENCE OPTIONS MENU

OPTION	DESCRIPTION	INVESTMENT/ COST	MAINTENANCE COST	LEVEL OF FLOOD PROTECTION	RECOVERY COST IF UNINSURED
	site out of the flood risk area				Refer to Insurance "Blue" card
Small Papakainga	3 x 2 Bedroom ($80m^2$) 3 x 3 Bedroom ($110m^2$) Papakainga	$3M	Assumed to be self sustaining/ funding	n/a – located outside of flood hazard area or if at existing site assume floor will be built above 100 year ARI flood level	N/A – located outside of flood hazard area if associated with new marae For >100yr ARI at existing site additional recovery cost of $1.5M

GLOSSARY

AEP = Annual Exceedance Probability is the likelihood of a flood of a given size being exceeded in any one year. For example a 1% AEP flood has a 1 in 100 chance of being exceeded in any one year. A 10% AEP flood has a 1 in 10 change of being exceeded in any one year.

ARI = Average Recurrence Interval is the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. ARI is also known as Return Period and is equal to the inverse of probability. A so-called 100-year flood does not mean that there is exactly one flood of this size every 100 years. It means that there is a 1 in 100 chance in any given year that a flood of this size or bigger will happen; it is therefore more correctly called a 1% AEP flood.

N/A = Not Applicable

Yr = Year

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Strategy and recording sheet

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income (plus)	Operating Costs (less)	Capital Cost (less)	Closing balance (equals)	Total Amount invested	How did your decisions perform?
HOW TO USE THIS SHEET – AN EXAMPLE				*Investment returns*	*Insurance; Maintenance; clean up*	*Investment; upgrades etc*	*Total cash in hand to carry forward to next period*	*Track your investments in this column*	
0	- *Funding recieved*		*$0*	*$1million*	*$0*	*$0*	*$1million*		
0 - 10	- *Paid Insurance* - *Upgraded kitchen*	Insurance = protection against damage Kitchen = Improved function of marae. Priority identified via survey	*$1million*	plus *$0*	less *$100k*	less *$350k*	equals *$550k*		*Good*
11-20	- *Paid Insurance*	Insurance = protection against damage	$550k		*$100k*		$450k		*OK but got flooded twice so insurance costs will go up*
21-30	- *Paid Insurance*	Insurance = protection against damage	$550k		*$200k*		$300k		*OK but running out of $$*

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income (plus)	Operating Costs (less)	Capital Cost (less)	Closing balance (equals)	Total Amount invested	How did your decisions perform?
0	Funding Recieved		$0	$4Million	$0	$0	$4Million		
0 - 10			$4Million						

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
10-20									

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
20-30									

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
30-40									
40-50									

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
50-60									
60-70									

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
70-80									
80-90									

MARAE-OPOLY

DECISIONS & BALANCE SHEET

Year	Actions	Reason for decisions	Opening Balance	Income plus	Operating Costs less	Capital Cost less	Closing balance equals	Total Amount invested	How did your decisions perform?
90-100									

GROUP WRAP UP: Did your strategy work? Why? Why not?

What went well? What would you take forward?

What would you do differently?

What have you learnt?

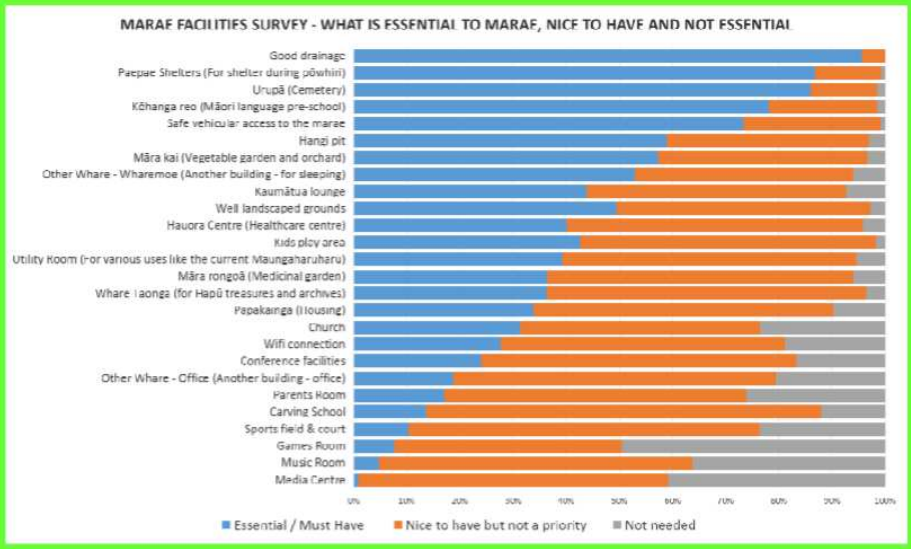
Whānau wish list information cards

WHANAU WISH LIST

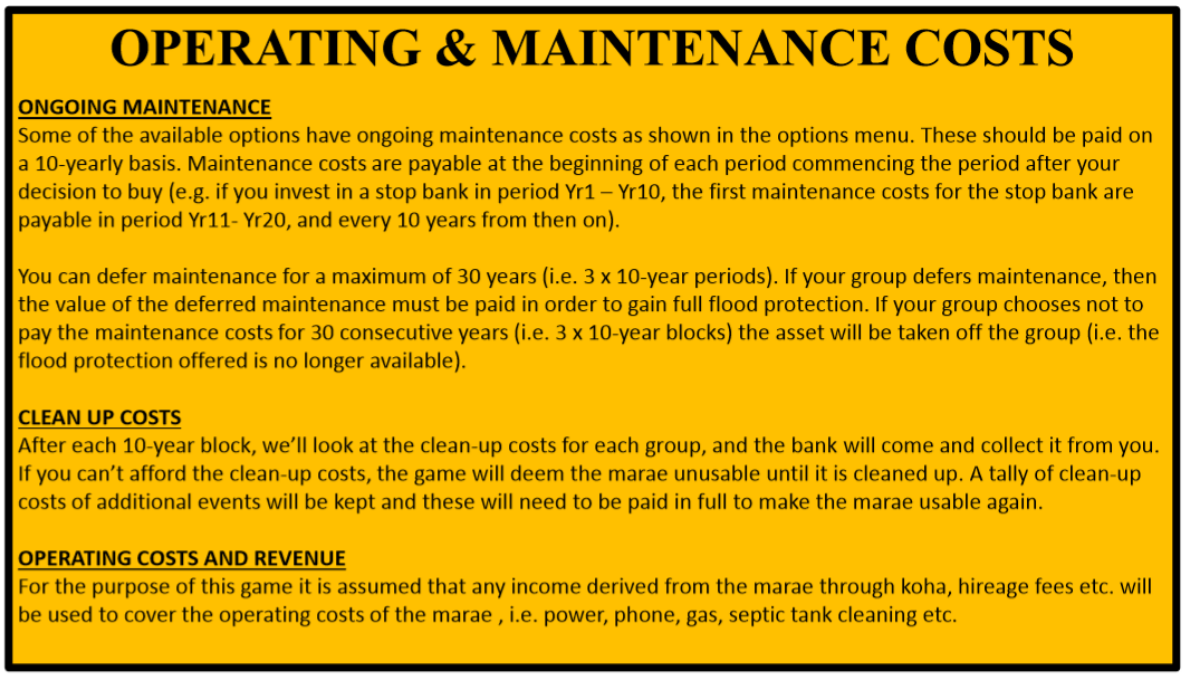
The top priorities for the marae and views on essential facilities identified through the Marae Vision and Facilities surveys are summarised on this card. Consider these priorities and views when making your decisions. For each 10-year period, you'll need to explain how your decisions have considered these priorities, and if they haven't explain why.

PRIORITY	ASPIRATIONS	FACILITIES	ACTIVITIES
1	Marae tikanga and maori values are practised	The kitchen is upgraded to modern standards	Tangihanga
2	A self sufficient and self sustaining marae (i.e. income, energy, kai, culture)	Disability access throughout/ Accesibility for everyone	Activities to support matauranga maori
3	A place for whanau to (re) connent	Purpose built spaces – mattress storage, shared seated areas etc	Explore sustainable energy and building materials for the marae
4	A place our tamariki/Rangatahi want to come to learn/develop tikanga and reo maori	Wharekai/kauta and ablutions are upgraded to modern standards	Prepare long term sustainability plan for marae
5	A place to learn tikanga, our history, te reo	Eco-friendly waste management	Waananga

WHANAU WISH LIST



Operating and maintenance costs card



OPERATING & MAINTENANCE COSTS

ONGOING MAINTENANCE

Some of the available options have ongoing maintenance costs as shown in the options menu. These should be paid on a 10-yearly basis. Maintenance costs are payable at the beginning of each period commencing the period after your decision to buy (e.g. if you invest in a stop bank in period Yr1 – Yr10, the first maintenance costs for the stop bank are payable in period Yr11- Yr20, and every 10 years from then on).

You can defer maintenance for a maximum of 30 years (i.e. 3 x 10-year periods). If your group defers maintenance, then the value of the deferred maintenance must be paid in order to gain full flood protection. If your group chooses not to pay the maintenance costs for 30 consecutive years (i.e. 3 x 10-year blocks) the asset will be taken off the group (i.e. the flood protection offered is no longer available).

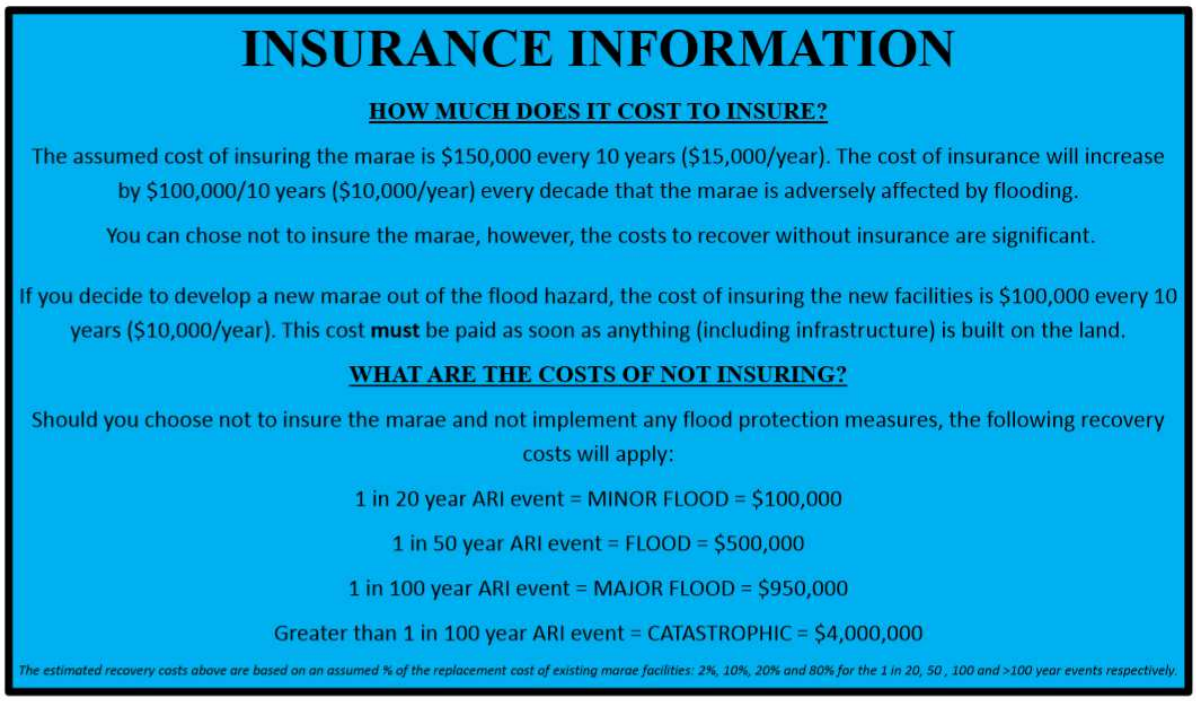
CLEAN UP COSTS

After each 10-year block, we'll look at the clean-up costs for each group, and the bank will come and collect it from you. If you can't afford the clean-up costs, the game will deem the marae unusable until it is cleaned up. A tally of clean-up costs of additional events will be kept and these will need to be paid in full to make the marae usable again.

OPERATING COSTS AND REVENUE

For the purpose of this game it is assumed that any income derived from the marae through koha, hireage fees etc. will be used to cover the operating costs of the marae , i.e. power, phone, gas, septic tank cleaning etc.

Insurance information card



INSURANCE INFORMATION

HOW MUCH DOES IT COST TO INSURE?

The assumed cost of insuring the marae is $150,000 every 10 years ($15,000/year). The cost of insurance will increase by $100,000/10 years ($10,000/year) every decade that the marae is adversely affected by flooding.

You can chose not to insure the marae, however, the costs to recover without insurance are significant.

If you decide to develop a new marae out of the flood hazard, the cost of insuring the new facilities is $100,000 every 10 years ($10,000/year). This cost **must** be paid as soon as anything (including infrastructure) is built on the land.

WHAT ARE THE COSTS OF NOT INSURING?

Should you choose not to insure the marae and not implement any flood protection measures, the following recovery costs will apply:

1 in 20 year ARI event = MINOR FLOOD = $100,000

1 in 50 year ARI event = FLOOD = $500,000

1 in 100 year ARI event = MAJOR FLOOD = $950,000

Greater than 1 in 100 year ARI event = CATASTROPHIC = $4,000,000

The estimated recovery costs above are based on an assumed % of the replacement cost of existing marae facilities: 2%, 10%, 20% and 80% for the 1 in 20, 50 , 100 and >100 year events respectively.

Flood related maintenance and recovery costs table

MARAE-OPOLY

FLOOD RELATED MAINTENANCE COSTS TABLE

This table is a reference to quickly assess the flood related maintenance costs associated with different options.

OPTION	# OF EVENTS	EVENT SIZE			
		MINOR (20 YR ARI)	FLOOD (50 YR ARI)	MAJOR (100 YR ARI)	CATASTROPHIC (>100 YR ARI)
Te Ngarue Riparian Planting	1	$20K	$50K	$100K	$200K
	2	$40K	$100K	$200K	$400K
	3	$60K	$150K	$300K	$600K
	4	$80K	$200K	$400K	$800K
	5	$100K	$250K	$500K	$1M
Lift buildings above 2% AEP	1	-	-	$50K	$200K
	2	-	-	$100K	$400K
	3	-	-	$150K	$600K
	4	-	-	$200K	$800K
	5	-	-	$250K	$1M
Lift buildings above 1% AEP	1	-	-	-	$200K
	2	-	-	-	$400K
	3	-	-	-	$600K
	4	-	-	-	$800K
	5	-	-	-	$1M
Build flood bank to protect site in 2% AEP	1	-	-	$50K	$200K
	2	-	-	$100K	$400K
	3	-	-	$150K	$600K
	4	-	-	$200K	$800K
	5	-	-	$250K	$1M
Build flood bank to protect site in 1% AEP	1	-	-	-	$200K
	2	-	-	-	$400K
	3	-	-	-	$600K
	4	-	-	-	$800K
	5	-	-	-	$1M
Preparedness response kit	1	$20K	$40K	-	-
	2	$40K	$80K	-	-
	3	$60K	$120K	-	-
	4	$80K	$160K	-	-
	5	$100K	$200K	-	-
Water proof the buildings	1	-	$10k	$20K	$250K
	2	-	$20k	$40K	$500K
	3	-	$30k	$60K	$750K
	4	-	$40k	$80K	$1M
	5	-	$50K	$100K	$1.25M
Drainage Improvement works	1	-	$10k	$20K	$100k
	2	-	$20k	$40K	$200K
	3	-	$30k	$60K	$300K
	4	-	$40k	$80K	$400K
	5	-	$50K	$100K	$500K

FLOOD RELATED MAINTENANCE COSTS TABLE

EXAMPLE:

Group A has invested in Riparian Planting; Flood bank to protect the site in up to 2% AEP and Drainage improvement works.

During the 10-year period there are two 20 year ARI floods; one 50 year ARI flood and one 100 year ARI flood.

The total **flood related maintenance costs** for Group A for the 10 year period is $270K made up of the following:

Te Ngarue Riparian planting = $190k = $40k + $50k + $100k

OPTION	# OF EVENTS	EVENT SIZE			
		MINOR (20 YR ARI)	FLOOD (50 YR ARI)	MAJOR (100 YR ARI)	CATASTROPHIC (>100 YR ARI)
Te Ngarue Riparian Planting	1	$20K	$50K	$100K	$200K
	2	$40K	$100K	$200K	$400K
	3	$60K	$150K	$300K	$600K
	4	$80K	$200K	$400K	$800K
	5	$100K	$250K	$500K	$1M

Flood bank = $50k = $0k + $0k + $50k

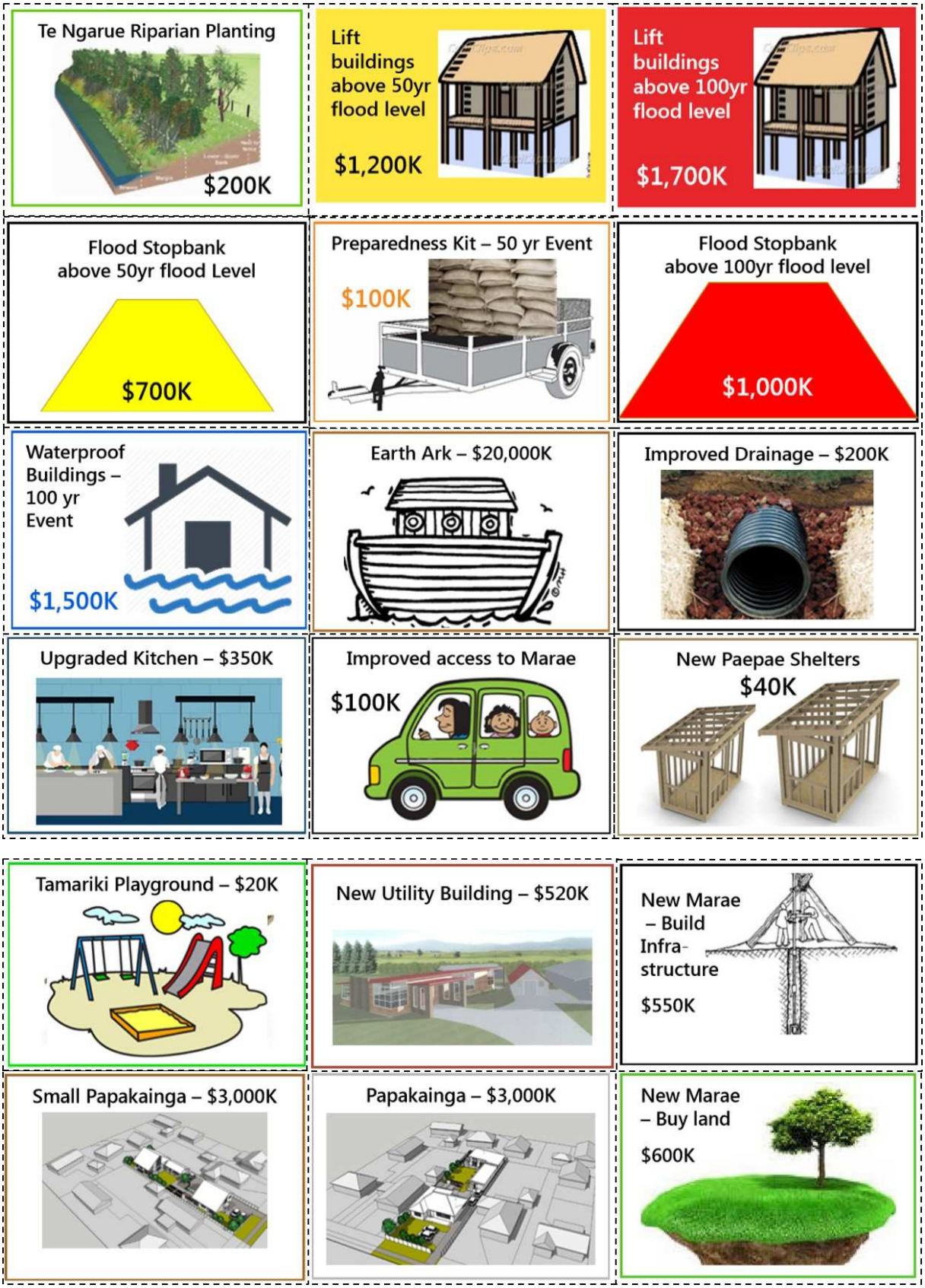
OPTION	# OF EVENTS	EVENT SIZE			
		MINOR (20 YR ARI)	FLOOD (50 YR ARI)	MAJOR (100 YR ARI)	CATASTROPHIC (>100 YR ARI)
Build flood bank to protect site in 2% AEP	1	-	-	$50K	$200K
	2	-	-	$100K	$400K
	3	-	-	$150K	$600K
	4	-	-	$200K	$800K
	5	-	-	$250K	$1M

Drainage Improvement works = $30k = $0 + $10k + $20k

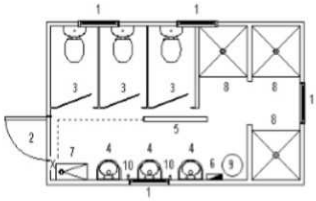
OPTION	# OF EVENTS	EVENT SIZE			
		MINOR (20 YR ARI)	FLOOD (50 YR ARI)	MAJOR (100 YR ARI)	CATASTROPHIC (>100 YR ARI)
Drainage Improvement works	1	-	$10K	$20K	$100K
	2	-	$20K	$40K	$200K
	3	-	$30K	$60K	$300K
	4	-	$40K	$80K	$400K
	5	-	$50K	$100K	$500K

NOTE: ROUTINE MAINTANENANCE COSTS ARE IN ADDITION TO THE FLOOD RELATED MAINTANANCE COSTS

Flooding strategy cards (N = 27)



New Ablution Facilities – $420K



Landscape New Marae Complex

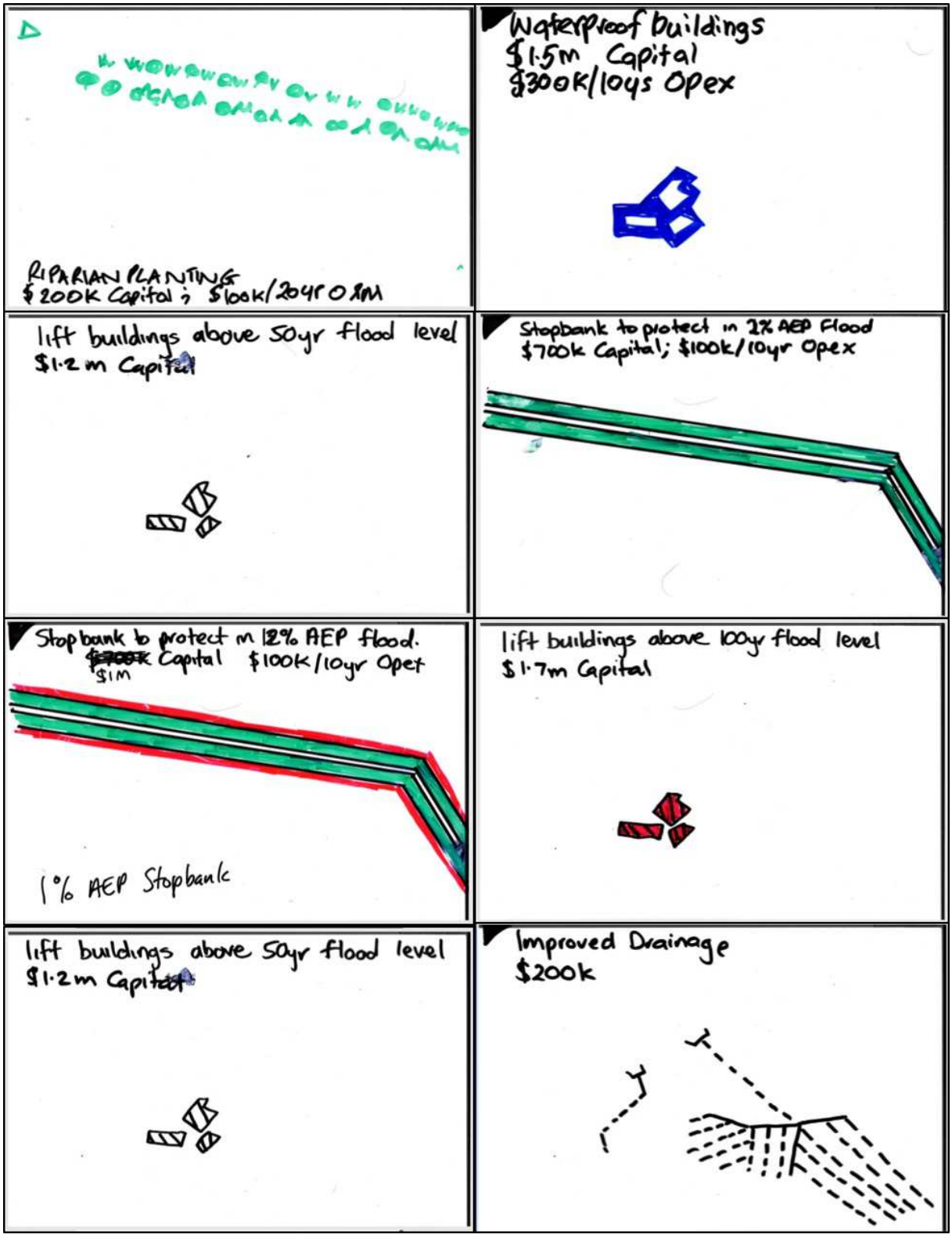
New Wharekai/Kauta – $2,450K

Land for Urupa

New Wharenui – $950K

$1,000K
Invested for 10 years

Map overlays (N=8)



Notes for facilitator

MARAE-OPOLY FACILITATOR NOTES

NOTES FOR THE OVERALL FACILITATOR(S):

You have many tasks to undertake/manage to facilitate the game including:

- Setting up the room/tables for playing
- Ensuring each group has a facilitator
- Setting up a projector and power point for the rainfall
- Randomly selecting a rainfall series for the game
- Setting up the strategy tracking board
- Allocating people to different groups
- Introducing the game – you can read out the instructions help this process. Go through each game piece and where possible enlist the help of others to introduce specific pieces of the game.
- Making sure that groups are paying maintenance and recovery costs where appropriate.
- Monitoring deferred maintenance and noting any lost assets as a result of unpaid maintenance
- Monitoring that recovery costs are being paid and noting where a marae is unusable.
- Ensuring the each group is putting their strategy cards up on the tracking board in the correct places
- Appointing a banker(s) & someone to distribute returns on investments to the groups
- Timekeeping
- Facilitating feedback sessions and recording how each group felt their decisions performed through the emoji cards
- Keeping a record of the decisions made for future reference
- Packing up the material for future rounds of the game

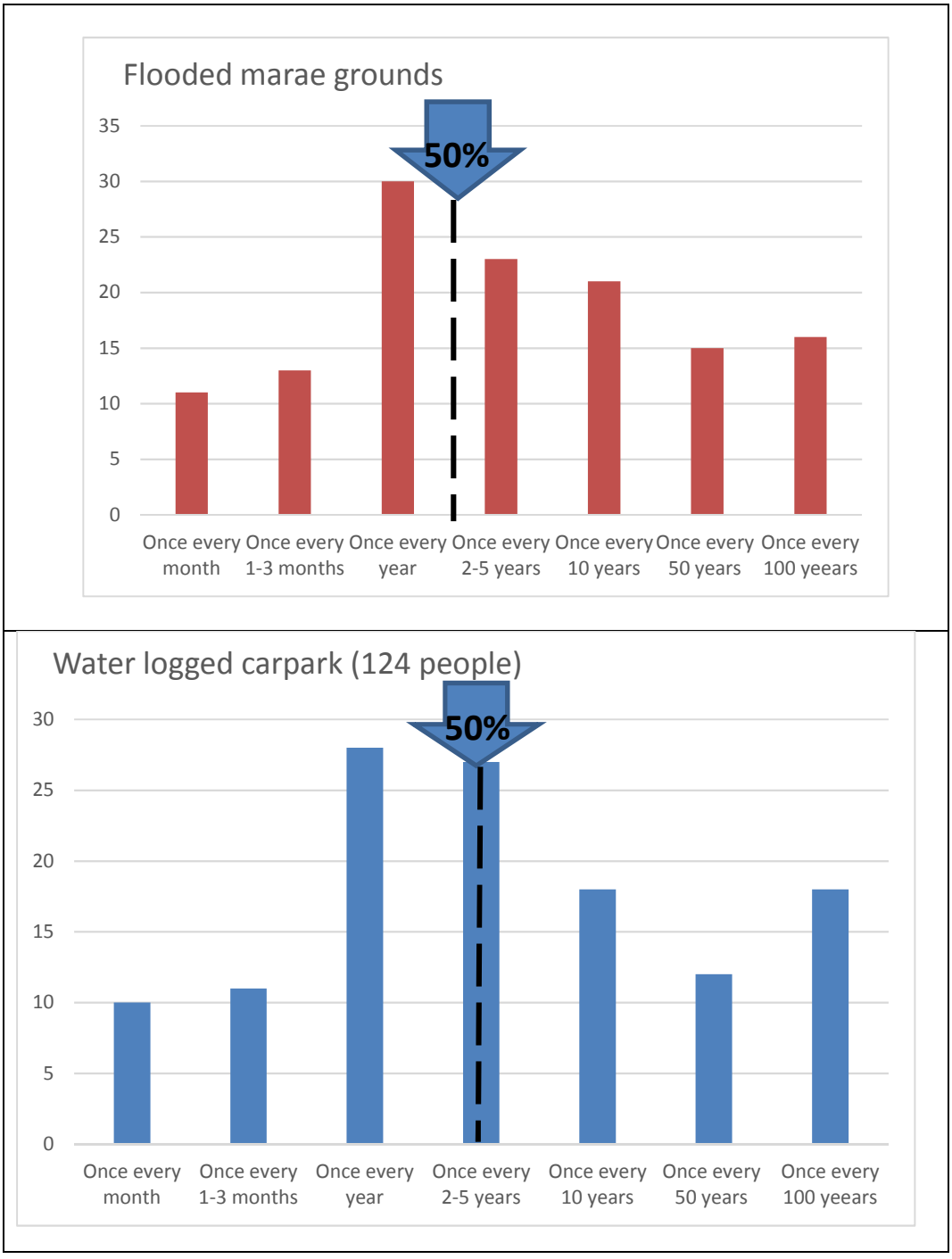
NOTES FOR THE BANKER:

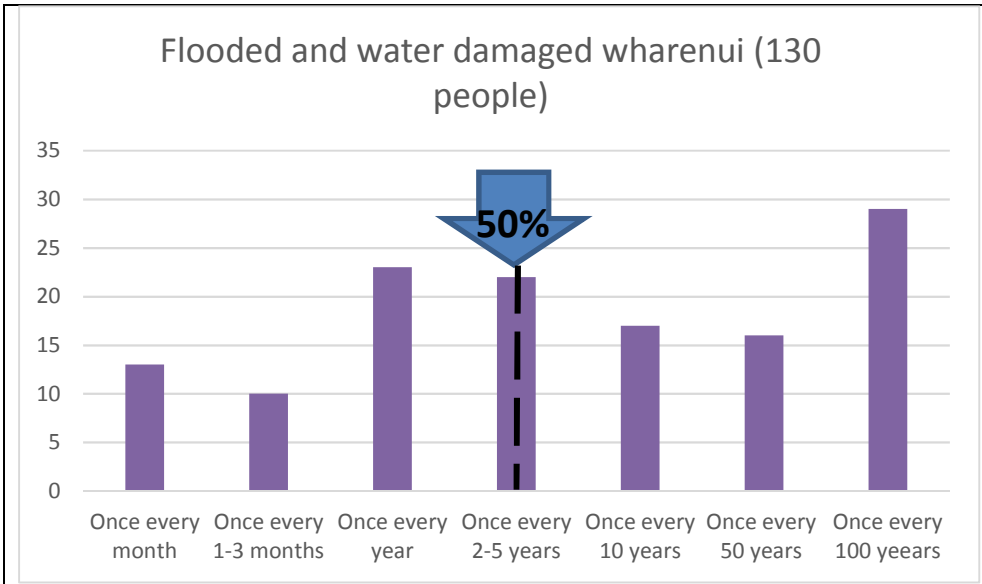
- Lay out your cash in logical order. It may help to get a box with dividers in it like a till
- Lay out the options cards and associated overlays for easy access
- Get a weight (e.g. stones, cups) for each group to keep their investment money under. This will make it easier to manage each groups investments
- The pink "M" cards should be given to each group rep when they've paid their maintenance
- The green "I" card should be given to each group rep when they've paid for insurance at the existing site
- The yellow "IN" card should be given to each group rep when they've paid for insurance at the new site

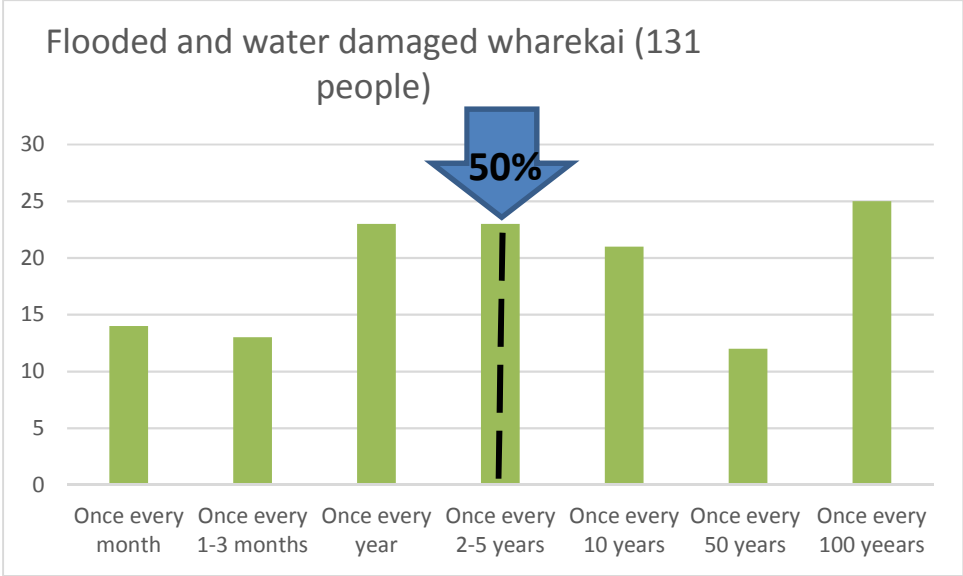
Appendix F Survey results data: Marae facilities and tolerance to floods survey

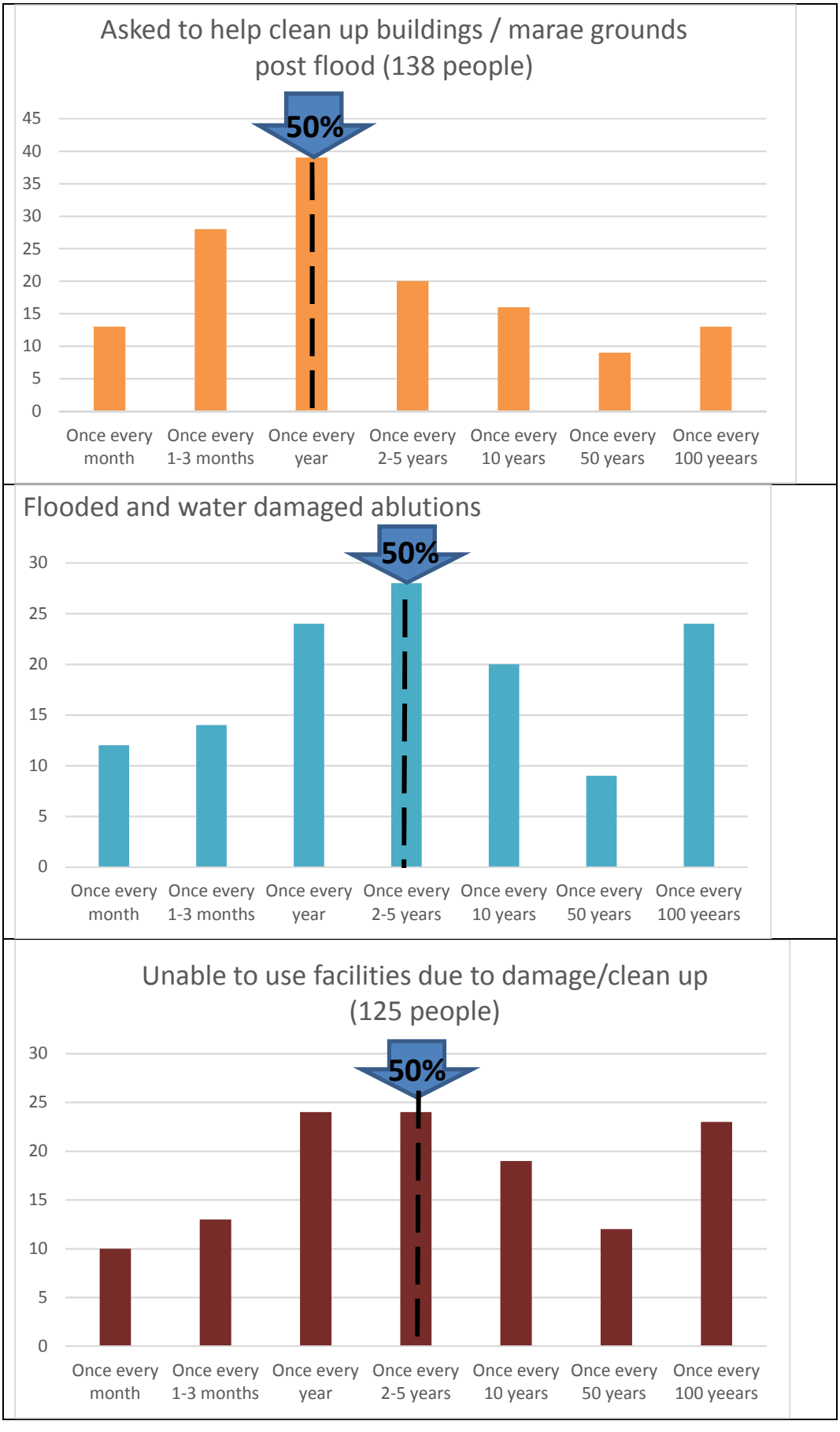
Question: How often could you live with the following effects of flooding and waterlogging?

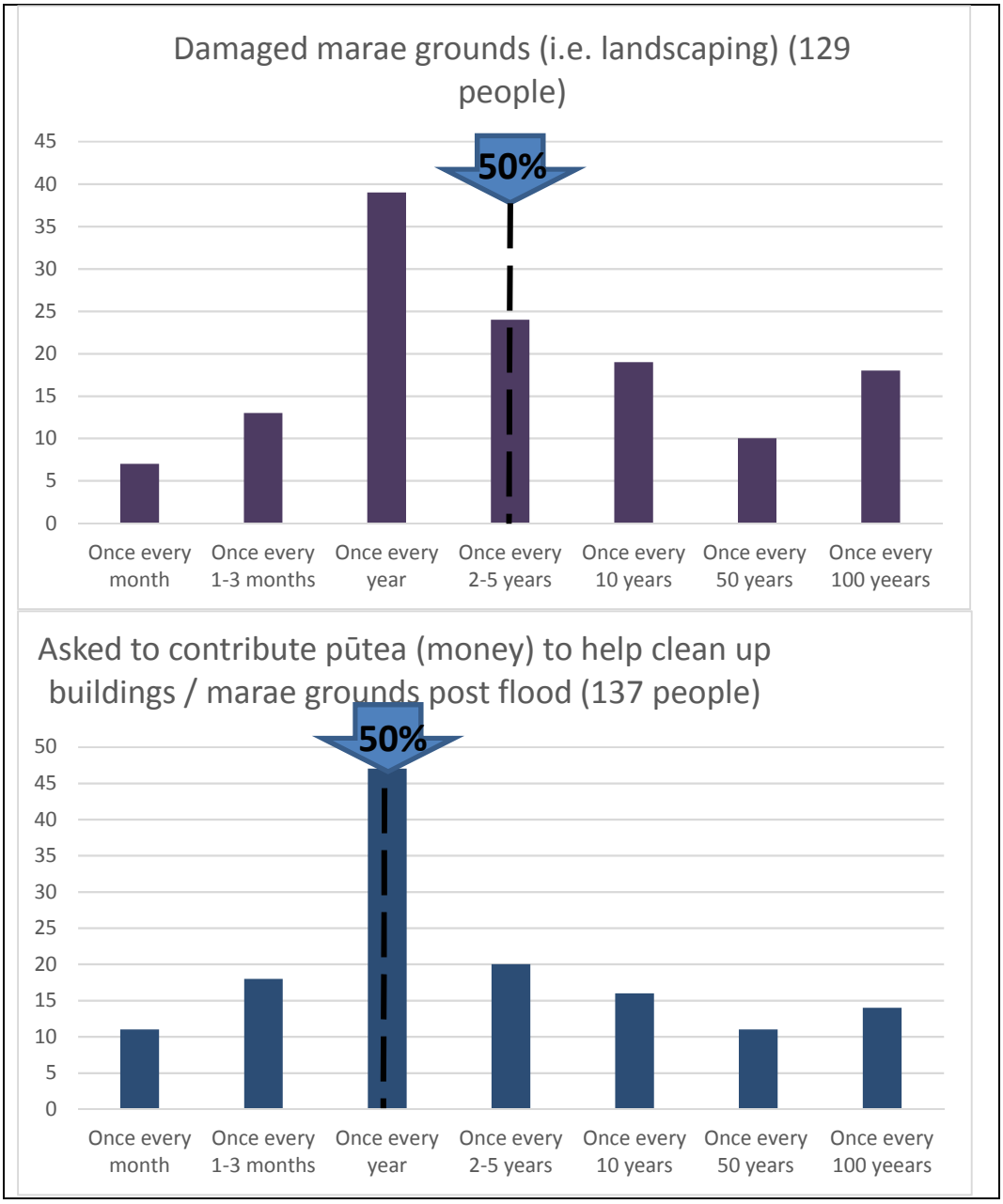
Note: The categories aren't affected a lot by where people lived, how old they were or how often they used the marae.

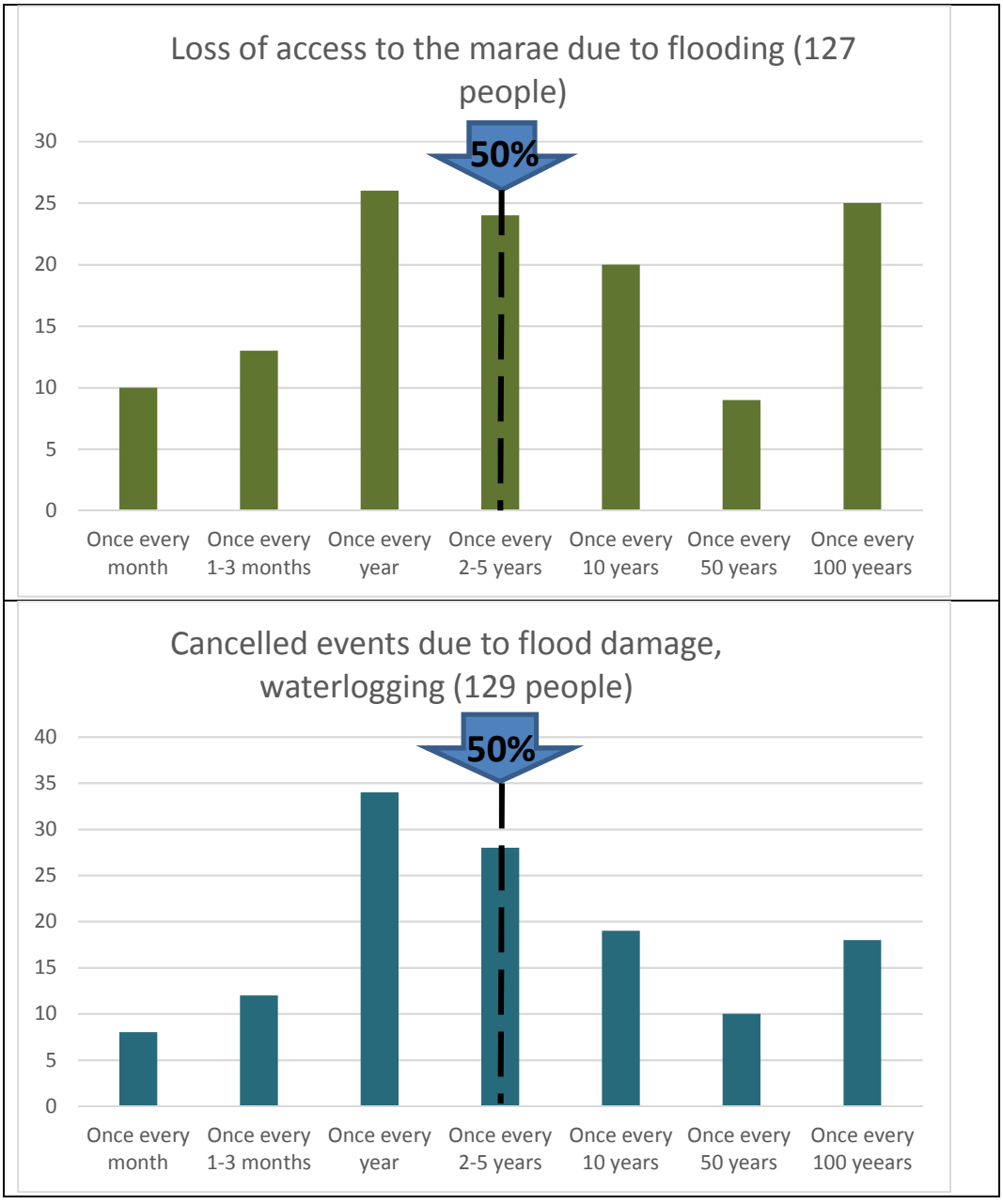


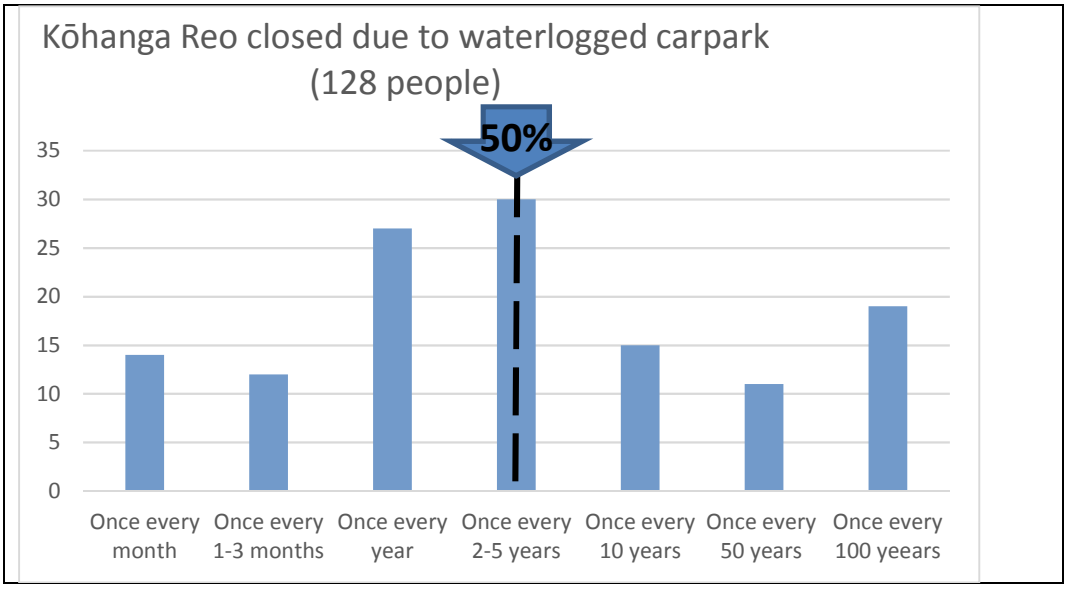

Flooded and water damaged wharenui (130 people)
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears


Flooded and water damaged wharekai (131 people)
30
25
20
15
10
5
0
50%
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears

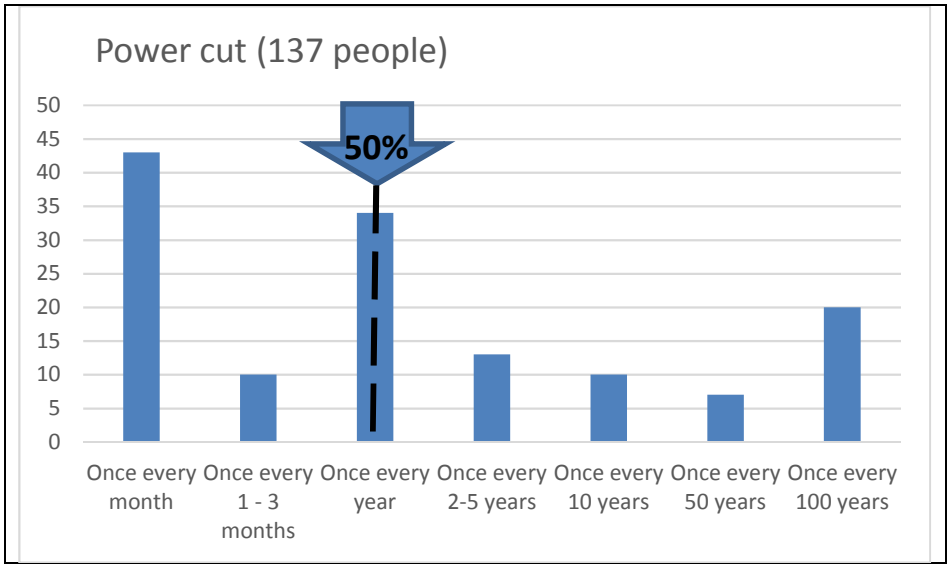

Asked to help clean up buildings / marae grounds post flood (138 people)
50%
45
40
35
30
25
20
15
10
5
0
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears
Flooded and water damaged ablutions
50%
30
25
20
15
10
5
0
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears
Unable to use facilities due to damage/clean up (125 people)
50%
30
25
20
15
10
5
0
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears

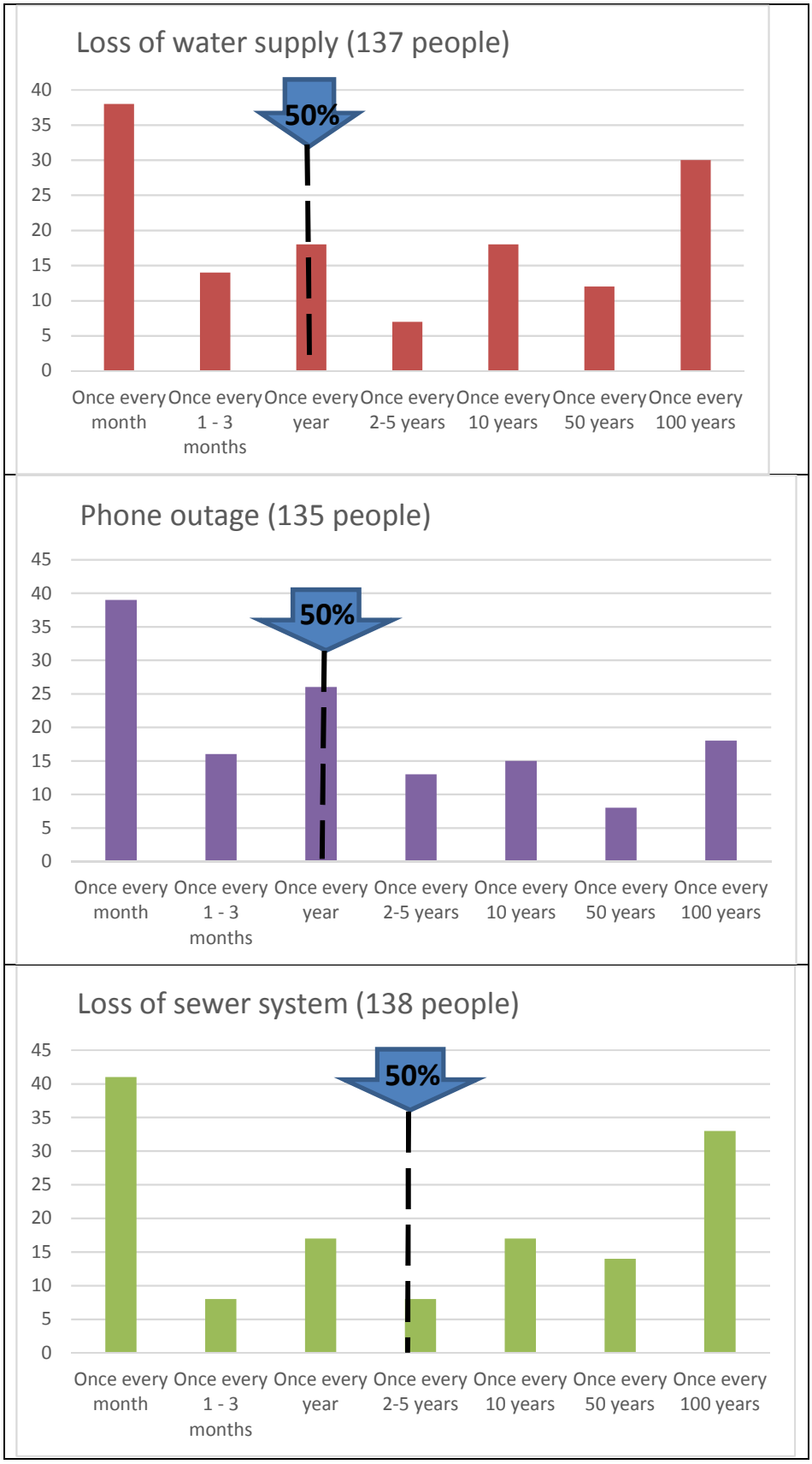

Damaged marae grounds (i.e. landscaping) (129 people)
45
40
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears
Asked to contribute pūtea (money) to help clean up buildings / marae grounds post flood (137 people)
50
45
40
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears


Loss of access to the marae due to flooding (127 people)
50%
30
25
20
15
10
5
0
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears
Cancelled events due to flood damage, waterlogging (129 people)
50%
40
35
30
25
20
15
10
5
0
Once every month
Once every 1-3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 yeears



Question: How often could you live with the loss of the following utility services at the marae?




Loss of water supply (137 people)
40
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1 - 3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 years
Phone outage (135 people)
45
40
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1 - 3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 years
Loss of sewer system (138 people)
45
40
35
30
25
20
15
10
5
0
50%
Once every month
Once every 1 - 3 months
Once every year
Once every 2-5 years
Once every 10 years
Once every 50 years
Once every 100 years

Appendix G Evaluation form

Instructions: Please circle the number that best represents how you feel about the statement on a scale from 1 (Agree) to 6 (Disagree).

1. I understand the purpose of this joint project between MTT and NIWA.

Agree Disagree

1 2 3 4 5 6

2. I think this way of deciding what to do to about the Marae and flooding makes sense.

Agree Disagree

1 2 3 4 5 6

3. I feel that my thoughts, ideas and knowledge have been valued at today's Hui:

Agree Disagree

1 2 3 4 5 6

6. I can see our ideas (from the last Hui) about how to cope with floods have been included in flood adaptation simulation

Agree Disagree

1 2 3 4 5 6

I didn't attend the last Hui *(circle)*

The flood adaptation simulation exercise

The flood adaptation simulation played today helped me to:

7. Think about and discuss what we want the Marae to be like in the future and how this could be done

Agree Disagree

1 2 3 4 5 6

8. Think about and discuss how we can cope with future flooding events with the money we have

Agree Disagree

1 2 3 4 5 6

9. Understand and discuss what different adaptation choices could work for Tangoio

Agree Disagree

1 2 3 4 5 6

10. Understand and discuss what the adaptation different choices mean for other things the hapu might want to do e.g install a new kitchen, new buildings, add new activities etc.

Agree Disagree

1 2 3 4 5 6

11. Think about and consider planning for the long term (next 100 years) - today

Agree Disagree

1 2 3 4 5 6

12. I have learnt something from my experience with the simulation game today

Agree Disagree

1 2 3 4 5 6

Please describe something you have learnt

13. Please describe how you have found today the simulation game today

14. I would take part in the next hui

Agree					Disagree
1	2	3	4	5	6

Any comments about the process or other aspects of today's Hui?

_____
_____
_____
_____
_____
_____
_____

Thank you for your feedback!