



Step 1: Clarify vision and objectives

At the core of the decision-making process is articulating a vision and set of clear objectives to guide the journey and outcomes.

The purpose of Step 1 is to articulate a shared iwi/hapū vision. The vision will help identify the collective objectives for the marae and its supporting community and help define what is essential to the health, well-being and function of the marae and iwi/hapū. Once the vision and objectives are clear they can be applied in the process of developing and evaluating possible adaptation pathways.

Step 1

A shared vision and collective objectives can be achieved in several steps:

1. Review any existing documents from the iwi/hapū/whānau to establish what vision and objectives the community has already expressed are important. This also ensures that earlier work is not repeated unnecessarily.
2. Hui to confirm the continued relevance of the existing vision and objectives. The hui will also enable you to collect information about the vision and objectives to clarify or better understand what they mean.
3. For those who cannot attend the hui gather their input through an online survey or other suitable means.

TIP: Additional ways to achieve this step

When previous information on iwi/hapū/whānau vision and objectives does not exist, it will need to be generated before proceeding with the rest of the Adaptation Decision-Making Model. Articulating a shared vision can be achieved through a combination of hui, interviews, wānanga and online surveys asking questions like:

- Q:** Describe (or draw) your vision for the marae in the future.
- Q:** What does the marae need to flourish?
- Q:** What makes a marae function well?
- Q:** What activities are important on a marae?

Fundamental to any decision-making process is defining who will make what decisions and what process will be followed to reach those decisions. These matters need to be agreed before proceeding with subsequent steps and doing this up-front sets clear expectations for all involved.



Tangoio experience

The hapū had established a vision and set of objectives previously. The existing visioning documents were reviewed and input sought (through hui and surveys) to confirm the relevance of this earlier work. The results from the hui and survey demonstrated that the vision ("Living our dreams") and objectives for the marae have altered little from earlier visioning exercises. The results reaffirmed key aspirations for the marae centred on a well-functioning built environment (i.e., buildings and amenities), support for a flourishing culture and key activities considered necessary for connectedness and well-being of the hapū. There was a high degree of agreement among the hapū on what was important.

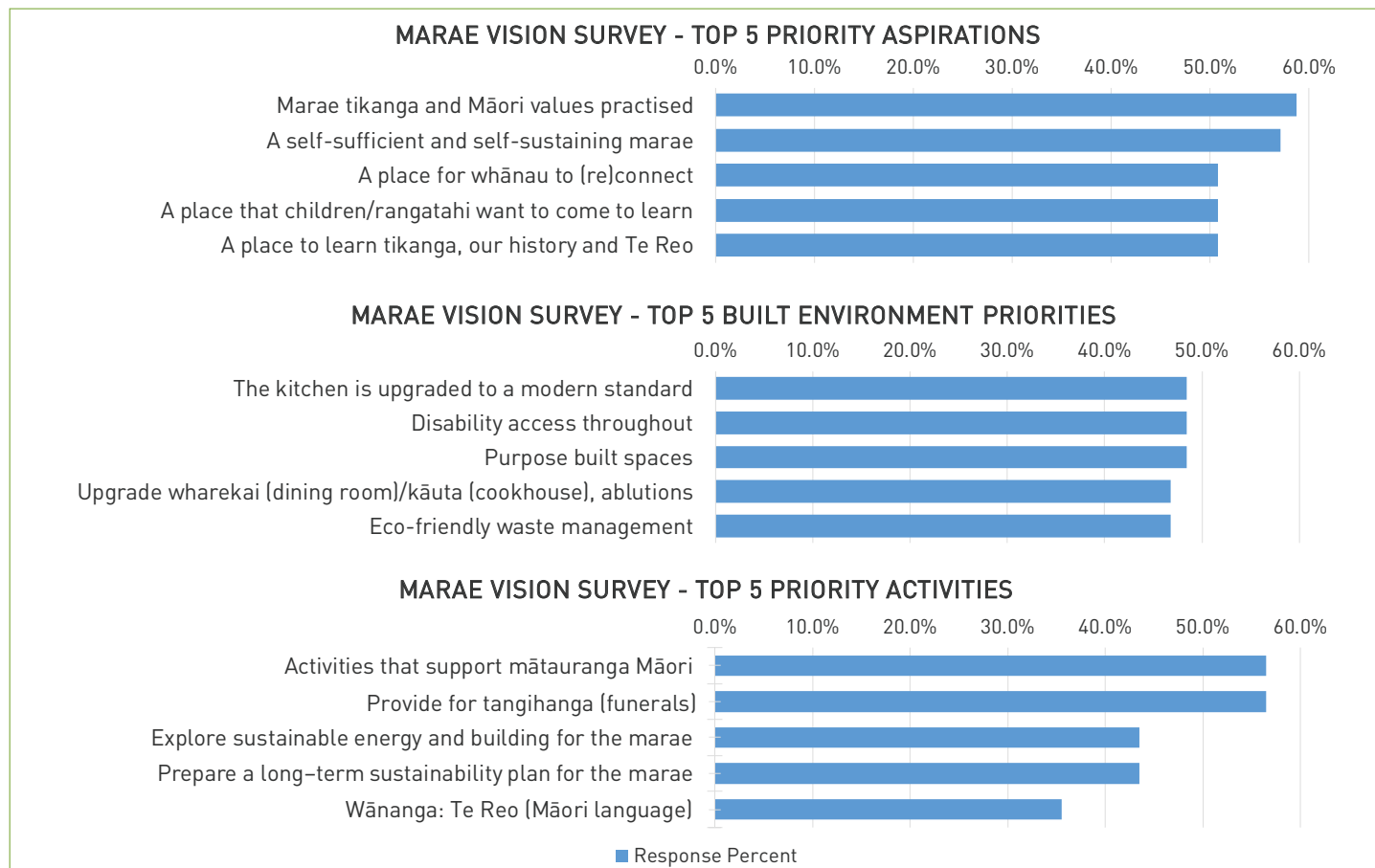


Figure 1: Top five priorities for the marae regarding overall aspirations, built environment and activities.

The information from the hui and surveys were combined to establish the top priorities for the marae. The top five priorities for the three categories explored are outlined in Figure 1.

The top five priorities for each category formed a key component of the marae-opoly game (Step 4) and provided a guide and reference for developing and evaluating possible pathways.



Workshop to develop a shared vision for the marae.



Presenting a vision for the marae back to the whā at Hui-ā-Hapū.

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz



Step 2: Understand past, present and future risks

Identifying, developing and choosing an appropriate pathway requires an understanding of the nature, extent and impact of past events. Insight into what the future impacts of climate change might be is also crucial.

Me hoki whakamuri, kia ahu whakamua, ka neke.



Sediment left after the flood waters from Cyclone Bola receded from Te Ngarue flood plain, 1988. Tangoio Marae circled.

This step is about developing a shared understanding of the past, present and possible future issues associated with climate change. Reaching a shared understanding of the past and present situation provides a solid platform from which to consider and analyse possible futures and, identify and develop adaptation pathways.

Step 2

There are two parts to this step, the first (2a) focusses on understanding historic flood events and associated impacts on the marae and the local community. The second (2b) focusses on the potential implications of different climate change scenarios over a range of future time-frames. This information sheet describes the methods adopted for the Tangoio Marae project.

a. Understanding past and present risks

Understanding past and present risks and issues starts with gathering information. At Tangoio Marae, this included:

- collating and verifying records from historic events
- interviewing kaumātua and others with history in the area to explore their experiences of such events
- developing a computer model of a known event (e.g., Cyclone Bola) to better understand the extent and depth of flooding. The results of the modelling were also verified by observations from those who lived through the event.

Technical and experience-based information often complement and enhance each other. Weaving this information together helps communicate the nature of past and present risks. At Tangoio Marae the technical and lived-experience information was intertwined through:

- hui
- videos to communicate the experiences and impacts of the events
- murals and posters e.g., a history of flooding mural brought together photos and comments from many sources and articulated the frequency, extent and impact of flooding in the valley, how people responded and the impacts on the community
- animated models and illustrations e.g., showing the flood water levels relative to marae buildings.

TIP: Additional ways to achieve this step

If the climate change issue is not clearly defined, start scoping with the people who initiated the discussion. Do your homework. Pull together all the relevant technical information you can find.

After all the ground work is done and you have some understanding of the past and present risks, communicate the issues through stories or narratives. Where possible, let those 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.



Interview in progress to record lived experiences with flooding at Tangoio Marae.



Hoani Taurima indicates high water mark on his whare next to Tangoio Marae resulting from Cyclone Bola, 1988.



Floodwaters downstream of Tangoio Marae during Cyclone Bola, 1988.

b. Understanding the future risks

There are many important elements involved in considering the potential implications of climate change on a community. Determining an appropriate level of investigation and communication methods will depend on the community, the risks faced, and where the community is on their adaptation journey. The methods used at Tangoio Marae to help define and improve understanding of possible future climate change risks and impacts included:

- demonstrating the concept of probability using a range of methods and relating that back to known events
- introducing some of the science around climate change
- acknowledging the uncertainty around climate change projections
- selecting several potential climate change scenarios and time-frames to test in the model (refer to Table 1).
- using the model (Step 2a) to assess the future risks and issues arising from climate change.

The scenarios investigated were selected to cover short, medium and long-term periods.

Table 1: Example: Modelled climate change scenarios¹.

Scenario	Year	Climate change scenario	Assumed sea level rise associated with RCP ³ (metres)
Bola ²	Present	None	None
Bola + Climate Change Scenario 1	2040	RCP ³ 6.0	0.2
Bola + Climate Change Scenario 2	2090	RCP 6.0	0.5
Bola + Climate Change Scenario 3	2120	RCP 8.5	1.36

Footnotes:

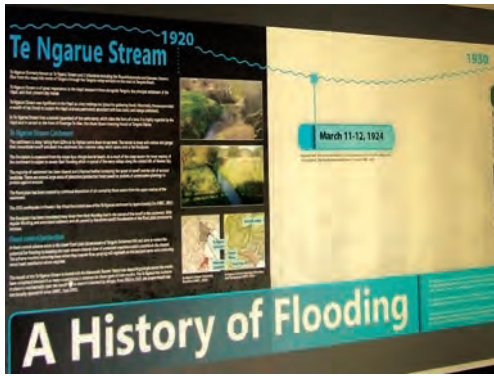
¹ The modelling undertaken as part of the project was not a comprehensive climate change impact assessment, but rather work from which to focus a conversation around the potential impacts of climate change on the marae and surrounding areas, and possible adaptation options.

² Cyclone Bola was selected as the base storm event for the modelling assessment because information on the event was available to calibrate the model. However, Cyclone Bola is not considered to be the "worst" event on record experienced at Tangoio Marae.

³ RCP stands for Representative Concentration Pathway. RCPs are predictions of how concentrations of greenhouse gases in the atmosphere will change as a result of human activities. There are four RCPs which range in concentration from very high (RCP 8.5) through to very low (RCP 2.6). A moderate scenario of RCP 6.0 was used to look at potential impacts of climate change. A stress test using RCP 8.5 was also undertaken.

The results of the climate change impact assessments were communicated by:

- focussing on the key concepts or outcomes, rather than specific modelling results i.e., more extreme weather, more often = increased likelihood of flooding = increased risks
- using posters and modelling simulations showing the differences between the known past event (e.g., Cyclone Bola) and future events.



Mural documenting historic flooding records and experiences from the Te Ngarue Stream catchment.



One of the two video productions made to convey information and experiences on specific flood events that affected Tangoio Marae.

Tangoio experience

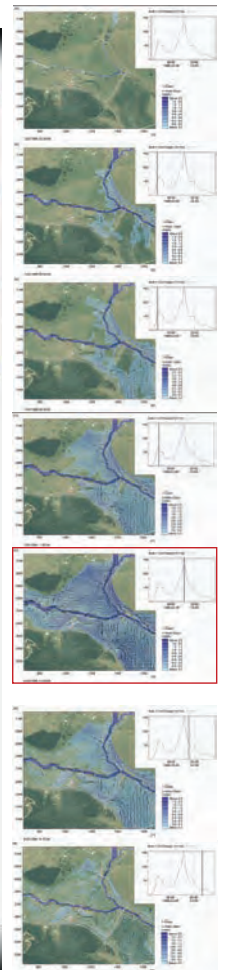
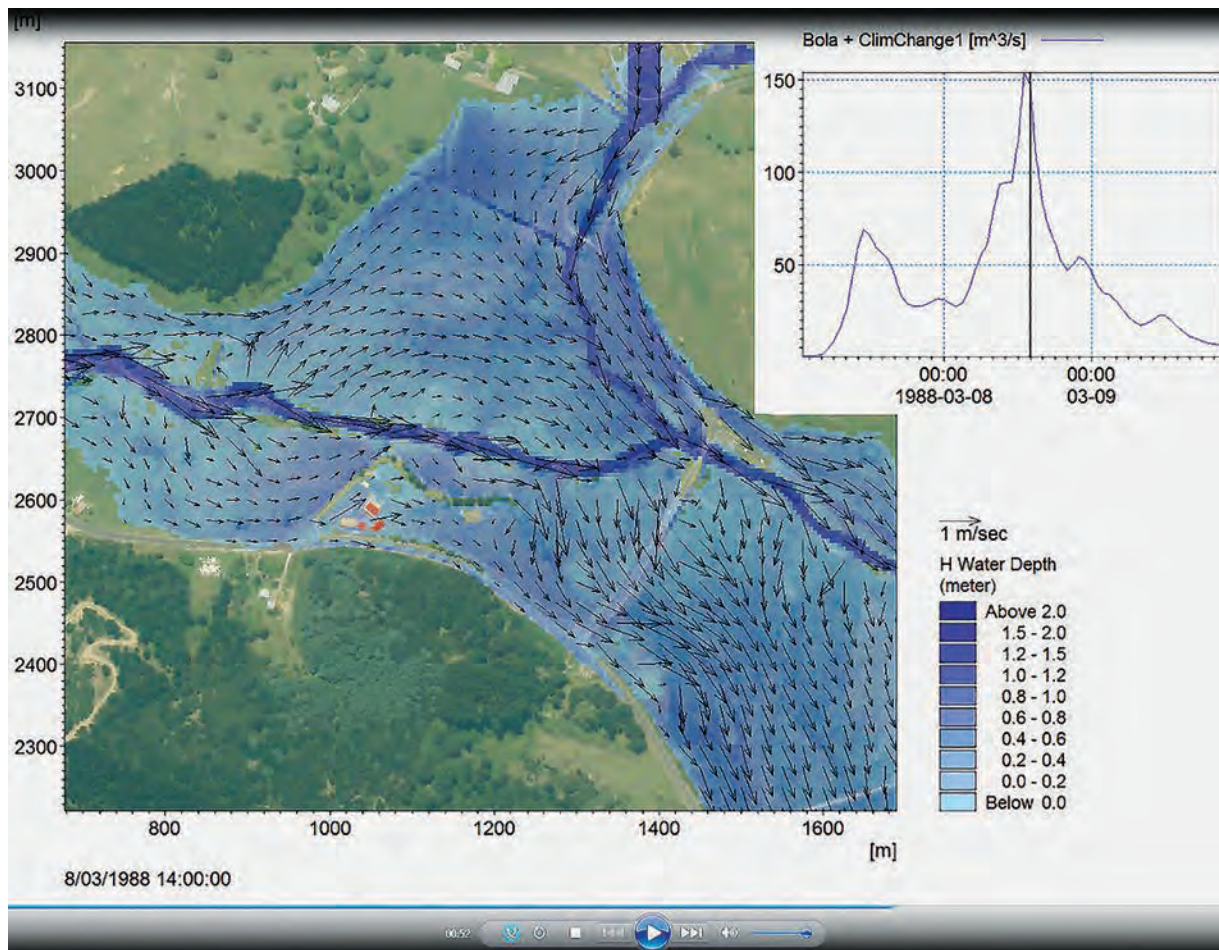
The information – data, stories, scenarios and models were brought together at a single hui to provide a seamless and integrated overview of the past and potential future flood events in the Tangoio Valley. It was important to do this all at once so that the social and physical impacts of flooding, as already experienced by some, were still fresh in the minds of those at the hui and remained connected to potential future risks and what could happen.

The mural and videos enabled those who have experienced flooding at the marae to share their experiences. Those who had not experienced flooding were also given better insight into the impacts of flooding.

More than 75% of the people who attended the hui felt the videos had increased their understanding of what a flood could be like, with more than 80% agreeing that the videos were a good way to help those who had not experienced a flood to understand what it could be like.

“Shows the effect it had on people at the time that lived in affected area” and “it gives a good indication of what happened and what could happen”

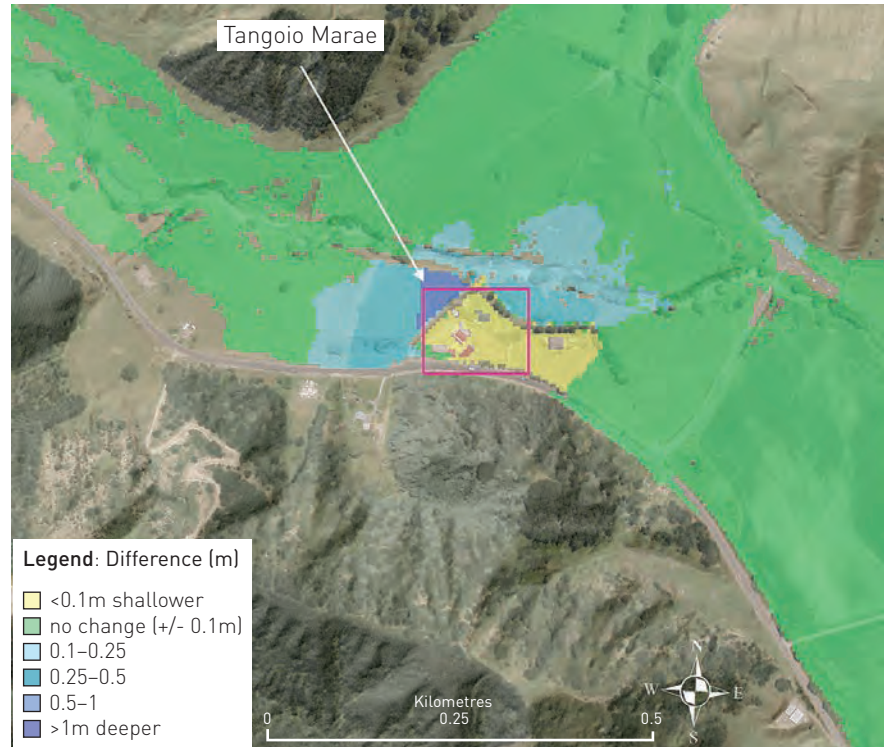
The calibrated model provided a sound foundation to assess potential impacts of a range of possible climate change scenarios.



A screen shot of the 'Bola + Climate change scenario 1' (RCP 6.0 out to 2040) modelling animation. The animation shows the floodwater extent and depth. The vectors (arrows) indicate the flow direction and velocity. The red points are buildings at Tangoio Marae.



Tangoio Marae whānau workshoping to identify options that contribute towards the agreed vision and objectives, and consider the current flood risks and possible future climate change impacts.



Modelling results showing possible future impacts of climate change RCP 6.0 out to 2040 compared to Cyclone Bola in 1988.

The modelling for the different climate change scenarios (including sea level rise) predicted increased peak water level downstream of the marae, but little change at the marae compared to the flood levels experienced during Cyclone Bola.

To put this into context, it was noted that flooding from Cyclone Bola is not the worst experienced at Tangoio Marae, and that the modelling results don't mean there is a low flood risk at the marae. In addition, the important themes associated with climate change still held true for the marae, and were taken forward to identify, define and evaluate different mitigation options and adaptation pathways:

Climate Change will result in more extremes in the weather, more often -> increased likelihood of flooding -> increased risks

Most hui attendants (more than 85%) agreed that the hui helped them gain a better understanding of what sort of floods could be experienced in the future. More than 85% believed there were things they could do to reduce the effect of floods on the marae and would take part in further hui to consider their options.

The ground work completed to develop a shared understanding of past and future issues and risks set the stage for exploring and defining potential options for the future.

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

At the end of the hui, attendees worked in groups to contribute towards Step 3 (Identify Options), to ensure they left with a positive view and sense of control over the adaptation decision-making process.

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz



Step 3: Identify options

This step prompts the community to identify options that achieve their objectives whilst considering the existing and potential climate change risks.

After establishing a shared understanding of community vision and objectives (Step 1) and the past, present and future climate change risks (Step 2), work with the community to identify a range of potential options to achieve the vision and objectives and manage the risks.

Step 3

1. **Identify options:** This process involves:

- brain-storming with the community to establish the full suite of options
- site visits
- physical assessment of the area including survey
- talking to members of the local community
- giving people time to contemplate options, talk to others and provide input.

2. **Define options:** Once options are identified, seek input to better define the options e.g., understanding the potential scale of upgrades to the marae and how much land might be needed (or may need to be protected) for the marae.

There are several methods to obtain input into defining each option including surveys, guided questionnaire and hui.

3. **Develop concept details:** Once the options are identified and some indication of scale obtained, concept details can be developed. These details should include an indicative building footprints and high level cost estimates. The concept details can be used to prepare the "Options Menu" which is a key resource for considering the range of pathways in Step 4. Presenting the options in a table form provides community members with easy-to-understand information. It is 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.

Note: The level of investigation, methods used and assumptions made to develop options should be highlighted so that people understand the level of uncertainty associated with the information provided for each option.





Tangoio experience

Options were identified through several hui with the hapū of Tangoio Marae and the Maungaharuru-Tangitū Trust. Site walkovers with members of the whānau were also undertaken to explore options further.

All of the options identified by the whānau at Tangoio Marae were considered and included on the Options Menu along with several additional options. Not all options sought to solve or reduce the existing flooding risk or exposure. The options included:

- 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

- improving site drainage
- upgrading the existing kitchen
- upgrading marae access.

An online survey was also used to help define the scale of different upgrade and marae complex development options.

A high level assessment was undertaken for each option to identify:

- a rough order estimate of capital and maintenance costs
- the level of flood protection to the marae
- pros and cons
- assumptions.

The investigations completed for this phase provided a key input to Marae-opoly (Step 4) and a starting point for investigating and developing the options further as part of the decision-making process [Steps 5, 6 and 7].



Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz



Step 4: Develop potential pathways: Marae-opoly

After identifying possible options in Step 3, it's time to start piecing them together to develop potential pathways to achieve the agreed vision and objectives.

Marae-opoly is a serious game that was designed to encapsulate the complex adaptation challenge in a way which could be understood and played by all participants. It seeks to reflect reality wherever possible and rely on reasonable assumptions where necessary. The aim of the game is to develop a marae that will fulfil the vision and objectives of the iwi/hapū/whānau through making adaptation decisions over a 100-year time frame on a set budget.

Step 4

1. The players are organised into small groups and presented with a range of options (Step 3), including flood mitigation/protection and upgrading existing or developing new facilities either at the existing marae location or on a new site. Many protection options have ongoing maintenance costs associated with them, players may also decide to invest their money (for a fixed return) and insurance can be purchased if desired.
2. Decisions are made in 10-year blocks meanwhile a rainmaker* is running in the background unleashing a range of rainfall events on the catchment. At the end of each 10-year block, the groups were asked to rate their chosen pathway given the flood events of the preceding decade and against the vision and objectives of the hapū.
3. The game is a facilitated process and each group's decisions are presented back to all the other participants and recorded on a large notice board for other groups to see.
4. The game can be played repeatedly using one of several rainmakers to develop and test different pathways.

**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 in any given gaming session is randomly selected from several different rainfall series. The rainmaker reflects the unpredictable nature of weather events and the uncertainty associated with different climate change futures.*



TIP Playing the game with mixed and targeted groups (i.e., groups made entirely up of tamariki, rangatahi, pākeke, or kaumātua) can give different parts of the whānau a better opportunity to contribute to identifying pathways for further consideration. Targeted groups also offer the benefit of being able to compare different views and approaches between the groups within the whānau in a fun and non-threatening manner.



Resources

The instructions, rainmakers and game pieces can be downloaded from the NIWA website. The game pieces include:

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, marae upgrades and relocation options. The menu describes the options, pros and cons, the upfront costs, and ongoing maintenance costs.
Decision & Balance Sheet	To track and record decisions, and cash balance.
Emoji Lollipops	To rate how players feel about the performance of their decisions throughout the game.
Whānau wish list 'GREEN' card	Summary of whānau aspirations and priorities to consider when making decisions.
Operating & Maintenance 'ORANGE' card	Details of operating and maintenance costs.
Insurance information 'BLUE' card	Details of insurance costs and the implications of choosing not to insure the marae.
Flood related maintenance cost table	Flood related maintenance costs for each option.

Tangoio experience

Each group applied a different option over the 100-year timeframe and was able to clearly describe the reason for their choices, their successes and the mistakes they made. Overall the players enjoyed the game and the key messages regarding adaptation were learnt in a memorable way – *“It was an awesome way of seeing the bigger picture and what that would look like”*.

For many, it enabled key conversations necessary for adaptation to occur in a non-confrontational, experimental way. Each group had to consider many factors in their decision-making like:

Q: What should we do and why should we do that?

Q: When should we act?

Q: What order should we do things?

Q: What will whānau think of these decisions?

Q: Do we have enough money?

Q: What can the whānau live with and live without?

The game was close enough to reality to reflect the necessary choices that needed to be made. Each group approached the simulation differently, some invested, others spent, they all experimented:

“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 decisions. We got too 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 which direction and having a set budget helped us to realise what we could spend and what we couldn’t.” (Group 2)

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz



Step 5: Evaluate pathways

After potential pathways have been identified (Step 4) it is time to evaluate them further.



The purpose of Step 5 is to evaluate possible pathways to provide enough information to make an informed decision, drawing on all the work and information gathered previously.

Step 5

Marae-opoly (Step 4) provided a method to contemplate the multitude of possible pathways available, and some preferred pathways (or at least common components) may have emerged to provide a long-list for further consideration.

Once a long-list of pathways is identified, it is likely that further investigation will be needed to evaluate them properly and reduce the number being considered. The type of further investigation needed will depend on the options and could include:

- concept or preliminary design investigations
- discussions with key stakeholders including Territorial Local Authorities (TLAs)
- seeking property advice
- discussions with external funding agencies.

Working through a series of questions may influence the pathway (particularly sequence and timing) and help narrow down the number of pathways further. Key questions to consider when short-listing and formulating your preferred pathway include:

- Does it deliver on the identified priorities (Step 1)?
- Is it affordable?
- Does the pathway support making just-in-time decisions?
- Can it be staged?
- How robust is the pathway? Can it hold up to different climate change futures?
- What are the impacts if part of the pathway is wrong?
- Is it flexible to changing information or circumstances?
- Does the pathway transfer risk to neighbours and/or future generations? Is that acceptable?
- What risk does the pathway not manage (residual risk)? is this acceptable?

A more comprehensive set of questions is available at www.niwa.co.nz/te-kuwaha/tools-and-resources



The process of evaluating each pathway against the key questions might result in some changes to the short-listed pathways or new pathways. 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
- have enough information now to choose one 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 pathways 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 pathway
- 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 MCA (Multi-Criteria Analysis). The comprehensive set of questions available on the website provide a useful starting point for any of the evaluation methods noted here. Irrespective of the method used, it is important that the overall pathway is evaluated, rather than the individual options that make up the pathway.

Tangoio experience

Initial rounds of Marae-opoly (Step 4) identified several common elements to the pathways being formed as well as several key differences.

Common features across all pathways	Differences
Short-term Options to protect the existing marae complex. Investment in deposits and/or land. Upgrading the existing marae. Maintaining insurance to protect existing marae complex.	Sequence and timing of interventions. Level of investment of the \$4,000,000 over the next 100 years in: a) the existing marae b) deposits and/or land.
Long-term Maintaining insurance to protect assets. Investment in deposits and/or land to provide continued income.	Tolerance to adverse impacts of flooding. Transition to new site vs upgrading at the existing site.

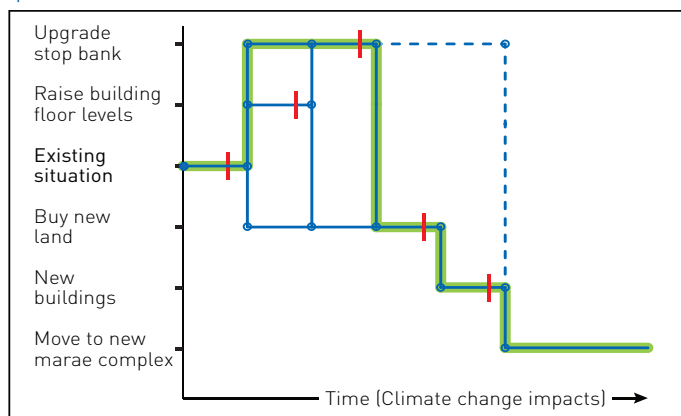
The hapū of Tangoio Marae are in the process of further investigation to evaluate options and pathways. All options, except Earth Ark, identified in Step 3 are being considered in more detail.



Example short-list of adaptation pathways for Tangoio Marae

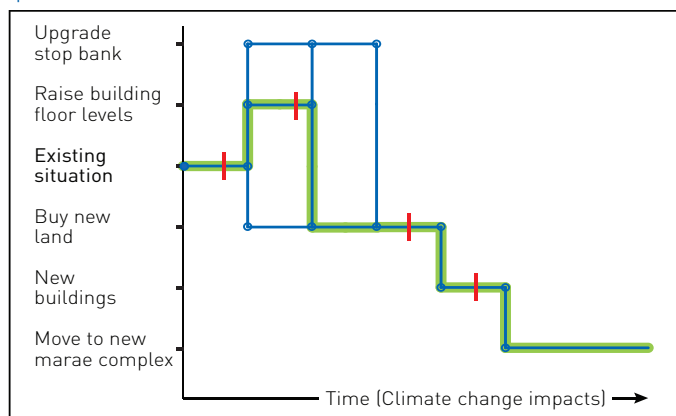
To demonstrate the adaptation pathway approach, we have developed a “short list” of options that draws on the common features of the pathways formulated through the Marae-opoly game. **These options are provided for illustrative purposes only and have not been developed or agreed by the whānau of Tangoio Marae or the Maungaharuru-Tangitū Trust.**

Option 1



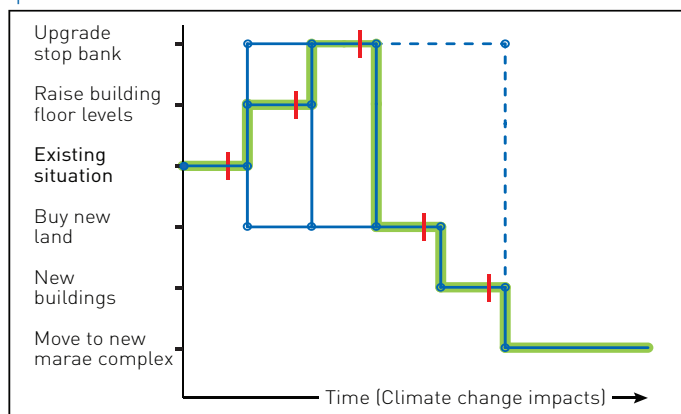
Option 1 involves monitoring until a pre-defined trigger is reached following which the stop banks will be upgraded to increase the flood protection to the marae. Subsequent actions (when the associated triggers are reached) are to purchase land to relocate the marae, develop the new site and finally moving.

Option 2



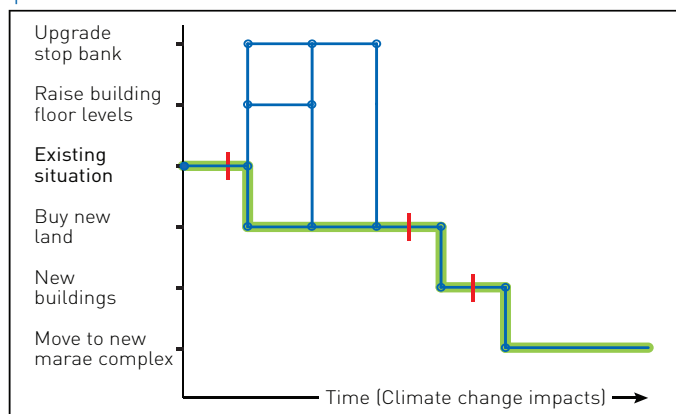
Option 2 involves monitoring until a pre-defined trigger is reached following which the building floor levels will be raised to increase the level of flood protection to the marae. Subsequent actions (when the associated triggers are reached) are to purchase land to relocate the marae, develop the new site and finally moving.

Option 3



Option 3 involves monitoring until a pre-defined trigger is reached following which the building floor levels will be raised to increase the level of flood protection to the marae. Subsequent actions (when the associated triggers are reached) are to upgrade the stopbanks; purchase land to relocate the marae, develop the new site and finally moving.

Option 4



Option 4 involves monitoring until a pre-defined trigger is reached following which land will be purchased to relocate the marae. Subsequent actions (when the associated triggers are reached) are to upgrade the stopbanks; purchase land to relocate the marae, develop the new site and finally moving.

— Blue Lines show the possible pathways that could be implemented.
 - - - Dashed Blue Line represents the option to maintain the stop bank protection while the new marae (or an alternative action) is being developed. In this case, the level of protection provided by the stop bank will be reduced but still offers some protection worth maintaining.

— Green Line shows the preferred pathway associated with each option.
 — Red Tick represents the trigger point that signals that work required to make the next move needs to start. Defining the trigger points and ongoing monitoring is described in Steps 6 and 7.

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
 Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
 Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
 Email: info@tangoio.maori.nz



Step 6: Choose pathway

A good pathway will be staged, flexible and robust for a range of possible futures.

This step involves choosing the preferred pathway and beginning to define how it will be enacted over time, including agreeing on trigger points that specify what actions will be taken and when.

Step 6

Knowing when to move from one option to another is not easy to define. It is unlikely to follow prescribed timeframes due to the deep 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 is required.

1. **Choose the 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 iwi/hapū/whānau 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 decision-makers. The decision-makers could be elected representatives such as tribal governance representatives, trustees, executive committee members or beneficiaries/shareholders.
2. **Define trigger points:** After the preferred pathway is decided, trigger points need to be defined. These are the points when it is time to move onto the next step of the pathway. For example, it could be when the cost of insurance increases above an agreed amount, or the cost of flood repairs exceeds 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, for example, once the trigger point is met there is still enough time to plan and implement the next step in the pathway.
3. **Define monitoring requirements:** These are the things that can and must be measured and monitored so that trends are picked up early enough for the iwi/hapū/whānau to decide to take an action to move on to the next step of the pathway. For example, keeping track of insurance costs, keeping a record of flooding impacts, etc.
4. **Document the pathway:** The pathway needs to be clear and well documented and the outcomes integrated into other iwi/hapū/whānau documents, plans and processes. The documentation should describe the sequence of options that are available to the iwi/hapū/whānau to respond to climate change impacts linked with the agreed trigger points and monitoring plan.





Step 6 Example: Pathway and triggers

This example is provided to demonstrate potential triggers that could be associated with a pathway and assumes that Option 1 from Step 5 is selected as the preferred pathway.

The preferred pathway is shown in Figure 1, and described in Table 1 below. Included are potential trigger points associated with each step, and actions that could be taken once the trigger point is reached in preparation for moving to the next step in the pathway. **This example is provided for illustrative purposes only. The adaptation pathway and triggers shown have not been developed or agreed by the whānau of Tangoio Marae or Maungaharuru-Tangitū Trust.**

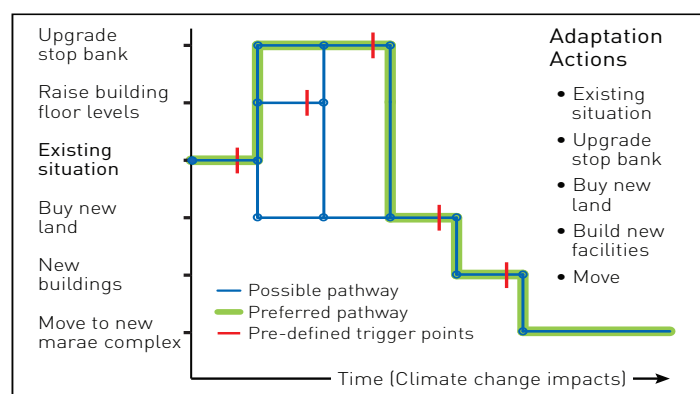


Figure 1: Example of preferred adaptation pathway is shown in green.

Table 1: Trigger points for the example pathway.

Step in pathway	Trigger point to move to next step	Implementation action
Existing situation	<ul style="list-style-type: none"> • marae access and use affected more than five times in 12 months due to flooding or • marae building(s) are flooded above floor level or • land suitable for new marae development becomes available 	<ul style="list-style-type: none"> • detailed design and construction of stop bank to provide more than 1% AEP¹ Flood protection • upgrade stop banks • consider purchasing for future development
Upgraded stop banks	<ul style="list-style-type: none"> • stop bank overtopped more than twice or • marae buildings are flooded above floor level or • cost of insurance exceeds \$50 k/annum or • sufficient finances available to fund purchase of new land 	<ul style="list-style-type: none"> • identify potential land for marae relocation • continue to maintain stop bank and marae • confirm availability of funds • buy new land
Buy new land	<ul style="list-style-type: none"> • decisions made on future of existing marae • sufficient finances available to build new marae complex 	<ul style="list-style-type: none"> • detailed design of marae complex • confirm availability of funds • develop new marae complex
New buildings	<ul style="list-style-type: none"> • decisions made on future of existing marae • new marae complex completed 	<ul style="list-style-type: none"> • move to new marae complex

¹ Annual Exceedance Probability (AEP) is the probability of a given flood event being exceeded in any one year. A 1% AEP flood event, means that there is a 1 in 100 chance in any given year that a flood of this size or bigger will occur.

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

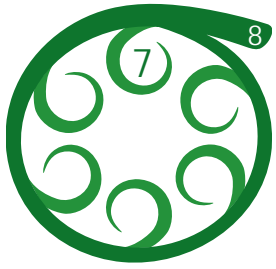
Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz



Steps 7 and 8: Implement, monitor and review pathway

An adaptation pathways approach by its nature requires ongoing monitoring review and adaptation to respond to the future as it unfolds.



Step 7

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

- deciding who will take overall responsibility for implementing the pathway
- communicating the pathway, triggers and monitoring needs and results
- integrating the pathway into all relevant iwi/hapū/whānau and marae documents, plans and processes
- 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
- embedding the pathway into all relevant decision-making.

Step 8

Monitoring and review of the pathway are critical to maintain its currency and relevance. The process is ongoing and fundamental to responding to changing needs and circumstances, new knowledge, experiences and lessons learnt.

The decisions made in Steps 7 and 8 also need to be incorporated into the overall pathways document.



Steps 7 and 8 example: Pathway monitoring and review

Table 1 below details some of the indicators and associated monitoring that could give effect to the example 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 the Maungaharuru-Tangitū Trust.**

Table 1: Indicators and monitoring for the example pathway.

Indicator	Relevance	Frequency	Monitor	Recording method
Investment performance	Monitor availability of funding to implement pathway.	Ongoing	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?	Ongoing	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 pathway report to MTT Board
Surrounding land-use changes	Have the risks to the marae changed?	Annual	MTT Environmental Manager	Annual pathway report 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

Find resources and more information at www.niwa.co.nz/te-kuwaha/tools-and-resources

Jackie Colliar

Project Manager/Environmental Engineer
Email: tekuwaha@niwa.co.nz

Dr Paula Blackett

Environmental Social Scientist
Email: Paula.Blackett@niwa.co.nz

Tania Hopmans

Maungaharuru-Tangitū Trust
Email: info@tangoio.maori.nz