Build Back Better
Aotearoa
New Zealand Ltd

Research report

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CLIMATE CHANGE IMPACTS ON MARAE

Build Back BETTER
Aotearoa New Zealand

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For the purposes of this report:

- Komiti marae and marae trusts/boards etc. will be referred to as marae kaitiaki (guardian)
- Rūnanga ā-iwi, iwi trusts/boards etc. will be referred to as iwi kaitaki (leaders).
- In this report hapori Māori is denoted broadly as Māori communities.

1 | Executive Summary

The Build Back Better Aotearoa New Zealand Ltd research team, guided by kaupapa Māori principles, delves into the impacts of climate change on marae. We used a holistic approach rooted in mātauranga Māori. Engaging with a diverse range of stakeholders and marae communities, we sought to identify and address challenges the marae were facing from climate change. We were particularly interested in assisting with cultivating adaptive strategies which were embedded in cultural values.

Marae face tangible challenges including coastal erosion, flooding, disruptions to traditional food gathering, and concerns about relocation. These concerns are affecting choices that marae are making for their future generations. The research shows that climate impacts extend beyond the physical structures, affecting cultural practices, treasured taonga, and whakapapa, jeopardising the fundamental connection to whenua.

However, the research demonstrated that limited knowledge of the future climate change impacts, financial resources, and relocation difficulties pose significant barriers to effective climate change adaptation. Our research involved a national survey of marae and the impacts they are facing together with meaningful dialogues and kanohi ki te kanohi interactions which provided rich insights into hapori marae, historical narratives, and contemporary challenges. The work in this report is a summary of the high-level findings and provides a view of the complex challenges, and how some marae are attempting to manage climate change impacts.

2 | Background

A marae represents not only physical structures but also carries profound spiritual significance, serving as a crucial conduit linking hapori Māori (Māori communities) with their whenua papatipu (ancestral lands). Comprising a cluster of buildings integrated into the landscape, the marae embodies a deep-rooted connection to the earth, symbolising the enduring bond between past, present, and future generations. Beyond being a simple gathering place, the marae functions as a spiritual sanctuary, nurturing cultural traditions and fostering unity among community members.

Traditionally situated near waterways to facilitate trade, transportation, and access to mahinga kai (food sources), many marae now tackle heightened vulnerability due to the escalating impacts of climate change. Rising sea levels, intensified storms, inland and coastal flooding, landslides, and wildfires pose imminent threats to marae, risking both their physical infrastructure and the taonga tuku iho (cultural heritage) they represent.

In response to these challenges, it is imperative for hapori Māori to prioritise safeguarding their marae from climate change risks. This requires the implementation of adaptive strategies, for example, the relocation of vulnerable structures, adoption of resilient building practices, and restoration of natural protective buffers. By embracing innovative approaches and fostering kia mahi ngātahi (gaining strength and resilience by working together), we can uphold the unique cultural identity of the marae while ensuring its preservation for future generations.

The overarching goal of our research is to address the pressing question: "How can we effectively protect and uphold the cultural heritage of our marae in the face of the climate emergency?" It is incumbent upon us to fulfil this responsibility, as neglecting to do so may result in irreversible loss of our cultural legacy. Therefore, our research focuses on the preservation, protection, and respect of the marae's cultural heritage, recognising them as vital bastions of cultural resilience amidst environmental adversity.

In light of the unprecedented threats posed by the climate emergency to our natural and cultural landscapes, it is important to develop robust strategies that ensure the resilience and sustainability of our marae. By placing indigenous knowledge and community engagement at the forefront, we can navigate these challenges and safeguard the integrity of marae for generations to come.

3 | Research Objectives and Outcomes

The main report on Aotearoa New Zealand's National Climate Change Risk Assessment (NCCRA) [1] highlights the urgent need for research on the sensitivity of cultural heritage sites, including marae, to climate change. To address this gap, we conducted the first comprehensive survey of marae in Aotearoa New Zealand to assess the extent of climate-related challenges faced by whānau, hapū, and iwi (Appendix 1). Working in partnership with marae kaitiaki (guardian) and iwi kaitaki (leaders), the Build Back Better Aotearoa New Zealand team (the team) developed a framework to identify these challenges and determine the necessary capability and capacity to address them, recognising that whānau, hapū and iwi often face these challenges alone.

Recognising the cultural significance of marae to Aotearoa, and the importance of safeguarding them for future generations, we are supporting whānau, hapū and iwi in identifying, adapting, and protecting marae, including reservation lands and all associated tāonga, from climate change impacts. By achieving these objectives, we aim to contribute positively to the wellbeing, resilience, and sustainability of Aotearoa's core of Māori culture, represented by marae.

Our research objectives include filling a knowledge gap for hapori Māori regarding the assessment of marae vulnerability to climate hazards and risks. We clarified the common challenges faced by marae kaitiaki and employed culturally relevant methods for assessing marae risks and vulnerability to climate impacts [2], empowering marae kaitiaki to make informed decisions about the future of their marae.

Furthermore, we strengthened Māori capability and capacity by using Māori researchers to conduct the majority of the mahi (work). We also increased the cultural competency of non-Māori researchers through marae visits and engaging with hapori Māori. We ensured all researchers understood the shared kaupapa (purpose) with the team and marae kaitiaki for addressing climate hazards and risks. Through our research, we fostered a collective understanding of marae tikanga (marae protocols, practices, and values) within the context of western climate change practices, creating meaningful and transformative outcomes for whānau, hapū, and iwi. Ultimately, our project prioritised indigenous voices and learnings, establishing cultural indicators and outcomes that reflect the values and aspirations of hapori Māori.

4 | Methodology

4.1 NGĀ HAERENGA (OUR JOURNEY)

Ngā Haerenga (our journey) serves as a blueprint for cultivating mutually enriching and adaptive partnerships with hapori Māori to bolster climate resilience. A parallel can be drawn between Ngā Haerenga and the traditional powhiri process, offering insight into its dynamics and significance. Similar to the powhiri, Ngā Haerenga begins with a formal acknowledgment and welcome, establishing a foundation of respect and reciprocity. It lays the groundwork for meaningful partnerships with hapori Māori, acknowledging their knowledge, expertise, and aspirations in addressing climate-related challenges.

Central to Te Haerenga are Ngā Tohu, or signposts, which mark significant milestones and progress along the journey. These signposts serve as guiding principles and significant stages in Ngā Haerenga, steering our collective efforts of building climate resilience together. Throughout Ngā Haerenga, our approach emphasises inclusivity and partnership, recognising the importance of cocreating solutions that align with kaupapa Māori. By embracing this methodology, we aim to forge enduring relationships and enact meaningful change in the pursuit of climate resilience.

Figure 1: Te Haerenga for building climate resilient marae

4.1.1 Karanga/Whakarite

Karanga/Whakarite represents the preparation of the manuhiri (visitors) at the whahora (gateway of the marae) before entering the marae as part of the pōwhiri process. For us, this kaupapa represented the preparation required by the team to deliver the research outcomes. The preparation included:

- the collation of relevant climate-related research on marae leveraging mātauranga ā iwi/hapū (iwi and hapū knowledge) and hītori (histories);
- connection and collaboration with other climate resilience researchers;
- creating a comprehensive, integrated marae kaitiaki and iwi kaitaki database;
- co-developing the climate change impacts on marae survey with key stakeholders in the research community; and
- obtaining Te Roopu Rapu i te Tika, Aotearoa Research Ethics Committee (AREC) [3] approval and guiding the researchers through Te Ara Tika Guidelines for Māori Research Ethics [4].

4.1.2 Wero

Wero represents the ceremonial challenge and holds significant cultural and symbolic value, often serving as a means to ensure peaceful interaction and to establish the purpose of gatherings or encounters. Engaging in Wero before conducting research on marae involves a respectful acknowledgment of the tikanga of the marae. By reaching out to marae kaitiaki to explain the research and requesting their participation in the survey, we demonstrated a commitment to establishing a meaningful relationship built on mutual understanding and consent.

Furthermore, extending this engagement to iwi kaitiaki across rohe (tribal areas) reflects a broader recognition of the interconnectedness and collective responsibility within Māori. Seeking whakaaro (ideas, plans) from iwi kaitiaki demonstrates a willingness to incorporate diverse perspectives and incorporate them into the research process, fostering a sense of inclusivity and empowerment.

4.1.3 Whaikōrero

Whaikōrero is the formal speech making process that takes place during the pōwhiri 'rangatira ki te rangatira' – 'leader to leader'. For us, this kaupapa included the assessment of the survey results based on a number of criteria e.g., geographic location, vulnerability assessment, availability, and access to climate change data etc. We developed a climate change reference framework for categorisation and prioritisation of marae impacted by climate change. Based on the framework we partnered with several marae to understand the impacts of climate change risks to their marae to develop a kete mātauranga which included cost-effective, innovative, and practical solutions to adapt to the impacts of climate change that uphold mātauranga Māori and evolve over generations.

4.1.4 Manaaki

The conclusion of the pōwhiri process with the practice of manaaki exemplifies the essence of hospitality and mutual respect. Manaaki encompasses the act of caring for and uplifting others, reflecting the interconnectedness and reciprocity deeply ingrained within tikanga. As the haukāinga (home people) host the manuhiri in the wharekai (dining hall), they extend their mana (prestige, authority) by sharing kai (food) and engaging in waiata (song). This act of hospitality

goes beyond mere provision of sustenance; it signifies a genuine gesture of welcome, acceptance, and inclusion. In the context of research collaboration, this stage symbolises the commitment between the team and the marae kaitiaki to uphold the principles of mutual respect, reciprocity, and shared purpose. By participating in the manaaki process, we acknowledge the significance of the partnerships forged during the pōwhiri and affirm our dedication to honoring the kaupapa we are working on together, laying a solid foundation for productive and ethical research collaboration.

4.1.5 Whakawātea

The concept of whakawātea, meaning to clear or exit, serves as a symbolic gesture of respect and closure. Within the pōwhiri, whakawātea signifies the process of leaving the marae, whether conducted informally or formally. It emphasises the importance of departing appropriately and respectfully, acknowledging the haukāinga and the kaupapa of the gathering. Integrating the concept of whakawātea into the completion of the research marks a significant milestone in the research process, signifying the culmination of efforts and the transition to the next phase of knowledge dissemination and application.

In this case, the completion of the kaupapa is intertwined with the integration of research outcomes into the Sustainability and Climate Change for Construction Industry Course at Massey University [5]. This course serves as a platform for transferring knowledge and practical examples of engagement and collaboration with hapori Māori to students. Through the course, students are introduced to the concept of community partnerships for sustainable development, which encompasses principles of mutual respect, reciprocity, and shared decision-making. By incorporating practical examples from the research collaboration with hapori Māori, students are encouraged to critically analyse and reflect on the dynamics of engagement and collaboration within diverse cultural contexts. The course aims to inspire students to explore how similar partnerships could be applied in their own professional contexts, fostering a deeper understanding of Māori perspectives, sustainable development practices, and ethical considerations in research and community engagement.

5 | Research Design

Guided by the foundational principles of kaupapa Māori, our research was driven by a commitment to Māori values and practices. We actively engaged with mātauranga by cultivating partnerships with established and emerging poutoko iwi (community leaders) and hapori Māori, both within our research team and among our key partners and stakeholders. Our research methodology was anchored in previous research and literature which provided essential context and insights into the existing challenges and opportunities of the impacts of climate change on hapori Māori.

The hapori marae-led research is designed to generate and disseminate knowledge within te ao Māori (the Māori world), offering a kete mātauranga of innovative, cost effective and practical Māori responses to climate change impacts. Drawing upon our familiarity and expertise in rangahau (research and inquiry) of tikanga and mātauranga Māori, we facilitated meaningful dialogues within hapori Māori and hapori marae, encouraging the recognition and reflection of their historical narratives alongside contemporary challenges. Our approach embraced the diverse and distinct Māori perspectives spanning whānau, hapū, iwi, and marae, revealing traditional practices that contribute to the preservation, transmission, and practical application of existing mātauranga.

6 | Data Collection and Analysis Methods

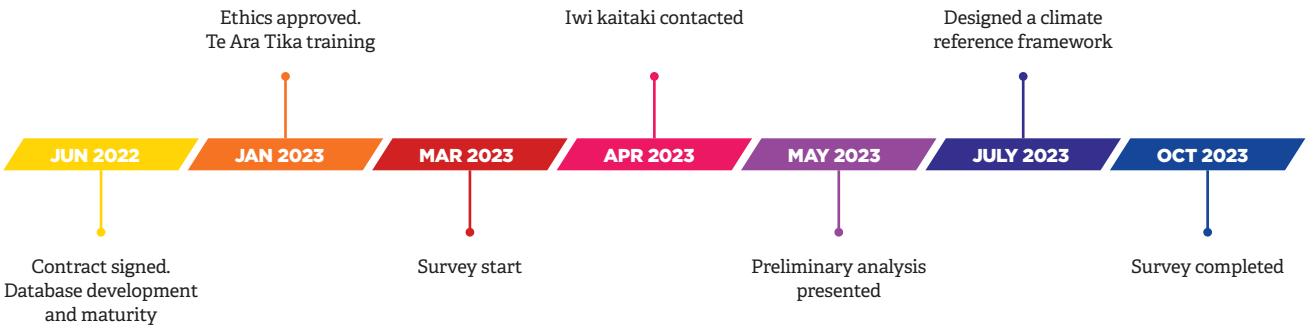
The below summarises the research as a whole divided into two stages; the climate change impacts on marae survey and the deep dive with individual marae.

6.1 CLIMATE CHANGE IMPACT ON MARAE SURVEY

In January 2023, the Aotearoa Research Ethics Committee granted full ethical approval (NZEC22_42) for our research on Climate Change Impacts on Marae. This approval encompassed the creation and utilisation of a Marae Information Sheet (MIS) and individual Consent Forms (CF), ensuring informed consent was obtained, with recognition given to the significance of oral consent by Māori. We developed a database comprising 778 marae across Aotearoa, which included information on marae kaitiaki and iwi kaitaki. This database was organised into nine distinct rohe: Te Tai Tokerau (Northland), Tāmaki Makaurau (Auckland), Waikato, Waiariki (Bay of Plenty), Tairāwhiti, Taranaki-Manawatū, Ahuriri-Te Matau-a-Māui (Napier-Hawkes Bay), Pōneke (Wellington), and Te Waipounamu (South Island).

Each researcher was assigned one or more rohe to contact, using a structured phone script to reach out to marae without email addresses. The training for researchers was led by the Primary Investigator, with regular check-ins to monitor progress and address any challenges or take up opportunities that were presented. The survey instructions were developed to align with Te Ara Tika and all research materials and databases were shared via a file sharing platform to ensure effectiveness and maintain consistency.

Contact with marae commenced in March 2023, allowing for inclusion of questions about recent severe weather events such as Cyclone Hale and Cyclone Gabrielle. To minimise recurrent trauma, dissemination of the survey to cyclone-affected rohe was deliberately delayed. In April 2023, we contacted 162 iwi kaitaki based on Te Puni Kōkiri Te Kāhui Māngai [6] to inform them of the research and request support. This resulted in 31 responses from iwi kaitaki for further communication and engagement. In May 2023, a preliminary analysis of the survey results from 54 participating marae was presented to BRANZ to draw attention to the evident climate change challenges marae were facing. A climate reference framework was designed for categorising and prioritising marae, including the development of an analytic rubric co-created with BRANZ.



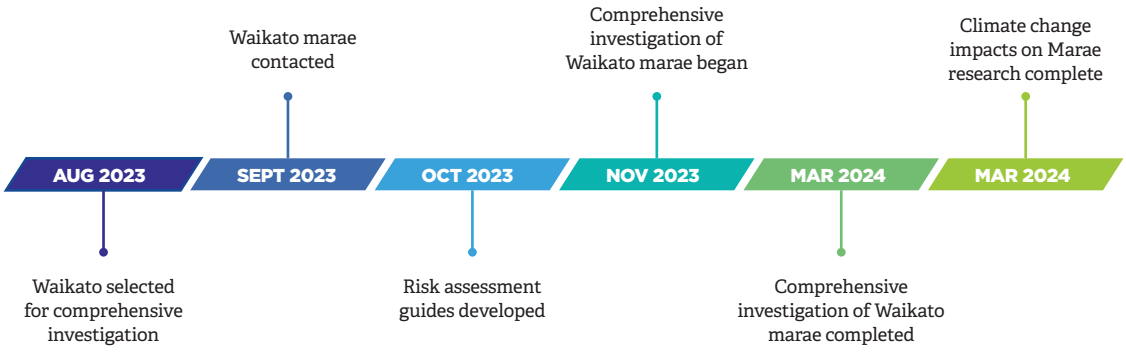
The team conducted a comprehensive analysis of survey responses using a census method, ensuring every response was considered. By October 2023, we had contacted 409 individual marae via email using a CRM (customer relationship management) system and SMTP (Simple Mail Transfer Protocol) service – an application to send and receive email between senders and receivers. We regularly reviewed the analytics which indicated an approximate 8% hard bounce rate (when the email can't be delivered for various reasons), reaching approximately 376 marae without any reports of the survey being marked as spam or unsubscribed.

6.2 CLIMATE CHANGE IMPACT ON MARAE COMPREHENSIVE INVESTIGATION

In August 2023, the BBB team presented to BRANZ three rohe—Te Moana-a-Toi (Bay of Plenty), Waikato, and Tairāwhiti (Gisborne)—for a comprehensive investigation of six marae. These regions were chosen due to similar climate change challenges faced by their marae from the climate reference framework. To support the framework, we developed a geospatial map of marae, aiding in the spatial analysis process. Following this analysis, Waikato was selected as the focus for the comprehensive investigation of marae.

In September, we contacted the marae in the Waikato rohe that had completed the survey and invited them to participate in the investigation. To support the risk assessment process the team used the Ministry for the Environment (MfE) 'He kupu ārahi mō te aromatawai tūraru huringa āhuarangi ā-rohe / A guide to local climate change risk assessments'. The team incorporated the assessment concepts from this guide into the development of a Climate Change Risk Assessment Guide (Appendix 2) tailored to each individual marae's circumstances. This document integrates principles of mātauranga Māori and global best practices for climate change, ensuring a holistic and culturally responsive approach to climate change risk and vulnerability assessment.

We requested that the users (researchers) of the Climate Change Risk Assessment Guide (for marae) should familiarise themselves with the Rauora framework [7]. Developed by Ihirangi, the operational arm of Te Pou Take Āhuarangi (Climate Lead) for the National Iwi Chairs Forum, this framework offers a cohesive set of cultural values and principles to guide climate action. Emphasising transformative action as a pathway to resilience, the Rauora framework underscores principles such as balance, interconnectedness, collaborative efforts, and intergenerational equity. These principles are complemented by a set of Māori values, providing a culturally grounded foundation for addressing climate change challenges within hapori Māori.



By incorporating insights from both the MfE guide and the Rauora framework, the Climate Change Risk Assessment Guide (for marae) offers a comprehensive approach to assessing and addressing climate risks, rooted in both mātauranga Māori and global best practices. This integrated approach ensures that climate action is not only effective but also culturally appropriate and sustainable for generations to come.

In addition to the Climate Change Risk Assessment Guide (for marae) we developed a Climate Change Impacts on Marae Guide (Appendix 3) for each individual marae. The content of this guide included:

- The Climate adaptation Process [8] [9].
- Conducting the research e.g., the team, timeframe, scale of assessment.
- Carrying out the risk and vulnerability assessment e.g., identifying and assessing climate hazards and elements at risk, methodology, geospatial analysis, and adaptation planning.
- The marae response to the climate impacts on marae survey.
- Climate change themes and questions organised under the themes below:
    - Theme 1: He huringa āhuarangi (changing climate) and whenua (land)
    - Theme 2: He tāngata (people)
    - Theme 3: Buildings and Infrastructure
    - Theme 4: Urutaunga (adaptation) processes
    - Theme 5: Rawa (resources)
- Maps of marae and surrounding rohe and how to identify climate hazards.
- Ethics requirements e.g., Marae Information Sheet (Appendix 4) and Consent Forms (Appendix 5).

The comprehensive investigation of Waikato marae commenced in November 2023 and concluded in March 2024, allowing for an in-depth examination of the climate change impacts and adaptation strategies within this rohe. The team visited the marae and conducted kanohi ki te kanohi (face to face) interviews with kaumātua, hau kāinga (local people), rangatahi, and marae kaitiaki. During these sessions, a semi-structured questionnaire guided the kōrero.

Hapori Māori rightfully maintain ownership over their mātauranga, recognising it as a taonga and as such requires protection They advocate for respectful handling of their information, prioritising sensitivity, and discretion to protect individual and collective identities. Māori's stance on data ownership reflects a commitment to preserving their cultural integrity and ensuring that usage aligns with their values and aspirations. This approach fosters trust and collaboration while safeguarding against exploitation and misrepresentation.

"Mātauranga refers to Māori knowledge and all that underpins it, as well as Māori ways of knowing. Mātauranga is in our stories, our environments, our kawa and our tikanga. Mātauranga includes 'language, whakapapa, technology, systems of law and social control, systems of property and value exchange, forms of expression, and much more." [10]

Hapori Māori have experienced significant impacts from climate change across various domains, ranging from food security and water resources to environmental degradation, health concerns, and political dynamics. To comprehensively understand these effects, we utilised a risk and vulnerability framework, which involved several key stages. The process began with risk identification, where potential threats and challenges posed by climate change are identified and delineated. This initial step is crucial for defining the scope of these risks, leading to a thorough risk assessment that evaluates the severity and potential consequences of each identified risk. A structured approach was employed to develop risk management strategies aimed at mitigating the adverse impacts of climate change on indigenous populations. In addition, exploring the historical changes within hapori Māori offers valuable insights into their perceptions of risk. By examining how environmental shifts have unfolded over time, we gained a deeper understanding of how hapori Māori have historically adapted to te ao hurihuri, a changing world. This historical context enriches the current understanding of climate change impacts and informs strategies for resilience-building and adaptation within hapori marae.

7 | Findings

Our findings on the impacts of climate change on marae communities highlights the immediate and tangible challenges they face. These challenges include flooding and coastal erosion, resulting in significant land loss along coastlines and riverbanks. Furthermore, disruptions to traditional mahinga kai (food gathering places) and concerns about the need for relocation emphasise the urgent need to address climate-related issues. For instance, events like Cyclone Gabrielle and the heavy rain and flooding in 2022 causing extensive damage across Aotearoa serve as stark reminders of the ongoing imperative to tackle these challenges.

The cultural significance of marae extends beyond physical structures; it encompasses profound changes to treasured taonga, kaupapa Māori, and whakapapa (genealogy and connections) that define hapori Māori. Despite efforts to mitigate climate change, our climate change impacts on marae survey reveals significant barriers to adaptation, including limited knowledge, financial resources, and apprehensions about relocation.

> While all New Zealanders will feel the impact of these climate hazards, the ability of communities to adapt and their resilience will vary considerably across the motu. In particular, hapori Māori face heightened risks due to their geographical locations, the industries they work in, and current socio-economic circumstances.

Figure 2: Understanding climate hazards for hapori Māori – Insights for policy makers report 2023

In the next phase of our research, our team undertook an extensive examination, often referred to as a 'deep dive', focusing on marae within the Waikato rohe. This kaupapa allowed the team to gain a thorough understanding of the specific impacts of climate change affecting these marae and explore a wide range of potential solutions to effectively address these challenges.

To ensure a strategic and purposeful selection process, our team devised a comprehensive rubric to guide the identification of the rohe for this phase of the project. This systematic framework facilitated the selection of the area, and subsequent marae that not only closely align with our research objectives but also promise to provide the most valuable insights.

Each marae received a specialised kete mātauranga which included:

1. Mātauranga-a-iwi – A written summary report based on kanohi ki te kanohi interactions with individuals and in group wānanga (forum). The report primarily highlighted the impacts from climate change across the different environments i.e., social, cultural, natural, economic, and built environments.

2. Mātauranga-a-marae – A written report that consisted of:
   a. Summarised key points and lessons from the interactions with marae kaitiaki.
   b. The risk and vulnerability assessment process.
   c. Analysis and identification of climate change risks on the marae.

d. Adaptive strategies merging mātauranga Māori and scientific insights.
e. Suggested collaborative networks.
f. Climate adaptation pathways.

3. Geospatial mapping and drone surveying and imagery.

The findings from this phase can be categorised under the following themes:

a. He huringa āhuarangi (changing climate) and whenua (land)
b. He tāngata (people)
c. Buildings and Infrastructure
d. Urutaunga (adaptation) processes
e. Rawa (resources)

Below are the high-level results of the marae deep dives. Due to mātauranga and marae sensitivities no marae are identified, but each marae received comprehensive report that becomes their kete to share as they choose.

> Out at the sea I've noticed over the years that the sea levels are really huge, really high. It's a change because I used to go out fishing and I love my fishing. I'd go fishing on the rocks and the water level was always a certain, depending on what the tides were doing. It would come up so far from the rocks on the side and on a high tide, like a full moon, the sea level would come up almost to the top, but I notice today that the sea levels are constantly at that high level now.

7.1 HE HURINGA ĀHUARANGI (CHANGING CLIMATE) AND WHENUA (LAND)

Research clearly indicates that climate change is exerting various impacts on the whenua (land) surrounding marae. These effects include altered rainfall patterns leading to more frequent and intense storms, resulting in erosion along coastal and riverbank areas where many marae are situated. Moreover, rising temperatures and shifting weather patterns disrupt traditional planting and harvesting practices, affecting food sovereignty and cultural ties to the land. Recognising these potential impacts on local ecosystems and biodiversity is crucial. It involves assessing changes in vegetation, wildlife habitats, and ecosystem services such as water purification, pollination, and soil stabilisation. To tackle these challenges, we advocate for marae to adopt nature-based solutions like community gardens, tree planting, and habitat restoration to bolster resilience to climate change impacts. These green infrastructure measures not only mitigate environmental risks but also offer additional benefits such as enhanced biodiversity, air quality, and community wellbeing.

> I think growing up there were definite, you could definitely say, "oh this is the summer months, these are the spring months, this is autumn." There was a definite line that was there, but now you're just getting weather, all types of weather, any time. There's definitely a change in the weather.

Furthermore, we propose the implementation of ecosystem-based climate adaptation measures, which include habitat restoration, sustainable land management, and biodiversity conservation. These practical and cost-effective approaches aim to enhance ecosystem resilience, safeguard natural resources, and provide numerous benefits for both he tāngata (the people) and te taiao (natural environment). Restoring natural ecosystems serves

as a buffer against coastal erosion, storm surges, and flooding, while simultaneously offering habitats for biodiversity and cultural resources. By integrating these strategies, hapori Māori and hapori marae can effectively address climate-related challenges while preserving their cultural and environmental heritage.

7.2 HE TĀNGATA (PEOPLE)

Climate change poses significant risks to he tāngata connected to marae. The increased frequency of extreme weather events, such as cyclones and floods, has disrupted daily life, threatened livelihoods, and compromised community health, safety, and wellbeing. Climate change has indirectly affected community health and wellbeing through alterations in environmental conditions, food security, and social dynamics. Addressing climate-related health risks, like heatwaves, vector-borne diseases, and mental health impacts, necessitates integrating public health considerations into climate adaptation planning processes.

> Nobody drinks the water out of the tap, they won't even have a cup of water, they'll boil the water, or they'll bring their own water in. If we turn our taps on fast, we'll get brown water, They got a new pump they replaced the water pumps, but they didn't replace the lines, the lines were still rotting under the ground hence they're leaking.

> For me it is the change in availability of water. I'm talking about the traditional practice of fermenting corn. We could do that really quite easily; we had our processes and part of that was to have clean running water. With the change in the water we've had to revert to using drums, because the water no longer clear, it's impacted on that practice...

Shifts in temperature and precipitation patterns have impacted mātauranga Māori potentially leading to the erosion of cultural heritage and identity within hapori marae. Recognising and addressing the disproportionate impacts of climate change on vulnerable populations, including hapori Māori, low-income households, and marginalised groups is crucial for promoting social equity and justice. This involves ensuring inclusive decision-making processes, equitable access to resources and information, and targeted support for those most affected by climate-related risks. By incorporating principles of environmental justice and human rights into adaptation strategies, we can foster more resilient and equitable communities in the face of climate change.

To tackle these challenges, hapori marae are advocating for the diversification of livelihoods to enhance resilience to climate change impacts. This may entail promoting alternative income-generating activities, such as eco-tourism, agroforestry, or sustainable fisheries, to reduce reliance on climate-sensitive sectors and increase adaptive capacity. Empowering hapori marae to lead climate adaptation initiatives represents a practical and collaborative approach. By fostering community participation, ownership, and leadership, hapori marae can develop adaptation strategies that are tailored to their specific needs, priorities, and circumstances.

7.3 BUILDINGS AND INFRASTRUCTURE

Marae buildings and infrastructure face various challenges due to climate change. One of the most significant threats is posed by extreme weather events, such as storms, cyclones, and flooding damaging buildings and infrastructure These events have compromised the structural integrity, safety, and functionality of the buildings, including meeting houses (wharenui), kitchens (kāuta), and communal areas (wharekai). Additionally, flooding has impacted infrastructure like water supply systems, sewage systems, and electrical systems, disrupting essential services and creating health hazards.

> For the most part of last year, that road was either blocked because of slips or because of flooding, the road was the main entry into our marae.

> In 2021 we had to have a working group to clear everything for our whare because the rain is just so intense. And it affected this place. It affected holes in our ceiling, the walls, the roof of our house. It wasn't just normal rain.

Coastal marae are particularly vulnerable to rising sea levels and storm surges. Erosion of coastal land has led to the loss of valuable cultural sites and infrastructure. Seawater intrusion has also contaminated freshwater sources, rendering them unusable for drinking and irrigation. Additionally the changing climate conditions has exacerbated existing challenges with building maintenance and preservation. Higher temperatures and increased humidity levels has accelerated the deterioration of building materials, leading to more frequent repairs and replacements. Traditional construction materials, such as untreated timber and thatch, have been especially susceptible to decay under changing environmental conditions.

To address these challenges, marae communities are increasingly adopting climate-resilient design and building practices. This includes retrofitting existing structures to improve their resilience to extreme weather events, such as reinforcing foundations and elevating buildings above flood-prone areas. Additionally, incorporating sustainable building materials and techniques, such as using locally sourced and renewable materials, can enhance resilience while reducing environmental impacts.

> Back in the days I remember, as a diver, to depend on the sea. We used to have patterns of wind changes that we knew. Whenever there was a south westerly wind, we knew the easterlies were coming the next day, so we were off fishing, those were the signs that we used.
>
> We also used the Pōhutukawa tree, the flowers on the tree tells us the kaimoana were fat, so off we go, we just used those signs.

Overall, addressing the impacts of climate change on marae buildings and infrastructure requires a holistic approach that integrates traditional knowledge, community engagement, and innovative adaptation strategies. By investing in resilient infrastructure and fostering community resilience, marae can continue to serve as cultural and social hubs for generations to come.

7.4 URUTAUNGA (ADAPTATION) PROCESSES

Incorporating traditional Māori knowledge (mātauranga Māori) into adaptation strategies can provide cost-effective and resilient solutions. This may involve reviving traditional practices related to land and water management, such as planting native vegetation to prevent erosion or using natural materials for construction to withstand extreme weather events. Marae communities are engaging in adaptation processes to address the impacts of climate change. This includes implementing strategies such as building seawalls or planting vegetation to mitigate erosion, diversifying food sources to adapt to changing agricultural conditions, and strengthening community networks to enhance resilience in the face of climate-related challenges. Incorporating traditional knowledge and practices alongside modern adaptation strategies is crucial for effective adaptation.

> For this year now there's been three cyclones and look at the devastation and the impact that it's done. I don't even remember, we only used to get one cyclone a year maybe.

Empowering marae communities to lead climate adaptation initiatives was emphasised as a practical and resilient approach. By fostering community participation, ownership, and leadership, marae communities could develop adaptation strategies that are tailored to their specific needs, priorities, and circumstances. Engaging the Marae community in adaptation planning and decision-making processes can lead to practical and locally relevant solutions. Community members can contribute valuable insights and local knowledge, helping to identify priority areas for adaptation and co-designing appropriate interventions. Investing in education and capacity building programs was emphasised as a cost-effective and practical adaptation pathway. By increasing awareness, knowledge, and skills related to climate change adaptation, marae communities could enhance their resilience and adaptive capacity over the long term.

7.5 RAWA (RESOURCES)

Climate change poses significant challenges to the sustainability and resilience of hapori marae, particularly concerning the availability and quality of essential resources. One critical impact is the alteration of rainfall patterns, leading to fluctuations in water availability for drinking, cooking, and sanitation. Changes in ecosystems have disrupted the abundance and distribution of traditional food sources, thereby jeopardising both food security and cultural practices deeply rooted in the whenua.

> Lack of funding and the interest in our area means that we really struggle to get assistance with shoring up our roads and the banks around our roads.

> We used to always hear frogs at night and go and hunt for tadpoles, we'd go and hunt. We used to have a lake over here, now there are houses, we used to have swamps and we used to have frogs, no more frogs, we used to hear frogs all the time."

Addressing these challenges necessitates the development and implementation of sustainable resource management practices tailored to the unique needs of hapori marae. This involves leveraging a range of skills, expertise, and capacity-

building efforts to enhance the resilience of marae in the face of climate change impacts. Skills and expertise in water conservation techniques are essential for managing dwindling water resources effectively. This includes implementing rainwater harvesting systems, adopting water-efficient technologies for sanitation facilities, and promoting community awareness and participation in water-saving practices. Capacity-building initiatives focused on biodiversity preservation are crucial for safeguarding traditional food sources and ecosystem health. This involves training community members in ecological monitoring and restoration techniques, promoting the cultivation of indigenous plant species, and establishing protected areas to conserve biodiversity hotspots. By empowering hapori marae with the skills and resources needed to adapt to changing environmental conditions, marae can enhance their resilience and safeguard their cultural heritage for future generations.

> **Addressing the impacts of climate change on hapori marae requires the combination of mātauranga Māori and practices, with scientific approaches to create holistic solutions, cultural continuity, and intergenerational learning.**

8 | Presentation of Findings

We have embraced a 'Te Mana Whakahaere' approach, reflecting Māori governance principles within our research efforts. This approach recognises Māori Data Sovereignty, honoring mātauranga Māori, and upholding kaitiakitanga (guardianship) responsibilities concerning the safeguarding and sharing of information derived from our research initiatives.

Our contributions extended to publications such as the BRANZ BUILD publication in August 2022 and the BRANZ Annual Review for the year 2023. These publications serve as significant avenues for disseminating insights and findings from our research, thereby contributing to the advancement of knowledge within relevant fields. In August 2023, we presented at the Transition to a Zero Carbon Built Environment Programme Research Showcase. This event provided an invaluable opportunity to share our research outcomes and insights aimed at fostering sustainability within the built environment.

Furthermore, in November of the same year, we presented at the International Indigenous Climate Change Research Summit. Our presentation focused on the pertinent topic of Unveiling the Climate Change Realities: A Glimpse into the Vulnerabilities of Aotearoa's Marae. This engagement allowed us to shed light on the unique challenges and vulnerabilities faced by hapori Māori in Aotearoa amidst the changing climate landscape, emphasising the importance of indigenous perspectives in climate change discourse.

9 | Conclusions

Climate change poses significant risks to hapori Māori, particularly concerning their deep connection to the whenua which forms the cornerstone of their tūrangawaewae, a place to stand and a sense of belonging because of whakapapa. The impacts of climate change directly affect this connection, disrupting the delicate balance between people and te taiao. Increasing frequency and intensity of climate hazards, such as extreme weather events and rising sea levels, pose threats to ecosystems, biodiversity, and natural resources that hapori Māori rely on for sustenance, cultural practices, and spiritual connection.

Climate risks extend to hapori marae, which serve as focal points for cultural, social, and spiritual activities. The vulnerability of marae and surrounding communities to climate hazards has already led to instances of damage and destruction of buildings, infrastructure, and cultural sites. In some cases, the severity of climate impacts may necessitate the relocation of marae to safer locations, disrupting longstanding connections to whenua papatipu and challenging the very essence of tūrangawaewae. This forced displacement not only threatens physical structures but also undermines the spiritual and cultural significance embedded in these sacred spaces.

The need for adaptation and resilience-building measures is paramount to address the immediate and intergenerational impacts of climate change on hapori Māori and their connection to the whenua. This includes implementing strategies to mitigate climate risks, such as strengthening infrastructure, restoring natural ecosystems, and integrating mātauranga Māori with contemporary science to inform decision-making and resource management.

Fostering community-led initiatives and partnerships that empower hapori Māori to adapt to changing environmental conditions and preserve their cultural heritage is essential. By acknowledging the interconnectedness of people, land, and culture, hapori Māori can navigate the challenges posed by climate change while upholding the principles of kaitiakitanga (stewardship) and rangatiratanga (self-determination). In our commitment to supporting marae communities, we have actively collaborated with selected marae to co-create solutions aimed at mitigating the impacts of climate change. By fostering collaborative partnerships and tapping into local expertise, our goal is to empower marae to effectively tackle climate-related challenges and bolster their resilience for the benefit of future generations.

For instance, in regions facing increased flooding and coastal erosion, one potential adaptation strategy involved implementing natural coastal defences such as mangrove restoration or the construction of sea walls. These measures not only mitigate erosion impacts but also preserve the cultural integrity of the coastal landscape surrounding the marae. In areas where traditional food sources are compromised due to climate-related changes, communities can explore alternative agricultural practices that are more resilient to fluctuating environmental conditions. This can involve adopting drought-resistant crops or reviving traditional cultivation techniques adapted to the new climate realities.

Our research aims to provide practical guidance and support to hapori marae as they navigate the complexities of climate change adaptation. By developing tailored strategies and measures informed by mātauranga-a-iwi, and cultural values, we strive to ensure that the cultural significance of marae remains intact for generations to come. Through collaborative action and proactive adaptation, marae can continue to thrive as vital cultural and social hubs in the face of changing environmental conditions.

> The outcomes of this work resulted in a kete mātauranga for marae that supports the continued growth in understanding and actioning the impacts of climate change giving hapori Māori the ability to assess and respond to climate risks impacting the resilience and wellbeing of their people.

10 | Areas for Future Research

The research has uncovered significant findings relating to the climate challenges facing marae. The research team have begun to answer questions of what the climate change impacts on marae and how can they be mitigated. The research is a journey towards continuous protection of Aotearoa's cultural heritage.

Further research questions could start to understand longer term assessments including:

- How do observed climate change impacts on marae translate into long-term consequences for cultural practices, land use, and community wellbeing?
- What are the intergenerational implications of climate change for hapori Māori, and how can adaptation strategies be tailored to address these?
- What role do intergenerational knowledge transfer and capacity-building play in fostering climate resilience within hapori marae?

In addition, the research shows a tension between mātauranga Māori and western science, which has been debated in the New Zealand media. Integration of the two world views should provide more opportunities for partnerships and knowledge transfer. Therefore some research questions arise, such as:

- How can traditional mātauranga Māori be further integrated into national climate adaptation planning and implementation?
- What are the key challenges and opportunities associated with merging mātauranga Māori with western science in the context of climate change resilience?

As our research has a focus on infrastructure and the built environment, we would recommend the following enhancements to current research:

- How can climate-resilient design be applied to enhance of marae infrastructure, considering both traditional and modern building techniques?
- What are the economic and social implications of managing marae buildings to withstand climate-related hazards?

Our research has shown that active partnerships produce trust and respect, which enables researchers and hapori Māori to work together. We have learnt from engagement and partnership opportunities and have the following recommendations for future analysis.

- How can community engagement strategies and partnerships be developed to enhance climate adaptation for marae?
- How can collaborative partnerships be leveraged to share knowledge and best practices for climate adaptation?

Finally, our research found that policy settings for climate adaptation of marae are generally lacking. We would recommend the research questions:

- What policy frameworks and governance structures are needed to support effective climate adaptation and cultural preservation for marae?

11 | Recommendations

The Build Back Better team are now actively working with marae in Aotearoa to overcome some of the obstacles to climate change impacts. In addition to ongoing work, the team recommend that collectively we need to:

11.1 STRENGTHEN COMMUNITY RESILIENCE:

Empowering hapori Māori and hapori marae with the necessary resources and skills is essential for effectively addressing climate-related challenges. By providing support and training, Māori can develop the capacity to adapt and respond to the impacts of climate change. Additionally, fostering community-led initiatives encourages collaboration and innovation, allowing for tailored solutions that align with the unique needs and values of each hapori marae. These initiatives not only build resilience but also promote mana motuhake (self-determination) and sustainable practices, ensuring long-term viability and wellbeing.

11.2 STRENGTHEN INFRASTRUCTURE RESILIENCE

Integrating climate-resilient design and building practices into marae infrastructure is paramount for enhancing durability and sustainability in the face of climate change. This involves incorporating traditional construction methods and materials that have withstood the test of time, ensuring structures are robust and adaptable to shifting environmental conditions. Additionally, embracing sustainable resource management practices such as water conservation and biodiversity preservation is essential. By implementing rainwater harvesting systems, greywater recycling, and drought-resistant landscaping, marae can reduce water consumption and enhance resilience to water scarcity. Similarly, integrating native vegetation and habitat restoration initiatives can promote biodiversity, support ecosystem health, and mitigate the impacts of climate change. Embracing these approaches not only strengthens the resilience of marae infrastructure but also honors cultural heritage and fosters sustainable stewardship of the land for future generations.

11.3 ENHANCE KNOWLEDGE:

Mātauranga Māori emphasises interconnectedness, sustainability, and the interplay between humans and nature. This worldview offers a nuanced perspective on climate change, viewing it not just as an environmental issue but as a disruption to the delicate balance between land, sea, and sky. Western science provides valuable tools and methodologies for understanding and addressing climate change. It offers precise data, predictive models, and technological innovations that can inform adaptation strategies and resilience-building efforts. The integration of these two worldviews holds immense promise. By bridging mātauranga Māori with Western science, hapori marae can access a comprehensive toolkit for climate change adaptation. This fusion of traditional ecological knowledge with contemporary scientific insights will lead to more

effective and culturally appropriate strategies. Ultimately, the integration of mātauranga Māori and Western science is not only about addressing climate change but also about fostering cultural revitalisation and empowerment within hapori marae. By embracing diverse knowledge systems and perspectives, we can forge a path towards a more resilient and inclusive future for all.

11.4 SHARE THE LEARNINGS

To empower hapori marae in navigating the challenges of climate change, it's imperative to lead the development and widespread distribution of research findings and resources tailored to their specific needs. Establishing collaborative networks plays a crucial role in facilitating knowledge exchange and capacity-building among hapori marae grappling with similar climate change challenges. By fostering connections and partnerships, hapori marae can pool their collective wisdom, experiences, and resources to develop innovative solutions and support one another in implementing effective adaptation measures. These collaborative networks serve as hubs for information-sharing, skill-building workshops, and peer-to-peer learning opportunities. Through dialogue and collaboration, hapori marae can harness the strength of unity to confront the impacts of climate change and emerge stronger and more resilient. By investing in research, resource development, and collaborative networks, we empower marae communities to proactively address climate change and safeguard their cultural heritage and livelihoods for generations to come.

11.5 DEVELOP POLICY FRAMEWORKS

The research serves as a foundation to advocate for policies that are not only responsive to the challenges of climate change adaptation, but also dedicated to the preservation of Te ao Māori (Māori worldview). By presenting evidence and data-driven insights, this research provides a compelling case for policymakers to prioritise initiatives that contribute to the revitalisation and safeguarding of marae. By integrating mātauranga Māori into policy frameworks, policymakers can ensure that climate adaptation strategies are not only effective but also respectful of indigenous values and ways of life.

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13 | Appendices

Appendix 1: Survey Report