Perceptions of Environmental Restoration Efforts at the Wairarapa Moana in Aotearoa

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Submitted to Rawiri Smith and Ian Gunn

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ABSTRACT

The Wairarapa Moana is culturally and economically significant to many. Since the 1800s, changes to the area have diminished its mauri [life force]. The goal of this project was to determine what may make the Wairarapa Moana Restoration Plan more holistic. We gathered perceptions on the current Restoration Plan from government employees, iwi members, farmers, recreational users, and Lake Wairarapa stakeholders. Analyzing perceptions from each stakeholder group, we determined that the plan should improve water quality, biodiversity, and engagement. We suggest moving stock exclusions further from the waters' edge, incorporating pest fish management to current biodiversity efforts, and organizing youth engagement. When the environment is healthy, the communities around it are too.

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AUTHORSHIP

To explain our authorship and work distribution among the group members of this project, we will explain the different roles that each group member followed for the majority of the project timeline.

Section	Initial writer	Main editor	Final edits
Abstract	Gabby	Michelle	Nika
Executive summary	Gabby and Nika	Michelle	Nika
Introduction	Michelle	Gabby	Nika and Sam
Background	Gabby	Michelle	Nika
Methodology	All collectively wrote and discussed	Michelle	Gabby and Michelle
Results and Analysis	Gabby and Nika	Michelle and Sam	Michelle
Conclusion	Gabby and Sam	Michelle	Nika
Appendices	All contributed	Michelle	Nika

The following paragraph discusses each group members' contribution to the data collection and analysis process. Michelle and Gabby facilitated and took notes during most interviews, while Sam led a couple of interviews. Regarding the data coding, Nika and Sam completed the majority of the research of data coding software. Additionally, Nika created the whole list of codes to use during the analysis, and Sam refined this list. Nika also completed the majority of the first reads of coding for an interview and its transcript, as well as compared the coded interviews completed by other group members. The coding of the rest of the interviews was mostly divided evenly between group members Sam and Gabby with Michelle tagging a few of the transcripts.

Regarding communication, including emailing and organizing meetings with our sponsors and advisors, Michelle took the lead. Michelle wrote most of our group emails. In addition, she kept our group alias and outlook calendar up to date and organized. Whenever the group had to travel, Michelle or Sam helped organize train and bus departures. Sam led the organization and formatting of the final paper, including formatting the table of contents, table of figures, and table of tables. All group members created figures for the final paper.

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EXECUTIVE SUMMARY

BACKGROUND

The Wairarapa Moana is an extensive wetland system located on the southern part of Aotearoa New Zealand's North Island. The system is comprised of three main bodies of water: the Ruamāhanga River, Lake Wairarapa, and Lake Ōnoke. The Wairarapa Moana is culturally and economically significant to many Māori [indigenous people] from Ngāti Kahungunu and Rangitāne [iwi, or tribes of the area], farmers, and recreational users and has been since the arrival of humans in Aotearoa New Zealand. Original Māori residents placed cultural and spiritual importance on this land. The water in the Wairarapa Moana provided abundant food sources such as tuna [freshwater eel]. The native Māori residents of the area prioritized living with the natural behavior of the environment and appreciated its organic flooding. This land was part of their mauri [life force]. In the 1800s, European settlers began to arrive and spread throughout Aotearoa New Zealand, including the Wairarapa Moana. Management and ownership over the area shifted into the hands of the Europeans, as agriculture in the lush flat valley took root. Soon, the Wairarapa Moana was home to many cattle and supported the livelihood and passions of the new farmers.

The farmers did not favor the natural flooding of the Wairarapa Moana. When the area flooded, water covered their fields and destroyed their harvests. To prevent this, the government developed the Wairarapa Moana Lower Valley Development Scheme in the 1960s. This scheme redirected the Ruamāhanga River around Lake Wairarapa to prevent deluges from upstream and installed barrage gates at the exit of Lake Wairarapa to prevent tidal flooding. This effectively redesigned the Wairarapa Moana and protected farmland so agriculture could thrive. However, there were unintended consequences of cultural and biodiversity losses. With decreases in water flow and depth in an already shallow lake, fewer native species entered the waterways, including tuna. Native wetlands of the area could no longer be used traditionally by the Māori.

Looking at the current state of the Wairarapa Moana, it is evident that the system is now unhealthy and in need of restoration. Sediment levels are rising as by-products from nearby developments collect in the now stagnant water. Additionally, wetland areas have lost their native ecosystems due to low water levels and the addition of invasive species. The community has noted the damage and is working on restoration efforts. In 2022, Kāhu Environmental Limited developed the Wairarapa Moana Restoration Plan to outline restoration steps focusing on biodiversity and engagement. We were tasked with evaluating whether this plan was successful in considering all stakeholder perceptions. The goal of this project was to develop

recommendations for the Wairarapa Moana Restoration Plan to be more holistic by identifying the common priorities of stakeholder groups. To accomplish this goal our team outlined the following objectives:

1. Study the restoration plan, the site, and the existing environmental legislation concerning the Wairarapa Moana
2. Capture the range of stakeholder positions and perceptions of the proposed restoration strategies
3. Develop recommendations for the priorities of a holistic restoration plan

METHODOLOGY

To begin, we conducted archival research, performed site visits, and conducted policy interviews. We learned about governmental strategies that were recently implemented, such as co-governance between the Māori and the British Crown. We also studied treaties and settlements between Māori and the Crown. During site visits, we documented the poor state of the Wairarapa Moana using photos captured on our phones. To learn more about relevant legislation, we conducted interviews with four experts on Te Mana o te Wai policy, the Māori concept of the "power of water". Interviewees ranged from policy makers with government and Māori perspectives to local community center workers in Wellington. From these interviews, we gathered that the Ministry for the Environment provides funding for community efforts specific to each unique situation in the implementation of Te Mana o te Wai. The most important requirement for this work is partnership with the tangata whenua [local indigenous people]. Misunderstanding between government interpretation, public opinions, and Māori on some aspects of the policy is an obstacle in the implementation.

Next, to capture the range of stakeholder perspectives we conducted another round of interviews (Objective 2), using a semi-structured interview strategy. This loose style of interviewing allowed the interviewees to share more of their knowledge with us, rather than be bound to specific questions. These interviews differed from the educational interviews described above regarding Te Mana o te Wai. We interviewed four major stakeholder groups including government officials, farmers, iwi members, and recreational users to capture the range of their perceptions on the current restoration efforts at the Wairarapa Moana.

RESULTS AND ANALYSIS

The 5th major stakeholder that was considered was Lake Wairarapa. To build Lake Wairarapa's stakeholder profile, we collected insights from all our interviewees on what they thought Lake Wairarapa would want in the restoration. We analyzed data and perceptions on the restoration efforts and the desires of Lake Wairarapa using NVivo and MAXQDA software. On transcripts of each interview, we labeled frequent trends in interviewee knowledge and answers with specific codes. First, we will explain the finalized stakeholder profile that we formulated for Lake Wairarapa.

Ten of our 13 interviewees responded that they thought Lake Wairarapa wanted to be healthier, but their descriptions on how to achieve this varied. Responses that we included in the Healthy category incorporated desired for improving biodiversity and water quality. Six of our 13 interviewees expressed how Lake Wairarapa wants to be healthier by increasing its native biodiversity and its native wetlands. In addition to being healthy seven of our 13 interviewees expressed how Lake Wairarapa wants to be engaged with more by the community. Results therefore reveal that Lake Wairarapa wants to be healthier by having its native biodiversity and wetlands restored and to have more engagement with the surrounding communities. For the three most frequent answers, at least one interviewee from each stakeholder group agreed.

Further analysis revealed that the major challenges facing the restoration efforts are the conflicting interests of stakeholder groups, politics, and bureaucracy and regulation. For these three most frequent answers, at least one interviewee from each stakeholder group agreed. Twelve of our 13 interviewees expressed varied interests of stakeholder groups as a major challenge facing the restoration efforts, making it the most frequent answer, while five of them also mentioned social challenges such as lack of trust, historical context, unreasonable expectations, and racism. Eight of our 13 interviewees mentioned bureaucratic barriers and regulations as another major challenge in the way of obtaining productive results. Additionally, seven of our 13 stakeholders expressed lack of political interest as a major challenge.

Along with these three major challenges facing the restoration efforts, we considered what our stakeholders would incorporate in their own ideal restoration. This data collection and analysis aided us in developing our recommendations for a more holistic plan because we compared the main priorities from each stakeholder group. At least one interviewee from each stakeholder group expressed the following perceptions. In their ideal plan, ten of our 13 interviewees included improving water quality, nine of our 13 interviewees included increasing biodiversity, and seven of our 13 interviewees included increasing engagement. This encompassed engagement between the community and the wetlands, in addition to engagement between stakeholder groups.

RECOMMENDATIONS

Before developing our recommendations, we considered the approaches in the Wairarapa Moana Restoration Plan. To maintain consistency with our data on stakeholder perceptions and Lake Wairarapa's desires, we focused on approaches in the plan that corresponded with our most popular stakeholder perspectives on their ideal plans. Specifically, we observed the site-specific approaches relating to water quality, biodiversity, and engagement. The recommendations are explained in order of importance to our interviewees: water quality, biodiversity, and engagement.

Recommendations for Water Quality

The plan briefly addresses solutions for improving water quality in the area; however, it is not the plan's main priority. We recommend improving stock exclusions and sewage management. Half of the site-specific plans include stock exclusions (Kāhu Environmental, 2022). Moving fencing back from the edge of the water would create space to cultivate a native riparian border. Aotearoa New Zealand studies show that the roots of the plants located along the edge of the waterway could trap and absorb chemical runoff that is leaching from the farm soil into the water (*A Tree That Could Help Save Rivers*, 2023; Gines & Mishra, n.d.). We understand this would reduce land to raise livestock, so we recommend growing native manuka trees and kawakawa plants which could be used to make products which could be sold for profit.

We recommend that a few other solutions be further investigated by those with more expertise. First, we recommend investigating making a wetland downstream of the sewage pond on Donald's Creek to naturally filter out excess nutrients and sediment of the treated sewage. This would be similar to the manmade wetland system implemented at Kaiwaiwai Dairy Farm. Additionally, we recommend looking into the possibility of reconnecting the Ruamāhanga River to Lake Wairarapa and dealing with sediment further up the catchment.

Recommendations for Biodiversity

The plan strongly focuses on addressing the biodiversity in the area. Our data supports continuing to implement efforts to combat this, with the addition of combatting pest fish. An interviewee suggested sailing a flat boat across areas of the wetland to strip up the pest fish and harvest them out of the lake. We recommend asking fish and game experts for help on looking into this strategy and other methods. We understand that diminishing pest fish would disadvantage recreational fishers. If native fish populations return because of these efforts, then recreational fishers could fish for native species such as tuna.

Recommendations for Engagement

Briefly alluded to in an appendix, the plan suggests a summer day camp using the existing infrastructure. We think a summer day camp would be very effective in connecting newer generations to the Wairarapa Moana and should be highlighted in greater detail in the plan. Additionally, we also recommend field trips to the Wairarapa Moana allowing students to see and connect with the area. Establishing camps and field trips to the region will encourage youth engagement with the Wairarapa Moana and motivate future generations of government officials, Māori, farmers, and recreational users to care for the area.

CONCLUSIONS

By encouraging such youthful engagement in conjunction with improving water quality and increasing native biodiversity, the Wairarapa Moana Restoration Plan will align more closely with the desires of its stakeholders. Future research could delve into community perceptions of specific restoration strategies rather than the overall plan. Another research avenue could investigate how to communicate the ideas and strategies presented in the Wairarapa Moana Restoration Plan in a succinct and easy to understand way to the wider community, possibly through storytelling.

GLOSSARY

Te reo Māori	English translation used[1]
Aotearoa	Land of the long white cloud, name of New Zealand
Hapū	Subtribe of families
Iwi	Tribe
Kaitiakitanga	Guardianship and stewardship
Kaiwhakahaere taiao	Environmental manager
Kākahi	Freshwater mussel
Kāwanatanga	Governance
Mahinga kai	Traditional food sources and methods of gathering
Mauri	Life-force
Pātiki	Flounder type fish
Pepeha	Proverb of the ancestors and Māori introduction that includes relations to natural landmarks, such as mountains and rivers
Rongoā	Māori remedies and wellness
Tangata whenua	Local indigenous people of the land
Taonga	Treasure
Te ao Māori	Māori worldview
Te Ika-a-Māui	The fish of Māui, name of the North Island
Te Mana o te Wai	The power of water
Te taiao	The natural environment
Tonga	South
Tuna	Freshwater eel
Whakapapa	Geneaology

[1] As opposed to English where there are many words that have the same meaning, words in te reo Māori often have multiple meanings which are discerned through context (Smith, Ra). In the glossary, we have translated the words according to the definitions we meant in context, but please note these are not the only definitions. For example, hapū can also mean pregnant.

CHAPTER 1: INTRODUCTION

The Wairarapa Moana is a wetland system that includes Lake Wairarapa, Lake Ōnoke, the Ruamāhanga River, and the surrounding wetlands located on Te Ika-a-Māui [the North Island] of Aotearoa New Zealand. For hundreds of years, local Māori have revered Wairarapa Moana as a taonga [treasure], recognizing its immense cultural and spiritual significance (*Wairarapa Moana Wetlands Project*, n.d.). This wetland system is home to a wide diversity of flora and fauna, which has made this region recognized as an internationally protected Ramsar site.[2] In addition, the wetland system is important to various groups who live and work near the Moana, including local farmers, neighboring iwi, governmental bodies, and recreational visitors. The Moana shares a complex history of cultural, economic, and bureaucratic issues and triumphs with stakeholders.

Co-governance strategies in Aotearoa New Zealand have been challenged by a cultural divide between Māori and European frameworks, with western colonization dominating. In recent years, the country has taken steps to include Māori principles in their governing strategies. The step most impactful to the Wairarapa Moana is the inclusion of "Te Mana o te Wai" in the National Policy Statement for Freshwater Management. Te Mana o te Wai, which translates from te reo Māori [Māori language] to "the power of water" prioritizes the health of the water above drinking and commercial needs (*NPSFM*, 2020).

Recent studies on the Wairarapa Moana indicated that the stakeholders largely agree that the health of the wetlands has deteriorated (Mazzucco et al., 2016). Major stakeholders include farmers, government employees, recreational users, and iwi members; yet each stakeholder has a unique perspective on how to restore it and at which point restoration can be deemed successful. The disagreements between stakeholders regarding best practices to restore the health of the water system have resulted in uncertainty about outcomes for the Moana.

In 2022, Kāhu Environmental Limited developed the Wairarapa Moana Restoration Plan, which outlined steps to be completed between 2022 and 2025 to improve cultural, ecological, and pest issues, while creating jobs, celebrating events, and monitoring the wetland system. We evaluated the current Wairarapa Moana Restoration Plan by collecting feedback from the stakeholders. Considering the conflicts regarding the management of the lake as reported by previous research teams (Boynton et al., 2022; Dalton et al., 2021; Mazzucco et al., 2016), it was important to identify how the proposed plan aligned with the interests of all those involved to

[2]Ramsar sites are wetlands internationally recognized for their crucial global biodiversity by the Convention on Wetlands (*Ramsar Site(s)_1*, 2018).

bridge the divide. This better informs the next holistic steps for the plan while maintaining support from all parties as well as the mauri of the Wairarapa Moana. To accomplish this goal, we identified the following objectives: 1. Study the site, existing environmental legislation concerning the Wairarapa Moana, and the Restoration Plan; 2. Capture the range of stakeholder positions and perceptions of the proposed restoration strategies; and 3. Develop recommendations for the priorities of a holistic restoration. Based on our findings, we recommend improving the water quality through fencing changes and natural filtration, improving biodiversity through strategies proposed in the plan with the addition of managing pest fish, and improving engagement between communities and the Moana through youth outreach. Our work ensures that all stakeholders' perspectives are represented to create a more holistic, and therefore supported, restoration plan for the Wairarapa Moana.

This paper breaks down the process to achieve these objectives into four chapters. The first chapter, the Background Chapter, familiarizes the reader with the complex cultural, economic, and political situation. The Methodology Chapter describes site visit documentation and interview strategies. The third chapter, the Results, Analysis, and Recommendations Chapter, states and analyzes our findings and includes our recommendations. Lastly, the Conclusion Chapters explain the lasting effect of this project.

CHAPTER 2: BACKGROUND

Located in the Wairarapa region, the Wairarapa Moana is the largest wetland system on the southern part of Aotearoa New Zealand's North Island (*Wairarapa Moana Wetlands*, n.d.). We illustrate the evolution of the Wairarapa Moana wetlands through a form of storytelling, where you will get to know the character of focus, Lake Wairarapa. We take you on the journey from when the Wairarapa Moana was first discovered by Māori settlers, to its current position in Aotearoa New Zealand. Lastly, we explain the importance of this Interactive Qualifying Project (IQP) that is sponsored by Rawiri (Ra) Smith and Ian Gunn.

We will start a long time ago…

when the Wairarapa Moana was first encountered by humans. Long after Māui pulled the fish that became the North Island out of the water, Haunui-ā-Nanaia rested from his pursuit of his wife and her lover at the summit of Remutaka. As he looked down from the peak, his eyes began to glisten with tears as he observed the mauri [life source] and calming presence of the water that lay at the base. Hence, he named Wairarapa Moana, "sea of glistening waters" (Smith, Ra). The Wairarapa Moana encompasses the freshwater Lake Wairarapa, the estuarine Lake Ōnoke, the Ruamāhanga River, and many surrounding swamps, marshes, rivers, and streams (see Figure 1).

Figure 1 The Wairarapa Moana region with Lakes Wairarapa and Ōnoke (Google Maps).

Soon the beautiful land **received more Māori people**, with its rivers boiling with tuna on their migration to tonga [south], its beds nourishing colonies of kākahi [freshwater mussel], and its life-giving mana [power]. Lake Wairarapa and its surrounding wetlands became a cultural meeting place and source of kai [food]. The people learned from the natural processes of the lake. They understood its natural floods and appreciated them as a means of new growth.

In the early 1830s **Europeans began arriving** (*History of New Zealand, 1769-1914*, 2020). Western settlers carried with them changes from across the oceans such as mammals for farming, new species, new beliefs and religions, and new goods for trading. These new people favored the lush sprawling flatlands with many rivers throughout for farmland. Aimed at obtaining sovereignty over the entire country with the consent of the Māori chiefs, the British Crown drafted the Treaty of Waitangi in 1840. More than 500 **Māori chiefs signed the Treaty of Waitangi** (*History of New Zealand, 1769-1914*, 2020). Different understandings of the treaty make it controversial now. Most notable the word "sovereignty" was translated as "kāwanatanga" [governance] in the Māori version (*The Treaty in Brief*, 2017). Following the ratification of the treaty, the Māori suffered immense human and cultural losses. During the next 45 years, estimates of Māori population almost halved from 80,000 to 42,000, partially due to the diseases introduced by European colonists (Pool & Kukutai, 2011).

With the signing of the treaty more Europeans arrived and with the establishment of more and more farms, the new settlers soon began to call the Wairarapa Moana home as well (Halford, 2019). It was a caregiver that supplied them with all their needs; however, space and usage of the Wairarapa Moana was limited. As new species made themselves comfortable (Ogle, n.d.), they **harmed species native to the Wairarapa Moana** (*Resource Management Act 1991 No 69*, 2022).

Additionally, western farmers entering the region interfered with the practices of the Māori. The Māori used the land as a life source and prioritized living with the natural functioning of the environment. Since the British Crown took control of Māori land in the 19th century, new landowners took over and sought economic and occupational use of the land (*The Unsettling Truth about the Treaty*, 2018). The shift in power and land ownership to **the British Crown soon interrupted the initial and traditional use of the region** resulting in significant environmental changes. For example, the Ruamāhanga Catchment lost roughly 98% of the wetlands it once had before human settlement (see Figure 2) (Tomscha et al., 2019).

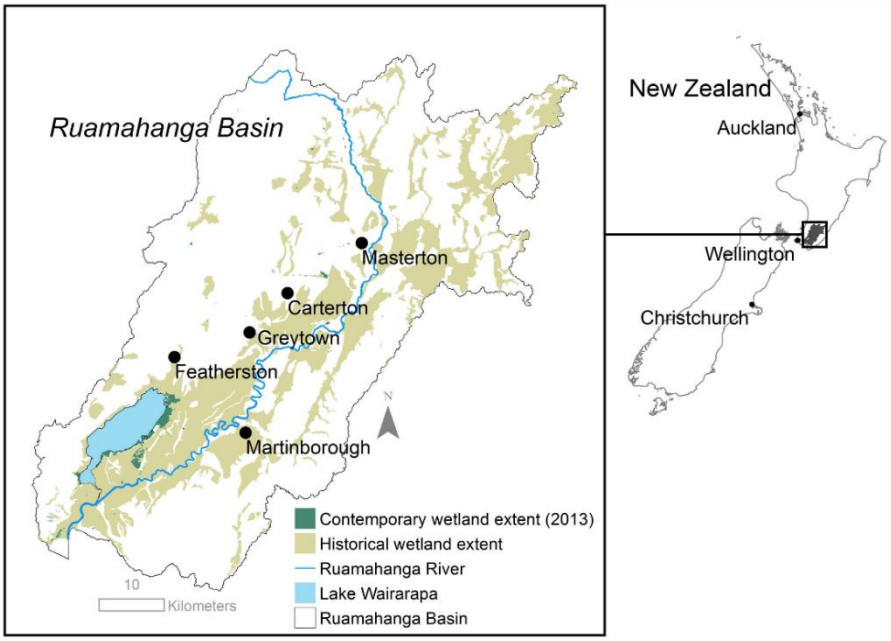

Figure 2 Historical versus contemporary wetland coverage of the Ruamāhanga Basin (Tomscha et al., 2019).

Nevertheless, Lake Wairarapa continued flooding, sometimes to three times its size. In 1947 Lake Wairarapa flooded drastically, encompassing extensive areas of land, including the surrounding farmlands. In the 1960s, **the government developed the Lower Wairarapa Valley Development Scheme to prevent such flooding and to contain the lake**. This scheme included diverting the Ruamāhanga River around Lake Wairarapa, as well as controlling the lake with barrage gates (*Lower Wairarapa Valley Development Scheme | Greater Wellington Regional Council*, n.d.). With the flooding of the lake under control, more land became available.

The installation of the barrage gates and redirection of the Ruamāhanga River benefited the community is some ways; but nevertheless, there were **consequences for the Wairarapa Moana**. The barrage gates controlled and isolated Lake Wairarapa. Runoff and sediment from surrounding farms and developing nearby towns accumulated in the lake (EWG, n.d.). Lake Wairarapa's water became cloudy due to low water levels and chemical build up (Perrie & Milne, 2012). The water quality and health of the Wairarapa Moana diminished, and with it, its mauri. With the decrease of water flow and water depth, smaller amounts of tuna passed into the lake. Personal anecdotes collected from Wairarapa residents detail changes they have witnessed since they were children (*WAIRARAPA Lake Stories*, n.d.). One resident, Teresa Aporo, reminisced about eeling with her brothers on the Ruamāhanga River. She remembered all the activities happening on the Wairarapa Moana when she was a teenager and remarked on the lack of it now because of how dirty the water has become. She recalled how the bird life disappeared and the water level had dropped. Taiawhio Gemmell remembered the only and last time he saw the practice of eeling when he was five or six years old in the 1970s-1980s (*WAIRARAPA Lake*

Stories, n.d.). This mātaranga Māori informs the science which shows a biodiversity deficiency. Currently the wetland system hosts a total of 327 species: 189 of which are indigenous and 138 of which are invasive to Aotearoa New Zealand (Ogle, n.d.). In 2020, an updated article in the Resource Management Act recorded that nearly 30% of the native species are endangered or threatened, meaning more than 50 of the native species are in danger (*Resource Management Act 1991 No 69*, 2022). Additionally, some native wetlands diminished without the water flow encompassing them.

The government created the "National Water Conservation (Lake Wairarapa) Order" in 1989 to improve the health of Lake Wairarapa and recognize the role that the lake plays in wildlife habitats with its natural water level fluctuations which it calls "an outstanding feature of Lake Wairarapa" (Paul Reeves, Governor-General, 1989). Furthermore, the Waitangi Tribunal, which was built off the Treaty of Waitangi Act, resulted in more awareness surrounding Māori philosophies and cultural significance of sites such as the Wairarapa Moana. A Deed of Settlement passed through Parliament in December of 2022 **granting ownership of the beds of Lake Wairarapa and the Ruamāhanga River to Ngāti Kahungunu and Rangitāne** (Fuller, 2022).

Presently, the **Moana needs restoration**. The Wairarapa Moana is important in the lives of many people including farmers, government employees, recreational users, and iwi members, who notice the damage in the area. The community has started helping the Moana by putting new rules in place. In 2022, **Kāhu Environmental developed the Wairarapa Moana Restoration Plan** to outline approaches to improve the health of the Wairarapa Moana. The plan works to incorporate co-governance strategies newly established between the British Crown and original Māori settlers.

The Wairarapa Moana Restoration Plan focuses on the cultural, ecological, recreational, and economical values of the area. To incorporate traditional Māori culture and concepts, the plan incorporates Te Mana o te Wai, a new policy that governs the community's relationship with fresh water. This regulation includes involving the tangata whenua [local indigenous people] to lead a more partnered approach for managing the freshwater body (Kāhu Environmental, 2022). To address ecological concerns in the area, the plan aims to improve diverse ecosystems in and around Lake Wairarapa through initiatives surrounding planting and pest trapping efforts. Regarding recreational and economic value, these objectives of the plan are less detailed than others, but still important for restoration. Within these two categories, strategies are incorporated into the cultural and ecological value sections.

Ever since the plan was published in 2022, there have been steps taken to put it into action; however, different groups feel underrepresented and not listened to. It is necessary that we **listen to and evaluate all the main stakeholders' perspectives** to create recommendations

for the restoration. The five main stakeholder categories we focus on for this project are local iwi, farmers, government employees, recreational users, and Lake Wairarapa. For the plan to be effective, **stakeholder groups and the community in Aotearoa New Zealand need to agree and compromise on restoration strategies for the well-being of the Moana**. It is important for both stakeholders and the public to acknowledge that we as a population are healthier when the environment is healthier. This IQP holds great significance to not only the surrounding Wairarapa community, but also the greater Aotearoa New Zealand community.

Our IQP is sponsored by Rawiri (Ra) Smith and Ian Gunn. Ra is the Kaiwhakahaere Taiao [Environmental Manager] for the Kahungunu ki Wairarapa and advised the Ngāti Kahungunu Ki Wairarapa negotiators on whakapapa [genealogy] and taiao [environment] during the Deed of Settlement negotiations. Ian is a retired Environmental Manager for the Greater Wellington Regional Council (GWRC) with a focus on projects concerning the Wairarapa Moana wetlands. Ra and Ian shared their insight and some perspectives on what they deem a holistic plan. Ra and Ian's major goal, besides sharing their own knowledge with us, was to connect us with other members of the community so we may try and recommend more holistic approaches for the Wairarapa Moana Restoration Plan.

CHAPTER 3: METHODOLOGY

In this section, we review the goal and objectives for our project and explain the methodologies for completing each objective. The goal of this project was to develop recommendations for the Wairarapa Moana Restoration Plan to be more holistic by identifying the common priorities of stakeholder groups. To accomplish this goal our team:

1. Studied the restoration plan, the site, and the existing environmental legislation concerning the Wairarapa Moana
2. Captured the range of stakeholder positions and perceptions of the proposed restoration strategies
3. Developed recommendations for the priorities of a holistic restoration plan

Figure 3 below maps our strategies for accomplishing each objective.

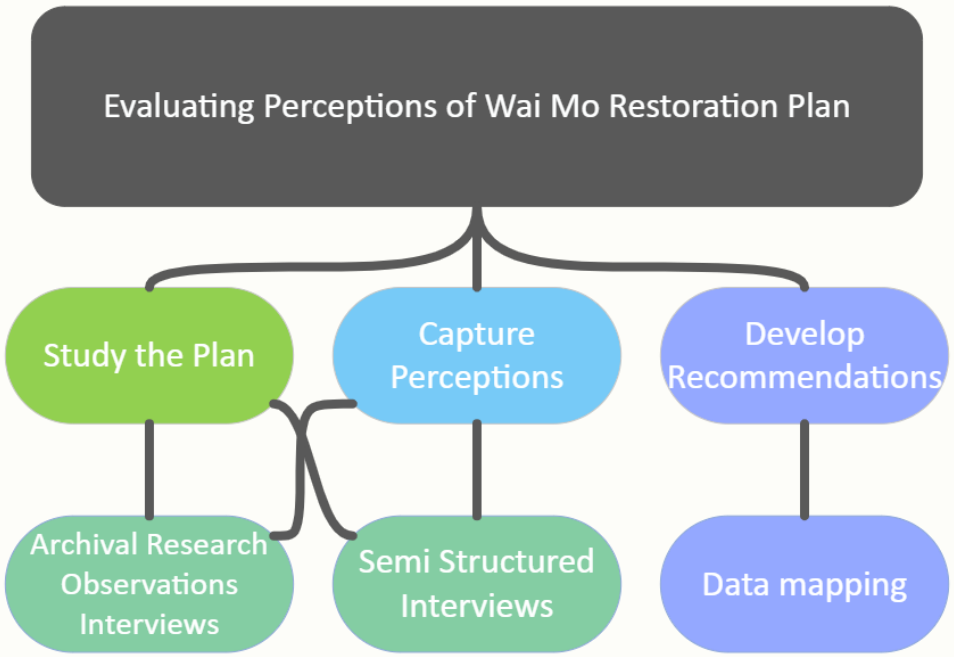

Figure 3 Flow chart displaying the purpose of each action.

OBJECTIVE 1: STUDY THE SITE, EXISTING ENVIRONMENTAL LEGISLATION CONCERNING THE WAIRARAPA MOANA, AND THE RESTORATION PLAN

Our first objective was to conduct baseline research to better understand the site and the restoration plan as it exists now. We visited the Wairarapa Moana with our sponsors where they guided us through the flow of the water and highlighted important sites, such as the barrage gates, Lake Wairarapa, and Lake Ōnoke. To understand the region, we photographed and documented observations of the wetlands and its environs. This included areas we observed to be in poor states, for example sedimented waters and wetlands that had been invaded by pests. We gained a full understanding of the region, which prepared us for the interviews with stakeholder groups. This allowed for a visual and spatial understanding of the Moana and its communities as well as comparisons of their standpoints with our archival research. We prioritized the interviewees' opinions over the archival research findings when we formulated the recommendations.

Our approach for policy and plan comprehension was to conduct thorough archival research and interviews with those familiar with the Te Mana o te Wai policy. This involved reviewing historical documents and recent policy decisions. We gained clarity with local treaties, legislation, orders, policies, and other recent community decisions. Regarding the interviews, we asked interviewees from governmental and Māori standpoints about the Te Mana o te Wai freshwater management system. This strategy was necessary to better interpret the circumstances of the governance of the Wairarapa Moana as the context for the restoration plan. To augment this baseline research, we conducted in-depth interviews with Te Mana o te Wai experts. The interview strategy is explained in the following section; however, the list of questions is in Te Mana o te Wai Interview Questions in Appendix A.

OBJECTIVE 2: CAPTURE THE RANGE OF STAKEHOLDER POSITIONS AND PERCEPTIONS OF THE PROPOSED RESTORATION STRATEGIES

The second objective was to understand and record the range of stakeholder positions and perceptions of the proposed restoration plan as well as their values. This plan directly affects a considerable number of stakeholders, as it dictates how individuals and communities can interact with the Moana. Our sponsors provided contacts for key interviews. We used semi-structured interviews as a means of collecting stakeholders' perspectives. We loosely organized lists of questions, found in Stakeholder Interview Questions, to let the interviewee "speak for themselves" (Ward, 2014). Furthermore, the unique structure of these interviews allowed flexibility in the conversation, so if questions were already answered by the interviewee as part of the answer to another question, we did not ask them again. We retrieved as much knowledge as possible from each interviewee. The interviewees were encouraged to speak freely without

being constrained, while guided in a general direction. It emphasized the importance of building a collaboration between the interviewer and interviewee, rather than interviewing solely to extract information (Ward, 2014).

We interviewed a few representatives from each stakeholder group. These included a sample of recreational users, partners among the Ngāti Kahungunu and Rangitāne communities, government employees, and farmers. We held the interviews in person (at various locations in Wellington and Wairarapa), and over Zoom. With consent, we recorded and transcribed the interviews. The consent forms for recording interviews and using interviewee information can be found in Appendix A: Interview Information. We arranged two interviewers per interviewee, with one facilitator and one notetaker. We interviewed select stakeholders at the beginning of the project, but most of our interviews had to be conducted after Aotearoa New Zealand's end of holiday season in February.

During each interview we posed a few reoccurring questions. For instance, we asked each interviewee how they or their respective group interacted with the other groups involved in the area. This helped us gauge the dynamics and relations between the stakeholder groups. The most important questions that we asked all the interviewees were, "What do you think Lake Wairarapa would want for itself?", "If this were an ideal world and you had all the resources you need, what would you do to completely restore the area?", and "What do you see as some of the big challenges facing the plan?". Asking each stakeholder to give their perspectives on this enabled us to develop a point of view for Lake Wairarapa itself. See Appendix A: Interview Information for detailed questions. We coded all the data to look for recurring themes as explained in the next section.

OBJECTIVE 3: DEVELOP RECOMMENDATIONS FOR THE PRIORITIES OF A HOLISTIC RESTORATION PLAN

To develop recommendations for the priorities of a holistic restoration plan, we analyzed the range of stakeholder perceptions and identified common trends throughout all perceptions. We read through interview transcripts and listened to interview recordings to isolate reoccurring themes that appeared in the interviews. Using two qualitative data analysis software, NVivo and MAXQDA, two group members independently coded sections of each interview transcript according to the codes listed in

Appendix B: Data Coding. Next, a group member compared and combined the two separately coded interviews to ensure all codes and themes were accurately recorded.

By providing organization and structure to our data, qualitative coding added to the interpretation of the interview responses, the site visits, and the baseline findings. We processed our data from notes and transcripts and grouped responses thematically. We mapped the positions and perspectives of our stakeholders to inform our recommendations (*Essential Guide to Coding Qualitative Data*, n.d.).

We developed recommendations based on the assessment of our data from Objectives 1 and 2. We organized suggestions on what to prioritize or modify in the restoration plan to acknowledge the range of stakeholders' perspectives. The recommendations encouraged a participatory process, since improving the health of the Wairarapa Moana means looking at the whole experience.

CHAPTER 4: RESULTS, ANALYSIS, AND RECOMMENDATIONS

In the following sections, we explain the results and analysis process for this project. The results and analysis specific to each of the three objectives are elaborated on sequentially throughout the section. We analyzed two different types of interviews. We interviewed four experts on Te Mana o te Wai to address the existing environmental legislation of Objective 1. We then conducted and analyzed 13 interviews for stakeholder analysis for Objectives 2 and 3.

OBJECTIVE 1: STUDY THE SITE, EXISTING ENVIRONMENTAL LEGISLATION CONCERNING THE WAIRARAPA MOANA, AND THE RESTORATION PLAN

We obtained the following findings through interviews and site visits to the Wairarapa Moana. The National Policy Statement for Freshwater Management is one of the most consequential environmental legislations to the Wairarapa Moana. Te Mana o te Wai is the main concept of the legislation and is a Māori phrase which prioritizes ensuring the life-supporting capacity of freshwater (*Te Mana o Te Wai Implementation*, 2021). Through interviewing policy makers Patsie Karauria and Jovan Motaraka-Harris at the Ministry for the Environment, policy contributor Riki Ellison at Te Puni Kōkiri, and community projects leader Ihaia Pukatapu, we gained the following understanding of the Te Mana o te Wai policy (see Table 1). While Te Mana o te Wai is part of national policy, communities implement it on the local scale. All four interviewees revealed this idea during our discussions on Te Mana o te Wai.

Table 1 Interviewees and their positions relative to working alongside Te Mana o te Wai.

Te Mana o te Wai Interviewees	Role
Patsie Karauria	Policy maker at the Ministry for the Environment
Jovan Motaraka-Harris	Policy maker at the Ministry for the Environment
Riki Ellison	Te Puni Kōkiri - Ministry of Māori development
Ihaia Pukatapu	Community projects leader

Karauria, Motaraka-Harris, Ellison, and Pukatapu also expressed how **community participation and connection to its water is key**. From our second set of interviews which will be expanded upon in the next section, a local landowner and a farmer told us: “People doing things voluntarily inevitably gives a better outcome.” In general, the Ministry for the Environment funds communities to reach the desired goal of obtaining a healthy water source; however, the ways in which the community may value water and communicate with the tangata

whenua [local indigenous people] varies between places (Karauria, Patsie). According to all four interviewees, it is **necessary that the local government councils work and engage with the tangata whenua in each community, but there is no consistently effective method to actively involve tangata whenua** as each community is unique. To give an idea of how tangata whenua are being included in community decisions across Aotearoa New Zealand, we have provided some different strategies that were shared with us, which are displayed in the boxes below.

Regional committees comprised of half tangata whenua representatives and half regional council representatives (Karauria, Patsie).

Planting according to the moon cycle (Motaraka-Harris, Jovan).

Incorporation of regenerative farming in areas where water quality is poor due to farming practices (Ellison, Riki).

In different communities, the implementation of Te Mana o te Wai is sparking local projects. To understand such projects, we visited Ihaia Puketapu. Most of our conversation with Puketapu focused on the challenges of implementing Te Mana o te Wai in the Wellington community to resolve current issues with water management. While similar issues of urban and agricultural runoff contaminating waterways exist in Wellington, he investigates urban solutions rather than rural, agricultural solutions.

Frustrations and Hopes

Both Puketapu and Ellison expressed frustrations at a lack of consensus and willingness to contribute. Puketapu directed most of his **frustration at the authorities**. He explained how he has advocated to them to make a change, but they take no action. He says they prioritize money and financials though the community and legislature advise otherwise. Nevertheless, he still **has hope and has drafted some policies** in hopes the local government will enforce them.

Ellison expressed **frustration at the racial divide**. Because the freshwater management policy stems from the Māori concept of Te Mana o te Wai, he says some non-Māori people find it difficult to understand and do not see its significance in policy making (Ellison, Riki). Our sponsors corroborated this as well. There is misunderstanding specifically involved with the six principles of this policy. For example, the "Stewardship" principle is controversy for Māori and other parties involved in freshwater regions. Stewardship is similar to kaitiakitanga [guardianship and stewardship], but it is not the same. Māori words tend to have more complex definitions than their English translations (Smith, Ra). Some interpret it as a divide between Māori and those of European descent. They expect the Māori to protect their own land as they see fit, and the other

landowners to continue to use their portion as they intend (Ellison, Riki). However, Ellison explained to us that Te Mana o te Wai is about the water quality as a whole. To holistically achieve healthier water, everyone needs to work together, and it is not just the responsibility of the Māori. Healthier water cannot just be achieved in zones (Ellison, Riki). While this is an issue that needs to be addressed, Karauria expressed hope that efforts to implement **Te Mana o te Wai will encourage collaboration and improve these relations**. She explained to us that she has already seen progress in that direction with an iwi building ties with their local government to implement Te Mana o te Wai where previously there had never been any partnership (Karauria, Patsie).

Te Mana o te Wai relates to the management of the freshwater wetlands of the Wairarapa Moana wetlands because multiple ruling groups, both governmental and iwi, hold jurisdiction in this area. This results in conflicts and difficulty in decision making relating to the management of the wetlands as a whole. Observing how community projects tried to implement Te Mana o te Wai around the Wellington area helped us understand execution approaches for restoring freshwater bodies for the community. We used this information to create recommendations for restoring the freshwater of the Wairarapa Moana.

Site Visits

After visiting the Wairarapa Region on multiple occasions, we documented the state of the Wairarapa Moana through pictures and notes. The images taken are displayed in Figure 4 and Figure 5 below.

Figure 4 Eastern side of Lake Wairarapa.

From the image of Lake Wairarapa in Figure 4, it is evident that there are high levels of sediment in the water of Lake Wairarapa. The cloudiness and murkiness of the high levels of sediment obscure the bottom of the lake, despite its shallowness. Due to its shallow nature, sediment is easily stirred up because the water is easily influenced by wind and wave patterns (Smith, Ra). In addition, the water experiences higher levels of phosphorus chemicals due to the runoff from surrounding farms in the region (Smith, Ra).

As explained in the Background Chapter and from information from our sponsors, Ra and Ian, we know that the suspended sediment in the water harms the health of the Wairarapa Moana. The suspended sediment in the lake blocks nearly all sunlight which prevents photosynthesis and makes it almost impossible for plants to grow in the lake. Ecosystems cannot thrive in these conditions and the health of the Wairarapa Moana degrades. In addition, the sediment in the lake greatly decreases the water quality. Māori culture greatly emphasizes the power of water and its requirement to be healthy. When referring to Te Mana o te Wai principles, as discussed in the beginning of this chapter, the health of the water needs to be prioritized over economic or human use. With the sediment in the lake, it is clear that water quality is not prioritized over other uses in the region. The water is not living up to its full potential nor providing a healthy habitat for its native ecosystems.

As mentioned previously, farm runoff increases levels of phosphorus in the water of Lake Wairarapa. This chemical increase results in high levels of algae growth in the lake and surrounding wetlands. While the role of wetlands is to capture pollutants, the Wairarapa Moana wetlands are oversaturated.

Figure 5 Boggy Pond (left) and Mirror Lake (right) along the Mirror Lake Walk..

Boggy Pond is a Wairarapa Moana wetland, which contains high levels of phosphorus in its water. In contrast to the algae free surface of the Mirror Lake, the smothering green algae on

the surface of Boggy Pond is evident, as indicated by the yellow arrow in Figure 5 above. The reflections of the surrounding vegetation and mountains on the surface of Mirror Lake show its clear surface. The overgrown algae along the surface of Boggy Pond prevents any reflection of trees or bushes from being seen. The depictions of the water's surface of Boggy Pond further highlights the poor health of the Wairarapa Moana.

Like the suspended sediment, the algae overgrowth on the surface prevents sunlight from entering the water body. This results in similar effects on the ecosystem, including inhibiting plants from growing. Furthermore, the algae colonies consume large quantities of oxygen in the water. Without a sufficient oxygen source, native species cannot survive in these waters. The lack of native species deteriorates the health of the Wairarapa Moana. The tuna is an example of a native species that used to live in abundance in the waters of Wairarapa Moana. In the past, Māori used tuna as a life and food source. One of our Iwi Stakeholders shared that he had interviewed elders 20 years ago that used the Wairarapa Moana consistently throughout their life. His interviewees claimed the abundance of freshwater tuna had substantially decreased, and that once there were so many swimming through channels in the wetlands that people around could hear all the eels colliding with each other while passing through (Potangaroa, Joe). Currently, only about 30 longfin tuna are caught near the opening of Lake Onoke on their way passing through to the sea (Potangaroa, Joe). This decrease in native species, like the tuna, occurred alongside the increase of chemical runoff and algae growth encompassing the past 20-30 years.

We recorded this decrease and endangerment of native species in the Wairarapa Moana wetland area in our Background Section. On our site visits, we documented efforts to eliminate invasive species on land. Figure 6 documents two different traps. Trappers commonly use these traps to capture pests like possums, rabbits, and rats. These invasive species predate on the native species in the wetlands and pose a threat to the health of the area. As our group walked through Boggy Pond, we observed traps like these, set up frequently along the path which indicates that there are efforts and possibly funding for decreasing non-native species in the Wairarapa Moana wetlands.

Figure 6 Human set traps for invasive species at Boggy Pond.

The existence of the Wairarapa Moana Restoration Plan and the installation of pest traps in the area provide evidence of restoration efforts. Despite these efforts we observed the poor condition of the Wairarapa Moana. The water quality is poor, preventing people from using the lake as they once did. Native plants and animals struggle to live in these waters due to sediment, algae, and pest populations.

OBJECTIVE 2: CAPTURE THE RANGE OF STAKEHOLDER POSITIONS AND PERCEPTIONS OF THE PROPOSED RESTORATION STRATEGIES

The second objective included capturing the range of stakeholder positions and perceptions of the proposed restoration strategies through interviews. This set of stakeholder interviews differs from the educational interviews on Te Mana o te Wai. We interviewed four

stakeholder groups including government employees, farmers, iwi members, and recreational users. Two interviewees fit into two stakeholder categories and were categorized in both respective groups in the table below. However, to illustrate the data succinctly in the following graphs, we placed them in their more prevalent category. We conducted a total of 13 interviews in a four-week period to capture ranges of stakeholder perceptions on the restoration efforts in the Wairarapa Moana. Table 2 below presents the interviewees.

Table 2 Interviewees and the stakeholder group they are graphed in, indicated by the black "X". "o" indicates secondary category.

Stakeholder Number	Government (GWRC, DOC, and/or SWDC)	Farmer	Recreational User	Iwi (Ngāti Kahungunu, Rangitāne)	Lake Wairarapa
Stakeholder 1	X				
Stakeholder 2	X				
Stakeholder 3	X				
Stakeholder 4	o			X	
Stakeholder 5	X				
Stakeholder 6	X				
Stakeholder 7				X	
Stakeholder 8		X			
Stakeholder 9		X			
Stakeholder 10		X			
Stakeholder 11		X			
Stakeholder 12			X		
Stakeholder 13			X	o	

The Lake Wairarapa column in the table above represents the lake's stakeholder position. Since we could not interview Lake Wairarapa, we used input from all our interviewees to build this profile. Therefore, all interviewees contributed to this category in their own way. This section explains our findings from our stakeholder interviewers.

After coding all interviews in NVivo and MAXQDA, we determined common themes and frequent codes. The main categories of codes were assessments, challenges, knowledge, impact/significance, and suggestions/strategies. In addition to these main codes, we had codes to tag answers to specific questions to analyze the responses on restoration definition, the lake's perspective, and the interviewee's ideal plans.

Appendix B: Data Coding lists all of the codes. The level of frequency of codes highlighted the importance of certain themes to interviewees. First, we will explain Lake Wairarapa's finalized profile, and following we will explain our findings on stakeholder's perceptions of the restoration efforts at the Wairarapa Moana.

Lake Wairarapa

We used interviewees answers to the question, "What would Lake Wairarapa want for itself?" to build Lake Wairarapa's stakeholder profile. For the three most frequently mentioned answers, at least one interviewee from each stakeholder group agreed, supporting its relevance. Ten of 13 interviewees expressed how they thought Lake Wairarapa would want to be **healthier** (see Figure 7). The Biodiversity and Water Quality categories contribute to the Healthy category. Different approaches to improving the health of Lake Wairarapa stemmed from varying definitions of restoration, including themes of biodiversity and water quality. An Iwi Stakeholder is quoted in the box to the left and illustrates the majority consensus that Lake Wairarapa wants to be healthier. Figure 7 illustrates the common answers to what the lake would want for itself in the restoration.

> "I would dare say that anything would want to be healthy."
>
> -Iwi Stakeholder

The next most common opinion, expressed by seven of our 13 interviewees, was that the lake wants to be **more engaged with** the community (see Figure 7). A Government Stakeholder, quoted in the box to the right, expressed how the lake does not want to be isolated, but it is not easy to access (Government Stakeholder). With greater accessibility, it could create a desire for people to be around it (Iwi Stakeholder). Easier access would allow for more people to form connections with the lake and with the land (Iwi Stakeholder). Lake Wairarapa wants attention, especially in certain areas of the region where the place can be enjoyed (Recreational Stakeholder).

> "I don't think the lake wants to be isolated, I think it wants people in it."
>
> -Government Stakeholder

Additionally, six of our 13 interviewees said that the lake wants to **increase its biodiversity**, with four of them specifically referring to recovering populations of native species and getting rid of invasive species (see Figure 7). Relating to increasing Lake Wairarapa's biodiversity, interviewees commonly mentioned recovering its function as a healthy caregiver to contribute to the wider whenua [nation] (Government Stakeholder). This would include recovering its interactions with other ecosystems within it and surrounding it (Government

Stakeholder). This includes returning space to the lake to allow it to do what it is intended to do (Iwi Stakeholder).

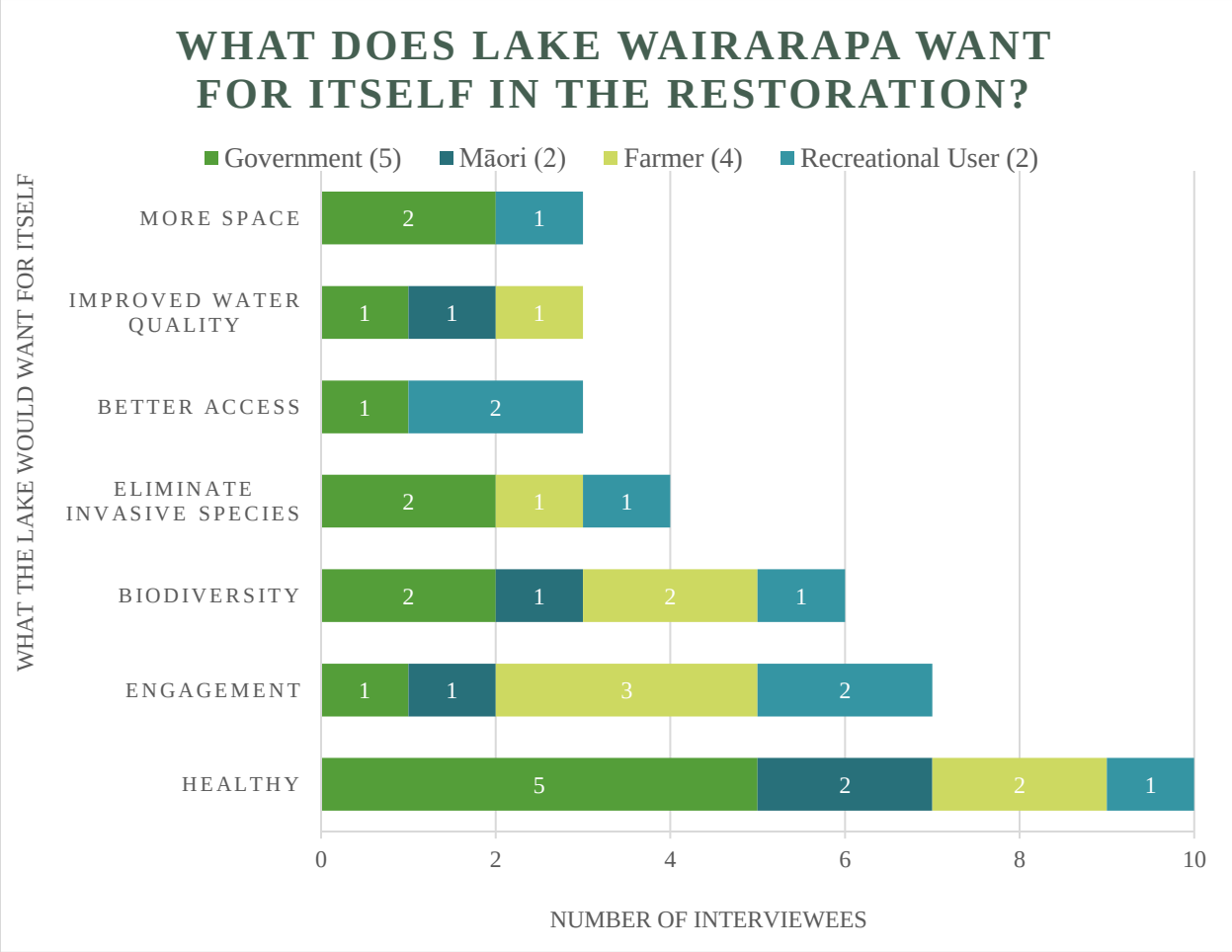

Figure 7 Interviewee perceptions on what they think the lake wants for itself.

Relating to increasing Lake Wairarapa's biodiversity, interviewees commonly mentioned recovering its function as a healthy caregiver to contribute to the wider whenua [nation] (Government Stakeholder). This would include recovering its interactions with other ecosystems within it and surrounding it (Government Stakeholder). This includes returning space to the lake to allow it to do what it is intended to do (Iwi Stakeholder). By giving the lake back its land, it will also return to its native roots, being surrounded by native wetlands that are not constrained (Farmer Stakeholder). A Farmer Stakeholder, quoted in the box to the left, emphasized the importance of the native wetlands. According to a

> "If I were the lake, the best thing I would like would be to be surrounded by native wetland."
>
> -Farmer Stakeholder

Recreational Stakeholder, the wetlands along the entirety of the eastern shore of Lake Wairarapa should be restored (Recreational Stakeholder). Additionally, the lifeforce of the lake would improve by recovering its caregiver role (Government Stakeholder). This would provide better access to cleaner water and make both the lake and community better than they were previously (Farmer Stakeholder).

According to the three most frequent interviewee answers to the question "What would Lake Wairarapa want for itself?", the profile reveals that Lake Wairarapa wants to be healthier by improving its biodiversity and water quality and to be more engaged with by the community. After completing the stakeholder profile for Lake Wairarapa, our group captured perceptions of the restoration efforts in the Wairarapa Moana of our five major stakeholder groups.

Challenges Facing the Restoration

When evaluating the coded interviews, many different challenges with restoration efforts were mentioned, as illustrated in Figure 8.

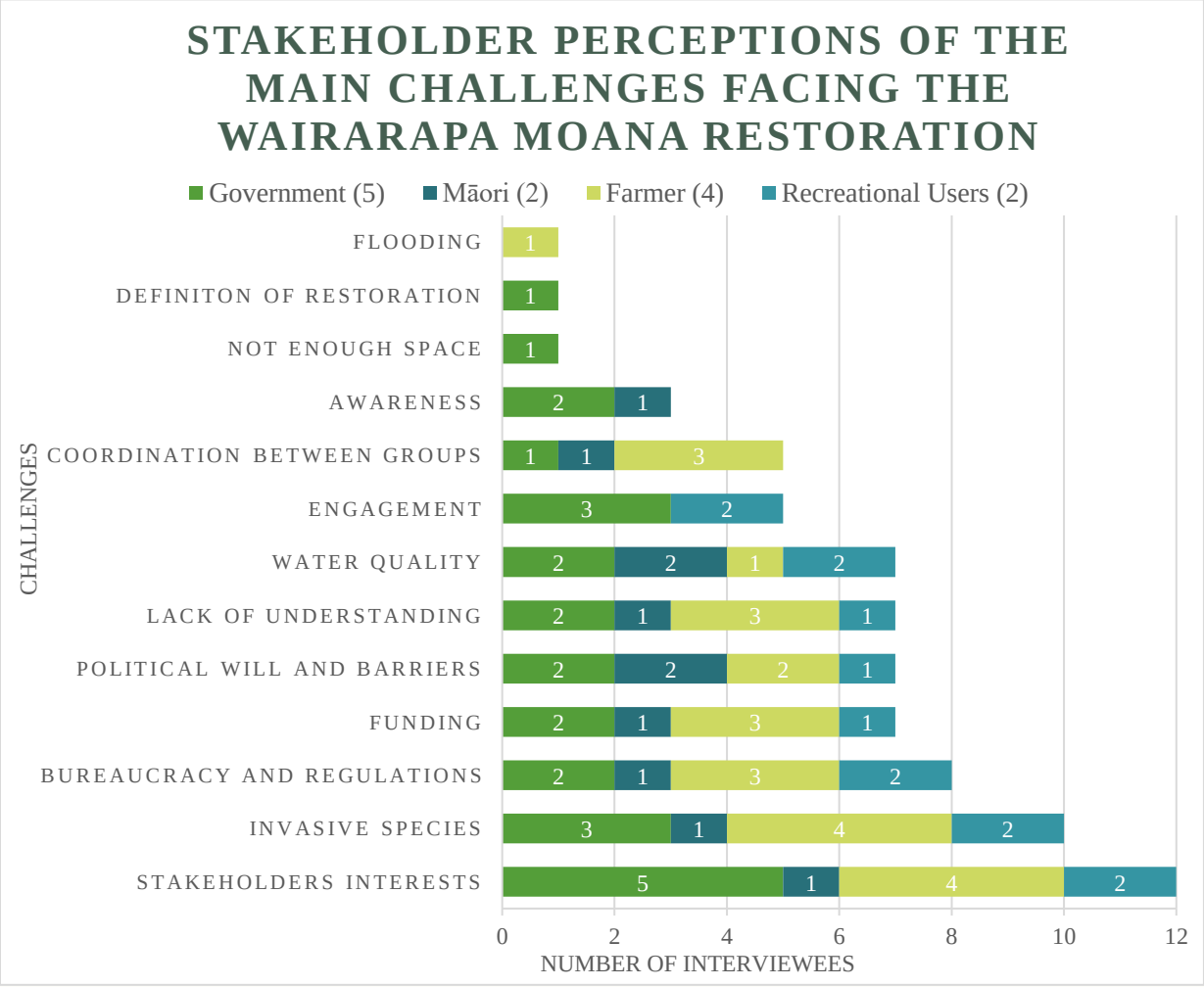

Figure 8 Major challenges facing the Wairarapa Moana restoration efforts perceived by interviewees.

At least one interviewee from each stakeholder group agreed on one of the three most frequently mentioned challenges of stakeholder interests, invasive species, and bureaucracy and regulations (see Figure 8). All but one interviewee discussed the challenges of differing **stakeholder interests**, making this the most frequent challenge (see Figure 8). A Farmer Stakeholder highlights this well in their statement, "I think the more challenging part, initially, might be getting people to agree on what they want to restore".

The second most frequently mentioned challenge was the threat of **invasive species**, with ten of 13 interviewees expressing concern. Interviewees mentioned plants and animals on land, as well as pest fish, like perch. A Recreational Stakeholder explained the threat of invasive species by stating, "our problem on the predator side is that our success with the wetland is temporary." They explained that if they eradicated pests in one area of their wetland, it would not matter because pests existed in the surroundings lands. Pest control requires extensive measures (Recreational Stakeholder).

Eight of our 13 interviews mentioned challenges with **bureaucracy and regulation** making it the third most frequent challenge. A Farmer Stakeholder highlights their struggle with bureaucracy in the box to the right. A similar sentiment was gathered from a recreational user who "would probably not undertake the restoration of the Wairio wetland if we were to start today, because the bureaucratic regulations are just enormous, unbelievably enormous, and unbelievably negative". This sentiment was shown by a Government Stakeholder themselves, saying: "And certainly from an indigenous perspective, you know, like it intimidates, and it exhausts mana whenua from having to have three conversations" when talking about having to deal with three different government bodies.

> "I've been to DOC meetings. We used to have a coordination committee and we were still blathering on about the same thing 30 years late. So, I just pulled the plug, all the farmers pulled the plug. It's a waste of time."
>
> -Farmer Stakeholder

The frustrations with stakeholder interest, bureaucracy, and regulation carried over to **politics**, a challenge mentioned by seven of 13 interviewees (see Figure 8). A Government Stakeholder mentioned "It's a clash of economy and environment, the classic one that tends to burn down the long-term vision". Our interviewees often expressed this sentiment with a Māori Stakeholder also saying, "They're going to be a huge challenge, because people are set in who they are and their values and stuff like that. And it's not saying that there's anything wrong with it. It's just saying that it's we don't have the same values" when discussing power in local government.

Other challenges that were also mentioned by seven or more interviewees were barriers to completion including **access**, **funds** for the restoration, **water quality/sediment**, and **knowledge** of the problem.

As we concluded the interview process, we determined that the restoration efforts at the Wairarapa Moana should be not only holistic, but also realistic. A challenge of differing stakeholder interests indicates that everyone will have to **compromise to achieve a holistic restoration** of the Wairarapa Moana. This can further be observed by reading a quote from a government stakeholder highlighted in the box to the left. As one government stakeholder said in our interviews, "What that means is you actually have to say no to some things." This requires those involved in the Wairarapa Moana Restoration Plan to identify and prioritize more significant and more impactful solutions, rather than proposing to fix everything.

> "A shared outcome is a challenge. It has been a challenge. It will continue to be a challenge."
>
> -Government Stakeholder

OBJECTIVE 3: DEVELOP RECOMMENDATIONS FOR THE PRIORITIES OF A HOLISTIC RESTORATION PLAN

In addition to the three major challenges mentioned above, we also considered what our stakeholders would incorporate in their ideal plan to make our recommendations. The three most common answers to the question "if this were an ideal world, what would you do to completely restore the area?" were **water quality**, **biodiversity**, and **engagement** (see Figure 9). This data collection aided us in developing our recommendations for a more holistic plan because we compared the main priorities from each stakeholder group.

According to Figure 9**Error! Reference source not found.** below, the three most c ommon aspects that interviewees thought should be included in an ideal restoration plan were improving water quality, biodiversity, and engagement with at least one interviewee from each stakeholder group. Ten of our 13 interviewees included improving water quality in their ideal plan. Nine of our 13 interviewees included increasing biodiversity in their ideal plan. Finally, seven of our 13 interviewees included increasing engagement in their ideal plan. Interviewees mentioned engagement with the community, the region, and between stakeholder groups.

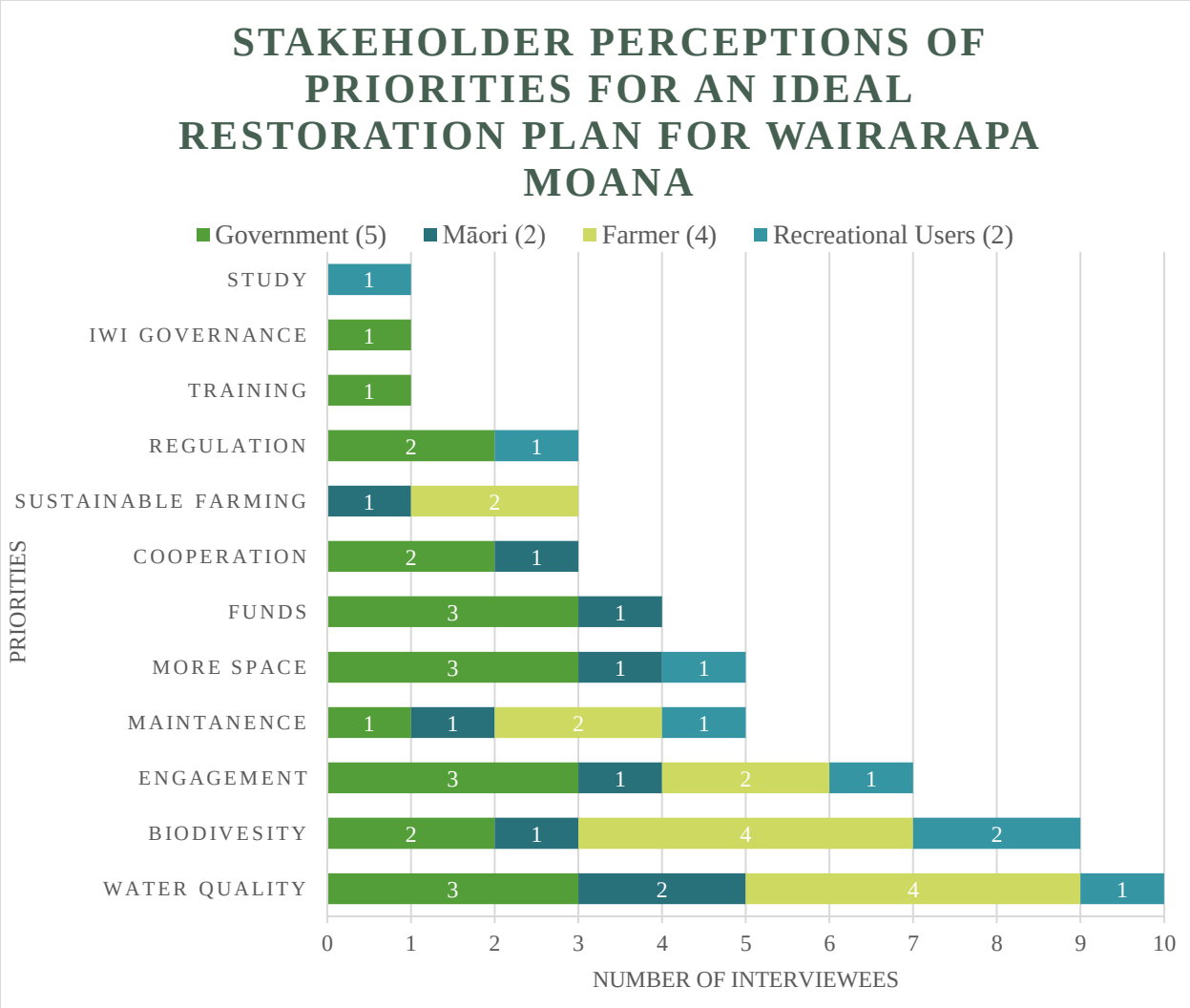

Figure 9 Interviewee desires for an ideal restoration plan for the Wairarapa Moana.

Developing Recommendations

To develop our recommendations, we considered the three most frequently expressed challenges, the three most frequent perceptions on what an ideal plan should include, and the desires of Lake Wairarapa.

To maintain consistency with our data on stakeholder perceptions and desires as displayed in Figure 10, we focused on approaches in the plan that corresponded with site-specific strategies for **water quality**, **biodiversity**, and **engagement**. The approaches contained in the Wairarapa Moana Restoration Plan also informed our final recommendations. Our recommendations are explained in order of most to least frequently mentioned ideal plan desires.

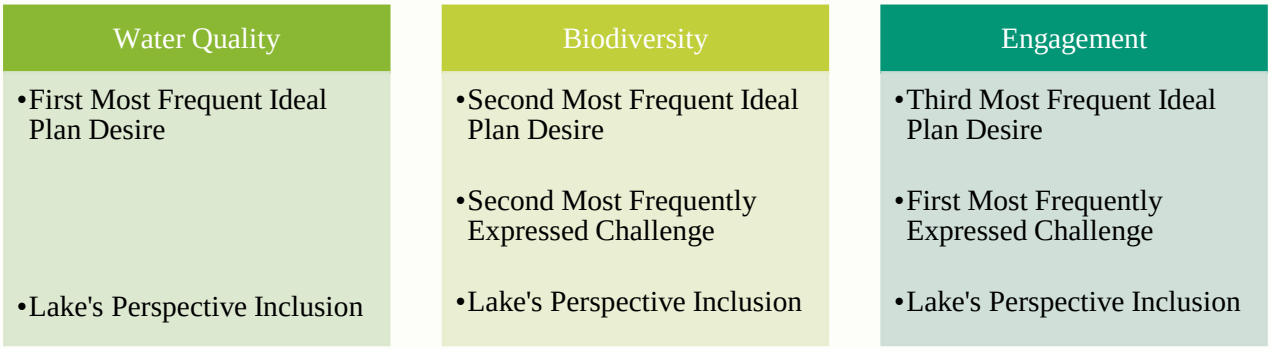

Figure 10 The three main focuses of our recommendations and their significance to interviewees.

Recommendations for Water Quality

Water quality was the most frequent aspect of ideal plan inclusion. Interviewees discussed various strategies on how to approach improving water quality. Most strategies were mild, such as fencing; however, some suggestions were more drastic. One such strategy, suggested by three of 13 interviewees, was to reconnect the Ruamāhanga River back into Lake Wairarapa. This would be a very distinct modification with the hope of returning the area to its previous state. We did not collect enough data to support this solution, nor was it within our expertise or knowledge base to recommend. We suggest experts research this solution and its consequences more.

The plan expresses that hydrological states and trends of the area "lie outside the scope of this report"; however, it does address water quality on a small scale (Kāhu Environmental, 2022). Nevertheless, it was the most important problem according to our interviews, while complying with Te Mana o te Wai policy (*NPSFM*, 2021). Because of its significance to our interviewees, our recommendations discuss the incorporation of water quality strategies.

Improved stock exclusions and sewage management strategies could improve water quality. The following recommendation expands on the plan's mention of stock exclusion at seven of 14 sites (Kāhu Environmental, 2022). Current national and regional policy states that all farmed cattle, deer, and pigs must be set back at least three meters away from all lakes, rivers, and wetland sites wider than one meter (*Stock Exclusion Regulations*, n.d.). Additionally, for break feeding, cultivating, or intensive winter grazing sites, stock must be five meters away from all lakes, rivers, and wetland sites (*Stock Exclusion Regulations*, n.d.). If the fencing were set back further from the water's edge as described by a Farmer Stakeholder, farmers could cultivate riparian borders of native plants. This would help improve the water quality of the waterways in two ways. First, the fencing would still protect the waterways from cattle walking through them. Second, the roots of the plants that are planted along the edge of the waterway could trap and absorb chemical runoff that is leaching from the farm soil into the water, as demonstrated in Figure 11.

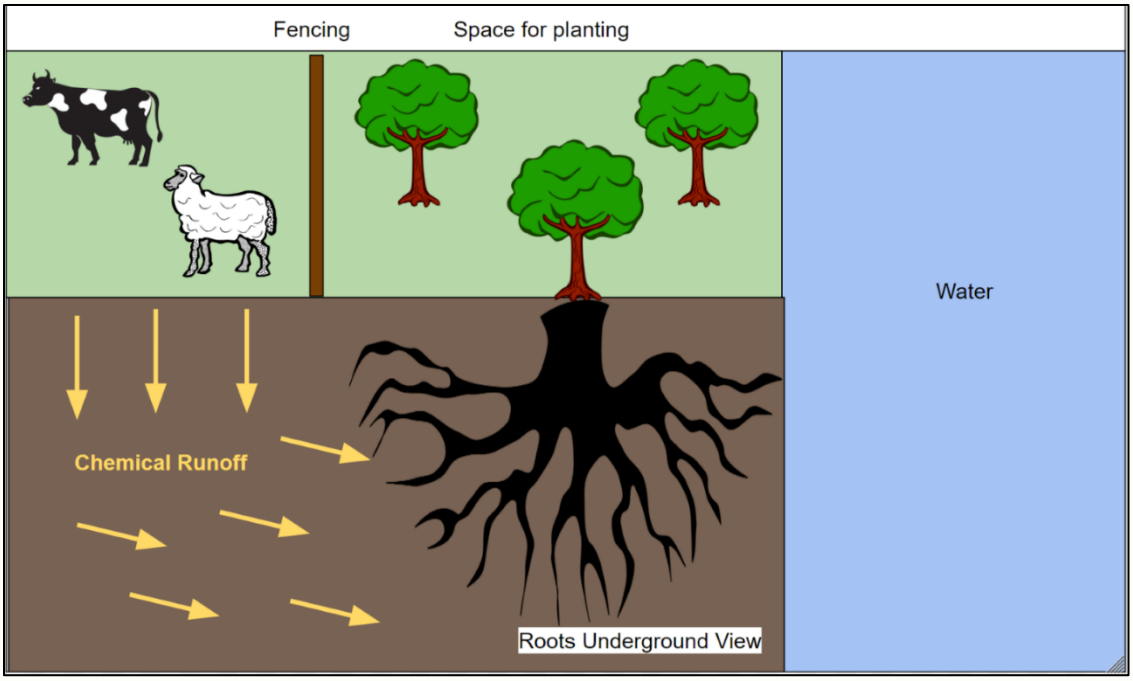

Figure 11 Benefits of a riparian border at the water's edge.

According to a New Zealand study performed by the Institute of Environmental Science and Research (ESR), a root system of 40,000 manuka trees reduced the leaching of pathogens and nitrate into Lake Waikato (*A Tree That Could Help Save Rivers*, 2023). Additionally, in another study, nitrate leached under native manuka and kanuka was observed to be 25 times less than that under Radiada Pine (Gines & Mishra, n.d.). Farmers could implement a similar strategy to reduce farm runoff into the water ways of the Wairarapa Moana.

By moving the fencing back from the edge, we understand that landowners will be losing land area for their cattle; however, it could benefit them as well. This space in between the fence and the water could be used to plant species that farmers and landowners could profit from to help support their livelihood, such as manuka trees and kawakawa plants.

Improved wastewater management systems could improve the water quality. Currently a wastewater treatment plant at Longwood Road treats sewage from Featherston and disposes of it in Donald's Creek which eventually feeds into the Wairarapa Moana (*Featherston Wastewater Treatment Plant Proposal Frequently Asked Questions*, n.d.; *Water and Sewerage*, n.d.). At the Longwood Road location, we observed a settling pond during one of our site visits with Ra. He mentioned how expensive sewage management is and the lack of natural solutions. Since wetlands are natural purifiers, we recommend creating and planting a wetland like the manmade wetland on Kaiwaiwai Dairy Farm, either before the water from the settling pond enters Donald's Creek or further down Donald's Creek. This would help clean the water and may

reduce the need for chemical management and costs. Expert research into the feasibility of this would be required.

Recommendations for Biodiversity

Biodiversity was the second most frequent aspect of ideal plan inclusion and the second major challenge facing the restoration efforts. Interviewees discussed planting and removing invasive species to improve biodiversity. From the Wairarapa Moana Restoration Plan, we observed a strong focus on plant biodiversity with steps addressing pest control and native planting at every site (Kāhu Environmental, 2022). Dividing the 14 sites into zones monitored by different groups of people may result in more attention given to the planting and pest trapping efforts; therefore, the maintenance of these efforts could be more easily managed. Based on our interview findings, the plan addresses restoring biodiversity effectively; therefore, we recommend that the plan follow through with these efforts and add the following concern.

Three of our 13 interviewees expressed concerns regarding pest fish in the Wairarapa Moana. If there were a pest fish trapping strategy incorporated in the plan, this would help restore native fish populations. One of our interviewees suggested this could be done through sailing a flat boat across areas of the wetland to strip up the pest fish and harvest them out of the lake. We recommend asking fish and game experts for help on looking into this strategy and other methods. We understand that diminishing pest fish would disadvantage recreational fishers. If native fish populations return because of these efforts, then recreational fishers could fish for native species such as tuna.

Recommendations for Engagement

Engagement was the third most frequent aspect of ideal plan inclusion and the major challenge facing the restoration efforts. Interviewees mentioned that disagreements and conflicts regarding management of the Wairarapa Moana are deeply rooted. One way the plan addresses this is by incorporating tangata whenua as leaders in the planting efforts at Boggy Pond, Matthews Lagoon, and Wairio Wetlands (Kāhu Environmental, 2022). The Wairarapa Moana Restoration Plan also briefly mentions starting a summer day camp in one of the appendices. A summer day camp could be an effective way to connect the new generations to the Wairarapa Moana. School field trips are another way to encourage such connections. It is important for the youth and upcoming generations to have opportunities to make enjoyable memories in the Wairarapa Moana area. The engagement of young people is crucial to the future of restoration efforts and the Wairarapa Moana.

CHAPTER 5: CONCLUSION

The Wairarapa Moana wetlands system located on the southern part of the northern island of Aotearoa New Zealand holds significance in the lives of many. Various groups of stakeholders connect with this land for different reasons. Due to developing cities and increased farming in the area, the state of the Wairarapa Moana wetlands has deteriorated. With so many groups involved in the Wairarapa Moana region, it is difficult to find a restoration solution in which all stakeholders feel heard. The goal of this project is to develop recommendations for the Wairarapa Moana Restoration Plan to be more holistic by identifying the common priorities of stakeholder groups. To do this, we first studied the current Restoration Plan, the site, and the existing environmental legislation concerning the area. Then we interviewed government officials, Māori, farmers, and recreational users to capture their perceptions on the current restoration efforts. We built a fifth stakeholder as Lake Wairarapa itself, from all our interviewees' perspectives on what they think Lake Wairarapa would want in the restoration. We identified the three major challenges and determined the three major aspects of an ideal restoration plan.

Based on the major challenges facing the efforts, the aspects that interviewees included in their ideal plans, and the desires of Lake Wairarapa, our team developed a set of recommendations to propose a more holistic approach. Our recommendations expand on how to execute current approaches to water quality, biodiversity, and engagement in the plan. Our first recommendation builds on the current stock exclusion regulations to use native plant species to reduce chemical runoff. Our second recommendation builds on the current biodiversity site-specific strategies in the plan and adds pest fish management. Our last recommendation focuses on increasing youth engagement with the Wairarapa Moana. We recommend expanding the summer day camp for children, as well as school field trips to connect students to the area more.

We suggest the following avenues for future project work concerning the restoration efforts in the Wairarapa Moana. Future research could focus on community perceptions and rankings of certain restoration strategies. Alternatively, future projects could develop strategies to communicate the goals and processes of the Restoration Plan to the wider community, possibly through traditional story telling. This spreads the project and technological aspects of the research to a wider audience. Because this area is important to many, and holds mauri, it is important to continue restoration efforts so that one day the Wairarapa Moana will be fully restored. Healthy environments increase the health of communities and people around it. The Wairarapa Moana wetlands should be enjoyed in a healthy state by all for generations to come.

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APPENDIX A: INTERVIEW INFORMATION

The following appendices composing Appendix A include all information relating to our conducted interviews. Sections 8.1 and 8.2 list sample interview questions that were asked to interviewees depending on their respective stakeholder group and asked of our Te Mana o te Wai experts, respectively. Section 8.3 contains a list of all interviewees. Section 8.4 contains the consent forms used to obtain permission from our interviewees.

STAKEHOLDER INTERVIEW QUESTIONS

Policy Experts and Government Officials (DOC, GWRC, and SWDC)

We thank you for joining us today to discuss the restoration of the Wairarapa Moana.

1. We understand that you are _____ at _____. Could you please describe what this entailed?
2. To begin we would like to ask how you define the term "restoration"?
3. What do you know about the current Wairarapa Moana restoration efforts?
4. How is the your department involved with and affected by the restoration efforts of this area?
5. What do you see as some of the big challenges facing this plan? And what parts of the plan do you support or disagree with the most?
6. We understand the DOC, the GWRC, and the SWDC all hold jurisdictions in this area, could you explain how these groups work together for the wetlands?
7. We are aware that suspended sediment is a big concern in the water of the lake, in your opinion, how has this affected lake ecosystems of the Wairarapa Moana?
8. If this were an ideal world and you had all the resources you need, what would you do to completely restore the area?
9. For the purposes of our project, we are trying to build a stakeholder profile for Lake Wairarapa in the restoration efforts. What do you think Lake Wairarapa would want for itself?

10. We understand there are different stakeholders involved and affected by the plan. Do you think they work well together on the restoration? How do they influence each other or interact with each other? Are there any challenges in this?
11. We know that Kahungunu ki Wairarapa has recently been granted 90% of the area and Rangitāne 10%, what changes do you expect to see now that the iwi groups have more control over the lake?
12. For the restoration to be successful, participation from the community is key. As a community member, what would make you more inclined to help with the restoration efforts?

Local Iwi

We thank you for joining us today to discuss the restoration of the Wairarapa Moana.

1. We understand the Wairarapa Moana region holds cultural significance to the Māori culture, how does this area hold importance in your life?
    a. What is your relationship with the lake? How do you interact with it and why?
    b. What areas do you visit most frequently?
2. We are familiar with your position as _____ in the _____. What type of responsibilities do you hold?
3. To begin speaking about the restoration of the Wairarapa Moana, we would like to ask how you define the term "restoration"?
4. What do you know about the current Wairarapa Moana Restoration efforts?
5. What are your (personal, and _____(iwi)) concerns about the health of the Wairarapa Moana, and how does the plan address it?
6. What do you see as some of the big challenges facing this plan? And what parts of the plan do you support or disagree with the most?
7. If this were an ideal world and you had all the resources you need available to you, what would you do to completely restore the area?
8. We are aware that multiple groups of people are involved with this land for cultural, managemental, and recreational purposes. In what ways, if any, do you interact with farmers or recreational users?

9. We understand the DOC, the GWRC, and the SWDC all hold jurisdictions in this area, how do you interact with any governmental groups regarding policies and other decisions?
10. For the purposes of our project, we are trying to build a stakeholder profile for Lake Wairarapa in the restoration efforts. What do you think Lake Wairarapa would want for itself?
11. For the restoration to be successful, participation from the community is key. As a community member, what would make you more inclined to help with the restoration efforts?

Landowners and Farmers

1. We understand that you farm _____ in the _____ region/place. How long have you resided on and used your land in the Wairarapa Moana region?
    a. What specific area do you live in?
2. We know this land has been favorable for farming practices, how does this land provide for your needs?
3. We thank you for joining us today to discuss the restoration of the Wairarapa Moana. To begin speaking about the restoration of the Wairarapa Moana, we would like to ask how you define the term "restoration"?
4. What do you know about the current Wairarapa Moana Restoration efforts?
5. What do you see as some of the big challenges facing this plan? And what parts of the plan do you support or disagree with the most?
6. We are aware that this area's health has degraded, how would you describe the current state of the Wairarapa Moana?
7. If this were an ideal world, and you had all the resources and money available to you, what would you do to completely restore the area?
8. We are aware that multiple groups of people are involved with this land for cultural, managemental, and recreational purposes. In what ways, if any, do you interact with governmental bodies, iwi, or recreational users?

9. For the purposes of our project, we are trying to build a stakeholder profile for Lake Wairarapa in the restoration efforts. What do you think Lake Wairarapa would want for itself?
10. For the restoration to be successful, participation from the community is key. As a community member, what would make you more inclined to help with the restoration efforts?

Recreational Users

1. We understand that you are a _____ on Lake Wairarapa. Can you describe your activities on the water and what makes you passionate about them?
    a. Are you involved with any other organizations, and what type of access do they have to the area?
2. What makes the Wairarapa Moana a favorable location for _____?
3. In your time using this area, have you noticed any changes in the Wairarapa Moana? How would you describe this area's state?
4. We thank you for joining us today to discuss the restoration of the Wairarapa Moana. To begin speaking about the restoration of the Wairarapa Moana, we would like to ask how you define the term "restoration"?
5. What do you know about the current Wairarapa Moana Restoration efforts?
6. What do you see as some of the big challenges facing this plan? And what parts of the plan do you support or disagree with the most?
7. If this were an ideal world, and you had all the resources and money available to you, what would you do to completely restore the area?
8. We are aware that multiple groups of people are involved with this land for cultural, managemental, and recreational purposes. In what ways, if any, do you interact with governmental bodies, farmers, or iwi tribes?
9. For the purposes of our project, we are trying to build a stakeholder profile for Lake Wairarapa in the restoration efforts. What do you think Lake Wairarapa would want for itself?

10. For the restoration to be successful, participation from the community is key. As a community member, what would make you more inclined to help with the restoration efforts?

TE MANA O TE WAI INTERVIEW QUESTIONS

The following questions were asked during interviews with Te Mana o te Wai experts.

1. We are familiar with your current position _____. Could you describe what this position entails, or what your other work has entailed?
2. We thank you for joining us today to discuss Te Mana o te Wai. To begin we would like to ask you how you think about Te Mana o te Wai in your own words?
3. Is this policy generally supported or are there differing viewpoints on it?
4. Are there any challenges facing the implementation of this policy? Do they change based on location or group of people involved?
5. We know one off the 6 principles is Stewardship, which is "the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations" (Essential Freshwater Te Mana o te Wai Factsheet). How do you think the community accomplishes this and how is participation measured?
6. How has Te Mana o te Wai been implemented in situations with visible or documented improvements in water quality?
7. What kinds of methods are used to actively involve tangata whenua in decision making and policy implementation?
8. We have noticed that there are responsibilities for tangata whenua to upkeep Te Mana o te Wai. What type of actions have been taken by these groups to maintain the upkeep, and what available resources are being used?
9. The restoration plan we have been studying seems to address social, economic, and cultural well-being as its main priorities. What do you think about this?
10. We have some confusion on how Te Mana o te Wai would work regarding previously existing freshwater management structures. Examples of existing management structures

would be like the flood gates at the Wairarapa Moana. In a situation like this, how would Te Mana o te Wai be considered for structures created before this system came into effect?

INTERVIEWEES

Te Mana o te Wai Interviewees:
Riki Ellison

Patsie Karauria

Jovan Mokaraka-Harris

Ihaia Puketapu

Stakeholder Perception Interviewees:
Aidan Bichan

Katie Brasell

Vern Brasell

Miranda Cross

Jane Donald

Jim Flack

Mike Grace

Jim Law

Joe Potangaroa

Kereana Sims

Natasha Tomic

Stephanie Tomscha

Tia Tuuta

(Not in order with stakeholder number)

CONSENT FORMS

In Person Interview Consent Form

We are a group of students from Worcester Polytechnic Institute (WPI) in the United States. We are conducting interviews to learn more about the perceptions of the Wairarapa Moana Restoration Plan. If you are willing to participate in this project, please read and note your preferences on this form. The final results will be made public.

Do we have your permission to record video of this interview?
Yes ☐ | No ☐

Do we have your permission to record audio of this interview?
Yes ☐ | No ☐

Will you allow us to include your name and other identifying information (such as a photo)?
Yes ☐ | No ☐

Will you allow us to use your words for use in our final report?
Yes ☐ | No ☐

I understand that these interviews will be published at WPI for educational purposes and made available to the public.

Signature: Print: Date:

Zoom Interview Consent Script

Without recording, we will ask if we have permission to record.
If the participant answers “yes”, then:

[tell the participant the following with the camera/recorder rolling]:

“This project is recording interviews as part of an educational project. By appearing on camera/audio, you are consenting to the use of your image/voice for the purpose of our project which will be published on the WPI website.”

“Please say your name and your title (if applicable).”

[person states name, etc. Then we say]

“We are here on [say the date] to talk about ....” And continue with the interview as scheduled.

At the end of the interview, we can send the recorded interview to them if they want it.

At this point we also ask them if they want to withdraw consent for us to use the video recording.

APPENDIX B: DATA CODING

The list of codes below was used to code qualitative perception responses from all our stakeholder interviewees. Coding was done on interview transcripts in NVivo and MAXQDA software.

DATA CODES

- Assess
  - Assess_Barrage
  - Assess_Engagement
    - Assess_Engagement, Negative
  - Assess_GovernanceChange
  - Assess_GWRC
    - Assess_GWRC , Challenging
  - Assess_GWRC , Challenging
  - Assess_Laws
    - Assess_Laws, Challenging
  - Assess_Pests
  - Assess_Plan
    - Assess_Plan, Good
    - Assess_Plan, Poor
  - Assess_Sediment
    - Sediment_Perch
  - Assess_Settlement
  - Assess_SWDC, Challenging
  - Assess_WaiMo
  - Assess_WaiMo_Coordination
    - Assess_WaiMo_Coordination , Challenging
  - Assess_WaiMo_Coordination , Challenging
  - Assess_WaiMo_Governance
    - Assess_WaiMo_Governance , Negative
  - Assess_WaiMo_Governance , Negative
  - Assess_WaiMo_Restoration
    - Assess_WaiMo_Restoration , Positive
    - Assess_WaiMo_Restoration, Challenging
  - Assess_WaiMo_State
    - Assess_WaiMo_State, Poor
  - Assess_WaterLevel
  - Assess_WaterQuality
- Case
  - Case_Involvement_Maori
  - CaseStudy
- Challenges
  - Challenges_Awareness
  - Challenges_Definition
  - Challenges_Engagement
    - Challenges_Location
  - Challenges_Flooding
  - Challenges_Funds
  - Challenges_Governance
    - Challenges_Political
    - Challenges_Regulation
      - Challenges_Bureaucracy

- Challenges_InvasiveSpecies
  - Challenges_Perch
- Challenges_Knowledge
  - Challenges_KnowledgeEcology
  - Challenges_Scope
  - Challenges_UnderstandingMaoriConcepts
  - Challenges_UnderstandingProblem
- Challenges_Plan_Coordination
- Challenges_Restoration
- Challenges_Space
- Challenges_Stakeholders
  - Challenges_Community
  - Challenges_RecUsers
  - Challenges_Social
  - Challenges_Values
- Challenges_WaterQuality
  - Challenges_Sediment
  - Challenges_Sewage

Concerns
Confirm
ConnectionsToWaiMo
Data
Definition
- Definition_Personal
- Definition_Technichal

Engagement
- Engagement_Stakeholders
- Engagement_Swimming

Experience
Facts
Findings
GetInvolved
Holistic
- Holistic_Plan_No
- Holistic_Plan_Yes

Ian
Ideal_Plan
- Ideal_IwiGovernance
- Ideal_Plan_Biodivesity
- Ideal_Plan_Engagement
  - Ideal_Plan_Cooperation
- Ideal_Plan_Funds
- Ideal_Plan_Maintanence
- Ideal_Plan_MoreSpace
- Ideal_Plan_Regulation
- Ideal_Plan_Study

- Ideal_Plan_SustainableFarming
- Ideal_Plan_Training
- Ideal_Plan_WaterQuality
    - Ideal_Plan_BarrageGates
    - Ideal_Plan_Fencing
    - Ideal_Plan_Redivert
    - Ideal_Plan_Sewage
- Ideal_Restoration

Impact

- Impact_BarrageGate
- Impact_ClimateChange
- Impact_Restoration_Culture
- Impact_Restoration_Ecology
- Impact_Restoration_Economy
- Impact_Restoration_Iwi
- Impact_Sediment

Involvement

- Involvemenet_Landowners
- Involvement_DOC
- Involvement_GWRC
- Involvement_Maori
- Involvement_MOPI
- Involvement_Personal
- Involvement_Stakeholders
- Involvement_SWDC

Knowledge

- Knowledge_Plan , No
- Knowledge_Plan, Yes
- Knowledge_Policy
- Knowledge_WaiMo_Ecology
- Knowledge_WaiMo_Governance
- Knowledge_WaiMo_Rest
    - Knowledge_WaiMo_Rest, Poor
    - Knowledge-WaiMo_Rest, Poor
- Knowledge_WaiMo_State

Loss

Matauranga_Maori

- Matauranga_Rongoa

Occupation

Priorities

Quote

Ra

Recommendations

Responsibilities

Significance_WaiMo

- Significance_Ecosystem

- Significance_Farming
- Snowball
- Strategies
  - Fencing
  - Planting
  - Trapping
- Suggestion
  - Suggestion_Access
  - Suggestion_Awareness
  - Suggestion_Case
  - Suggestion_Holistic
  - Suggestion_Involvement
  - Suggestion_Partnership
  - Suggestion_Regulation
  - Suggestion_Restoration
  - Suggestion_WaterQuality
  - Suggestions_Redivert
- TMOTW
  - TMOTW_Incorporation
  - TMOTW_Incorporation , Negative
- WaiMo_Perspective
  - WaiMo_Perspective_Access
  - WaiMo_Perspective_ConnectiontoHabitats
  - WaiMo_perspective_Engagement
  - WaiMo_Perspective_Healthy
    - WaiMo_Perspective_Biodiversity
      - WaiMo_Perspective_InvasiveSpecies
        - WaiMo_Perspective_Perch
    - WaiMo_Perspective_WaterQuality
  - WaiMo_Perspective_MoreSpace