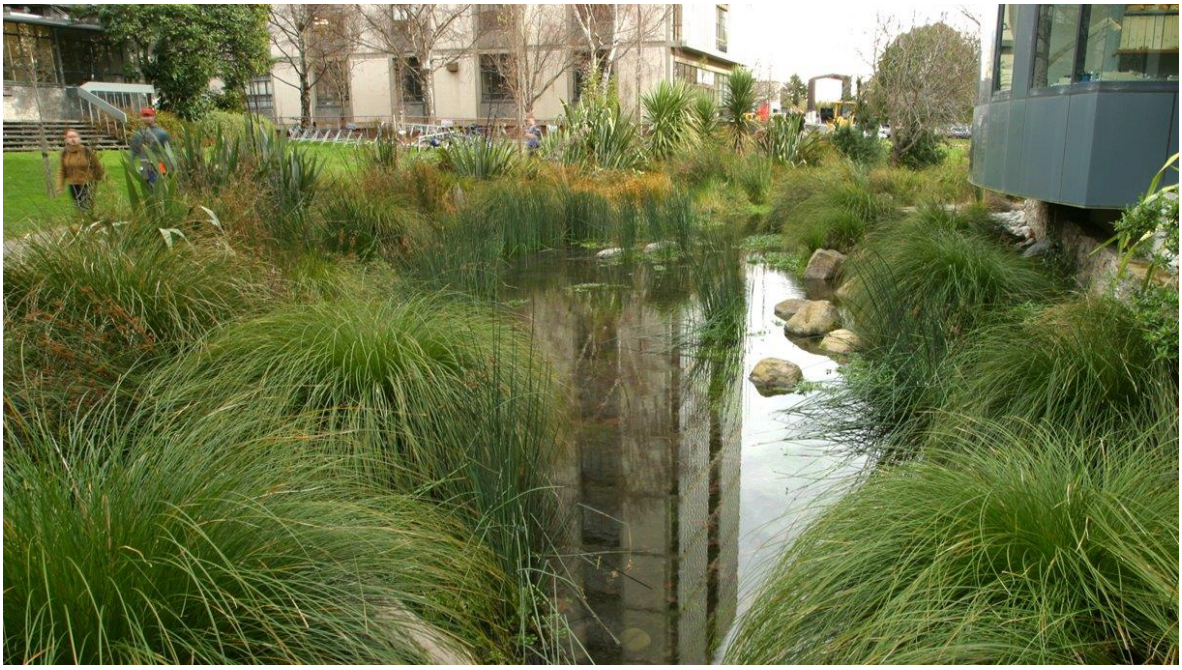

Updating the Waiutuutu/Okeover Stream Restoration Signboards

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In Association with Te Whare Wānanga o Waitaha/University of Canterbury Sustainability Office

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1. Executive Summary

- The Waiutuutu/Okeover stream flows through Te Whare Wānanga o Waitaha/University of Canterbury's Ilam campus.
- Current signboards explaining the history of the stream and restoration efforts over the past 20 years are outdated and not engaging.
- Our research question was: "how can we effectively communicate, engage and inform the community about the restoration of the Waiutuutu/Okeover stream using signboards?"
- We used a mixed-method approach (qualitative and quantitative) with literature reviews forming one element. Five reviews covered how restoration efforts have influenced: stormwater engineering, community engagement, stormwater impacts, life within the stream and the importance of Mātauranga Māori.
- Another element of our research design were semi-structured interviews, carried out with key stakeholders, including ecologists and civil engineers. These two methods allowed us to gather accurate information to use on updated signboards.
- To justify our hypothesis that the current signboards are not engaging we carried out observational surveys at three of the current signboards.
- Results from these surveys found that generally there was a high number of people showing no interest in the signboards or the stream. However, for two sites there was no significant difference between those showing an interest, and those not showing interest. This could be a result of low statistical power.
- We produced seven recommended signboard drafts which explain the narrative of the stream's history and restoration. We included interactive elements which encourage readers to engage with the environment around them. Te Reo translation is under consultation as the signboards will be bilingual.
- Limitations of our project included the number of observational surveys we were able to undertake, our research method, COVID-19 level 2 restrictions, and time constraints.
- It would be interesting to examine whether the updated signboards, once in place, have a greater number of people showing an interest in them.

2. Introduction

Our research assignment focused on updating the signboards along the Waiutuutu/Okeover stream at Te Whare Wānanga o Waitaha/University of Canterbury (UC). The signboards currently in place were installed 20 years ago and are outdated. We aimed to research and gather relevant information to update the signboards in a way that would ensure their longevity. Creating a narrative on the signboards that flowed from either direction along the stream was important to educate readers whilst avoiding repetition. We proposed a total of seven signboards along the Waiutuutu/Okeover stream, each focusing on a different aspect.

Our research question was "how can we effectively communicate, engage and inform the community about the restoration of the Waiutuutu/Okeover stream using signboards?". This required research about the restoration in terms of stream ecology, community involvement, stormwater management, and its relevance to Mātauranga Māori.

Restoration efforts to improve the quality of the Okeover stream began in 1998 with riparian planting, sediment control and in-stream modifications to improve habitat (Blakely & Harding, 2005; Painter, 2018). These were carried out to improve degraded water quality, as a result of surrounding urban development. The stream was originally spring-fed, however with the increase of impermeable surfaces and establishment of road culverts, the water table lowered and reduced its natural flow (Blakely & Harding, 2005). Furthermore, contamination from stormwater and runoff, consisting of heavy metals and nutrients, increased sediment, and reduced hydrological flow, are consequences of urban development (Blakely & Harding, 2005). Although the wider stream catchment expands to residential areas, it is important to consider that UC has significantly contributed to its degradation with more than 40 discharge pipes releasing stormwater and air-conditioning wastewater (Blakely & Harding, 2005; Charters et al., 2014). However, restoration efforts continue today with more stormwater management plans installed and under negotiation.

There are currently four signboards in place (Appendix A). The first signboard (Appendix A, Fig A.1), located at the Waiutuutu Community Garden, discusses the ephemeral section and general mitigative actions for individuals. The second signboard at Engineering Road demonstrates how the infiltration basin, rain garden and swale work (Appendix A, Fig A.2). The two remaining signboards on the Engineering Core bridge and School of Biological Sciences bridge discuss stream ecology and the history of the restoration (Appendix A, Figs A.3 & A.4).

Further research concluded that despite restoration efforts continuing for more than 20 years, there is a lack of knowledge about the stream's degraded water quality and the restoration project. In 2010, telephone surveys conducted resulted with 50% of respondents thinking the Waiutuutu/Okeover stream was a healthy waterway, 56% recalling media coverage about streams, rivers or waterways, while only 21% remembered media coverage about Canterbury waterways, but not this specific

stream (Bond et al., 2010). Knowledge or awareness of the degradation of the Waiutuutu/Okeover stream and the restoration efforts seemed to be considerably low therefore encouraging us to create signboards with updated and informative content.

This report will discuss:

- Five literature reviews relevant for our research topic
- Research methods
- Results
- Discussion of the results including the recommended signboards
- Limitations of the methods and research assignment in general
- Conclusion of the project

3. Literature Review

We synthesised relevant information to achieve our goal of updating the signboards to make them more engaging for students and the wider public. To do this we examined the scientific literature to date, by splitting our topic into five sub-themes.

3.1 Engineering: Stormwater Management

The literature review explored the effectiveness of stormwater management facilities at UC, with a specific focus on low impact development (LID) infrastructures such as rain gardens and vegetation swales. Research suggested that rain gardens were effective in nutrient removal from stormwater and reducing the hydrological streamflow (Hamel & Fletcher, 2014). This would consequently benefit the Okeover stream restoration by reducing the number of contaminants entering and preventing in-stream habitats from being destroyed by heavy flows. However, the literature review also discusses important factors to consider regarding the effectiveness of rain gardens. These include the variability of plant traits such as root thickness and depth, flooding tolerances, nutrient uptake potential as well as the ability of different plant species to absorb other contaminants such as hydrocarbons, *Escherichia coli* and heavy metals (Morash et al., 2019; Muerdter et al., 2018). Limitations regarding the effectiveness of rain gardens were explored by Charters et al. (2014); Fraga et al. (2016), who explained that UC currently discharges stormwater and wastewater through 48 discharge points into the Okeover stream, and that there is a lack of research on the wider catchment. Research also suggested that swales were effective in reducing sediment and providing permeable surfaces through which stormwater can infiltrate (Charters et al., 2014; Morash et al., 2019).

3.2 Community Engagement

The literature review highlights the importance of community engagement and how the wider community interest can benefit stream restoration. The studies suggested that communities who get the chance to participate in the restoration are more likely to leave a longer-lasting restoration effect (Druschke & Hychka, 2015). Involving the community is a crucial aspect of how the stream water is treated. This could be due to funding and facilities accessible for water treatment (Bos & Brown, 2015). The Waiutuutu streams restoration was started in the late 1990s by students of the Kakariki group from the University of Canterbury. At the same time, the Kakariki group also began the first community garden on the North West side of Ōtautahi. The restoration was not funded by any external organisations, unlike the community garden which was supported by the Canterbury Foundation now known as the Rata Trust. The student led restoration started wider community involvement by educating people about how they can help improve stream degradation. This is because if the community is involved in restoration they need to be informed so they can prepare a plan, so as not to cause additional damage (Bond et al., 2010). Building on what Bond et al. (2010) discussed about the need for education in the wider community, the process of updating the signboards around the Waiutuutu/Okeover stream will help achieve this.

3.3 How Stormwater Impacts and Influences Natural Ecosystems

This literature review focused on the impacts and influences stormwater has on natural ecosystems and the harm that our waterways can endure if oversight of these impacts is present. Stormwater can severely impact and alter natural ecosystems. It does this by altering the natural flow of these waterways. Flow is often changed via an increase of volume or velocity of water. Walsh et al. (2012), stated: “all urban stormwater delivered through conventional drainage systems is delivered to the receiving water unfiltered, through pipes, resulting in more frequent, larger flood peaks of shorter duration and of poor quality”. Alongside the mass amounts of water being added to the system, stormwater runoff brings many contaminants along with it. These can come in the form of sediments, metals, and pollutants that runoff from the surrounding land use or from further up the catchment. Karlavičienė et al. (2009) discussed the importance of toxicity testing bottom sediments of ecosystems to test for these contaminants. It is important for New Zealand to maintain, monitor, and protect our national waterways by acknowledging the impact stormwater has on our natural ecosystems so we can look to mitigate its impacts.

3.4 Interweaving Science with Mātauranga Māori as a Means of Restoring the Mauri or Life Essence of the Waiutuutu

The literature expresses how interweaving science with Matauranga Māori could help improve the methods used to restore the degrading waterways across New Zealand, as well as “provide another

paradigm for connecting people with nature" (Marques et al., 2018). Mātauranga Māori is simply indigenous knowledge that has been experienced by our ancestors and has been passed down to future generations in order for the upcoming to learn the rhythms of the tide, the passing of the different moon phases and the most appropriate times to harvest and plant different types of food to feed the people. Mātauranga Māori was implemented in the restoration of the Kaiwharawhara River in the Wellington region. This project saw kete harakeke (flax baskets) and oral traditions being performed in the translocation of kakahi to help improve the waterway as a means of restoring the mauri of the Kaiwharawhara and the connections Maori have with nature (Michel et al., 2019). However, the inclusion of Mātauranga Māori in restoration projects or ecological science is limited (Walker et al., 2019) as "only 12% of government departments involved in restoration involve Māori at any level" (Mills, 2003). Therefore, through this literature review, it stresses the importance of incorporating Mātauranga Māori into restoration projects as this could foresee greater urban ecology strategies that result in greater ecological outcomes and connections with the environment (Walker et al., 2019).

3.5 The Impact of Urban Stream Restoration on Ecological Communities in Streams

The literature indicates that restoration efforts have little impact on aquatic invertebrate community recovery. The Waiutuutu/Okeover and other restored streams have similar levels of diversity and taxonomic richness as their non-restored counterparts (Blakely & Harding, 2005; Stranko et al., 2012; Violin et al., 2011). The species present in the stream are tolerant of poor water quality and habitat degradation (Winterbourn et al., 2007). Heavy metal levels in the Waiutuutu/Okeover are high, as a result of stormwater inflows, and copper pipes and roofs at UC (Blakely & Harding, 2005). These levels can damage ecological communities and therefore likely play a substantial part in the absence of recovery (Blakely & Harding, 2005; Winterbourn et al., 2007). Road culverts, which are present along the stretch of the Waiutuutu/Okeover on campus restrict the ability of adult insects to fly upstream (Blakely et al., 2006). Sediment is another issue in the steam, which is worsened by low flows. This reduces habitat availability for aquatic invertebrates, and the number of egg-laying sites available (Blakely et al., 2006; Winterbourn et al., 2007). Increasing large substrate increased the number of eggs laid by free-living caddisflies (*Hydrobiosis parumbripennis*) (Blakely et al., 2006). This lack of recovery emphasises the importance of signboards, as they have the power to encourage people to be involved in restoration, and stormwater contamination reduction.

4. Methods

The methodological framework for our research assignment was used to address our research question. We used a mixed-method approach with both quantitative and qualitative research.

Beginning with the qualitative research we conducted semi-structured interviews with key partners and stakeholders relevant to our assignment, as identified by our community partner. The stakeholders consisted of Jon Harding and Angus Mcintosh who are part of the Freshwater Ecology Research Group, Frances Charters from the Civil and Natural Resources Engineering, and Colin Meurk who works with the Christchurch 360 Trail. Harding and Charters are current members of the UC Waterways Action Group which has had significant involvement in the stream restoration. We also worked closely with Abby Suszko, from the office of the Assistant Vice Chancellor for Māori at UC, as well as the head of Ngāi Tuahuriri, Te Maire Tau as a partner.

We asked open-ended questions which resulted in more detail and discussion throughout the interview. From talking with each stakeholder and partner we were able to obtain knowledge about the Waiutuutu/Okeover from different perspectives. This included ecological, biological, engineering and cultural perspectives. The information we collected from the interviews was analysed using narrative analysis (Gomez & Jones, 2010). This is because our community partner wanted people reading the signboards to read a narrative which told the story of the stream and the importance of it.

Using the information gained from interviews we were able to build on our pre-existing knowledge which helped us continue our research. We obtained useful literature and resources from Te Marie Tau and Abby Suszko including the Grand Narrative for Christchurch. Having this resource allowed us to find appropriate pieces of information which we could use to tell the story of the Waiutuutu/Okeover stream and how waterways are significantly important for Māori.

There was one aspect of research we had already completed before the interviews. Each of our group members completed a literature review on a relevant topic around our assignment (Section 3).

Quantitative research was conducted using observational surveying at the locations of three existing signboards. Observational surveys tend to be used in conjunction with interviewing as they are both key aspects of research ("The SAGE Encyclopedia of Qualitative Research Methods," 2008). We recorded engagement and non-engagement with the stream using the survey, using the categories in Appendix B. Each observational survey lasted one hour and was conducted at different times of the day. Each of the locations were surveyed three times. One of the main reasons we used observational surveys was so that we could justify moving the location of signboards, as they are currently located in high traffic areas and have limited space for people to stop and read them Our null hypothesis was – “there is no difference between the number of people showing no interest in the signboards or stream and number of people showing an interest in the signboards or stream”. After surveying was completed the data was analysed in Excel. We visualised it using graphs, to and gauge an understanding of our data. We used a clustered bar graph to help portray the observational data in a way that makes data simple to read and evaluate. We predicted that on the 14th of September there would be fewer people walking, due to Christchurch still being in COVID19 level restrictions. We

also predicted that most people will not stop to read the signboards which were in inconvenient places.

5. Results and Discussion

5.1 Results and Discussion of Observational Survey

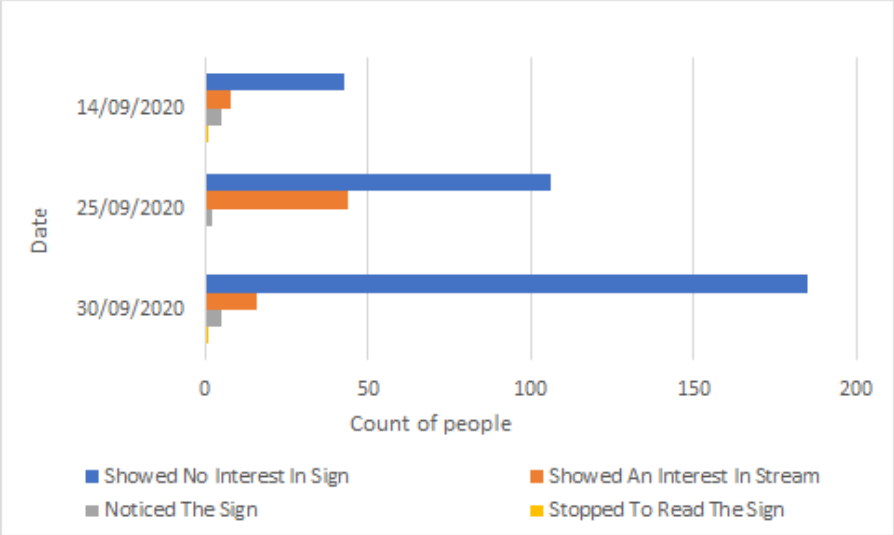

Figure 1 Clustered bar graph showing the counts of people observed at the bridge to the Engineering building

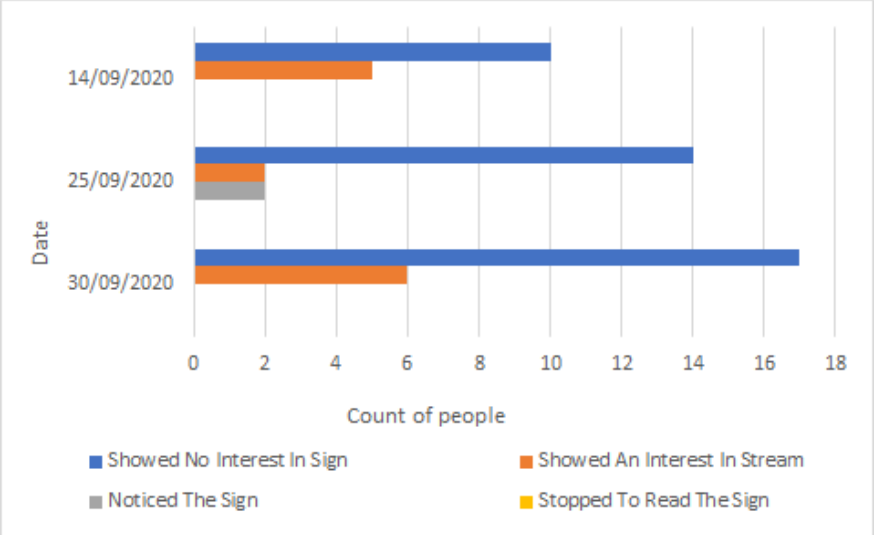

Figure 2 Clustered bar graph showing the counts of people observed at Te Ngaki o Waiutuutu/Community Gardens

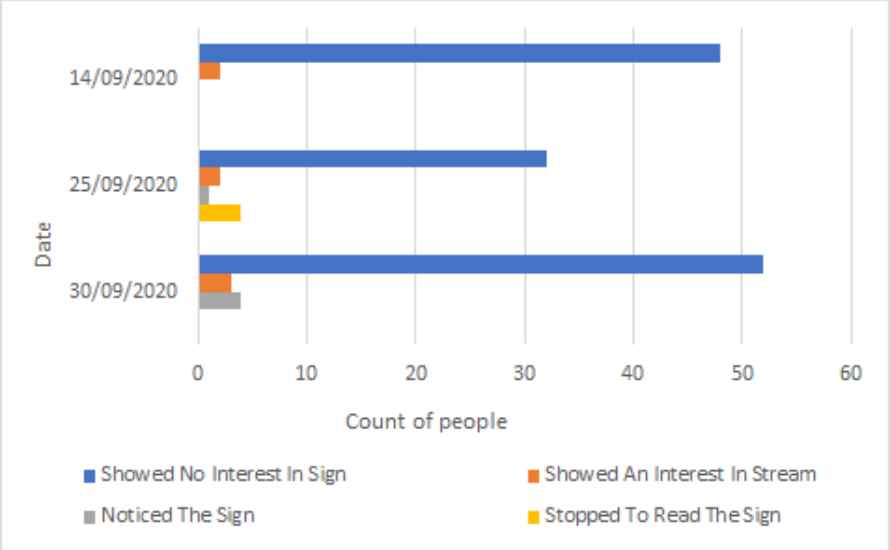

Figure 3 Clustered bar graph showing the counts of people observed at the bridge by the Biological Sciences car park

Table 1 T-Test comparing those people who showed an interest in the signboard or the stream and those who showed no interest

Location	T-Stat (2 dp)	Two-tailed *P*-Value (2 dp)	df
Engineering Core	1.99	.18	2
Community Garden	4.11	.05	2
Biology Carpark	6.11	.03	2

5.11 Engineering Core Bridge Signboard

Looking at the P-value for the Engineering Core location there was no statistically significant difference between those showing an interest in the signboard or the stream and those who showed no interest (Table 1). Therefore, we cannot reject the null hypothesis. This could be a result of low statistical power as we had a small sample size (n=3) and could be improved by having a greater sample size.

The count for people showing no interest in the signboards or stream was 334 out of a total 416 observed (Fig. 1). This is 80.3% of the total observations for this location. This location experienced a large amount of traffic over the testing period apart from on the 14/09/2020 where only 57 individuals were observed (Fig 1). This is likely a result of COVID19 level 2 restrictions. As there is a high amount of traffic within this observational area it would make sense for us to locate a signboard here. Placing it in a spot that stands out and gives people the opportunity to stop and read the signboard without hindering the high foot traffic flow.

5.12 Community Garden Signboard

Looking at the p-value for the Community garden signboard location there was no statistically significant difference between those showing and interest in the signboard or the stream and those who showed no interest (Table 1). Therefore, we cannot reject the null hypothesis. This *P*-value slightly exceeds the alpha value of 0.05 (Table 1). Again, this could be a result of low statistical power as we had a small sample size (n=3) and could be improved by having a greater sample size.

This site had the lowest total number of people observed across the 3 sites (56). Of these 56 people, 41 showed no interest in the signboard or stream (Fig. 2), this was 73.2 %. Again, showing the same thing as the Engineering core bridge site (Fig. 1), with most people showing no interest in the current signboards or stream. At this observation site, 23.2% of the individuals observed showed an interest in the stream, this was particularly interesting as it was the largest proportion of people acknowledging the stream over the 3 locations. With this in consideration, it would give us reasoning to believe this would be a suitable place to put one of our new signboards.

5.13 Biological Sciences Carpark Signboard

Looking at the p-value for the Biological Sciences carpark there was a significant difference between those people showing an interest in the signboard and stream and those showing no interest (Table 1.). We can therefore reject the null hypotheses. This would mean the null hypotheses is rejected and it would show there is a difference between the counts of people looking at the signboards or stream and people that are not acknowledging either.

This site experienced the same trend of people not acknowledging the stream or signboard, with this site having the largest proportion of people showing no interest. Out of the 148 individuals counted at this site 132 showed no interest in either the signboards or the stream (Fig. 3) this made up 89% of observations at this site. This site also had the largest count of individuals stopping to read the signs, this came to a total count of 4 individuals over the 3 observational periods. With this in consideration, it would give us reasoning to believe this would be a suitable place to put one of our new signboards.

5.14 Implications

Our analysis found that there is a significant need for the addition of new signboards as our observations showed high proportions of individuals showing no interest in the stream or the current signboards. Of all the individuals counted over the 3 observational sites, 81.7% of these individuals showed no engagement with the stream or sign.

5.2 Recommended Signboard Drafts

5.21 Signboard Placement

Our recommended signboard placement (Appendix C) was based upon the results of our observational survey, our experiences throughout the project, and a walk along the stream with our community partner, who identified appropriate places for signboards to be placed. Signboard placement was also largely dictated by content, as there were particular areas which were significant for example the community gardens. One sign, by Engineering Road already had the physical structure in place, so this was not moved. Signboards on bridges were moved in front of bridges, to capitalise on high traffic areas, while ensuring they were convenient to read and didn't inhibit traffic flow.

5.22 Signboard Content

Signboard content was developed using information synthesised from interviews and literature reviews. Content was designed to complement and link with placement. Explaining the narrative of the stream's history and restoration was an important part of our desired outcome so we kept this in mind when considering both content and placement. To improve reader engagement, each signboard has one or two sentences encouraging people to identify things in front of the signboards, or as they walk along the trail. This encourages people to interact with both the signboard content and the environment around them.

We were excited by the opportunity to make our signboards bilingual, and Te Reo translation process is currently under consultation. As this process will extend past our project end date, we have left space on our recommended signboard drafts for this. Content covered included the history of the stream and its restoration, community engagement, stormwater contamination and mitigation methods, life within and around the stream, inflows, cultural practices, values and narratives (Appendix D). These were all topics considered important during both our literature reviews and interviews.

To make the signboards more eye-catching, we included photos or diagrams. These included pictures of animals which live in and around the stream, and historical photos showing the changes in the stream over time (Appendix D). To maintain consistency, we used similar titles for each signboard, keeping the same suffix of "Our Waterway", but changing the prefix to match the signboard content, for example, the signboard by Te Ao Marama has the title "Significance of Our Waterway" (Appendix D, Fig D.7). We used "Our Waterway" because we felt it would make people feel like they have ownership over it, and its protection.

5.23 Signboard Design

One thing that we were particularly aware and cautious of was the that we do not have experience in graphic design. Therefore, our recommended signboards are more of a guide than a final design.

These will go to a signboard designer who will edit them and produce physical signboards taking into account our recommendations.

Our community partner suggested that we include a map showing the locations of the different signboards. We designed this using Sketchbook, with a transparent map of campus below, showing landmarks to help people navigate the trail (Appendix D). One group member redrew the diagrams on the signboard (using Sketchbook) on Engineering road (Appendix D, Fig D.3) including more labels. They also drew a simple diagram of the rain garden (Appendix D, Fig D.5), in consultation with F. Charters. We included QR codes with links that will be able to be changed without the QR code on the signboard having to be changed, increasing the longevity of the signboards. These allow for additional information to be provided without crowding physical signboards with text.

We wanted to make the designs consistent, and so we adhered to the same placement for the UC logo, 360 trail logo, map of the trail, and QR code. To keep text readable, we broke it up into sections using subheadings.

5.3 Limitations

Many limitations arose during this research assignment in relation to attaining the results for the signboard placement, content and design that have impacted the quality of the results. In regard to the observational survey conducted to target the engaged or non-engaged community on the current signboards, surveying at the community garden, engineering and biology building only happened 3 times. This meant that we obtained results with low statistical power as only sampling 3 times is not a great representation of the overall traffic. Whilst doing the survey, we also made many assumptions about the individuals walking past the signboards, based on their body language. Therefore, this could lower the validity of the results as we cannot assume that people are interested in the stream, based upon head movement. It was also hard to distinguish whether or not they were part of the community walking the trail or students, as we surveyed during the week when classes were still on. This may have introduced a bias into our data. If we sampled during the weekend or during different times of the day there may have been more community members present, and our results may have changed. On one of the three days we surveyed, Christchurch was under COVID19 level 2 restrictions. This would have affected the traffic going past these signboards on this particular day compared to the other days surveyed as some classes were only available online during that period. We could have improved the accuracy of our data by doing our observations at the same time, although in some situations this was not possible as we could not find times where we were all free.

Another limitation was the short timeframe provided to conduct this project. To collate the information needed to put on the signboards, we had to meet with stakeholders and partners which

involved scheduling our own time to suit theirs. Some stakeholders were only free at certain times of the week due to work and/or personal reasons which affected the pace that we were trying to complete sections of the project. We did consider qualitative surveys, however, we felt this would not be achievable in our timeframe.

The short timeframe has also affected our group as Te Reo translation is yet to be added to the signboards due to being under consultation. Thus, ultimately resulting in the signboards not being completed to provide to the graphic designer, and therefore no physical production of signboards in our timeframe.

6. Conclusion

In conclusion, this report was focussed on creating signboards that would increase engagement of the community in current restoration projects of the Waiutuutu/Okeover stream at UC. The ultimate goal was to ensure that the information gathered from literature reviews, interviews and the survey would contribute and influence the decisions made regarding the content and placement of the updated signboards.

The results obtained from observational research largely supported our hypothesis that more people showed no interest in the current signboards. This helped us to justify relocating the signboards to more suitable places such as in front of the bridge as opposed to on it, where it is inconvenient for people to stop.

Moving forward, further steps which have been recommended to our community partner include finalising the design with the graphic designer, completing the Te Reo translation process, and finalising the content and link directory for the QR codes. These steps will require time to be completed properly, as well as further collaboration with qualified partners.

We feel that we have created signboards that effectively communicate, engage and inform the community about the restoration efforts for the Waiutuutu/Okeover stream.

7. Acknowledgements

We would like to acknowledge the following stakeholders, who contributed their time and expertise to this project: Angus McIntosh, Jon Harding, Colin Meurk, Frances Charters and Abby Suszko. We would like to thank Te Maire Tau as a Partner from Ngāi Tuahuriri. We would like to acknowledge the support of our supervisor Alexandra Meister. We would like to thank our community partner Matt Morris for his time and commitment to this project.

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9. Appendices

Appendix A: Current Signboards

Figure A.1 Current signboard located outside the Waiutuutu Community Garden. This signboard shows a map of the Waiutuutu/Okeover stream catchment and discusses the ephemeral section and small-scale actions individuals can take to help restore the waterway.

Figure A.2 Current signboard located outside the Facilities Management on Engineering Road. This signboard demonstrates how three different stormwater management frameworks (swales, rain gardens, and infiltration basins) function. It also contains spelling mistakes, wrong Te Reo translations and lacks some diagram labels.

Figure A.3 Current signboard located on the bridge between the Engineering Core and Ernest Rutherford buildings. This signboard mainly talks about the history of the stream restoration and contains photos showing its transformation.

Figure A.4 Current signboard on the bridge outside the School of Biological Sciences. This sign also talks about the history of the stream restoration but discusses some of the techniques used.

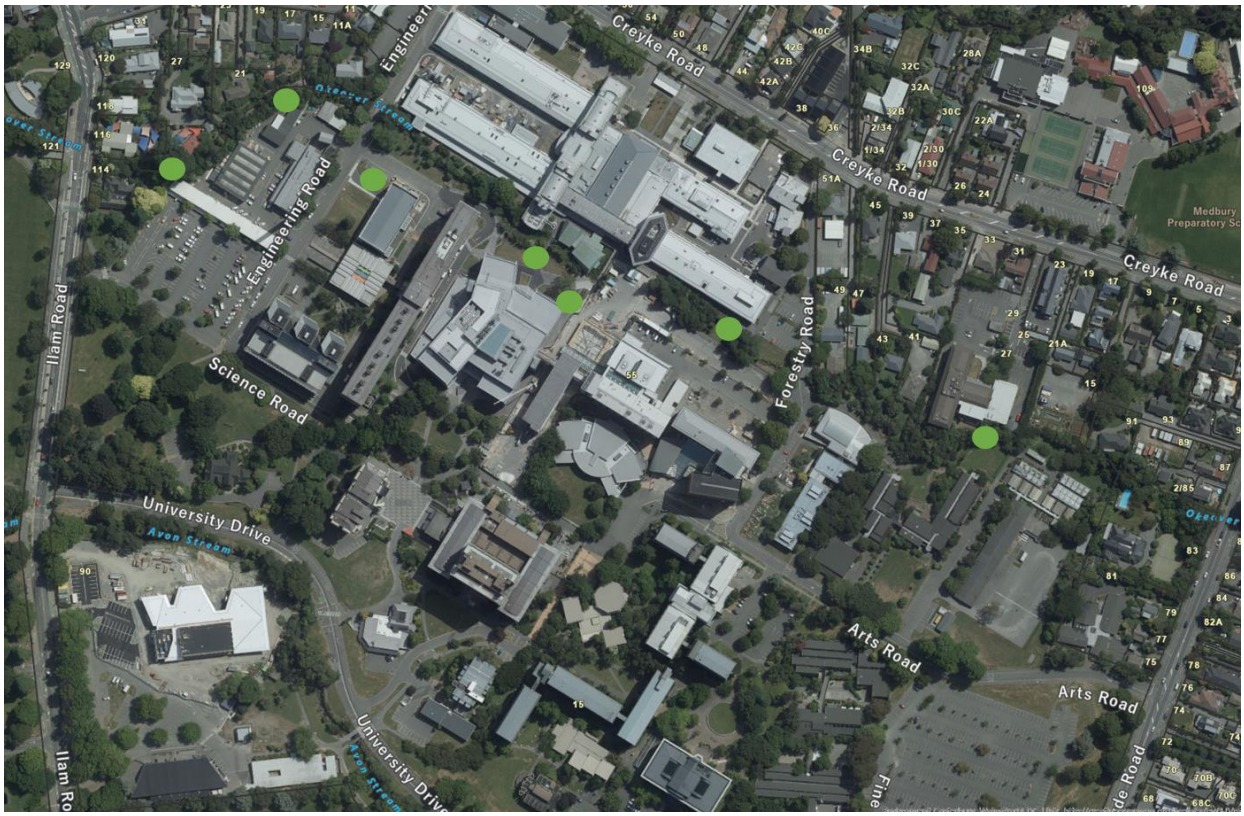
Appendix B: Observation Survey Form

OBSERVATIONAL SURVEY

Time:
Date:
Location:
Duration:
Weather:

	Observations:
People walking past the signboard (not looking at signboard):	
Looked at/noticed the signboard (kept walking):	
Stopped to read the signboard:	
Showed an interest in the stream (turned head or stopped to look):	

Appendix C: Map of Te Whare Wānanga o Waitaha/University of Canterbury campus with dots indicating recommended signboard site locations



Appendix D: Recommended Signboard Drafts

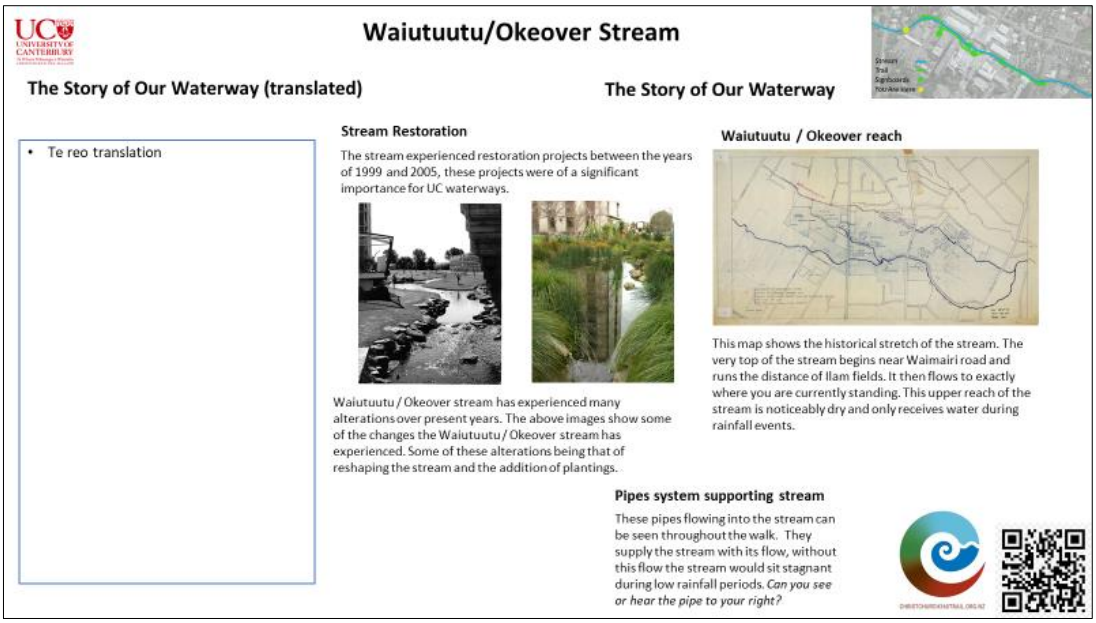


Figure D.1 Signboard draft, for the signboard which will be located by the first bridge on the path from Ilam road to campus. It focuses on the history of the stream, with a map of the extent of the streams historical reach. We also discussed restoration work carried out, with before and after photos showing the change. It also mentions stream inflows.

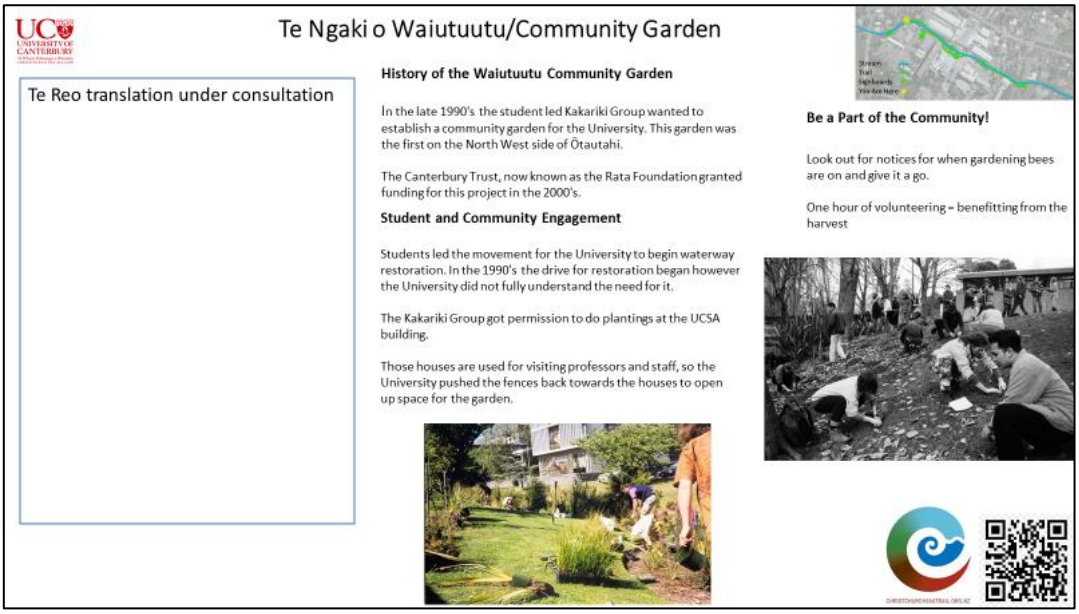


Figure D.2 Signboard draft, for the signboard which will be located opposite Te Ngaki o Waiutuutu/community gardens, this signboard centres on the theme of the garden's history, which was led by students, funded by an external organisation. The photo features students volunteering with plantings.

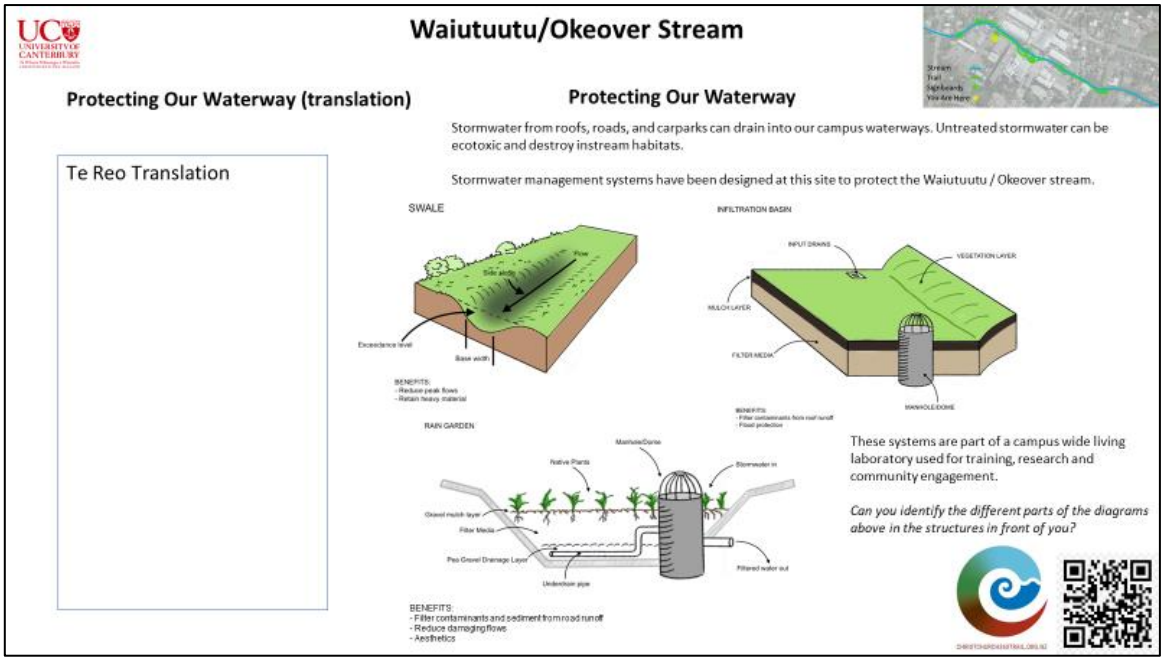


Figure D.3 Signboard draft, for the signboard which will be located on Engineering Road. It discusses and explains the stormwater management features which are located in front of the sign, including swales, infiltration basins and rain gardens.

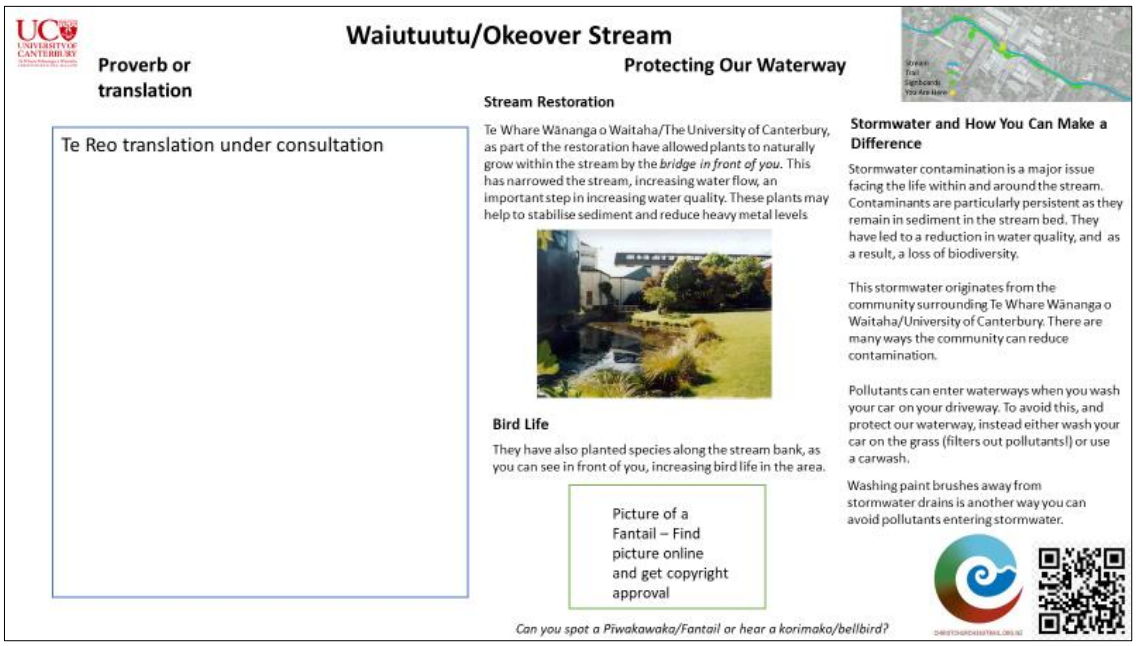


Figure D.4 Signboard draft, for the signboard which will be located before the bridge to the Engineering Building. This signboard covers restoration (plantings and stream narrowing), bird life, stormwater impacts on biodiversity and actions the community can take to reduce stormwater contamination. Photo of fantail still to be found.

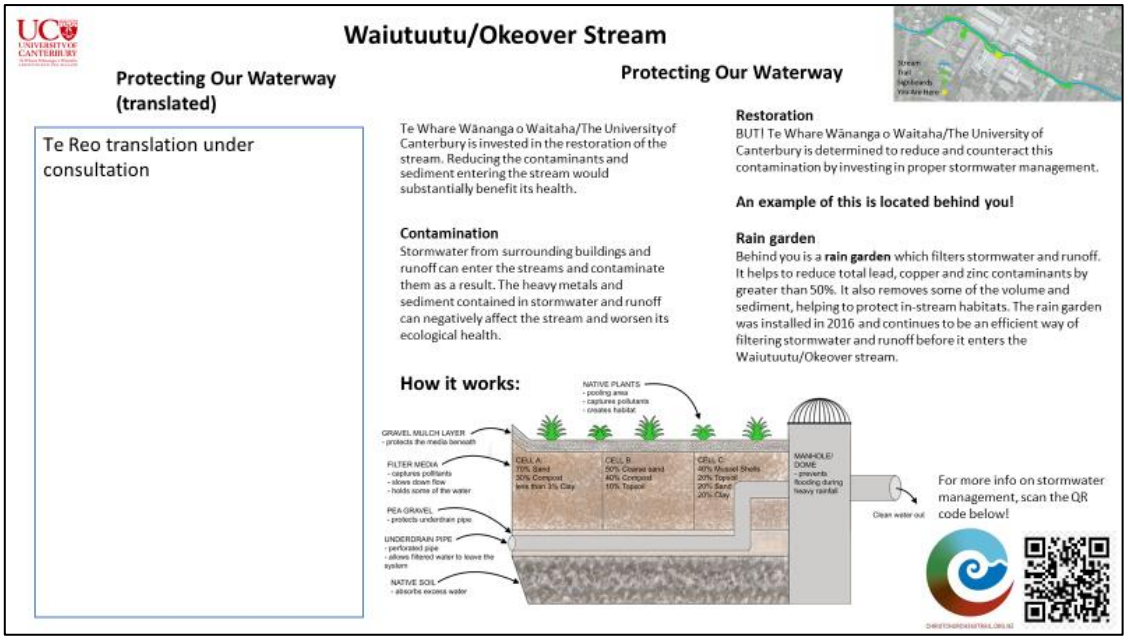


Figure D.5 Signboard draft, for the signboard which will be located by the Ernest Rutherford Rain Gardens. It discusses stormwater contamination; its impacts and mitigation efforts being undertaken by Te Whare Wānanga o Waitaha/University of Canterbury. Diagrams courtesy of Mitzie Bisnar in consultation with Frances Charters.

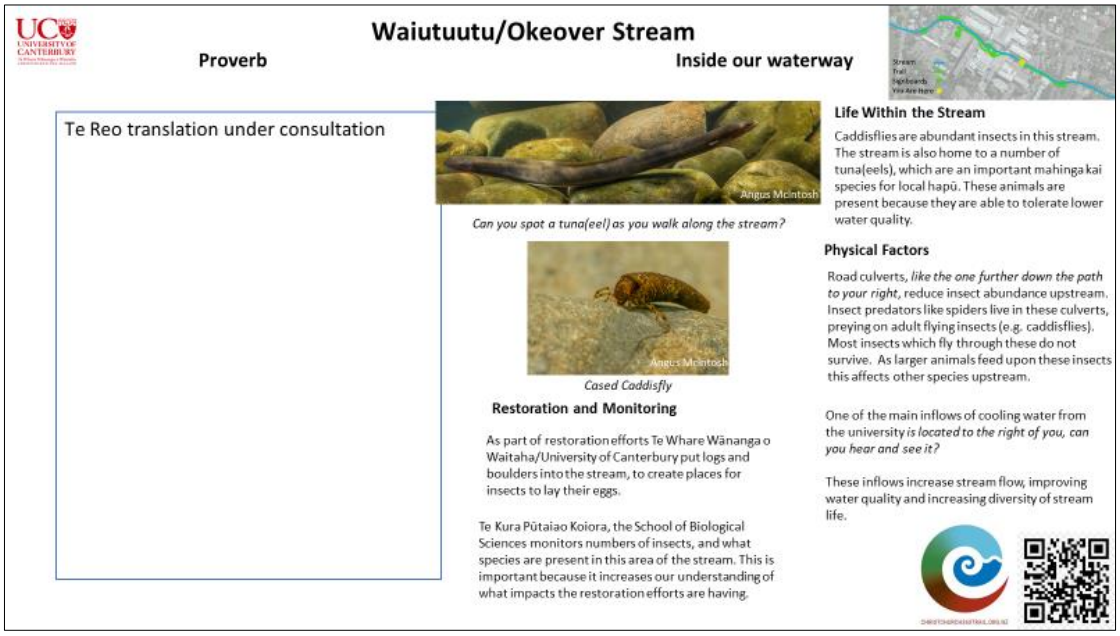


Figure D.6 Signboard draft, for the signboard which will be located before the bridge opposite the Biological Sciences Building. It covers restoration and monitoring efforts, road culverts, animals within the stream and inflows. Photos courtesy of Angus McIntosh.

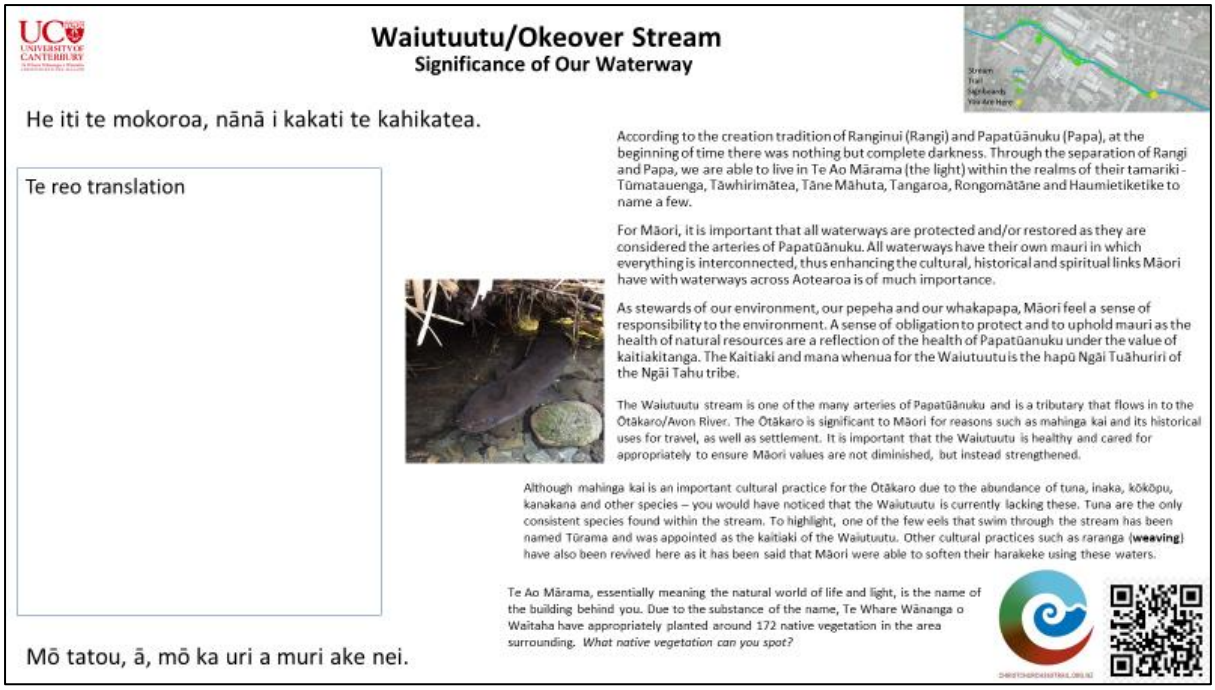


Figure D.7 Signboard draft, for the signboard which will be located by Te Ao Marama. It covers cultural practices, values and narratives. It features a picture of Turama, the Kaitiaki or Guardian of the Waiutuutu. It also mentions the native vegetation which surrounds this area.