Kaiate Falls Water Quality

An assessment of public preferences for intervention options

Report prepared for Bay of Plenty Regional Council

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Executive Summary

This report presents the results of a survey about Kaiate Falls in the Bay of Plenty region. The purpose of the study is to better understand the non-market values of Bay of Plenty residents and their preferences for possible interventions to improve water quality in Kaiate Stream.

710 people completed the web survey. Just over a third of people said they knew at least a bit about Kaiate Falls, and a similar proportion could remember visiting it at some time in the past. Kaiate Stream is the 11th most popular site in the region, and six percent of people said they had visited in the past year.

Respondents were asked to rank their most and least preferred intervention options given different distributions of the cost of each option. The intervention options were:

1) No additional intervention;
2) Complete fencing only;
3) Complete fencing and riparian planting;
4) Banning grazing in upstream of the falls;
5) Purchasing and retiring grazing land around the falls for public use.

Options 2, 3, and 4 allowed for a distribution of costs between ratepayers and affected land-owners, while option 5 would have to be funded entirely by ratepayers.

The most preferred intervention option was a grazing ban (Option 4) (37 percent of respondents), followed by retirement of land for public use (Option 5)(26 percent). The grazing ban (Option 4) was ranked last by only 6 percent of respondents. Retirement (Option 5) was the second most preferred option (26 percent), but had a larger number of people ranking it last (16 percent) compared with fencing. The no change option (Option 1) was preferred by only 7 percent of people and ranked last by 59 percent, indicating a strong overall preference for action.

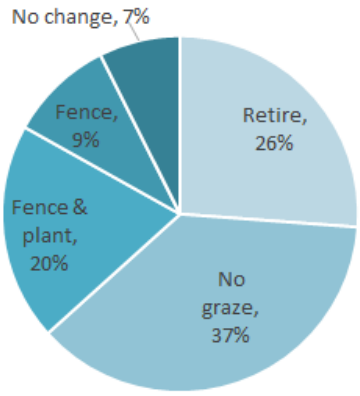

Figure 1 – Proportion of the time ranked highest

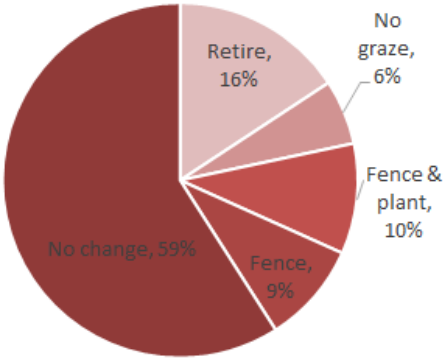

Figure 2 - Proportion of the time ranked lowest

The allocation of costs for a grazing ban (Option 4), fencing or planting (Options 2 and 3) had only a very small effect on preferences – probably because the cost per rateable unit was very small. The

biggest difference is for the “no change” option (Option 1), which was preferred by 3 percent of respondents if land owners pay the maximum for alternative options, up to 7 percent of respondents if ratepayers pay the maximum for alternative options.

When asked about their preferred level of water quality, over half of respondents chose the highest quality grade “A”. When asked who should bear the cost of improving quality, a third of respondents said land-owners. A third said ratepayers should contribute, 14 percent said central government and 9 percent said users or tourists. A quarter of respondents want to split the cost between two or more of these categories.

Two-thirds of respondents said they were personally willing to pay an annual amount to improve water quality at Kaiate Falls. Half were willing to pay more than $10 per year. Depending on how conservative the correction for hypothetical bias, Bay of Plenty residents’ total willingness to pay (WTP) to improve water quality at the Kaiate Falls may be in the order of **$0.9 million to $2.9 million** per year, or $9 to $29 per resident household.

1 Introduction

The Kaiate Falls Scenic Reserve is a popular recreational area within a short drive from Tauranga, Pāpāmoa, Mount Maunganui or Te Puke. It offers a short bush walk that leads to a series of waterfalls with deep swimming holes, a picnic area and scenic views.

Since 2015, a permanent health warning has been in place advising against swimming at the Falls due to high risk of infection. In spite of this advisory, the Falls continue to be popular with swimmers.

Based on monitoring since 2012, water quality at the Falls is in the orange "D" attribute state for *E. coli* (Scholes, 2018), as defined in Appendix 2 of the National Policy Statement for Freshwater Management (Ministry for the Environment, 2014). As illustrated in Figure 4, a stream is considered to be suitable for swimming if it is in the yellow "C" attribute state or above.

Figure 3 - Map showing Kaiate Falls location

The main types of bacteria found are from ruminants (cows, sheep, deer or goats and can be influenced by possum), with an avian influence at several locations, probably from birds that nest and feed above the Falls. Upstream farming activities are very low intensity and may not be financially viable if a lot of additional restrictions are put in place.

In recent years, landowners have invested in fencing and planting of streambanks above the Falls, with the support of local councils and the community. According to Bay of Plenty Regional Council estimates, approximately 16km of fencing is still required for the catchment to be fully fenced to exclude stock from the main streams. Riparian margins still unplanted total approximately 33.9 hectares according to these estimates.

The Bay of Plenty Regional Council has set out targets to improve the suitability for swimming of popular swimming sites around the region in its Long Term Plan 2018-2028. The Kaiate Falls are currently ranked as the worst monitored site in terms of suitability for swimming in the Bay of Plenty, yet, as described below, they remain a popular swimming site. The aim of this study is to better inform land management interventions in the catchment, bearing in mind the spectrum of possible interventions, their costs and the degree of uncertainty about their effectiveness. The purpose of this study is to understand the value that the wider community (based on the sample population) would place in water quality improvements at the Falls, and the relative acceptability of different intervention options.

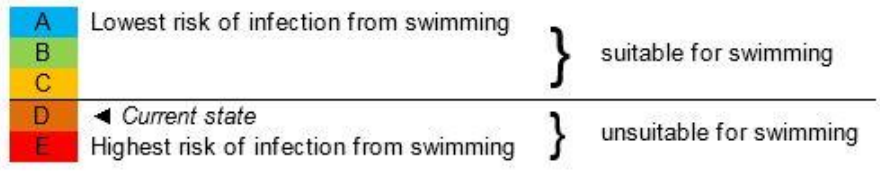

Figure 4 - Water quality scale

2 Method

2.1 Total Economic Value framework

Total economic value (TEV) is a framework that tries to solve the problem of how to articulate the obvious importance of natural capital and associated ecosystem services. Typically only a small proportion of ecosystem services can be captured by, and traded in markets. However, natural capital is the foundation upon which the other capitals are completely dependent (see Figure 5, below).

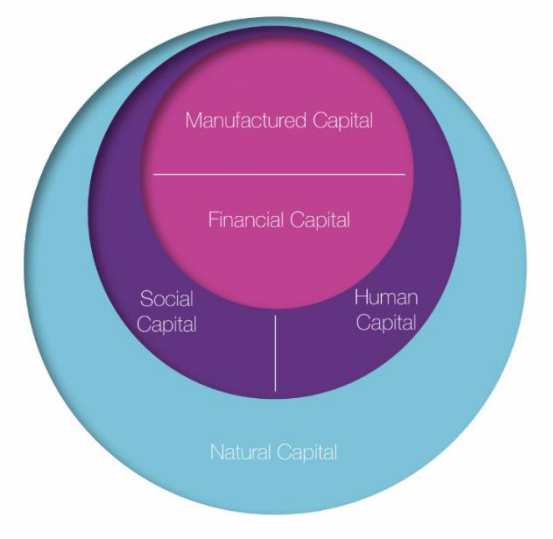

Figure 5 – An illustration of the five capitals[1]

In the TEV framework, the value of a natural resource (such as Kaiate Falls) is a combination of use and non-use values held by society. Use values can be further broken down into direct use (recreation, harvesting, cultural activities) and indirect use (scenic value). A large component of non-use value is option value, which is the option to use the site in future if the type of resource becomes scarcer or personal circumstances change. In addition, people may have non-use values because they perceive a benefit to preserving the resource for use by future generations and/or other species.

Researchers often try to estimate non-market total economic value in monetary terms. This can be done by (directly or indirectly) asking people how much they would be willing to pay (WTP) to improve or how much they are willing to accept (WTA) to allow degradation. However, non-market valuation methods have major limitations including:

- Contextual effects – "value" is hugely dependent on how the question is framed, and individual or environmental contexts. Even demand for market goods is fickle and dependent on the availability of substitutes and complements so this problem is not limited to public goods. Another contextual aspect is how the "next best alternative" is framed. Is another environmental project going to lose resources if this project is funded? If it is funded by a rates increase, what will the household have to give up? Value is an almost circular construct because it depends on the value of the next best alternative.
- Hypothetical bias – people may believe an environmental resource is important and say they are willing to pay a certain amount, but change their minds when the cost becomes real (and they are forced to give up their "next-best alternative", above).

[1] https://www.forumforthefuture.org/project/five-capitals/overview

- Myopia – over longer timeframes and higher uncertainty, the value of options increases significantly and tends to be severely underestimated.[2]
- Preference construction – people have little experience thinking about their preferences for environmental goods and have no chance to learn through feedback from previous decisions[3] so are probably constructing them on the spot. Therefore, their stated WTP is likely to be unreliable.

Using real-world decisions ("revealed preferences") such as recreation trips can avoid the problems of hypothetical bias and preference construction. However, travel costs analyses are still highly dependent on the assumption of the next best alternative, and results can be highly variable due to seasonal, sampling, or other external effects. Nor can revealed preference techniques capture option or non-use values.

The expectation of deriving a specific monetary non-market value that will be stable over a useful period (e.g. a 10-year council planning timeframe) seems very optimistic.

With all the problems associated with measuring values, what is the best way to get results that will be useful and reliable for policy decision makers? The answer lies in the concept of *incentive compatibility* (Collins & Vossler, 2009). In order to maximise validity, the preference elicitation question must be as similar as possible to the policy decision that needs to be made. If the intervention options are known, it is better to ask directly about preferences for these interventions rather than indirectly by estimating WTP for fish (for example).

The following Figure 6 illustrates the scope for error in linking individual values to environmental outcomes, and policy interventions. If a study focusses on obtaining precise estimates of what people value, there are two intervening steps required to relate this to a policy decision, with large potential for misspecification. Alternatively, asking directly about preferences for the intervention means that it doesn't matter *what* the individual values, or whether they have the same beliefs as experts. The question is more incentive-compatible.

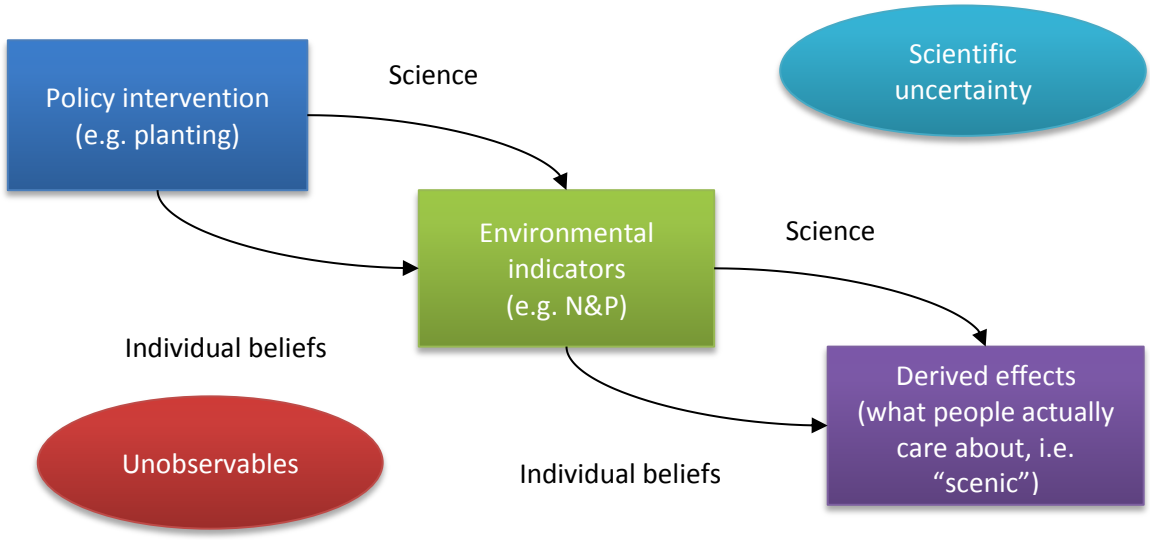

Figure 6 - Diagram showing the imprecise links between intervention, outcome, and personal values

[2] Which is why people are still building over high class soils when signs point towards global food shortages in the longer term
[3] As required by the *discovered preference hypothesis* (Braga & Starmer, 2005)

The alternatives and associated outcomes must also be believable, and respondents need to believe there is at least a chance that decision-makers will act on the preferences expressed. As demonstrated by Marsh, Mkwara and Scarpa (2011), if respondents' perceptions differ from the description presented by the researchers, the results will be biased. If environmental outcomes are uncertain (as they often are), it reduces validity to present them as if they are certain. Nor is it ideal to experimentally adjust the "cost" of an option in order to estimate maximum WTP if this makes the cost unrealistic.

For this study a choice experiment is developed with the main objective of eliciting preferences for intervention options rather than calculating maximum WTP for a specific level of environmental quality. However, the survey also includes a question about personal WTP, for comparison.

2.2 Choice modelling framework

Choice modelling is a typical approach used to analyse people's preferences for discrete alternatives (i.e. separate and distinct policy interventions). The underlying premise is that people's values and preferences can be inferred by studying their choices in either a real or hypothetical setting. If the choice task is designed by a researcher (as opposed to passively observing choices) then it is called a *choice experiment*.

Utility maximisation is the most commonly used behavioural model in environmental economics and assumes that individuals choose the option that will maximise their personal utility (benefit). Utility may include altruistic dimensions - such as concern for people or other species who are negatively affected – so is not necessarily a purely selfish construct. There are alternative models (such as minimising regret) that may be more appropriate in some settings but these tend to yield similar results (Boeri, Longo, Doherty, & Hynes, 2012).

The origins of choice modelling are generally traced back to Thurstone's *Law of Comparative Judgement*[4] published in 1927 and random utility theory developed in the field of mathematical psychology. These developments recognised that utility (and therefore choice) have both a predictable component and a random, unpredictable component. If you observe an individual making repeated choices, they won't always make the same choice, for reasons that may be unknowable by the researcher.

The goal of choice modelling is to accurately estimate the predictable effects and make reasonable assumptions about the distribution of the random part. The model estimation process was greatly simplified by McFadden's 1974 ground-breaking use of multinomial logit models and Generalised Extreme Value (GEV) distributions to approximate multivariate-normal distributions. McFadden and Train (2000) also showed that by including appropriate random parameters and/or error terms, the resulting "mixed logit" model (the type of model used for this study) can approximate any true utility model and its associated substitution patterns.

2.3 Choice experiment design

In consultation with BOPRC staff, five alternative intervention options were developed for Kaiate Falls water quality for the purpose of this survey only. The descriptions presented to respondents are shown below.

[4] https://en.wikipedia.org/wiki/Law_of_comparative_judgment

Option 1 - "No additional intervention"

This option would have no additional cost to ratepayers or landowners, but water quality may remain the same or worsen into grade “E”.

Option 2 - "Full fencing"

Complete the additional fencing required to exclude all stock from waterways. There is a small likelihood of improving water quality to grade “C” but it may remain at the current grade “D”.

Option 3 - "Full fencing and planting"

Complete fencing and planting of all stream banks to exclude stock from waterways and reduce the amount of contaminants entering streams. There is a medium likelihood of improving water quality to grade “C” or better.

Option 4 - "No grazing in the catchment upstream of the Falls"

All grazing upstream of the Falls is banned. Landowners would have the option to develop different land uses (e.g. horticulture, forestry, mānuka) or sub-divide their farms for housing or lifestyle blocks. Because the catchment is very steep, the viability of alternative land uses is likely to be very limited. This option has a high likelihood of improving water quality to grade “C” or better.

Option 5 - "Retired to public use"

Retirement of upstream farms into public land, conversion of pasture into native bush, connecting to an existing network of reserves and walking tracks. No ongoing grazing upstream. Similar to option 4, this has a high likelihood of improving water quality to grade “C” or better.

2.3.1 Development of scenario attributes

The water quality outcomes associated with these options are relatively uncertain. Removing stock from the area entirely is believed to have the highest chance of improving water quality, followed by riparian fencing and planting, and then fencing alone. Scientists at BOPRC were not able to be more specific about the probability of improvement based on the information available. Water quality also varies significantly with season, rainfall, and other environmental factors. It is therefore impossible to predict what level of water quality a visitor to Kaiate Falls may experience in each scenario.

The costs of these options, however, are known with more certainty. The retirement option would cost approximately $10 million to buy properties from grazing land-owners and plant the area. The cost of a grazing ban is assumed to be a lost annual profit (earnings before interest and tax, EBIT) per hectare of $50. Potential profit from alternative land-use activities are not included as an offset because, even if they do exist, they would probably require substantial capital investment to be realised. To complete fencing and restrict stock from all waterways including ephemeral flows and seeps, would require an extra 16 kilometres of fencing at $18 per metre. To plant all riparian margins (approximately 33.9 hectares) would require 4,000 plants per hectare, at $5 per plant, for a total cost of $678,000.

Traditionally, choice experiments in New Zealand literature have asked respondents to trade-off different attributes of water quality (e.g. flow, clarity, ecological health, fish stocks) as if the outcomes were predictable (e.g. Bell et al., 2012; Marsh, 2012; Tait, Baskaran, Cullen, & Bicknell, 2012) or the probability of achieving a target known (Phillips, 2014). However, these approaches are of little use to policy decision-making when interventions cannot be tightly linked to the quality levels used in the experiment.

A more useful question is *how acceptable* are the potential interventions to the public? Given that the benefits are uncertain and they will require further costs or restrictions for landowners, further costs to ratepayers, or both. The choice experiment developed is therefore a *labelled* experiment with the labels being the five options above. The only trade-offs respondents were asked to make were between likelihood of improvement and the proportion of the total cost paid by ratepayers versus landowners. This proportion only varies for options 2, 3, and 4. It is assumed that if the land was retired then the properties would have to be purchased at a fair market price, with no scope to impose further costs on land-owners. Option 5 has no additional cost to impose.

The costs included both annual and one-off payments so they were converted to an annual equivalent (6% discount rate, over 10 years) to simplify comparison. The following Figure 7 shows these costs are significantly higher than the profit from grazing, except for the grazing ban option where the cost is equal to grazing profit (as it is assumed landowners would be compensated for their lost profit).

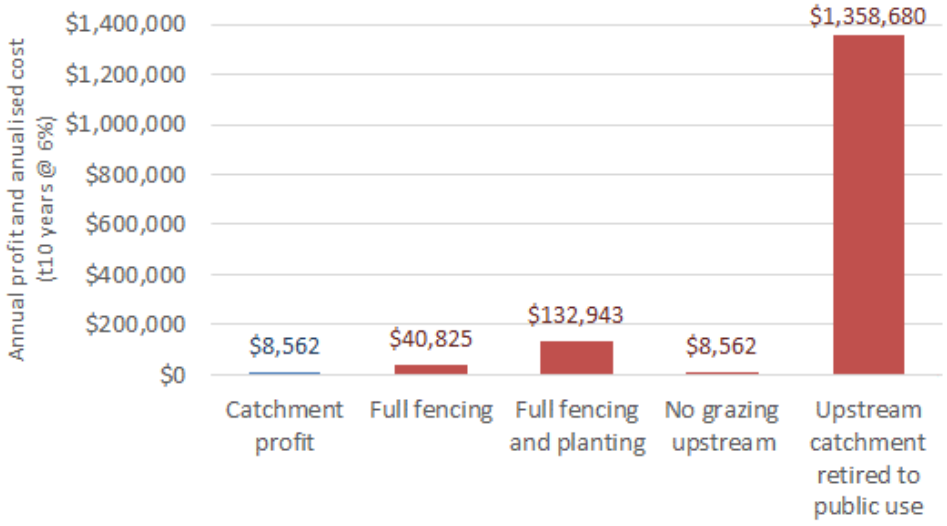

Figure 7 - Comparison of grazing profit and annualised intervention cost

The costs that would be imposed on ratepayers were expressed as an annual amount per rateable unit, and the percentage change that represents. These ranged from 16 cents to $10.87 per ratepayer. The costs that would be imposed on land owners were expressed as an average per affected landowner.

The final choice experiment included 4 choice cards per respondent, each with a different proportional cost split. The objective of the design was realism rather than statistical efficiency[5]. The order of these cards was randomised. Respondents were asked to fully rank the 5 alternatives on each choice card, in order to obtain the most information about preferences at an individual level without boring people with too many choice cards.

The following Figure 8 shows all the attribute levels across the four cards. Figure 9 shows the actual presentation of a choice card, which included a small image to represent each intervention.

[5] Having relatively few attributes and a large sample size, the design did not need to be statistically optimal

Intervention	Outcome	% of options 2,3 & 4 paid by ratepayers							
		0%		50%		75%		100%	
		Land owners	Ratepayers	Land owners	Ratepayers	Land owners	Ratepayers	Land owners	Ratepayers
Retired to public use	**High** chance of improving water quality	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)
No grazing	**High** chance of improving water quality	Cost per land owner: **$1,40** per year	No cost to ratepayers	Cost per land owner: **$713** per year	Cost per regional ratepayer: **$0.03** per year (+0.01%)	Cost per land owner: **$357** per year	Cost per regional ratepayer: **$0.05** per year (+0.02%)	No cost to land owners	Cost per regional ratepayer: **$0.07** per year (+0.02%)
Full fencing & planting	**Medium** chance of improving water quality	Cost per land owner: **$22,000** per year	No cost to ratepayers	Cost per land owner: **$11,080** per year	Cost per regional ratepayer: **$0.53** per year (+0.17%)	Cost per land owner: **$5,500** per year	Cost per regional ratepayer: **$0.80** per year (+0.26%)	No cost to land owners	Cost per regional ratepayer: **$1.06** per year (+0.3%)
Full fencing	**Small** chance of improving water quality	Cost per land owner: **$6,800** per year	No cost to ratepayers	Cost per land owner: **$3,400** per year	Cost per regional ratepayer **$0.16** per year (+0.05%)	Cost per land owner: **$1,700** per year	Cost per regional ratepayer **$0.24** per year (+0.08%)	No cost to land owners	Cost per regional ratepayer **$0.33** per year (+0.1%)
No change to current practices	Chance of **worsening** water quality	No cost to land owners	No cost to ratepayers	No cost to land owners	No cost to ratepayers	No cost to land owners	No cost to ratepayers	No cost to land owners	No cost to ratepayers

Figure 8 - Attribute levels of the four choice cards

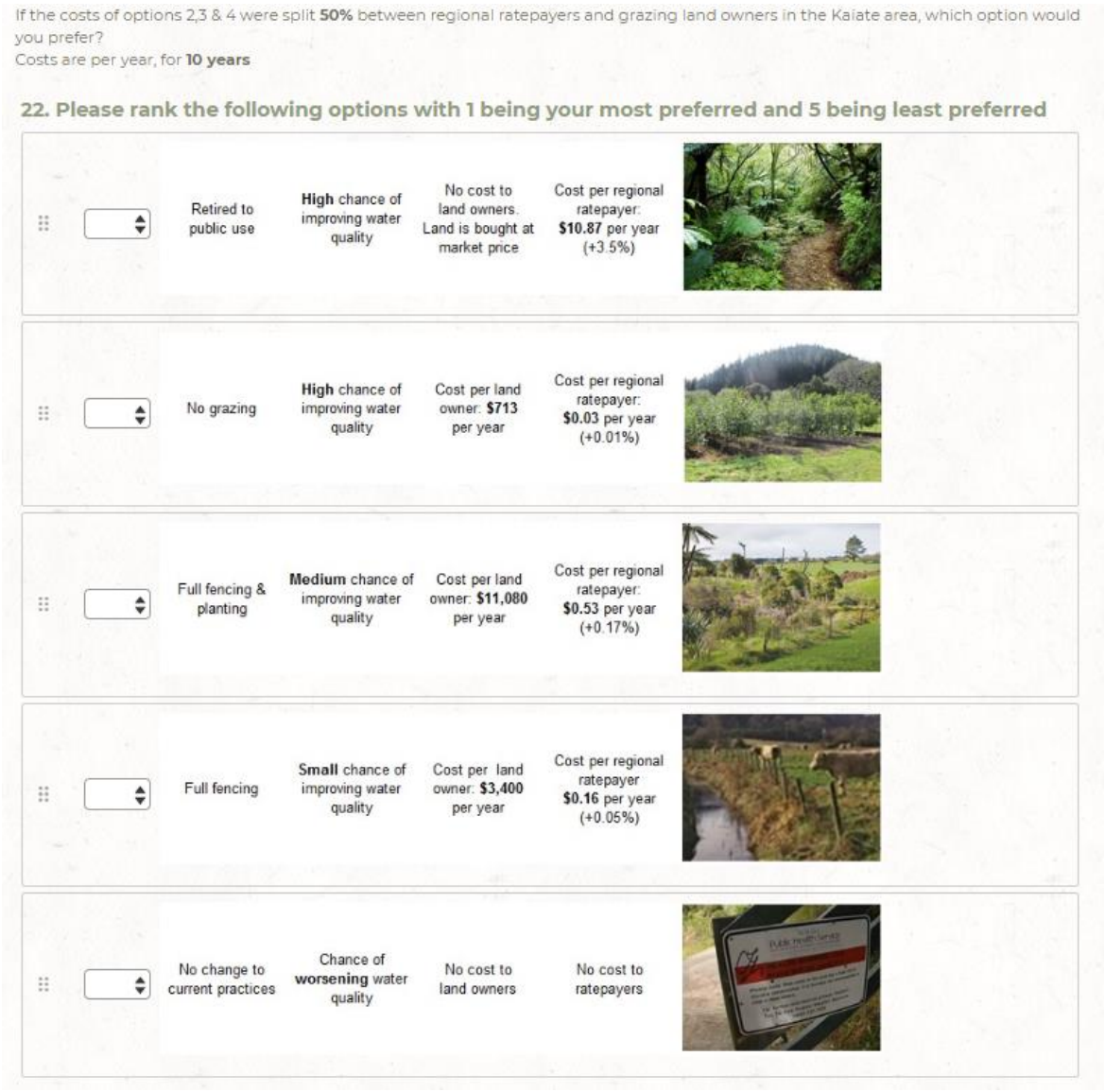

Figure 9 - Example choice card

2.3.2 Model specification

To analyse peoples' preferences for policy interventions for Kaiate Falls, this study uses a panel mixed logit model with correlated random parameters (fixed across choices by the same respondent) to allow for perceived similarities between different policy interventions. Respondents were asked to rank each option rather than just choose the best, in order to maximise the amount of information collected for each choice card. The data are modelled using an exploded logit specification (Lancsar & Louviere, 2008) which converts the ranks to sequential "best" choices from a reducing number of available alternatives. The dependent variable is 1 if the alternative is chosen for the rank level, otherwise 0. The different cost structures are modelled as fixed-effects interaction terms.

2.4 Willingness-to-pay analysis

Respondents were asked their maximum personal willingness-to-pay (WTP) for their preferred quality level. It is common for a significant proportion of people to have a zero WTP for a resource either because they don't care, or because they object to having to personally pay for it (a "protest bid"). This is a problem for statistical analysis because it means parameter estimates obtained by conventional regression methods (e.g. OLS) are biased. The solution is to use a Tobit model[6] which treats value as a "censored" variable which cannot be observed in the case of a protest bid. In section 3.7 of this report, a Type I Tobit model is used to explore variables that might reasonably be expected to be correlated with WTP.

2.5 Cluster Analysis

A cluster analysis is performed on the intervention rankings in order to explore any common characteristics of people with similar preferences. The method used is Ward's hierarchical clustering implemented by the *hclust* function in R[7]. Within-group means are calculated for all variables and T-tests are used to check for significant differences between group means and overall sample means.

2.6 Survey Instrument

A web survey was developed using the Survey Monkey platform. It included questions about recreational use of freshwater sites in the Bay of Plenty region, knowledge of Kaiate Falls, intervention preferences (the choice experiment), household and individual characteristics, preferred water quality and maximum willingness to pay.

2.7 Recruitment

Survey participants were sourced from a pre-recruited panel owned by market research company Research Now (also known as Valued Opinions). The use of a pre-recruited panel restricts multiple participations by the same individuals and is an increasingly popular collection mode (Windle & Rolfe, 2011). Other survey modes - such as telephone, mail or in-person interviews - now have more severe response biases than web surveys. In a previous study (Phillips, 2014), where participants were sourced from both a pre-recruited panel and Facebook/Google advertisements, the pre-recruited panel was found to be more representative of the population.

People in the database who were believed to live in the Bay of Plenty region were emailed a link to the survey, and they received rewards points for completing the survey. The use of mobile web browsers was anticipated, since two-thirds of New Zealanders now access the internet from smart

[6] https://en.wikipedia.org/wiki/Tobit_model
[7] Agglomeration method – Ward.D2 (https://www.rdocumentation.org/packages/stats/versions/3.5.1/topics/hclust)

phones[8]. Most questions worked equally well in mobile or desktop browsers, but for the choice experiment an alternative layout had to be presented to mobile users.

The target population was Bay of Plenty residents only, and the first question screened for region of residence in case the location information held by Research Now was wrong. See Appendix 6.1 for a complete list of questions. Prior to the first choice experiment question, respondents were shown the same description of the intervention options as in section 2.3 above. At the conclusion of the survey, respondents were given a chance to comment and express their views further.

[8] http://www.nielsen.com/nz/en/insights/news/2016/nz-mobile-keeping-kiwis-connected.html

3 Results

3.1 Summary statistics

There were a total of 710 completed surveys. Respondents had to live in the Bay of Plenty Region to qualify for the survey. The following Figure 10 shows a further breakdown of residence by local authority area. Almost half of respondents live in Tauranga City, a quarter in Rotorua District and a third in Western Bay of Plenty.

Compared with Census 2013 household counts, Tauranga residents are slightly over-represented (49% versus 42%) and Whakatāne residents slightly under-represented (8% versus 12%).

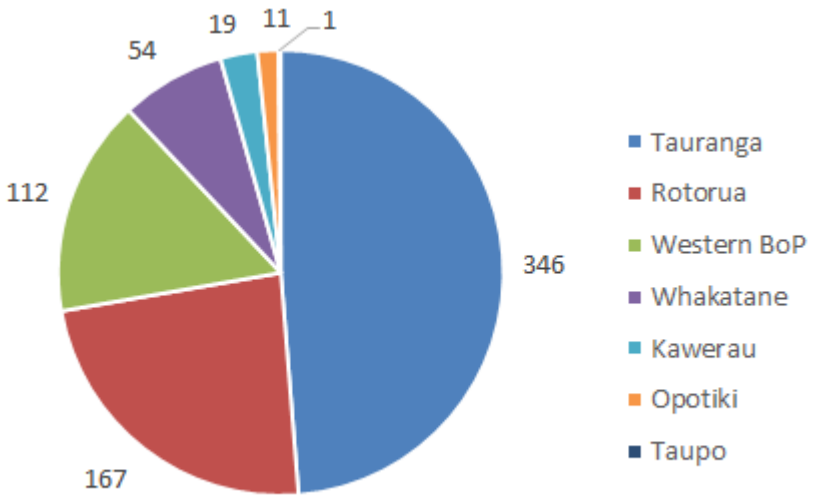

Figure 10 – Local Authority Area of Usual Residence

The following Table 1 shows the summary statistics of the sample. Women were over-represented in the sample, but this is not a concern since the unit of analysis is the household and women tend to express preferences that are representative of the household (Dosman & Adamowicz, 2006). The range of ages is fairly consistent with the population, although there are more households with children (39% compared with 33% in the population). Median household income is $62,500 and similar to the population median of $60,730; although both low and high income groups are under-represented. People who identify as Māori are also under-represented (15% versus 28% for the population). Note that an individual can have multiple ethnicities so they do not add up to 100%.

Weights were calculated to increase the proportion of Māori, high and low income respondents, in line with population means. This also had the effect of reducing the weight of households with children (from 39% to 34%) since middle-income households have more children. The weighted data are used for all further results reported.

Table 1 - Sample statistics

Values	Sample	Population[9]
Count	710	273,357
Female	0.68	0.52
Average age (17+ only)	47	49
17 to 30 years old	0.21	0.20
Over 60 years old	0.32	0.30
Child(ren) in household	0.39	0.33
Median household income	$62,500	$60,730[10]
Household income <$30k	0.16	0.25
Average of Income >$100k	0.13	0.21
Ethnicity - NZ European	0.78	0.76
Ethnicity - Māori	0.15	0.28
Ethnicity - Pacific Islander	0.02	0.03
Ethnicity Asian	0.04	0.05
Bay of Plenty ratepayer	0.71	N/A
Freshwater user	0.60	N/A

3.2 Recreational use

The results and analysis for the questions pertaining to general freshwater recreation are presented in Appendix 6.1.

3.3 Health warning

Survey respondents were asked if the presence of a health warning sign would make them change their plans to swim at the Kaiate Falls. The question asked "Assume you are planning to swim and you see the following sign. If the water looks, smells and feels OK, would you consider swimming there anyway?' Only 5 percent of people said they would still swim. The proportion was highest for under-20-year-olds (13%) and decreased monotonically with older age groups.

Figure 11 - Health warning shown to respondents

[9] 2013 Census unless otherwise stated
[10] Census household income adjusted for 11% income growth between 2013-18 (Statistics NZ Income Survey)

3.4 Kaiate Falls Visitation

Half of respondents live less than 26km from Kaiate Falls (29-minute driving time), making the location an accessible day trip. When asked about their familiarity with the site, 28% of people said they never heard of it. A third had heard the name, another third knew "a bit" and 5% said they were "very knowledgeable". A third of respondents said they had visited the site at any time in the past (that they could remember). Ten percent said they visited within the past year, which is higher than the number of people who indicated they had visited the site in the past year by selecting it from a list earlier in the survey[11]. Only a quarter of visitors said they swam during their last visit[12].

3.5 Choice experiment results

Respondents were asked whether they were completing the survey on a phone or larger screen, as the mobile version required a different layout to be readable. Just over a third said that they were using a phone. Separate and pooled models were estimated to test whether respondents using mobiles had different preferences. Results indicate that they were slightly different[13] but this could be due to differences in the type of people who used mobile phones rather than a presentation effect. Mobile users ranked "no change" lower and were more consistent in their rankings[14] (or were less influenced by cost). Due to a lack of any reason not to, small and large screen users are pooled for the remainder of this analysis.

3.5.1 Average ranks

Table 2 shows the average rank of each option, with 1 being most preferred and 5 being least preferred. On average, the grazing ban option (Option 4) was most preferred with an average rank of 2.23.

Table 2 - Average ranks by alternative and respondent screen size

	Average rank			Standard Deviation
Alternative	Small screen	Large screen	All respondents	All respondents
No change	4.08	4.24	4.19	1.22
Fence	3.11	3.13	3.12	1.13
Fence & plant	2.63	2.69	2.67	1.21
No grazing	2.39	2.15	2.23	1.25
Land retired	2.79	2.80	2.79	1.43

The following Figure 12 shows the proportion of times each option was ranked highest. Similarly, Figure 13 shows how often each was ranked lowest. No grazing (Option 4) was ranked highest by most people (37 percent) and ranked lowest by the fewest number of people (6 percent). Retirement (Option 5) was the second most preferred option (26 percent) but it was ranked lowest more often than fencing (Option 2) was ranked lowest, indicating a division of preferences.

[11] This incongruent result is not unusual and may be due to "availability bias" limiting the number of sites selected or "yes bias" when answering the site-specific question. The truth is probably somewhere in between

[12] Again, this is inconsistent with the all-site activity results where 75% of trips to Kaiate stream involved swimming/wading. However, the Kaiate-specific question did not mention wading and asked about the individual rather than including people (i.e. children) who went with them.

[13] Likelihood ratio test p-value = 0.041, allowing for scale differences

[14] Choice error 11% lower, p-value = 0.01

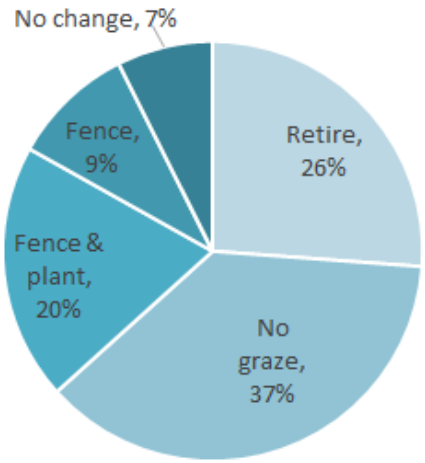

Figure 12 – Proportion of the time ranked highest

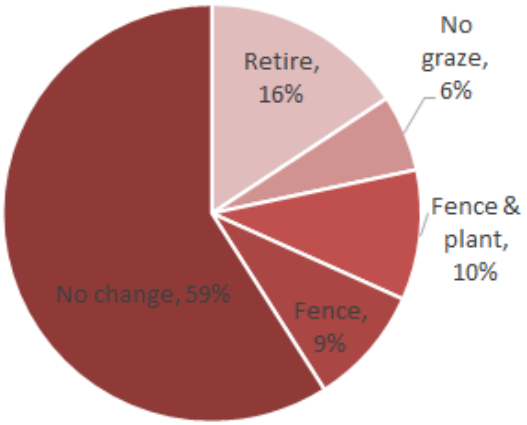

Figure 13 - Proportion of the time ranked lowest

3.5.2 Model results

A panel mixed logit model is used to analyse the effect of different cost structures on intervention preferences, and estimate sampling error. The model was estimated using Biogeme (Bierlaire, 2003) and the output is reported in appendix 6.1. The overall model fit is good with a pseudo r-squared of 0.227.

The alternative-specific parameters for each intervention are the reverse order to the average ranks - a higher coefficient means the alternative is **more likely** to be chosen. They are all significant and positive relative to the "no change" option, as expected.

The allocation of costs has only a **small effect** on intervention preferences and most of the interaction parameters are not significantly different from zero. The difference between 25%/75% and 50% cost splits had an even less detectable effect so these interaction variables are not included in the final model. This is probably because the costs were very small at an individual ratepayer level. The effect on choices can be seen in Figure 14, below.

A positive and significant covariance parameter means that if people rank one of the two options highly, they are likely to also rank the other highly. This is the case for "retirement" (Option 5) and fencing (Options 2 & 3) (with and without planting). "No graze" (Option 4) and "no change" (Option 1) are positively correlated, perhaps because both options avoid investment in buying or fencing land. "Fencing only" (Option 2) and "no change" (Option 1) are also highly correlated, perhaps because they are associated with the smallest improvement in water quality and both tend to be ranked low by most people. There is a negative covariance for "no graze" and the fencing options which implies that if people prefer one of those options, they rank the other quite low. The full set of random parameter correlations cannot be identified simultaneously, so the "retirement and "no change" combination is left out.

The model coefficients, variance and covariance matrices were used to simulate the sampling distribution and calculate confidence intervals for each option[15]. The following Figure 14 displays the results in a boxplot showing quartile ranges and whiskers indicating the 95% confidence interval. This boxplot also shows the effect of cost allocation on preference.

[15] Using the multivariate normal distribution generator (mvnorm) in R with 1000 draws of 1000 individuals.

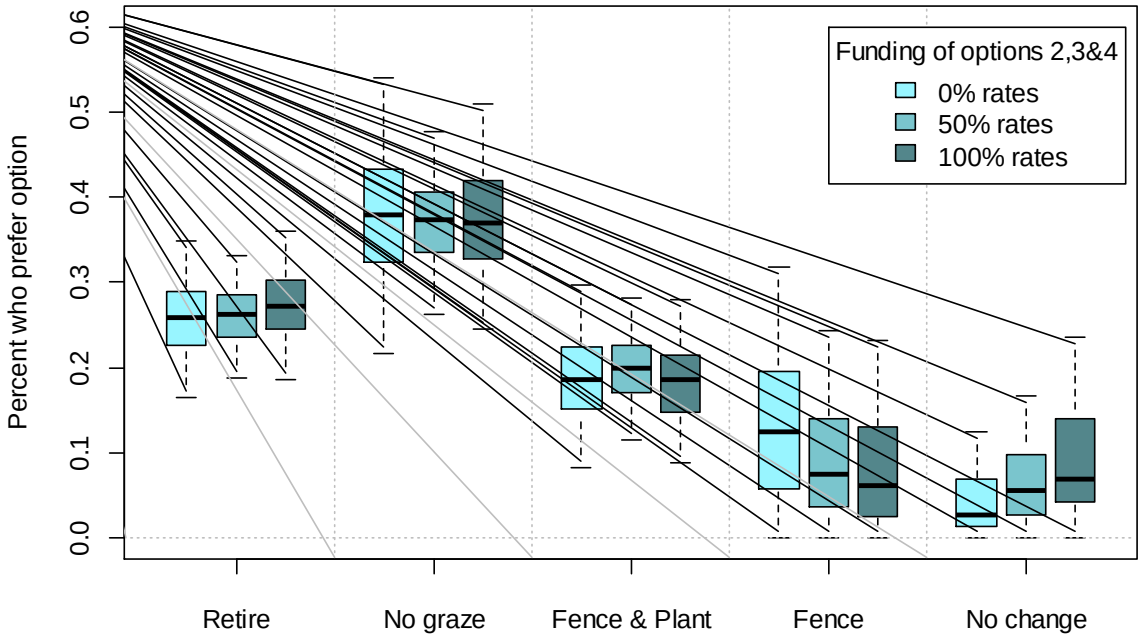

Figure 14 - Choice proportions under different cost distributions

Just over a quarter of the (weighted) sample preferred the **retirement** option (Option 5). If ratepayers had to pay 100% of the costs associated with options 2, 3 & 4 then the proportion of people who prefer retirement increases slightly to **27%.** The 95% confidence interval is 16% to 35% so we can be fairly certain the true population proportion is within this range.

The proportion of people who preferred a **grazing ban** (Option 4) was **38%** (23% to 53% confidence interval). This decreases to 37% if ratepayers have to bear the full cost.

The **fence and plant** option (Option 3) is preferred by **19%** of people, or 20% if ratepayers don't have to pay anything. The confidence interval is 9% to 29%.

The **fence-only** option (Option 2) is preferred by **12%** of people if land owners have to pay the full cost. If ratepayers have to pay it all then only 6% of people prefer this option. The confidence interval is relatively wide, 0% to 33%.

The proportion of people who prefer **no change** (Option 1) increases from 3% to 7% depending on how much of the cost of the other options ratepayers are expected to contribute. The confidence interval is 0% to 25%

3.6 Preferred quality and willingness-to-pay

Respondents were asked for their preferred level of water quality, expressed in terms of the water quality grades "A" to "E". It would seem rational to choose the highest quality level, if all else was equal. However, people were presumably thinking about the trade-offs required to achieve an improvement and factored this into their response. Over half of respondents chose the highest quality grade "A". Fifteen percent chose "B" and thirteen percent chose "C", the minimum level considered suitable for swimming. Two percent chose the current state "D". Seven people (1%) chose "E", perhaps because they feel that existing restrictions are too high. Twelve percent admitted they have no preference. These people with no preference for water quality tended to rank the "no change" option highly in the choice experiment, as one might expect.

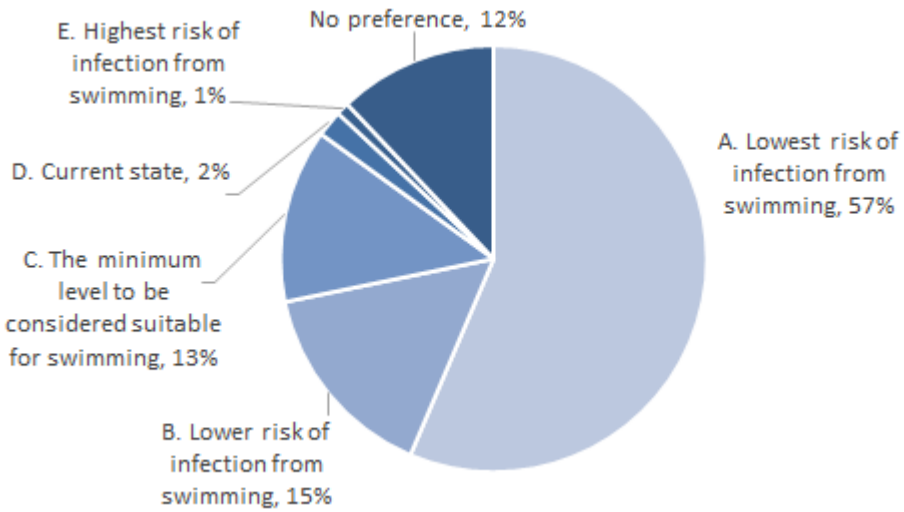

Figure 15 - Preferred level of water quality

Respondents who stated a preference were asked how they think achieving their preferred level of quality should be funded. The response format was free-text so required some coding and interpretation. Results are summarised in Table 3. Many people mentioned more than one party to contribute, so the percentages total more than 100. If they mentioned rates, council, local or regional government they were counted in the first category (32%). Similarly, mentioning taxes or central government added them to the second category (14%). Many people said the problem should be fixed by farmers, "polluters" or the people who caused the problem and these were assigned to the third category (36%). A small number of people (9%) said to charge users, tourists, or rely on donations. If people mentioned multiple parties or just said "split" or "everyone" they are included in the fifth category (25%). Almost a third of respondents gave either no answer, or said "don't know" or some non-specific or non-committal response.

Table 3 - How do you think the costs of improving water quality should be paid for?

Group identified	% of respondents
Rates (Local or regional govt)	32%
Taxes (Central govt)	14%
Charge farmers/"polluters"	36%
Charge users/tourists or rely on donations	9%
Multiple sources or "everyone"	25%
None identified	30%

3.7 Willingness-to-pay

If respondents selected a quality level that was better than current water quality, they were asked "what is the maximum amount you personally would be willing and able to pay, per year, in order to improve Kaiate Falls water quality to (the level specified in previous question)?".

The following Figure 16 shows the distribution of responses. People who did not want better water quality are assumed to have a personal WTP of $0. In addition, 21 percent of people who said they wanted improved quality were not willing to pay for it. Referred to as "protest bids", these responses illustrate an example of when stated WTP is not a good measure of non-market value. The average WTP is $90 but this is skewed by the 12 people with a WTP higher than $1,000.

The line shows the proportion of people who are willing to pay more than the bin range on the x-axis. This shows that 64 percent of respondents are willing to pay more than $0 but only half are willing to pay more than $10 per year (which also happens to be the approximate cost of the retirement option).

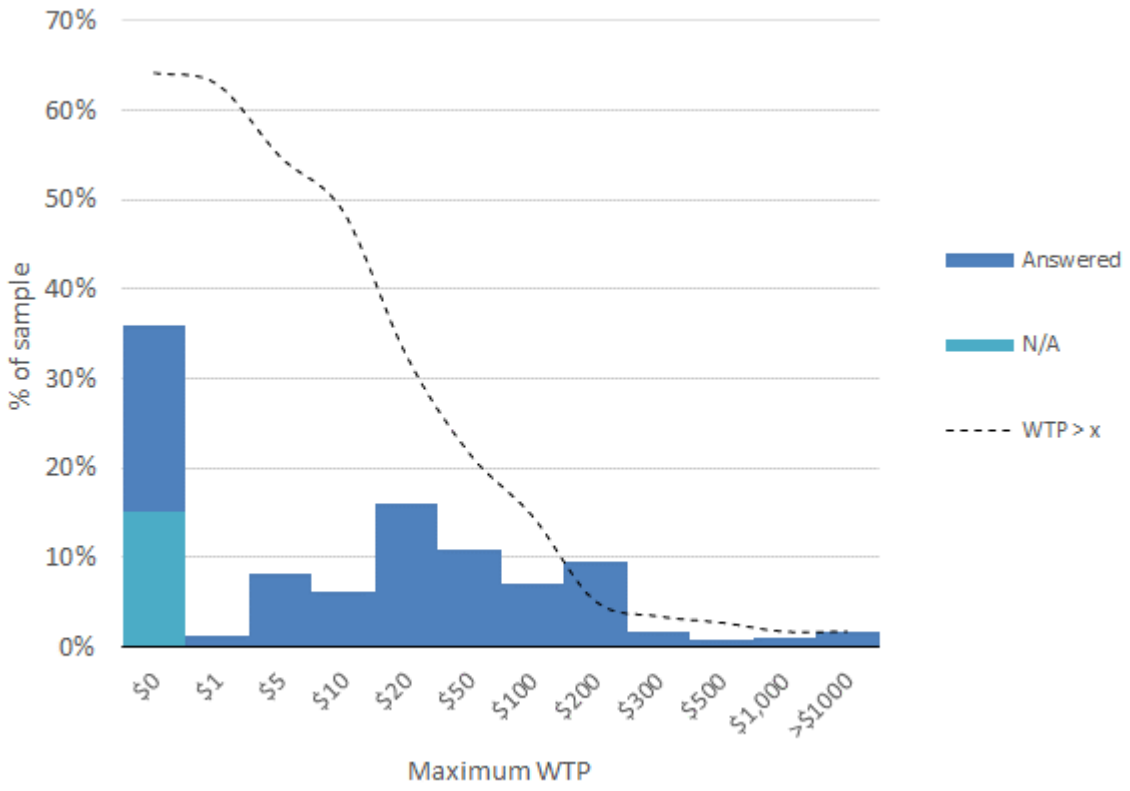

Figure 16 - WTP histogram

Some stated WTP values were very high, and a sensible adjustment for hypothetical bias might be to cap credible WTP at $200 per year. Assuming that the sample is generally representative of Bay of Plenty residents, then total (capped) WTP across 125,000 rateable units is **$2,900,000** per year. If maximum WTP is instead capped at a very conservative $20, the total is **$0.9 million** per year.

3.8 WTP regression

The purpose of the Tobit regression of WTP was to test if there were any individual characteristics that were strongly associated with having higher or lower WTP. The regression results (appendix 6.4) show that people who think ratepayers should pay (at least some of the cost) had a higher average WTP, and a higher probability of a non-zero WTP. People aged under 30, or with larger households also had higher average WTP. Variables with no significant detectable effect included income, familiarity with Kaiate Falls, and being a freshwater user. The regression explained very little of the variation in WTP overall.

3.9 Cluster analysis

Five distinct groups[16] emerged from the cluster analysis of intervention rankings. The following Figure 17 shows the preferences of each group, who have been given a descriptive label.

The first and largest group labelled "Prefers best quality" ranked equally high the interventions with the best chance of improving water quality. The second group ("Prefers ban") ranked grazing ban the highest and retirement very low. The third group ("Prefers retirement") ranked retirement highest and a ban lower. The fourth group ("Prefers fence & plant") instead ranked fencing and planting highly. The fifth group ("Non-interveners") preferred no change and ranked the expensive interventions lowest.

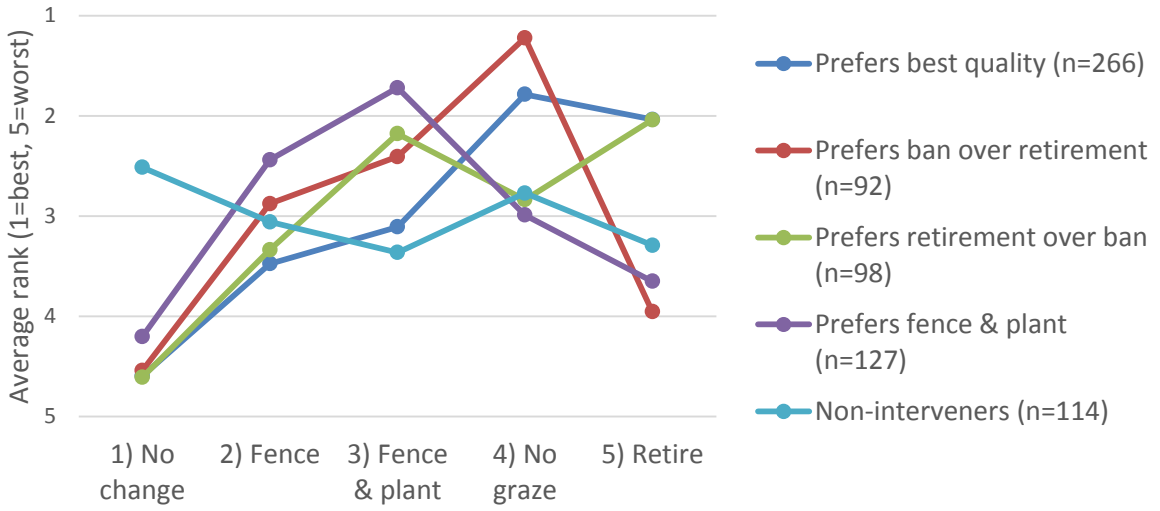

Figure 17 - Average rank by cluster group

People within each group share some common characteristics. The following Table 4 shows the demographic and other variable averages for each group, as well as for the overall sample. Statistically significant differences are indicated with a bold + (higher than average) or red – (lower than average).

The first group has a high proportion of people over 60 (38%), and people familiar with the site (46%). Most of them (68%) want "A" rated water quality. They have the highest average WTP ($28) and believe that both farmers and ratepayers should contribute. The second group want farmers to pay. They are more likely to have children and less likely to have low income. The third group, who prefer retirement, have no other distinguishing characteristics. The fourth group has the highest proportion of high income households (18%). The fifth group have the lowest WTP ($16) and the highest incidence of zero WTP. They are less familiar with the site, less likely to be female (58%), less likely to be ratepayers (25%) and more likely to identify as Māori (23%).

Being a freshwater user is not associated with any particular intervention preferences - unless the person is familiar with Kaiate Falls. Nor is there a significant association with district of residence - except for Ōpōtiki which may simply be a small-sample anomaly.

[16] The number of partitions to use in cluster analysis is often a subjective decision. The *gap criterion* advised 3 groups but visual inspection of the dendrogram (see appendix) suggested 2 additional partitions

Table 4 – Within-group means

Variable[17]	Prefers best quality (n=266)	Prefers ban over retirement (n=92)	Prefers retirement over ban (n=98)	Prefers fence & plant (n=127)	Non-interveners (n=114)	All
Female	0.72	0.68	0.70	0.66	0.58-	0.68
Under30	0.18	0.17	0.20	0.21	**0.31+**	0.21
Over60	**0.38+**	0.36	0.28	0.32	0.21-	0.32
Child in household	0.29	**0.41+**	0.31	0.29	0.33	0.31
Low income	0.16	0.10-	0.15	0.17	0.21	0.16
High income	0.11	0.17	0.08	**0.18+**	0.11	0.13
Māori	0.12	0.12	0.19	0.10	**0.23+**	0.14
Ratepayer	0.46	0.50	0.38	0.42	0.25-	0.41
Rotorua	0.23	0.17	0.27	0.25	0.26	0.23
Whakatāne	0.07	0.11	0.07	0.06	0.06	0.07
Kawerau	0.03	0.01	0.05	0.02	0.03	0.03
Ōpōtiki	0.02	0.00-	0.01	0.01	0.04	0.02
Freshwater User	0.57	0.58	0.60	0.61	0.64	0.60
Kaiate Familiar	**0.46+**	0.36	0.41	0.40	0.25-	0.39
Kaiate Visitor	0.37	0.33	0.38	0.39	0.21-	0.34
Wants "A" quality	**0.68+**	0.54	0.54	0.50	0.39-	0.56
Ratepayers should pay	**0.39+**	0.38	0.33	0.31	0.15-	0.33
Farmers should pay	**0.43+**	**0.55+**	0.38	0.33	0.12-	0.37
Zero WTP	0.29-	0.35	0.29	0.38	**0.53+**	0.35
Average WTP[18]	**28.22+**	16.79	20.90	19.95	16.03-	22.17

3.10 Other comments

People had the option to make addition comments at the end of the survey. After removing all the no/none/NA type responses, there are 158 comments which are presented in Appendix 6.5. A lot of these are demands for action to improve water quality. Some people mentioned security concerns and the need for cameras. Several people indicated they will be more likely to visit the site after learning about it in this survey.

3.11 Limitations

Web surveys exclude households without internet from the sampling frame but this is less of an issue now that 93 per cent of New Zealand households have an internet connection[19]. In addition, some people who don't have fixed line connections at home may access the internet via mobile, education institutions, or workplaces. As noted in section 3.1, the sample had to be re-weighted to correct for underrepresentation of Māori and low-and-high-income households.

Freshwater visitation and recreation results probably have measurement error due to imperfect memory and "yes" bias. In the first part of the survey only 6.1 percent of respondents selected Kaiate Stream as a site they had visited. However, in the second half of the survey 9.9 percent said they had visited within the past year. The true value is probably somewhere in between. Visitation data should ideally be independently verified using on-site counts.

[17] All except average WTP are expressed as a percent of the group
[18] Excludes unrealistically high "protest bids" over $1,000
[19] http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/yearbook/society/technology/connection.aspx

The choice experiment involved scientific uncertainty and the need to convey complex information to participants in a short amount of time. People may have had their own assumptions about current water quality and the likelihood of environmental or other outcomes associated with each intervention. However, this does not invalidate the results. In the real world, decisions need to be made in uncertain environments. And voters are not necessarily well informed about every issue when they vote, nor do they always agree with expert opinion. Construct validity depends on how well the question corresponds to the real-world decision, not how perfect the information is[20].

One limitation is that the interventions were presented in isolation from other Bay of Plenty Regional Council activities. The intervention options were framed as requiring a rates increase to pay for them. If funding was instead reallocated from other sites or other council priorities then results would be less valid. Nor are any spill-over effects (positive or negative) explicitly recognised.

It is possible that preferences would be different if the water quality outcomes were predictable. Whether it is possible or worthwhile to collect additional scientific information is a question outside the scope of this report.

The WTP results are expected to be the area most prone to bias and measurement error, for all the reasons discussed in section 2.1.

4 Conclusion

This study has shown that freshwater recreation is a popular pastime amongst a large proportion of the Bay of Plenty population. The Kaiate Falls site is one of many freshwater sites but this does not mean it is insignificant.

Most people want good water quality (grade A) at Kaiate Falls, and two-thirds of people said they were willing to pay at least a small amount of money to make this happen. Depending on how conservative the adjustment for hypothetical bias; total WTP for Bay of Plenty residents may be in the order of $0.9 million to $2.9 million per year, or $9 to $29 per resident household. .

The choice experiment results showed significant support for intervention regardless of whether ratepayers have to pay the full cost or merely part of it. No intervention had a clear majority. A grazing ban was the most popular and preferred by 37% of respondents (particularly amongst people who favour the “polluter pays” principle). A grazing ban was also most likely to be the second choice of people who preferred retirement. However, any of the intervention options would be more favourable with the majority than “no change”, which was consistently ranked low by almost everyone.

This report does not take into account the preferences of landowners in the Kaiate Falls area, who were still to be consulted when this survey was developed. The socially optimal policy intervention may involve a combination of interventions and/or compromise with regard to the preferences of landowners.

[20] https://en.wikipedia.org/wiki/Construct_validity

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6 Appendix

6.1 Recreational use results

Almost two-thirds (63%) of respondents said they had visited a lake, stream or river for water-based activities in the past 12 months. These respondents are designated “freshwater users”.

6.1.1 Number of trips

Freshwater users visited an average of 3.4 sites each, and made 18 trips in the past 12 months for the purpose of water-based recreation. If non-users are included, the average is 11.5 trips per person.

Figure 18 shows which sites people visited, expressed as a percentage of the entire sample. The most popular site is McLaren Falls, visited by 19% of people within the past 12 months. Other sites visited by more than ten percent of people are all in the Rotorua Lakes area and comprise Lake Rotoroa (15.9%), Lake Tarawera (13.9%), Lake Tikitapu (12.5%), and Lake Rotoma (12%). Kaiate Falls is the 11th most popular site, visited by 6.1% of respondents.

Figure 19 shows the number of trips to each site in the past 12 months, divided by the number of unique visitors to that site. Lake Rotorua had the highest number of repeat visits[21] with an average of 10.7 trips per visitor in the past 12 months. Visitors to Kaiate Falls went less frequently, with only 2.2 trips. Lakes tended to be visited more frequently by the sample population.

[21] The highest number of trips per visitor is actually for “Other Western Bay of Plenty” with 27.7. However, this category is an amalgamation of smaller sites and is skewed by 3 individuals who claimed to have visited a freshwater site in this area almost every day.

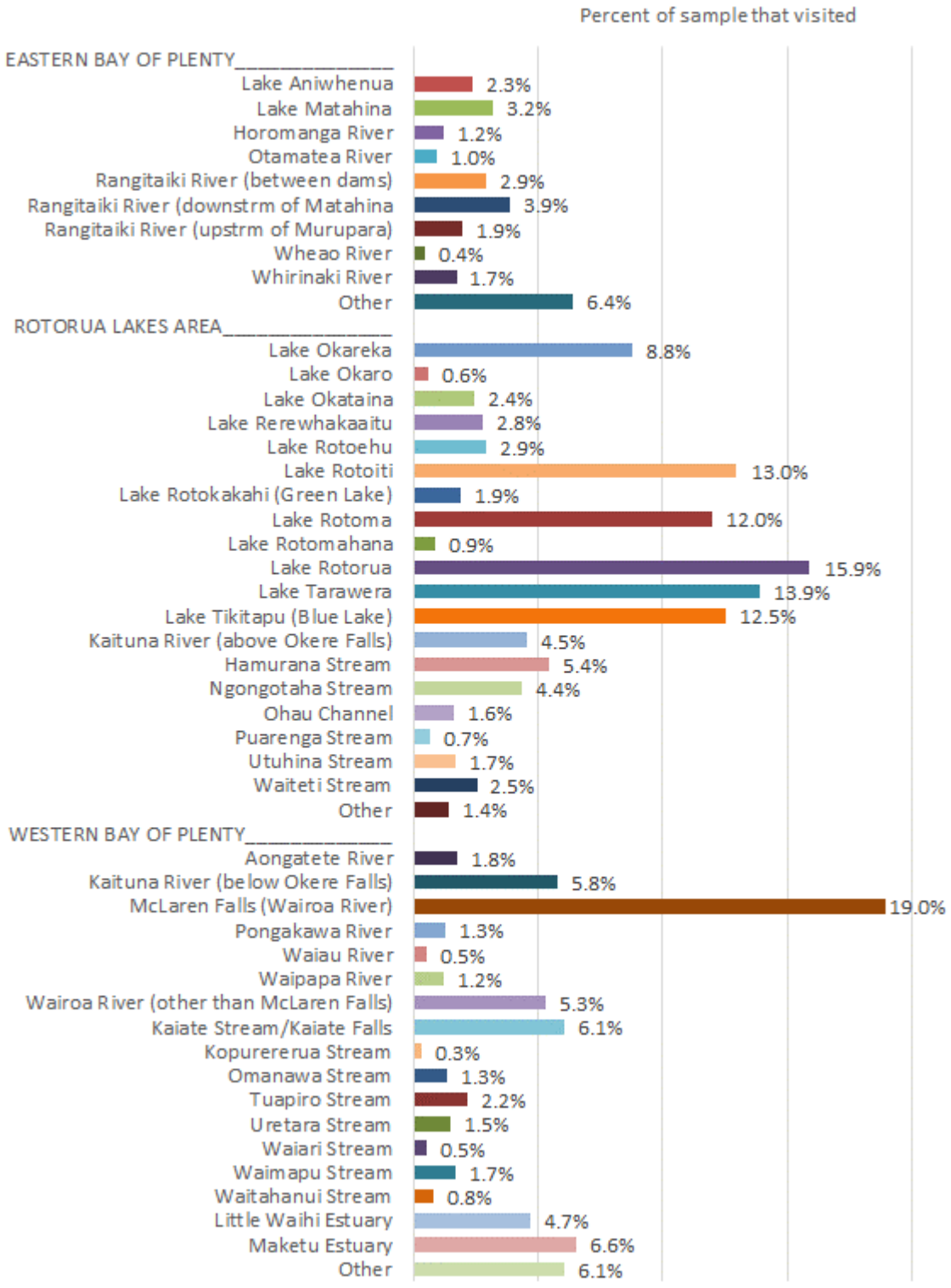


Figure 18 - Freshwater sites visited in the last 12 months, as a percentage of all respondents

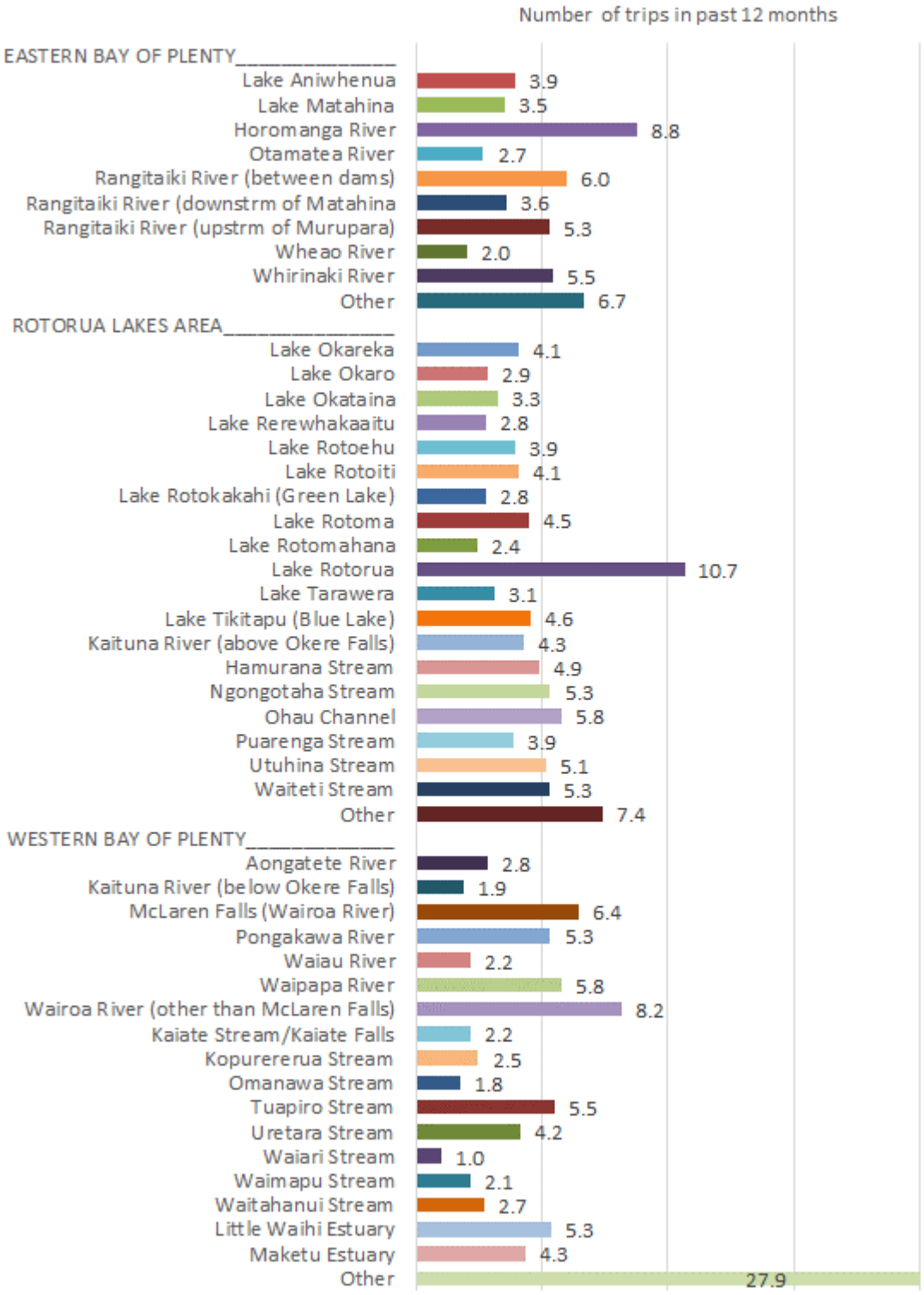


Figure 19 – Site visitor average number of trips to that site in the last 12 months

6.1.2 Activities

Respondents were asked how many trips to each site involved swimming/wading (in-water recreation), boating/sailing (on-water), and fishing/gathering māhinga kai. Table 5 shows the number of reported trips to each site and the proportion of these trips that included each type of

activity. The darker the cell shading, the higher the rate of that activity compared with the average across all sites. In total, 51% of freshwater trips involved in-water activities, 20% on-water and 20% fishing/gathering. Note that trips can include multiple activity types and some respondents specified "other" activities so the percentages can add up to more or less than a hundred.

The individual site with the highest number of swimming/wading (primary contact recreation) trips is Lake Rotorua (427), even though these were only 35% of trips to the site. Sites with higher proportions of primary contact recreation include upper Rangitāiki River (81%), Ohau Channel (85%), Little Waihi Estuary (84%) and a few other sites with fewer than 10 sample points. Kaiate Falls is relatively popular for primary contact recreation at 73%.

Lake Rotorua also had the highest number of boating (secondary contact) trips (239), although this was only 20% of all trips to the site. Lake Aniwhenua and Ohau Channel had the highest proportion of on-water recreation trips (67% and 85%, respectively). Only 8% of Kaiate Falls trips included on-water recreation, which is unsurprising considering the stream is barely broad enough for a kayak.

Sites with a relatively high proportion of fishing or mahinga kai gathering include Lake Aniwhenua, Rangitāiki River, Wheao River, and Waiau River.

Table 5 - Number of trips and proportion of trips involving activities

	Sample size	Total trips	Swimming or wading trips	Boating trips	Fishing or gathering trips
EASTERN BAY OF PLENTY					
Lake Aniwhenua	17	66	77%	67%	74%
Lake Matahina	23	79	68%	32%	17%
Horomanga River	9	77	35%	47%	44%
Otamatea River	7	18	56%	33%	29%
Rangitāiki River (between dams)	21	123	58%	48%	57%
Rangitāiki River (downstrm of Matahina	27	98	60%	13%	33%
Rangitāiki River (upstrm of Murupara)	14	73	81%	55%	64%
Wheao River	3	6	80%	50%	70%
Whirinaki River	12	67	64%	7%	28%
Other Eastern Bay of Plenty	46	304	60%	14%	35%
ROTORUA LAKES AREA					
Lake Okareka	62	254	71%	22%	12%
Lake Ōkaro	4	13	35%	35%	25%
Lake Ōkataina	17	56	60%	16%	20%
Lake Rerewhakaaitu	20	54	55%	33%	47%
Lake Rotoehu	21	81	41%	30%	29%
Lake Rotoiti	92	374	56%	33%	11%
Lake Rotokakahi (Green Lake)	13	37	29%	13%	15%
Lake Rotomā	85	383	66%	28%	16%
Lake Rotomahana	6	15	27%	23%	13%
Lake Rotorua	113	1206	35%	20%	12%
Lake Tarawera	99	308	71%	32%	29%
Lake Tikitapu (Blue Lake)	89	406	66%	23%	7%

Kaituna River (above Okere Falls)	32	137	46%	28%	34%
Hamurana Stream	38	188	50%	25%	27%
Ngongotahā Stream	31	165	18%	22%	22%
Ōhau Channel	11	65	85%	85%	13%
Puarenga Stream	5	18	22%	7%	7%
Utuhina Stream	12	61	46%	1%	7%
Waitetī Stream	18	95	50%	6%	4%
Other Rotorua Lakes Area	10	74	16%	29%	16%
WESTERN BAY OF PLENTY					
Aongatete River	12	35	78%	5%	40%
Kaituna River (below Okere Falls)	41	77	54%	34%	35%
McLaren Falls (Wairoa River)	135	867	32%	7%	33%
Pongakawa River	9	49	84%	28%	23%
Waiau River	4	8	62%	62%	62%
Waipapa River	9	50	59%	31%	9%
Wairoa River (other than McLaren Falls)	38	310	39%	6%	4%
Kaiate Stream/Kaiate Falls	43	93	73%	8%	8%
Kopurererua Stream	2	5	24%	59%	0%
Omanawa Stream	9	17	79%	8%	8%
Tuapiro Stream	15	84	67%	23%	20%
Uretara Stream	11	44	27%	7%	19%
Waiari Stream	4	4	100%	16%	33%
Waimapu Stream	12	26	43%	7%	7%
Waitahanui Stream	6	15	37%	8%	33%
Little Waihi Estuary	34	179	84%	16%	27%
Maketu Estuary	47	202	63%	6%	28%
Other Western Bay of Plenty	43	1199	51%	11%	9%
TOTAL		**8166**	**51%**	**20%**	**20%**

People who visited a site for fishing or gathering were asked what species of plants or animals they were looking for. A total of 182 people said they made at least 1 trip for fishing/gathering and 126 people specified at least one plant or animal type. The responses were cleaned to correct misspellings and remove non-useful answers[22]. Figure 20 shows the plants and animals identified, and the number and type of sites for which they were mentioned. Fish were the most common target, especially trout, eels and whitebait. Many people said they did not care what type of fish they caught. Trout and Eel were mentioned predominantly at lake and river sites. The other fish are saltwater species and were mentioned in regard to estuaries or rivers (presumably at the river mouth).

The most commonly mentioned plant was watercress, for lakes and river sites. "Beach grass" and "Beach vines" were mentioned by 3 people, although it is unclear what these are. Shellfish were popular at the two estuary sites. Crayfish were mentioned by 5 people at lake sites, and the lower Rangitāiki River. Several people mentioned birds (including penguins) although it is unclear whether they were catching them or just watching/feeding them. Two people mentioned "prunes" across 4 different sites - another unclear reference.

[22] For example: "none", "mountains", numbers or indecipherable combinations of letters.

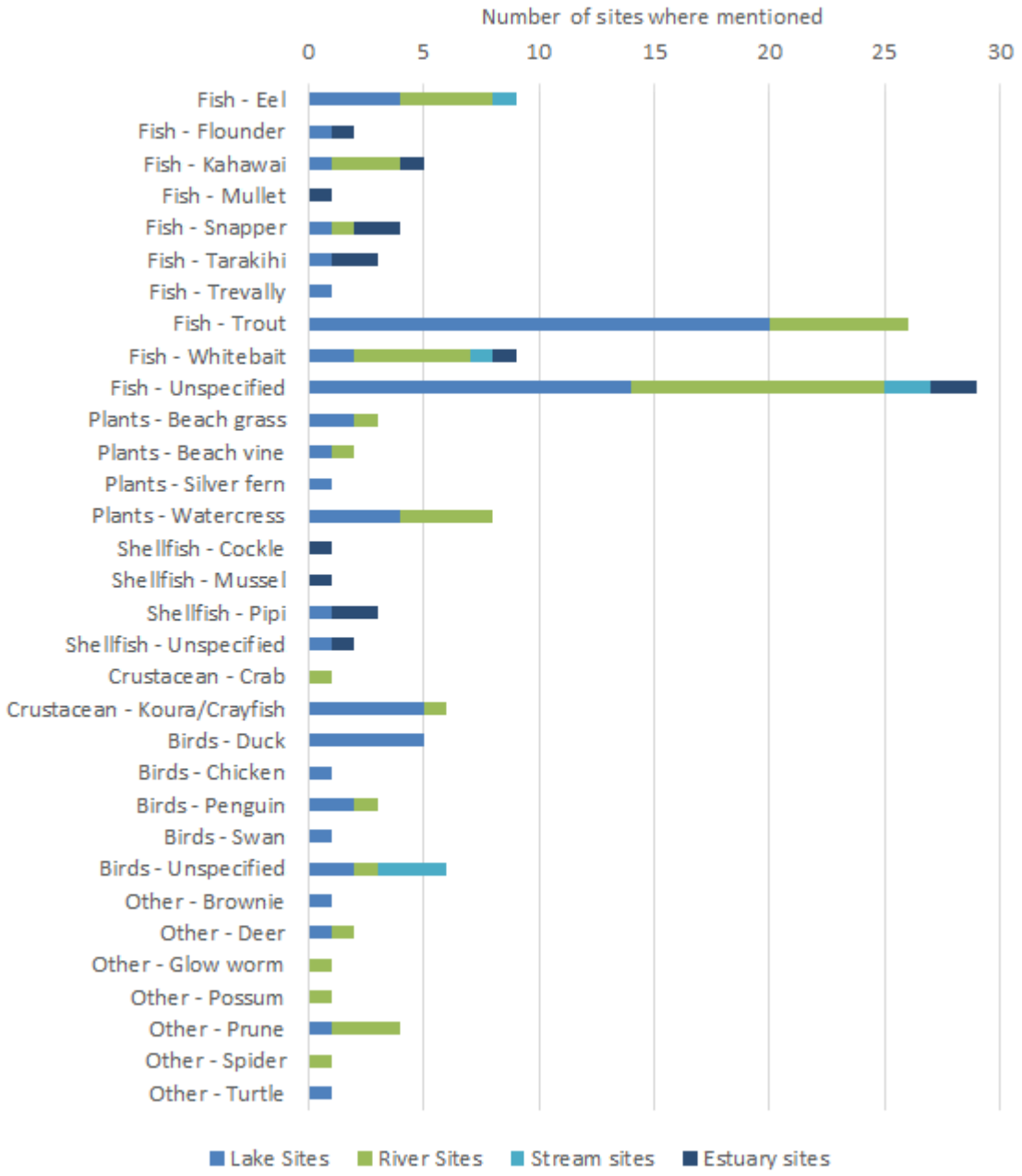


Figure 20 - Fishing / gathering species targeted

6.2 Survey questions

1. In which region do you usually live?
2. In which district do you usually live?
3. Over the last 12 months, did you visit a lake, stream or river for water-based activities?(E.g. swimming, boating/kayaking/rafting, freshwater fishing, whitebaiting, mahinga kai/food gathering)
4. So that we can calculate your travel distance, what suburb or area do you live in?
5. What lake, stream or river locations have you visited in the last 12 months for water-based activities?(E.g. swimming, boating/kayaking/rafting, freshwater fishing, whitebaiting, mahinga kai/food gathering) {List of sites}

6. How many times did you visit these locations in the past 12 months for water-based activities?(E.g. swimming, boating/kayaking/rafting, freshwater fishing, whitebaiting, mahinga kai/food gathering)
7. On how many occasions did you (or people in your group) swim or wade at these sites?
8. On how many occasions did you (or people in your group) do boating or sailing at these sites?
9. On how many occasions did you (or people in your group) do food gathering or fishing at these sites?
10. If you did fishing or gathering at these sites, what species of animals or plants were you looking for? (Leave blank if none)
11. What other leisure, recreational or cultural activities did you undertake at these sites? (Excluding swimming, wading, boating, fishing and gathering. Leave blank if none)
12. Assume you are planning to swim and you see the following sign. If the water looks, smells and feels OK, would you consider swimming there anyway?
13. How familiar are you with Kaiate falls in the Bay of Plenty Region? (See map below)
14. Have you ever visited the Kaiate Falls Scenic Reserve?
15. Have you ever swum at the Kaiate Falls Scenic Reserve?
16. When did you last visit the Kaiate Falls Scenic Reserve?
17. What size screen are you using to take this survey?

18. Choice question 50% cost split (randomised order)

If the costs of options 2,3 & 4 were split **50%** between regional ratepayers and grazing land owners in the Kaiate area, which option would you prefer?
Costs are per year, for **10 years**

22. Please rank the following options with 1 being your most preferred and 5 being least preferred

Retired to public use	**High** chance of improving water quality	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	
No grazing	**High** chance of improving water quality	Cost per land owner: **$713** per year	Cost per regional ratepayer: **$0.03** per year (+0.01%)	
Full fencing & planting	**Medium** chance of improving water quality	Cost per land owner: **$11,080** per year	Cost per regional ratepayer: **$0.53** per year (+0.17%)	
Full fencing	**Small** chance of improving water quality	Cost per land owner: **$3,400** per year	Cost per regional ratepayer **$0.16** per year (+0.05%)	
No change to current practices	Chance of **worsening** water quality	No cost to land owners	No cost to ratepayers	

19. Choice question with 100% of fencing, planting, and grazing ban costs on ratepayers

If Bay of Plenty ratepayers had to pay the full cost of each option, which would you prefer? Costs are per year, for **10 years**.

23. Please rank the following options with 1 being your most preferred and 5 being least preferred

Retired to public use	**High** chance of improving water quality	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	
No grazing	**High** chance of improving water quality	No cost to land owners	Cost per regional ratepayer: **$0.07** per year (+0.02%)	
Full fencing & planting	**Medium** chance of improving water quality	No cost to land owners	Cost per regional ratepayer: **$1.06** per year (+0.3%)	
Full fencing	**Small** chance of improving water quality	No cost to land owners	Cost per regional ratepayer **$0.33** per year (+0.1%)	
No change to current practices	Chance of **worsening** water quality	No cost to land owners	No cost to ratepayers	

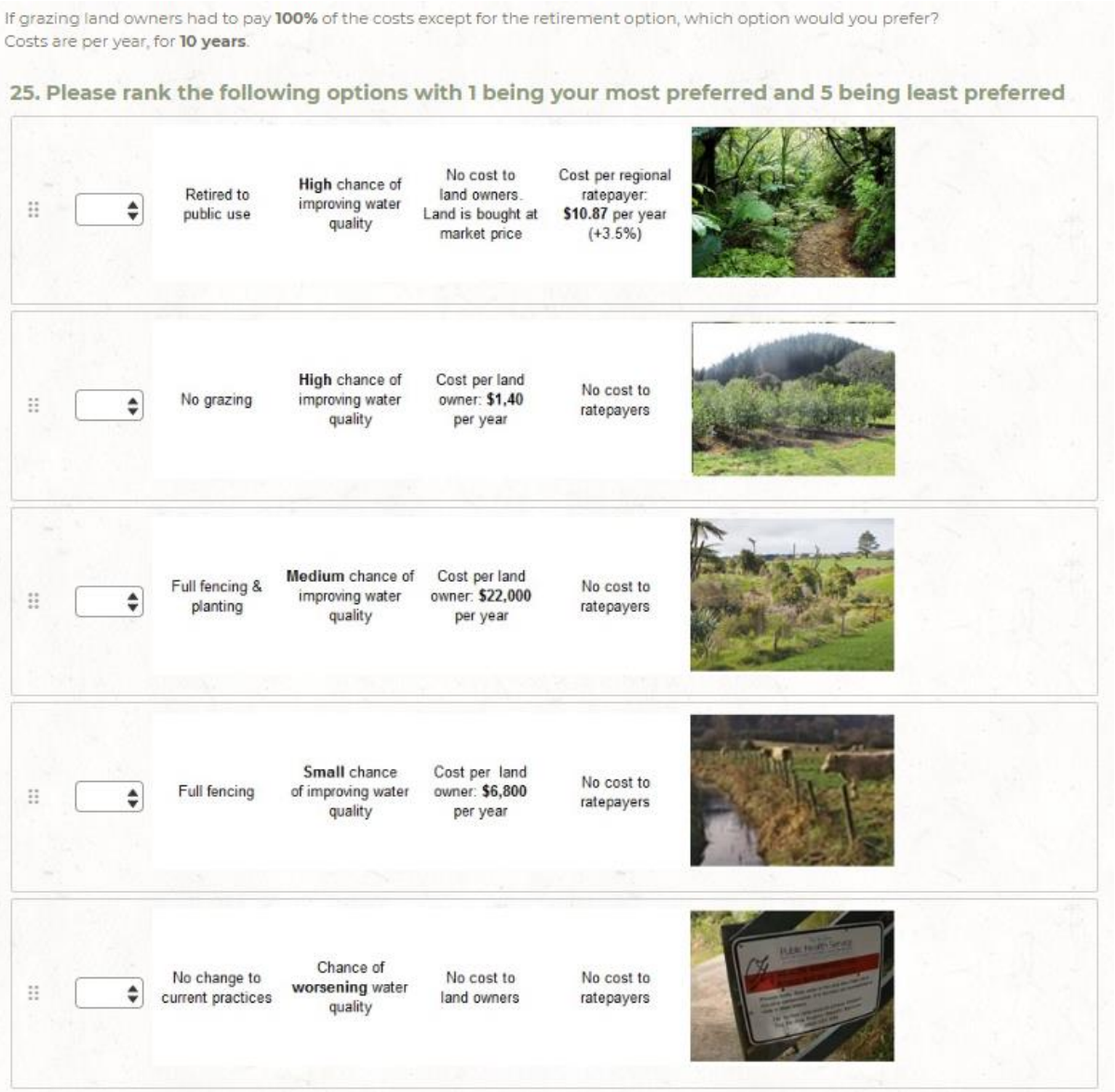
20. Choice question with 75/25% cost split for fencing, planting & grazing ban

If the costs of options 2,3 & 4 were split **75%/25%** between regional ratepayers and grazing land owners in the Kaiate area, which option would you prefer?
Costs are per year, for **10 years**.

24. Please rank the following options with 1 being your most preferred and 5 being least preferred

Retired to public use	**High** chance of improving water quality	No cost to land owners. Land is bought at market price	Cost per regional ratepayer: **$10.87** per year (+3.5%)	
No grazing	**High** chance of improving water quality	Cost per land owner: **$357** per year	Cost per regional ratepayer: **$0.05** per year (+0.02%)	
Full fencing & planting	**Medium** chance of improving water quality	Cost per land owner: **$5,500** per year	Cost per regional ratepayer: **$0.80** per year (+0.26%)	
Full fencing	**Small** chance of improving water quality	Cost per land owner: **$1,700** per year	Cost per regional ratepayer **$0.24** per year (+0.08%)	
No change to current practices	Chance of **worsening** water quality	No cost to land owners	No cost to ratepayers	

21. Choice question with fencing, planting, and grazing ban costs paid entirely by landowners



22. What is your gender?
23. What is your age group?
24. Which ethnic group(s) do you belong to?
25. Who lives in your household? Check all that apply
26. How much was the total before-tax income of your household last year?
27. Approximately how much is the total annual rates bill for your household for property within the Bay of Plenty Region?(If you own other property in the region, include those too)
28. What is your preferred level of water quality at Kaiate falls?
29. How do you think the costs of improving water quality should be paid for?
30. What is the maximum amount you personally would be willing and able to pay, per year, in order to improve Kaiate Falls water quality to {the level specified in previous question}

6.3 Biogeme model output

Model: Mixed Multinomial Logit for panel data

Number of Halton draws: 500

Number of estimated parameters:	23
Number of observations:	10960
Number of individuals:	697
Null log-likelihood:	-13101.98
Init log-likelihood:	-10124.053
Final log-likelihood:	-10103.617
Likelihood ratio test:	5996.725
Rho-square:	0.229
Adjusted rho-square:	0.227

Utility parameters

Name	Value	Std err	t-test	p-value
Retired - mean	2.85	0.161	17.72	0
No graze - mean	3.36	0.149	22.6	0
Fence & plant - mean	2.88	0.135	21.34	0
Fence - mean	1.98	0.116	17.03	0
No change - mean	0	fixed		
Retired - st. dev	3.09	0.135	22.82	0
No graze - st. dev	1.53	0.0699	21.92	0
Fence & plant - st. dev	1.09	0.0596	18.34	0
Fence - st. dev	0.116	0.0726	1.6	0.11
No change - st. dev	0.693	0.162	4.28	0
Retired - 0% rates for B,C,D	0.0921	0.121	0.76	0.44
No graze - 0% rates for B,C,D	0.167	0.121	1.38	0.17
Fence & plant - 0% rates for B,C,D	0.107	0.118	0.9	0.37
Fence - 0% rates for B,C,D	0.247	0.114	2.16	0.03
Retired - 100% rates for B,C,D	0.00733	0.118	0.06	0.95
No graze - 100% rates for B,C,D	-0.0205	0.118	-0.17	0.86
Fence & plant - 100% rates for B,C,D	-0.11	0.114	-0.96	0.34
Fence - 100% rates for B,C,D	-0.116	0.111	-1.04	0.3
√Cov Retired & No graze	2.27	0.155	14.66	0
√Cov Retired & Fence & plant	1.88	0.129	14.48	0
√Cov Retired & Fence	1.27	0.115	11.03	0
√Cov No graze & Fence & plant	-0.935	0.0668	-13.99	0
√Cov No graze & Fence	-0.714	0.0645	-11.08	0
√Cov Fence & Plant & Fence	0.918	0.0617	14.89	0

6.4 Tobit regression for WTP

Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept):1	-105.65779	28.29698	-3.734	0.000189 ***
(Intercept):2	5.23905	0.03926	133.431	< 2e-16 ***
Prefer quality A	51.21866	16.38820	3.125	0.001776 **
WhoPays - Rates	61.26311	17.16064	3.570	0.000357 ***

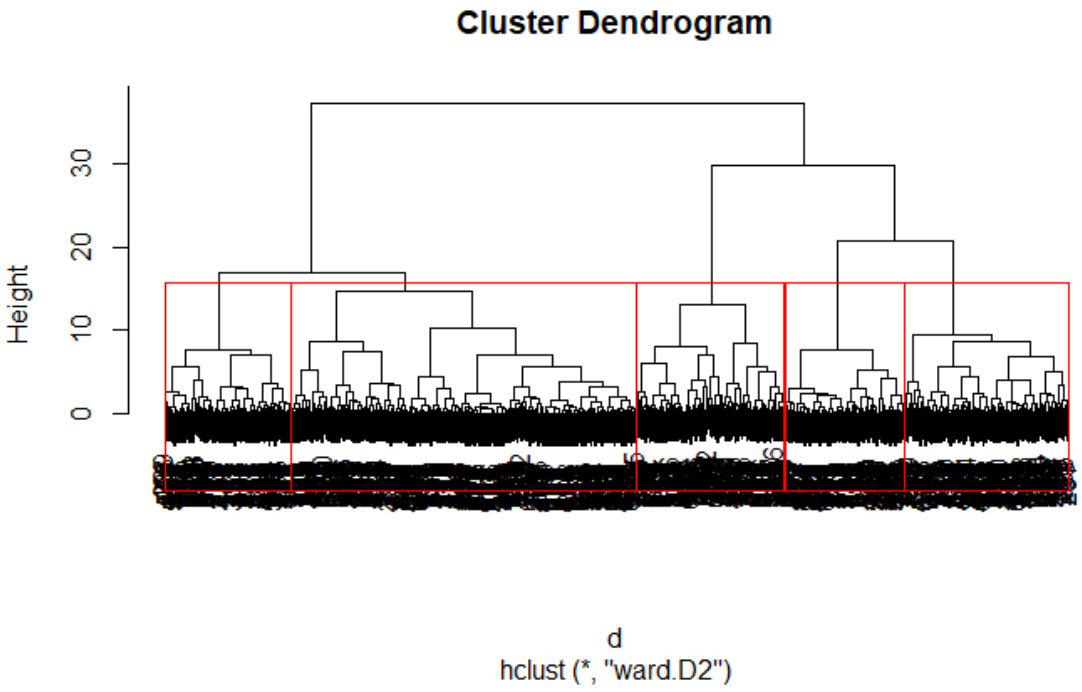
High income	18.08319	24.66927	0.733	0.463543
Ratepayer	-9.22640	17.93910	-0.514	0.607030
Under 30	45.52643	21.59919	2.108	0.035050 *
Over 60	-20.27899	20.11866	-1.008	0.313469
Freshwater User	1.83254	17.48081	0.105	0.916510
Household size	15.00620	9.04601	1.659	0.097141 .
Kaiate Familiar	25.12932	25.03722	1.004	0.315534
Kaiate Visitor	-0.08958	25.60290	-0.003	0.997208

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R^2 = 0.05215931

6.5 Cluster dendrogram

Dendrogram illustrating the cut-points for 5 groups



6.6 Final comments

- Sort it out!!! Stop farmers polluting our water
- I am concerned that people are still accessing this area for swimming and it doesn't appear to be well known that it is dangerous.
- Make it safe as rere falls on private farm land
- Yes no grazing, more public awareness
- needs filtering
- all of us shuold need to corporate with government for improving wter quality
- No, but I will be heading their this school holiday, to visit, with kids.. Thank you
- Clean the river an charge people to go swim there to help pay for cost of maintaining the place an waterways

- I think its a very important issue, the quality of water in our water ways rivers and streams. It contributes to a healthier environment and could potentially encourage more people to get out and enjoy the awesome natural waterways our region has to offer. I have a daughter with a lung condition called Bronchiectasis and as a general rule she is not aloud to swim in rivers, streams and lakes due to increased risk of infection and bugs in her lungs. It would be awesome to see the water quality improve at Kaiate falls and you never know it may even have a knock on effect for other areas.
- Penalise severely those caught polluting, allowing stock within 1.5 metres of waters edge, allowing spray drift and fertilisers etc to risk entering waterways. Monitor water frequently. Have a Hot line 7 days a week so people can report issues.
- Swimming should not be allowed. The Falls should be restricted from swimming like the Blue Spring at Putaruru
- It is imperative we look after our waters as we don't know what the future holds
- pity that it is so bad the farmers should made a fence
- Never heard of them but will make a point of going there once the weather warms up.
- Government should pay for better water we pay enough tax already
- Whats Happened to the water quality NZ wide
- improving water quality will show that the council actually cares about the rate payer in the area, because the people will continue to swim as they are now, but the council has the opportunity to make it a more safe and enjoyable experience.
- Fix it
- Dept of conservation should assist in ensuring all water qualities are safe for public
- Not really, just that it is important to protect all our waterways, not just Kaiate. Farmers should be responsible for the preservation of our waterways if said waterways run through their properties.
- do you have a sign at the falls itself or only at the top of the walk at the carpark? it was hard to tell our kids not to swim when others were doing it
- Get it clean
- Stop kem trails
- Keep our waters clean
- safety
- sort out the security problems then water quality you may get more interested in going there
- No. Just that it needs dealing with pronto.
- User pays as far as I am concerned I live near Lake Rotorua I swim in the lake regularly in the summer but still have to contend with the boats etcetera using the lake
- It’s a beautiful spot
- get on with it, less hui more Doi
- Dont think I have been there but it sounds like it is beautiful land that should be saved
- The people who use the falls should pay to go as well as the landowners and council perhaps but not the ratepayers.
- Toilets, water fountain, rubbish bins added to reduce pollution
- I cannot for the life of me work out why the rate payers would need to buy the polluting properties. All they need to do is stop applying polluting fertiliser. There are plenty of non-polluting options.
- Better to spend ratepayers money on natural resources than projects like museums. That is the reason people like living in the area.
- Revive a bit more the area with different options/activities to keep people busy and out of water
- A beautiful place to go for people to enjoy swimming and nature. It is so important that water quality be addressed and that nature be restored and that we all work towards this.

- Get farmers to clean their acts up and other land owners
- Just stop the farming and return it back to nature.
- Its embarasing. Cant believe that no action has been taken to fix this problem properly..our rivers are a disgrace. Some one needs to grow some balls and actually do something that will make a difference.
- Haven't been there but disgusting that you can no longer swim in NZ waters
- Strongly suggest NO SWIMMING as its destroying the ecological environment within the falls.
- have the surrounding business been looked at
- Are people actually getting sick by swimming there?
- No dogs allowed
- Can't give a true answer to question 20 as I live in a retirement village and our rates are included in our monthly fees. However, for clean water I would be happy for my rates to increase by whatever was necessary.
- I would like this to become a great site for those who enjoy recreation and a legacy for future generations
- How did the water quality get so poor? Maybe it is not too late to rectify the problem.
- It's just one of the many places that are being ruined by farm runoff and other waste from human activities. Sad that we humans seem hell bent on destroying this beautiful planet we have been given as a home.
- Create a walk with viewpoints and charge for access.
- I'd love to swim there one day, even take my future kids, so please do something to sort this out.
- I have never been here but believe those using these areas should expect to be able to swim safely. Stop animals from polluting these wasters - and impose greater penalties on "freedom" campers. Charge non-NZ citizens to access.
- No, because I'm no water expert.
- Make a paid (probably donation) entrance fo the falls to help to collect money to clean water.
- cleaning
- Do not allow swimming in areas that are not suitable for humans.
- Need to visit
- It is also very dangerous to kids and people not just the water.
- All areas need attention to attain a high water quality
- Farmer and public accountability needs to be implemented
- Again, just concentrate on the real issues. I mean at the end of the day there are still other places for people to swim which are much safer, such as the beach or pools, both of which have life guards there, but where else can we get our drinking and cooking water from that is a much better quality than what we currently have and are forced to use and pay for, where is the fairness or care for us???
- Support the kaupapa AOTEAROA
- It is very sad to find out about poor water quality in New Zealand.
- Fully protect the catchment area
- Lovely area and should be looked after for all to enjoy
- I haven't been there so I couldn't make an educated decision
- I would like to see the water purified by filters before it reaches the falls.
- Council should be doing more, maybe the local iwis may have some ideas
- I don't go there to swim. It is a beautiful area, and if water quality is improved, the area could be better utilised.
- There should be some level of natural bacteria in the water. My preferred option would definitely be increasing vegetation.

- I did not actually know that it was unsafe to swim there - I know people who still go. I'm quite shocked it's that bad.
- get rid of pests
- Get tougher on the farmers
- Just clean it up
- I would hate for the land above to be developed into housing - we should avoid this at all costs. More walking tracks and native bush would be awesome for the environment and for the local population. Urban sprawl should be avoided where possible.
- I live in Whakatane it is out of my area Tauranga City residents use it so the City should help with the costs of improving quality. Visitors pollute the area so maybe an admission charge.
- No clue - never been there and don't think I will now knowing the status of the water quality
- No but there should be a small charge for those who visit the falls. User pays
- poor water quality is a national disgrace
- No, I haven't been there but will visit to form an opinion
- Water quality at this site should be the same as at every other location, which is safe for swimming and food gathering.
- I hope it is fixed and restored to its former beauty
- No poor question layout
- It's very sad that we even need to.have this survey, there needs to be HUGE punishment for anybody that purposely ruins the environment, including loss of assets, i.e., car, land, prison etc..
- Land owners who graze- it should be compulsory to fully fence all streams and waterways and plant with suitable vegetation. With controls monitoring and fines. Landowners have got away with poor land management for years- not all - but many is an area near where I've lived in Welcome Bay- covered in weeds, poor fencing and poor animal management, with very little enforcement.
- Ask local schools and the community for volunteering to assist with water quality. Then perhaps have a plaque placed there so can feel proud that they helped.
- Keep animals away from water
- It should be closed for months to clean up the water
- Dont use the area, so feel the "user pays" should apply
- ask the kaitiaki of the whenua the maori landholders & the people directly involved within the area
- Haven't been able to access for some years (disability - sooo many places can't get to, like beaches :( ), but have very fond memories, absolutely beautiful spot
- good water
- sorry, just hoping we have lots of bright young sparks out there with great ideas on how to make this happen
- It's very hard for farmers who are carrying a difficult load anyway. Agriculture is our heritage and really important for New Zealand, but then again, so is tourism... You could put a donation box at the entrance to the walk. For us, it's a privilege to have such beautiful amenities on our doorstep, and it isn't wrong to contribute towards their upkeep, but it's a worry that visitors could not read the signs (maybe have them printed in many languages (??)) and could get sick. And also, we have many lovely places to go that require maintenance (e.g.The Mount, Otanewainuku, etc), and we can't afford to keep on paying for everything. In Oropi we'll be paying for our village hall for the next X years.
- Never been there, but I would wish it was unpolluted.
- Education for tourists and locals required to preserve NZ green and pure persona
- It should be cleaned and preserved.

- Not specifically, but as someone who belongs to 2 environmental groups; one that has restored a wetland and another that grows approx 20,000 plants pa that largely go into improving the environment, I am constantly angered by the environmental damage caused by farmers who also want to contribute little to remedy the mess they have caused
- Get it as clean as possible
- Only that, if the water quality was once very good, those responsible for reducing this should pay for restoring it.
- could also have a user pays system i.e entry fee
- No. Would love to bring it back to safe levels for our children to enjoy
- Good farming practices.
- Environment affections
- I hope it will be restored and preserved.
- The water quality is very poor on my previous visits. People were swimming but the water smelt like animal waste (dairy farm) and did not look clean. There was also rubbish in some areas as people did not clean up after themselves.
- All water quality is of concern in New Zealand, Regulations for any waterways and their use should be regulated and these terms stictly adhered too,
- Ever thought of introducing a new specie to the Kaiate Falls area? NZ native maybe.
- nil stop the problem that is causing it eg if caused by stock dont have any there
- This situation is not unique, all waterways are at risk. This should be considered as a start..... not an instant solution. Cost assessments should be soundly financially based and should show a 'return" on Investment" , not a feel good factor. Not a dream to appease our conscience.
- of no interest
- $2 coin entry fee to park via a pre purchased token
- dont know enough about it to coment
- yes make the none locals pay - why should we pay the bill for everyone else
- Nice to keep it going with a good reputation in our area
- Its us important that we hold on to these valuable recreation areas. Whilst farmers should be held accountable we are all responsible to improve waterways.
- is going to get worse for our grandchildren. best work a ten year plan now
- Fence farmers creeks and drains to prevent runoff
- Unsure as I have been there
- The water quality has been disgusting for years, The farmers are mainly responsible for this with little though to property run off or wondering stock. In reality the farmers need to financially account for the cost of their business practices in the environment. The farmers should pay for the cost of the damage to water quality in all areas they graze their stock. Harsh maybe but we have subsidised the market for to long.
- thought water quality had gotten better from years ago
- People shouldnt be swimming there anyway as it is too dangerous. Overseas, people just look at such falls, dont swim in them unless they are absolutely stupid. Let's keep it as a nature place, not a leisure place.
- It's great you are attending to this matter. As I kid I loved swimming in the Hautapu River (Taihape), and it seems only fair that such resources are preserved for present and future generations.
- never have visited however large subdivisions have beem built there so lots of children
- stock must be kept out of all our water ways
- maybe if possible set up a user pays way of paying for it, not sure how, but certainly worth considering, almost like a toll road?
- How has it become D grading. Surely there must have been previous tests done on water quality to try and prevent it getting this far

- Hey onto it asap.
- Whoever dirtied the water should be made to clean it up...
- police the polluters!
- Having only moved here a year ago, I still have intentions of visiting this area.
- it should be fully funded by user pays with the major cost on land owners if they do not fence securely with setbacks the land.
- Sad to know the water quality has declined so much. It has been a while since I swam up there as a teenager. Let this be a learning curve for other areas also at risk and act now.
- It needs to be as uncontaminated as possible
- Place is calm and comfortable
- I think it needs addressing like alot of other supposed fresh water Sites. I think that the rate payer should be left out of the cost as much as possible with a $figure that spreads across all fresh water sites needing addressing and not individual sites. Individual sites just adds up cost to rate payers as we go along. The people / businesses that have damaged these Sites are the ones responserble for repairing them.
- Water quality everywhere is a problem Education and water soluble fertilizers in the area as well as keeping stock back from water ways
- I didn't realise how bad the water quality actually is
- Consult local Maori and marae as they value the land and water
- Never been there. Heard about it. Will go there to see it in person.
- improve water quality
- I believe it is important to do all we can do return the water quality to the best it can be.
- Water quality anywhere impacts elsewhere, cleaning up water quality therefore has multiple benefits. Healthy water, healthy land, healthy people. And we do all want that don't we?
- Apply filters upstream to help restrict bacteria
- It’s annoying not being able to swim there so would be good if the water quality could be improved
- why not have something there for people who use it. we would pay when we visit it.
- not sure if security light for camper vans if not they need one there run with solar plus steel cage around it eg vandal proof
- Just to get it swimmable.
- we do need to urgently address our water issues. In the near future water is going to be more valuable than gold
- Cameras to monitor public use or misuse
- I don't believe farmers are totally to blame. Fence the rivers and plant trees to absorb toxins
- Try to manage fundraising for water improvements
- Everyone who want to swim should charge that use for the improvement of water quality.
- Rate payers shouldn't have to pay.
- all efforts should be made to keep the area in an unpolluted natural state
- everyone needs to get onboard
- You could initiate a user pays option, like a gold coin donation box.
- Enjoyable nature