Australian Water Recycling
Centre of Excellence

Economic viability of recycled water schemes—Technical Report 2

Community values for recycled water in Sydney

A report of a study funded by the
Australian Water Recycling Centre of Excellence

Marsden Jacob Associates, March 2014

Community values for recycled water in Sydney

Project Leader

Phil Pickering
Marsden Jacob Associates
Melbourne office:
Postal address: Level 3, 683 Burke Road, Camberwell
Victoria 3124 AUSTRALIA
Telephone: +61 3 9882 1600
Facsimile: +61 3 9882 1300

Contact: Phil Pickering ppickering@marsdenjacob.com.au

Partners

Hunter Water
Australian National University
Sydney Water

About the Australian Water Recycling Centre of Excellence

The mission of the Australian Water Recycling Centre of Excellence is to enhance management and use of water recycling through industry partnerships, build capacity and capability within the recycled water industry, and promote water recycling as a socially, environmentally and economically sustainable option for future water security.

The Australian Government has provided $20 million to the Centre through its National Urban Water and Desalination Plan to support applied research and development projects which meet water recycling challenges for Australia's irrigation, urban development, food processing, heavy industry and water utility sectors. This funding has levered an additional $40 million investment from more than 80 private and public organisations, in Australia and overseas.

ISBN 978 1 922202 05 5
ACN 072 233 204

Date of publication: March 2014

Publisher:
Australian Water Recycling Centre of Excellence
Level 1, Margaret Street, Brisbane, Queensland 4000
www.australianwaterrecycling.com.au

This report was funded by the Australian Water Recycling Centre of Excellence through the Australian Government's National Urban Water and Desalination Plan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Executive Summary

Sydney households are willing to pay significant amounts to increase recycled water supply in Sydney

The clear finding from this survey of a representative sample of 1,240 Sydney households is that most Sydney households are willing to pay higher rates and charges to have more recycled water supplied in Sydney in the future, compared to the volume of water currently being recycled now.

The results set out in this report show that almost 90% of Sydney households would be willing to pay something towards increased recycled water supply in Sydney between now and 2030. Exactly how much extra Sydney households are willing to pay generally depends on the type and scale of water recycling, where the recycled water is used, and how extra wastewater is disposed of, in addition to other factors such as household socioeconomic status, location, and whether households already use recycled water in their homes.

Table E 1 at the end of this Executive Summary shows how much Sydney households are willing to pay on average each year for extra recycled water outcomes in Sydney. The recycling measures ('attributes') used to estimate Sydney households' willingness to pay for extra recycled water in Sydney were developed through extensive consultation with policy makers, as well as the Sydney public.

The choice modelling survey used to estimate Sydney households' willingness to pay for extra recycled water supply outcomes in Sydney was designed and applied to ensure that the values obtained more likely understate Sydney households' willingness to pay than overstate it.

On average, the survey results show that Sydney households have clear preferences for increasing recycled water supply in Sydney. The survey results also show that Sydney households also have some clear preferences for where the extra recycled water is used, and where extra wastewater is disposed. On average:

- **Sydney households are on average willing to pay between $2.65 and $48.38 per year for an additional 10-40GL per year of recycled water by 2030, depending on the use of the recycled water;**
- **Sydney households are willing to pay an average of $0.87 per year for each extra GL of recycled water supply by 2030 in Sydney (95% confidence interval $0.62 to $1.12 per year);**
- **Sydney households would most prefer extra recycled water to be used by business and industry in Western Sydney (for things like manufacturing and cleaning workspaces)**. On average, Sydney households would least prefer extra recycled water to be used by homes in Western Sydney (for things like flushing toilets and watering gardens).
- **Sydney households are willing to pay more if extra wastewater is disposed in Sydney Rivers than if it is disposed into the Ocean.** Sydney households are willing to pay an average of $5.68 per year to have extra wastewater disposed into Sydney Rivers, rather than the ocean (95% confidence interval $0.46 to $11.11 each year). Households may prefer this outcome because of historical concerns over Sydney's ocean discharge, or because the survey noted that wastewater released into Rivers is treated to a higher (tertiary) standard than Ocean disposal, where water is primary treated

Sydney households are willing to pay for these recycled water outcomes starting now, even though they were told that changes would occur between now and 2030, and will take time to happen. They are willing to pay extra in addition to existing charges and fees they already pay.

Marked differences in Sydney households' awareness of water recycling in Sydney, and Sydney's water cycle

Our survey results highlight marked differences in Sydney households' awareness of where their water comes from, and where wastewater goes to. Almost all (92%) Sydney households know that dams supply most of Sydney's water. However:

- around 30% of Sydney households are not aware that desalination water is being used by Sydney's homes, businesses and Councils;
- 36% of Sydney households are not aware that recycled water is being used in Sydney and 44% are not aware that recycled water is not used for drinking; and
- 40% of Sydney households were not aware that treated wastewater is released into Sydney's Rivers and Ocean.

Sydney households' willingness to pay for extra recycled water differs based on socioeconomic characteristics

The household willingness to pay estimates in this report show that, on average, Sydney households are willing to pay significant amounts to increase recycled water supply in Sydney in the future. They are also willing to pay different amounts to have this recycled water used by different end users – in particular they much prefer the recycled water being used by businesses and industry than Western Sydney households.

Many Sydney households' willingness to pay for future recycled water supply outcomes in Sydney will differ from this average. For policy and planning it is instructive to understand how and why willingness to pay differs across Sydney households, where possible.

Evaluation shows that the drivers of differences in household willingness to pay for extra recycling in Sydney include:

- **Household income:** households with higher income have a stronger preference for shifting from the status-quo situation – that is, they are willing to pay more to increase recycled water supply in Sydney in the future. This outcome is consistent with economic theory and the findings of many stated preference studies valuing environmental outcomes and policies with public benefits.
- **Age:** older respondents have a stronger preference for shifting from the status quo – that is, older respondents are more likely to prefer more recycled water supply in the future. This finding is also consistent with many stated preference studies valuing public policy options.
- **Gender:** compared to women, men have a stronger preference for keeping the status quo. This outcome is consistent with the findings of many stated preference studies valuing environmental outcomes and public policy options.
- **Households connected to recycled water supply:** are more willing to pay for extra wastewater to be recycled in Sydney than households that are not receiving recycled water.
- **Households using Sydney's Rivers for recreation:** are more willing to pay for extra recycled water to be used to augment environmental flows in Sydney Rivers than households that do not recreate in Sydney Rivers. This outcome is consistent with many stated preference surveys, and suggests these households may place a use-premium on improved River outcomes.

Sydney households clearly want to be consulted about wastewater recycling in Sydney future, and can make complex trade-offs

Choice Modelling involves people being asked to make what are sometimes complex trade-offs. In this Sydney water recycling application of Choice Modelling, a sample of Sydney households were asked to make trade-offs between higher household rates and bills, and extra wastewater recycling to 2030, relative to the base case. Households completed this task drawing on the water supply information they were given in the survey in addition to what they already knew of Sydney's water supply, wastewater discharge and recycling. Many households completing the survey weren't aware that Sydney households were already receiving recycled water, or that treated sewage is now being related into Sydney Rivers and Ocean. Many households didn't live in Western Sydney, where most of the future water recycling outcomes will occur.

Despite this lack of background, the survey results and feedback provided by survey participants show that Sydney householders are engaged in the topic. Just less than 91% of Sydney households that started this survey completed it. This is a high response rate for any type of survey. Many people provided comments showing that they were engaged in the choice survey, saw the exercise as positive community engagement, and believed the outcomes of the consultation were important to Sydney's future water supply planning.

Table E 1: Sydney household willingness to pay ($ per year) for recycled water attributes

Extra recycled water to…	WTP/extra GL	10 GL	20 GL	30 GL	40 GL	95% CI 40GL
Western Sydney homes	+0.87	2.65	11.34	20.02	28.71	16.02 - 41.10
Environment	+0.87	5.62	14.30	22.99	31.67	20.21 - 42.79
Council	+0.87	8.91	17.59	26.28	34.96	25.01 - 44.62
Business and Industry	+0.87	22.33	31.01	39.70	48.38	38.25 - 58.51
Change from river wastewater disposal to ocean wastewater disposal		+5.68	+5.68	+5.68	+5.68	+0.45 - 11.12

1. Introduction

1.1 Background

Marsden Jacob Associates (MJA) is currently undertaking a project with the Australian Water Recycling Centre of Excellence (AWRCoE) to develop an economic assessment framework for recycled water projects. The AWRCoE economic assessment framework is aiming to establish a near comprehensive economic value for recycled water – that is, an economic value of recycled water that accounts for all of the private and public costs and benefits of supplying recycled water to end uses and users.

In Australia and overseas, most studies looking at how much households are willing to pay for recycled water have focussed on household end use. The bulk of these studies have shown that people are open to using recycled water for low personal contact household uses, such as watering trees and shrubs in their garden. People are more reluctant to use recycled water for high personal contact activities (for a review of this literature see Hurlimann and McKay, 2007; Dolnicar and Hurlimann, 2010).

The potential community benefits of recycled water extend beyond private household boundaries. For example, water recycling provides indirect benefits to communities including:

- sustainable water use, leaving higher quality water available for drinking water supplies;
- reduced disposal of wastewater into environments like rivers and oceans;
- increased flows in rivers when recycled water is used to augment flows, or reduce water offtake;
- potential avoidance of new water source development, such as new dams; and
- watering of amenity sites, such as parks and wetlands.

From an economic perspective, it is important to understand not only how much households are willing to pay to get recycled water to their own household for private use, but also how much households are willing to pay to secure these other indirect benefits that recycled water can provide. It is also important to understand how households' preferences for these indirect benefits change depending on whether the indirect benefits are provided through recycled water versus water from other sources, such as dam water, or desalination water.

The few studies that have looked at the indirect benefits of recycled water in Australia suggest households are willing to pay to secure the indirect benefits that recycled water can provide. Po et al (2005) found that more than 90 percent of Australian households they surveyed thought it was acceptable to use recycled water in public parks, golf courses, and for flushing toilets. More than 80 percent agreed that it was acceptable to use recycled water for watering lawns and gardens or pasture land. Hurlimann and McKay (2005) found that community members were on average willing to pay $29.20 per annum to reduce sewage ocean outfall and $17.80 annually for a continually green appearance of public open spaces.

1.2 Objectives

To estimate the economic value that Sydney households place on the indirect benefits of recycled water, MJA carried out a large sample choice modelling study of Sydney households. The choice modelling study identified a range of indirect use attributes for recycled water in Sydney, and asked respondents to choose between options for future recycled water supply, recycled water end use, and wastewater discharge.

The survey focussed on the potential to supply recycled water to Western Sydney, and emphasised that the majority of the impacts of extra wastewater recycling would be observed in Western Sydney. This approach was used because (1) it reflects the likely reality of future recycled water developments in the Sydney Urban Area and (2) it allows the values of people living in Western Sydney to be compared to values of survey respondents living outside it. This segmentation is important because the Western Sydney population is more likely to be a direct consumption use beneficiary of future recycling projects in Sydney. Using this segmentation allows the study team to see if there are marked differences in willingness to pay between those who are likely to be direct beneficiaries, and those who are not.

The findings set out in this report are based on the results of the large sample choice modelling survey of Sydney households, and are representative of Sydney households overall. The findings measure in dollar terms the evidently significant value that many Sydney households have for recycled water to be used in places other than their own private household.

The findings in the report show that most Sydney households are willing to pay extra household rates and bills to have more wastewater turned into recycled water in the future, compared to how much wastewater is being recycled now.

A key finding is that Sydney households are willing to pay much more to have this extra recycled water used by business and industry, by Councils, or by the environment (in the form of environmental flows) in Western Sydney than they are to have the extra recycled water used by Western Sydney households. This is an important finding that fills a key gap in understanding the economic value of recycled water - the finding shows that Sydney households' value for recycled water in community / indirect benefit uses *exceeds* their value for recycled water being used by households. This finding has clear and significant implications for understanding the economics of public recycled water programs and investments.

Exactly how much extra Sydney households are willing to pay for more recycled water in Western Sydney in the future generally depends on the type and scale of water recycling, how leftover wastewater is dealt with, as well things like household socioeconomic status, whether households' currently use recycled water, and use of Sydney Rivers.

The findings show that Sydney households state that are willing to start paying now for measures that increase recycling in Western Sydney, even though they were aware that these recycling projects and outcomes can take up to 2030 to happen. Sydney households indicated in the survey that they are willing to pay extra for the extra recycled water outcomes proposed, amounts that would be additional to existing taxes and fees that they already pay the Government. They are willing to pay in annual instalments indefinitely, starting from now.

1.3 Choice modelling

MJA selected choice modelling as the preferred approach for establishing Sydney households' economic value of the indirect benefits of recycled water because it:

- can be used to value multiple indirect outcomes arising from wastewater recycling;
- was considered to be more defensible than other possible approaches for establishing the economic value of recycled water in indirect uses; and
- can estimate non-use and direct and indirect use values for recycled water. Non-use values are economic values that people assign to goods or services (including public goods, public assets or public resources) even if they never have or may never use the resource. We show later in this report that while many Sydney residents may never experience the benefits of say, a regional Western Sydney Council using recycled water to irrigate a sports-field, they are still willing to pay

to secure these outcomes - these households could have non-use[1] values for these recycled water outcomes. We also show that households who visit or use Sydney River are willing to pay more to have more recycled water flushing out Rivers and Creeks in Western Sydney - these households have use and potentially non-use values for these recycled water outcomes.

Using choice modelling as the preferred approach for establishing Sydney households' economic value for indirect benefits of extra wastewater recycling is consistent with current NSW Treasury Guidelines for Economic Appraisal recommendations where no established framework exists for valuing non-traded outputs (NSW Treasury Policy paper TPP07-5).

Choice modelling is a 'stated preference' technique that can be used to estimate non-market environmental benefits and costs. Choice modelling is increasingly being used to understand households' preferences for environmental goods and services and as an input to economic and Government decision making – either as a means of quantifying benefits for cost-benefit analysis or for identifying preferred policy bundles.

In simple terms, choice modelling involves surveying a sample of people, who are expected to experience the benefits / costs of some future resource management strategy, and asking respondents a series of questions about their preferences for alternative future resource management strategies. Each question, called a 'choice set', presents to respondents the outcome of usually three or four alternative resource management strategies. The outcomes of the alternatives are described in terms of a common set of attributes.

The alternatives shown to respondents are differentiated by the attributes having different levels. One of the alternatives – that relating to the 'business as usual' (BAU) or 'status quo' option – is held constant and included in every choice set.

The levels of the attributes in the alternatives involving change from the BAU are distributed according to an experimental design so that respondents are faced with a wide range of future outcomes. Respondents' choices of their preferred alternatives demonstrate their willingness to trade-off one attribute against another.

When one of the attributes used to describe the alternatives is monetary, estimates of respondents' willingness to pay (WTP) to secure additional units of the non-market environmental benefits described by other attributes (or to avoid non-market environmental costs described by other attributes) can be calculated. It is also possible to use Choice Modelling results to estimate the values respondents hold for the changes from the BAU to some alternative strategy. WTP value estimates from Choice Modelling studies are consistent with welfare economics theory and the requirements of economic cost-benefit analysis.

Choice surveys provide a means to understand peoples' preferences for things that cannot be observed through market transactions. In the past, the results of some stated choice studies (including contingent valuation and choice modelling) that have estimated non-market benefits and costs have been criticised and excluded from cost-benefit analysis. Decision makers have sometimes concluded that choices made by people in a hypothetical market condition will not be the same as what they would actually do in a real market.

However, our view is that this criticism can largely be overcome through well-designed and well implemented choice surveys. Well designed and implemented choice surveys are consequential and incentive compatible. When surveys are consequential, respondents believe the responses they give in the survey will have a policy impact. When surveys are incentive compatible, respondents have an

[1] We say ' could have non-use' because it is still possible that households expect that they will receive a direct or indirect use benefit from Councils using recycled water in this way – i.e. the benefit that more potable water will be available for their household use in times of supply shortage.

incentive to reveal their true preferences when answering the survey. Evidence shows that values obtained from consequential and incentive compatible stated choice surveys approximate values estimated using methods that rely on the preferences of people as revealed by their actions (Carson et al, 2006).

Annexes 1 and 2 in this report documents the design approach and testing procedures used in this project to confirm the choice modelling survey instrument was consequential, incentive compatible, and minimised hypothetical bias. The survey development and testing approach used in this project was based the approaches and experience that the MJA consortium have accumulated over the past decade by delivering more than 50 choice modelling surveys, including more than 30 choice modelling surveys that have valued preferences for natural resource management policies and their attributes, ten choice modelling surveys since 2000 that have valued preferences for riverine health attributes, and more than 20 choice modelling surveys delivered by internet panel.

The design approach used, and the statistical strength, internal consistency, and consistency with economic theory of the results obtained, mean that we are confident in the study's results and the valuation estimates obtained.

1.4 Approach

The Sydney recycled water choice modelling project was delivered in six stages. The project delivery stages are summarised below, and detailed in Annex 1:

- **Review** –the project team reviewed background reports prepared to facilitate the completion of the consultancy and other background material. An initial choice matrix of attributes and levels was developed via a workshop of technical and policy experts held at Sydney Water.
- **Design** – an initial draft choice modelling questionnaire was designed that is consistent with the policy issue under investigation. The survey was designed so that it could be readily understood and accepted by potential respondent households, and consistent with best practice in minimising incentives for respondents to misrepresent their true choices in what is a hypothetical decision environment.
- **Trial and refine** – qualitative research involving both focus groups and in-depth interviews was completed. The MJA consortium ran four focus groups in North Sydney, Parramatta and Penrith. More than 30 people from a range of socio-demographic strata took part in the focus groups. The qualitative research helped to refine the choice modelling survey instrument, the attributes and levels chosen, and tested for content validity. The step also ensured that information provided in the survey was seen by respondents as being unbiased, clear and understandable. The draft choice modelling survey was reviewed by Government and non-Government stakeholders, and feedback incorporated.

  The refined choice modelling survey was then pre-tested with a sample of 127 respondents to make sure there are no application issues evident prior to the main survey. These respondents were drawn from an internet panel sourced from MyOpinions, one of the research industry's leading internet panel providers.
- **Conduct survey** – survey response data collected from the 150+ focus group and pre-test respondents was used to estimate a preliminary choice model. The parameters estimated in the preliminary model were used to develop a D-efficient experimental design for use in structuring the choice sets used in the final choice modelling survey. D-efficient experimental design is discussed in Annex 1. Estimating the D-efficient experimental design had the advantage of improving the

statistical power of the subsequent choice models. Prior implicit prices for the survey were estimated from the pre-test data.

The final choice modelling survey was delivered via internet panel. A total of 1,255 panel respondents completed the survey. Survey participants were recruited by Survey Sampling International (SSI) sourced from MyOpinions. Email invitations were be sent out by MyOpinions, and respondents agreeing to undertake the survey were diverted to the SSI site where they completed the survey. The email invitations did not tell invitees what the survey was about.

Survey respondents lived in the Sydney Significant Urban Area (SUA), were household rate or bill payers, Australian citizens or permanent residents, and over the age of 18.

- **Statistical analysis, weighting and willingness to pay estimation –** survey data were cleaned and tested, reducing the number of respondents to 1,240. This dataset was analysed for sample representativeness and choice consistency. The survey data were re-weighted using a rim weighting approach discussed in Annex 1 so that the survey sample proportions matched the Sydney household profile. The rim weighting procedure means the results presented in this report are representative of Sydney households overall. Annex 1 includes unweighted and weighted survey respondent characteristics, and compares these to the Sydney household profile.

  Household willingness to pay was estimated using a random parameter logit (RPL) model in utility space, estimated on the population weighted data. Annex 1 and Annex 3 include the full RPL model results and technical discussion. The RPL model overcomes IIA violations, explicitly models the panel nature of the choice data and takes into account potential correlations in the error terms caused by the sequential nature of the choice set answers within each questionnaire. Models that estimated willingness to pay directly ('WTP space' models) were estimated and found to yield statistically similar results.

- **Reporting –** MJA discussed the preliminary results with key stakeholders, and finalised this report.

1.5 Consultation and engagement

Community and stakeholder engagement is a key element of water planning, and the Sydney Metropolitan Water Plan. In addition to the community feedback obtained from the focus groups and survey pre-testing, a number of key stakeholders review and provided feedback on drafts of the choice modelling survey including members of the Australian Water Recycling Centre of Excellence Project Advisory Committee and Sydney Water.

1.6 Outline of this report

The remainder of this report consists of a single chapter and four technical Annexes as follows:

- chapter 0 summarises the results of the recycled water choice modelling survey, and includes estimates of household willingness to pay for additional measures that will increase recycled water supply to Western Sydney;
- Annex 1 details the project approach;
- Annex 2 discusses key survey design considerations;
- Annex 3 presents summary data tables; and
- Annex 4 includes the choice survey presented to Sydney household respondents.

2. The survey and results

Key findings from the survey of 1,240 Sydney households who completed the Sydney recycled water choice modelling survey are reported in this Chapter. All summary findings reported in this Chapter are weighted, meaning they are representative of Sydney's overall population[2].

Before presenting household level estimates of willingness to pay, we briefly profile respondents' awareness of water and water recycling issues amongst Sydney households. Results highlight Sydney households' mixed awareness of where their water comes from, and of water recycling in Sydney.

Key measures testing the recycled water survey's consequentiality and incentive compatibility are also presented before the willingness to pay results. These measures show respondents reporting that the water recycling choice modelling survey was well understood, consequential and incentive compatible.

Annex 1 includes more detailed information about the survey respondents, and technical results.

2.1 Sydney households' awareness of Sydney water issues and water recycling

The choice modelling survey briefed respondents about Sydney's current water supply and supply sources, wastewater disposal and recycled water use. The survey then outlined how Sydney's water needs would increase in the future with population growth, that much of this population growth would occur in Western Sydney and how Sydney's extra future water needs could be supplied and extra wastewater disposed (Annex 3). After reading this information, respondents answered questions that self-assessed their prior awareness of these issues.

Results show marked differences in Sydney households' awareness of where their water comes from, and where wastewater goes to. Figure 1 shows that almost all (92%) Sydney households know that dams supply most of Sydney's water. However:

- around 30% of Sydney households are not aware that desalination water is being used by Sydney's homes, businesses and Councils;
- 36% of Sydney households are not aware that recycled water is being used in Sydney and 44% are not aware that recycled water is not used for drinking; and
- 40% of Sydney households were not aware that treated wastewater is released into Sydney's Rivers and Ocean.

MJAs evaluation shows that household awareness of desalination, recycling and wastewater disposal are correlated ($o<.01$)[3] – that is, households that say they are aware that desalination water is now being used in Sydney are also more likely to say that they are aware that recycled water is being used in Sydney, and that treated wastewater is being disposed into Sydney Rivers and Ocean. Evaluation also shows that self-reported awareness that recycled water is being used and wastewater is being released

[2] Throughout this Chapter the term 'Sydney households' means the population weighted household survey responses. We use the term Sydney households because statistical testing showed that the re-weighted household survey population profile effectively matches the overall Sydney population profile, based on key ABS household indicators. Because of this matching, we assume that the re-weighted population results are therefore representative of the Sydney population – that is, if we surveyed all Sydney households we would obtain similar results as shown in this Chapter.

[3] Throughout this report we show p-values. In this report, p-values generally show that we have formally tested for statistically significant differences between populations of interest. Reported p-values of $p<.01$, $p<.05$, and $p<.10$ show that there are statistically significant differences at the 1%, 5% and 10% levels respectively. Lower p-values show more statistical strength, i.e. that we can reject the assumption that the populations are the same with more certainty.

generally increases with age and education (p<.05) and if households say they are already using recycled water in their homes (p<.01).

Figure 2 illustrates the significant regional differences in Sydney households' awareness of water recycling and use. Generally, households in SA4 regions that are closer to where recycled water is currently being used by households or is planned for future use – Parramatta, Baulkham Hills and Hawkesbury, Blacktown, Ryde, South West, and the Outer South West – are more likely to say they are aware that recycled water is being used in Sydney (p<.05). In these regions more than 70% of households are aware that recycled water is being used in Sydney – this compares to just more than 50% of households in Sydney's inner city and eastern regions.

Figure 1: Sydney households' self-reported pre-awareness of issues and water recycling

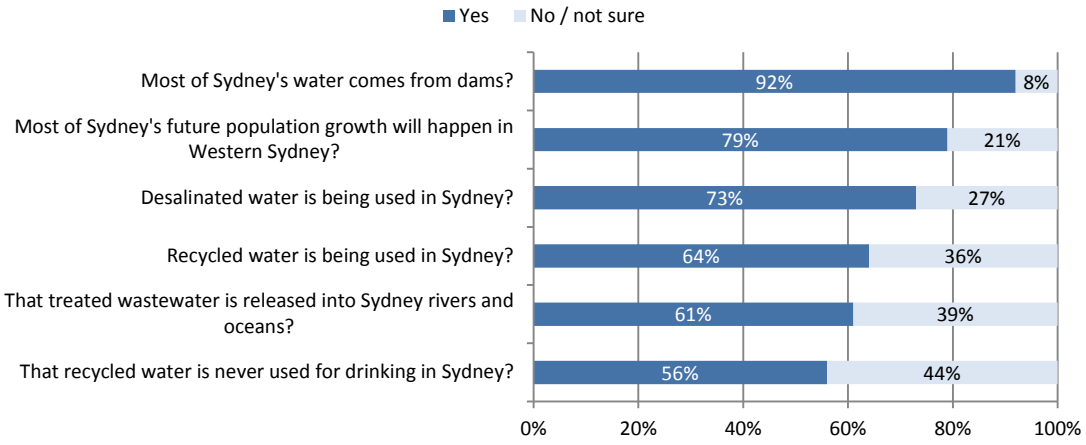
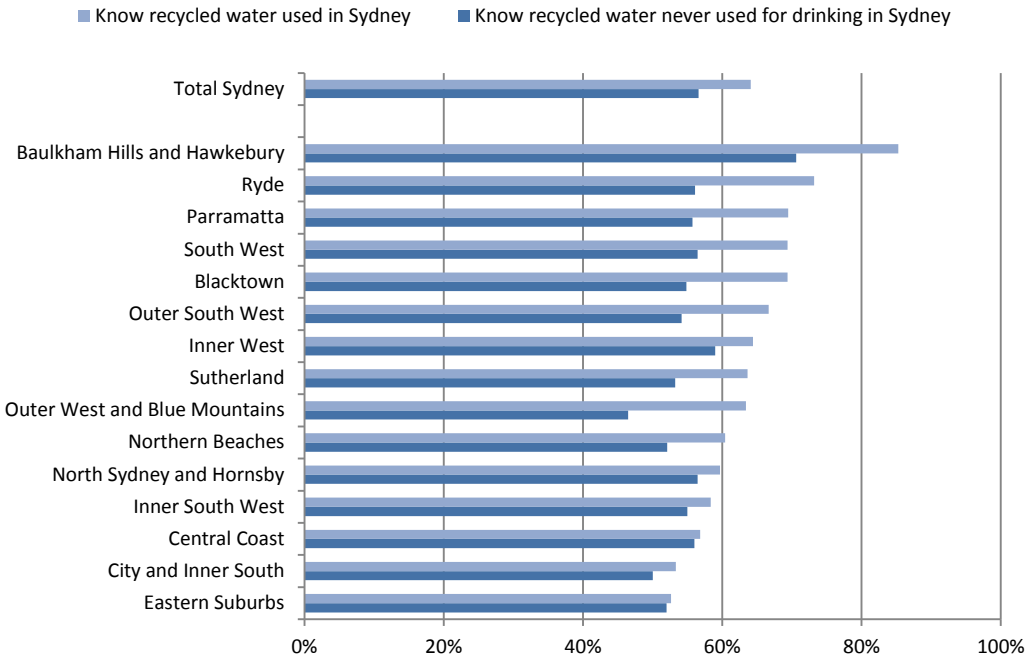


Figure 2: Sydney households' self-reported pre-awareness of water recycling by region



2.2 The choice task

The introduction to choice modelling in section 1.3 of this report highlighted that the technique requires people to make repeated trade-offs between different outcomes described by attributes and their levels in a choice set. When one of the attributes in a choice set is monetary, willingness to pay can be estimated from the choices people made.

The Sydney recycled water choice modelling survey included four attributes - three attributes measuring how much extra recycled water would be recycled in Sydney by 2030, where the extra recycled water would be used in (Western) Sydney, where extra wastewater that was not recycled would be disposed, and one attribute measuring how much extra households would have to pay to obtain the environmental outcomes described. Annex 1 and Annex 2 detail how the four environmental and one monetary attributes shown in Table 1 were defined, and how their attribute levels were selected. Figure 3 shows a screen shot of an example choice set as it was presented to survey respondents. Annex 4 of this report contains the full survey completed by respondents.

In terms of understanding significance of the willingness to pay estimates reported in the next section of this report, the key specification points about the choice task are:

- **Willingness to pay values are measured relative to a well-defined base case.** That is, the willingness to pay estimates in this report hold for the base case (BAU) used, and no other. Using a different base case could yield different household willingness to pay estimates, because the trade-offs households make would change.

  The BAU base case used in this study showed respondents that no extra wastewater would be recycled in the future to 2030, extra to the amount currently being turned into recycled water. Wastewater extra to what Sydney is already generating would be dispose into Sydney Rivers – this reflected the fact that most population growth, and therefore wastewater growth, will occur in Western Sydney.

  The alternative options showed extra water being recycled relative to the base case, and gave options for where this extra recycled water supply would be used and how the extra wastewater that was not recycled was disposed. Households had to pay more to obtain either of these outcomes, but nothing more to get the base case outcomes. Figure 3 shows one example of this choice set presentation.

- **Willingness to pay is how much households are willing to pay each year for a one unit increase in an attribute.** Households are willing to pay these amounts each year through rates and bills. They are willing to pay starting now, even though they were told that benefits may not happen immediately – i.e. that extra recycling would happen between now and 2030.

- **Estimates are average WTP for 'on average' changes.** That is, the WTP estimates are not site or location specific – values are generalised to all regions in Western Sydney.

- **Estimates are valid between each attribute's minimum and maximum unit of measure.** These are the minimum and maximum values of each attribute shown to survey respondents. These values are shown in Table 1 in the far right column. The WTP estimates reported in the next section can be used to estimate the community benefits of extra wastewater recycling in Sydney between these minimum and maximum values, not beyond them.

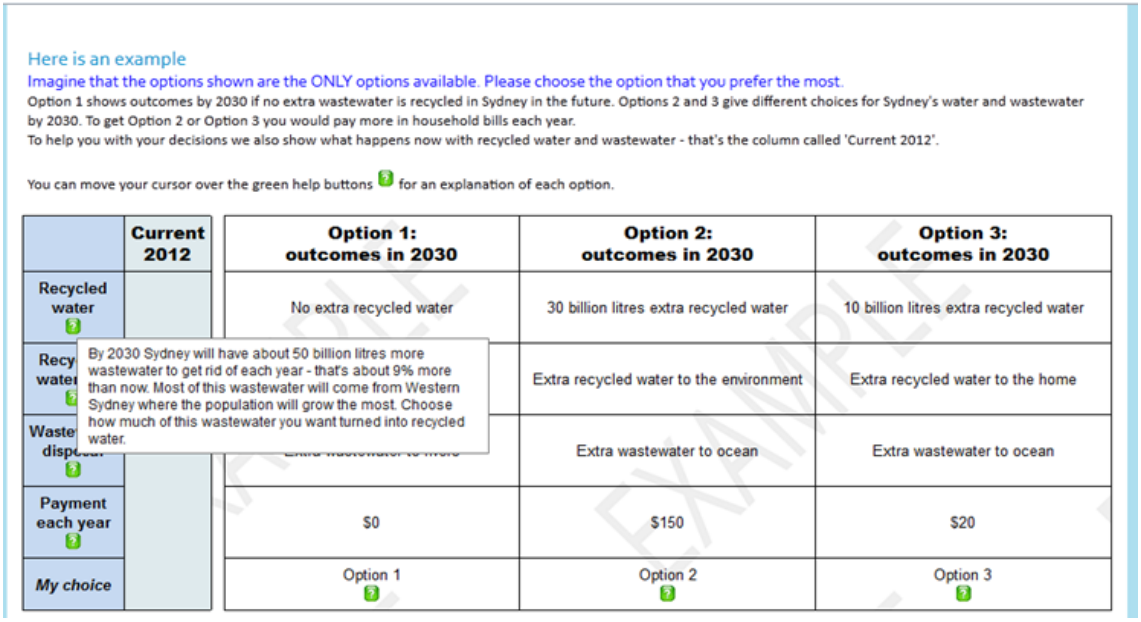
- **Estimates are proxies for community values, and measure direct, indirect, and potentially non-use values for extra recycling outcomes in Western Sydney.** The community values do not distinguish what type of community values households are giving – that is, whether they are driven by direct or indirect use or non-use preferences.

- **Recycled water attributes and their levels provide a comprehensive description of welfare dependent outcomes.** In simple terms this means that attributes measured the main things about wastewater recycling in Sydney that 'mattered' to people, and they were willing to pay for. This means the willingness to pay estimates give a comprehensive accounting of wastewater recycling outcomes that Sydney households are willing to pay extra to obtain. This means the willingness to pay values should be interpreted as the maximum amount Sydney households are willing to pay to secure these extra wastewater recycling outcomes, relative to the base case.
- **Willingness to pay for water recycling attributes are independent of one another.** This means the willingness to pay for the water recycling and wastewater disposal attributes used in the choice modelling study don't double count values – the attributes chosen, survey design and statistical analysis of the data mean that the willingness to pay values of each attribute can be added together without double counting.
- **Attributes and their levels are based on best practice design principles.** These principles are discussed in Annex 1 and Annex 2. They include that the attributes were precisely defined, values presented in absolute and relative terms where possible, used clear points of comparison with the base-case, and focussed on describing direct outcomes of alternative wastewater recycling strategies, not proxies for these. Attribute level combinations in the choice sets were selected based on an experimental design that means the values estimated are based on choices made in an efficient trade-off space.

Table 1: Attributes and levels used in the Sydney recycled water choice modelling survey

Attribute	Description	Unit of measurement	Current level	Base case existing actions in 2030	Option 1 and 2 alternative actions in 2030
Recycled water	Volume of extra wastewater recycled in Sydney by 2030	GL	50 GL	No extra recycled water	10 / 20 /30 / 40 extra GL
Recycled water use	Where extra recycled water is used in Sydney in the future	Use point	Most recycled water is used by councils and businesses for things like irrigation, watering grounds and flushing sewers. Around 20,000 homes in Sydney also use recycled water for things like flushing toilets and watering gardens. Highly treated recycled water is also used to help maintain the healthy flow of the Hawkesbury-Nepean River.	No extra recycled water	Local Councils in Western Sydney / Business and industry in Western Sydney / Environmental use in Western Sydney / Homes in Western Sydney
Wastewater disposal	What happens to Sydney's extra wastewater that is not recycled in the future	Disposal point	Wastewater that isn't recycled is treated and released into Sydney's rivers and the ocean.	Extra wastewater to Sydney Rivers	Sydney Rivers / Sydney Ocean
Household cost	How much extra households pay in higher rates and bills each year	$		Nil	$10 / $20 / $50 / $100 / $150

Figure 3: Example of a choice question in the Sydney recycled water choice modelling survey



Here is an example

Imagine that the options shown are the ONLY options available. Please choose the option that you prefer the most.

Option 1 shows outcomes by 2030 if no extra wastewater is recycled in Sydney in the future. Options 2 and 3 give different choices for Sydney's water and wastewater by 2030. To get Option 2 or Option 3 you would pay more in household bills each year.

To help you with your decisions we also show what happens now with recycled water and wastewater - that's the column called 'Current 2012'.

You can move your cursor over the green help buttons for an explanation of each option.

	Current 2012	Option 1: outcomes in 2030	Option 2: outcomes in 2030	Option 3: outcomes in 2030
Recycled water		No extra recycled water	30 billion litres extra recycled water	10 billion litres extra recycled water
Recy wate		By 2030 Sydney will have about 50 billion litres more wastewater to get rid of each year - that's about 9% more than now. Most of this wastewater will come from Western Sydney where the population will grow the most. Choose how much of this wastewater you want turned into recycled water.	Extra recycled water to the environment	Extra recycled water to the home
Waste disp			Extra wastewater to ocean	Extra wastewater to ocean
Payment each year		$0	$150	$20
My choice		Option 1	Option 2	Option 3

EXAMPLE

2.3 Understanding, consequentiality, and incentive compatibility of the choice task

Choice modelling asks people to make what are sometimes complex trade-offs. In the Sydney water recycling choice modelling study households were asked to make trade-offs between higher household rates and bills, and extra wastewater recycling, less wastewater discharge, and recycled water end uses, relative to the base case. Households completed this task drawing on the Sydney water supply information they were given in the survey in addition to what they already knew of Sydney water supply. Section 2.1 showed that many households completing the survey weren't aware of aspects of Sydney's water supply and wastewater discharge programs. Many weren't aware that recycled water was now being used in Sydney, or Sydney's future water supply needs.

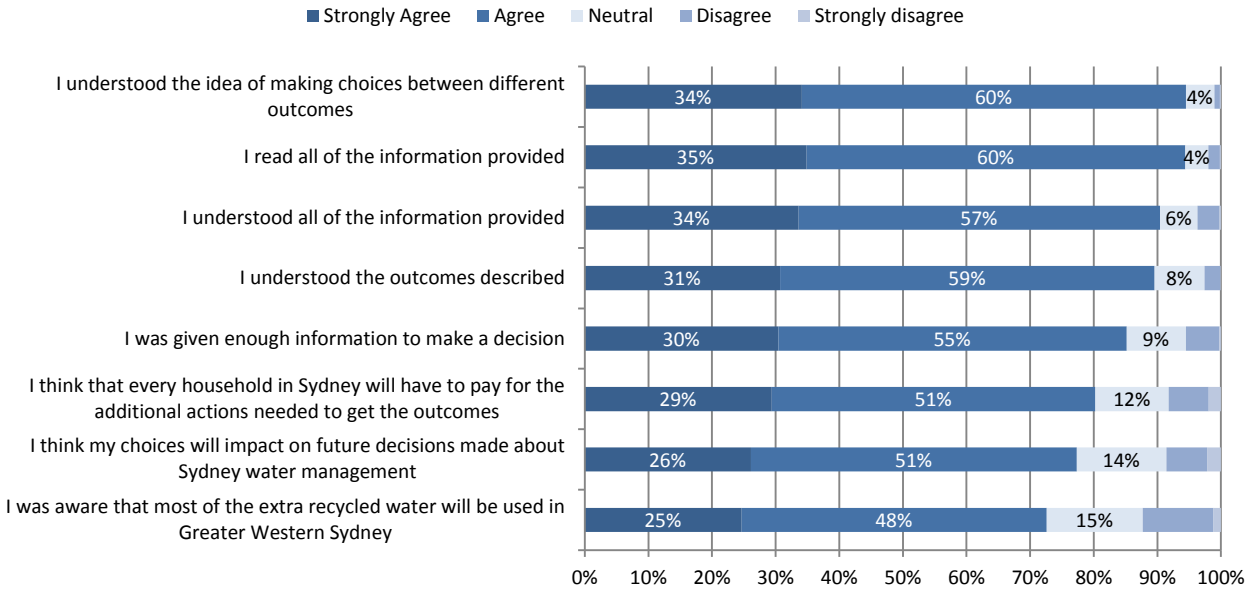
Given these pre-conditions, understanding whether respondents completing the choice modelling survey believed it was consequential and hence incentive compatible is an important precursor to having confidence in the willingness to pay estimates. Section 1.3 of this report introduced and discussed the importance of consequential and incentive compatible choice survey design, and that values obtained from consequential and incentive compatible stated preference surveys have been shown to approximate peoples' real behaviour in real markets.

Figure 4 shows that most respondents reported that they understood the information provided to them in the questionnaire, had enough information to make an informed decision, could make the trade-offs required in the choice tasks, and believed the choices they made in the survey were consequential.

Prima facie, these self-reporting results suggest that the design approaches used by the study team to ensure the survey instrument was understood, consequential, incentive compatible and minimised hypothetical bias worked for more than 90% of survey respondents on most measures. In short, the positive self-reporting scores shown in Figure 4 suggest that on most measures, generally more than 90% of respondents believe that they were being asked to make real choices about future water recycling in Sydney, and that the NSW Government was really going act to implement the choices that Sydney households made.

Statistical evaluation of the survey responses that tested for understanding and hypothetical bias shows that comprehension, consequentiality and incentive compatibility self-reporting scores are the same across all Sydney regions, and by age, education, household income and whether respondents had environmental training. This result suggests that there are not systematic differences in levels of understanding or hypothetical bias between these groupings.

Figure 4: Sydney household self-reported assessments of understanding and consequentiality



2.4 Household willingness to pay

2.4.1 Why the household willingness to pay estimates are conservative

Before presenting the household willingness to pay estimates, it is worth stressing why the estimates shown in the next three sections are more likely to be under-estimates of true community preferences than over-estimates. These reasons are:

- **Estimates include households who prefer the status quo.** Stated preference studies often exclude households who are not willing to pay anything in the choice modelling survey – that is, households that always prefer the BAU to any of the options they have to pay for. While there can be valid reasons for doing this, excluding households that prefer the status quo and are not willing to pay for extra water recycling can result in higher estimates of average WTP. Including households with zero willingness to pay may yield more conservative estimates.
- **Estimates exclude the Alternative Specific Constant (ASC).** This is an important technical point. The ASC is a parameter output from the estimated choice models. It measures all of the impacts on respondents' choices resulting from unobserved reasons – that is, reasons not accounted for by the variables included in the choice model. In practical terms, in the Sydney water recycling choice modelling study, the ASC measured Sydney households' unobserved reasons for preferring more wastewater recycling (in Western Sydney) irrespective of the attributes and their levels. The ASC therefore reflects the amount that households were willing to pay to increase recycled water supply in Sydney relative to the base case outcomes in 2030 that aren't explained by the water

recycling and wastewater disposal attributes and the socio-economic descriptors of the respondents that were included in the model.

The ASC in the models estimated was significant and had a large dollar value (in the range of $167 and $208 per household each year). This result shows that households are willing to pay 'a lot' more than their marginal WTP for the extra recycled water supply attributes listed in Table 1.

There are several possible explanations and behavioural drivers that may contribute towards this strong WTP to shift from the status quo. Some of these explanations and drivers would suggest including the effect in welfare estimates and benefit-cost analysis of recycled water supply projects, while others would suggest excluding it. To be conservative, we have excluded this large ASC WTP estimate, and have only reported the WTP for the recycled water supply attributes listed in Table 1.

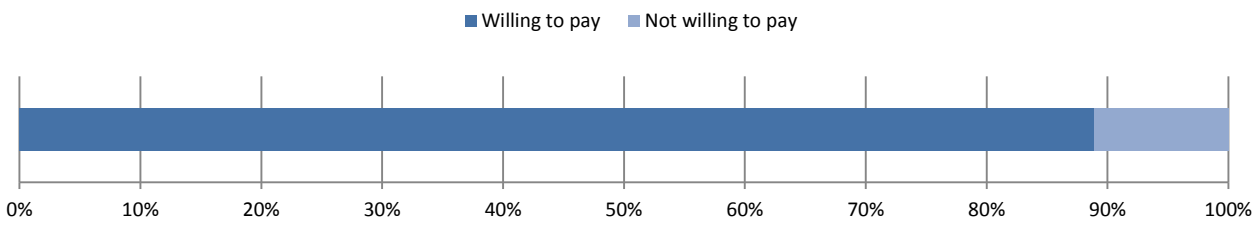
- **Estimates are population weighted to represent Sydney households.** We show in Annex 1 that our survey was marginally over-weighted towards households and regions with higher education and income levels. Past evidence and economic theory suggest that Australian households with higher income and more education are often willing to pay more for environmental improvements and recycling schemes when asked in stated preference surveys. Reweighting the household survey data to better align with Sydney's overall household population will have likely reduced overall WTP estimates.
- **Survey design and analysis based on a conservative approach.** Survey design and analysis procedures are set out in Annex 1 and Annex 2. The design approach used, and the models estimated have focussed on obtaining conservative estimates. The survey development and testing approach used in this project were based on the approaches and experience that the MJA consortium have accumulated over the past decade by delivering more than 50 choice modelling surveys, including more than 30 choice modelling surveys that have valued preferences for natural resource management policies and their attributes, and more than 20 choice modelling surveys delivered by internet panel.

2.4.2 Incidence of Sydney household willingness to pay

Sydney households had a high incidence of willingness to pay for extra recycled water supply and / or reduced wastewater disposal in Rivers and the Ocean relative to the base case described in section 2.2. Population weighted survey results (Figure 5) show that almost 90% of respondent Sydney households chose at least one alternative that involved extra payment from the supply options presented to them in the choice sets.

While there are 10% of Sydney households that aren't willing to pay, MJAs evaluation found these households cannot be readily identified based on household characteristics like region, income, education, environmental training and others.

Figure 5: Sydney households willing to pay in at least one choice scenario



2.4.3 Average Sydney household willingness to pay

Sydney households' average willingness to pay for increases in recycled water supply and wastewater discharge attributes are summarised in Table 2. Column (3) shows how much Sydney households' are willing to pay for marginal changes in recycled water supply and wastewater disposal relative to the base case, and columns (4) and (5) show the 95% confidence intervals for the average household willingness to pay estimate. Specification tests showed that the median and average willingness to pay estimates were effectively identical, so only average values are shown. All of the willingness to pay estimates in Table 2 are significant at the 5% level or greater. This is a high level of statistical significance, and means we can be confident that respondents Sydney households hold positive values for all of the attributes.

The confidence intervals show the maximum and minimum (the upper and lower bound) values that the average household's willingness to pay lies between with 95% probability. In simple terms and using the recycled water volume attribute as an example, the confidence interval shows that 95 times out of 100 Sydney households' annual willingness to pay for each extra GL of recycled water supply between now and 2030 is between $0.62 and $1.12 per year.

On average, the results show that Sydney households have clear preferences for increasing recycled water supply in Sydney, and that Sydney households also have some clear preferences for where the extra recycled water is used, and where extra wastewater is disposed. On average:

- **Sydney households are on average willing to pay between $2.65 and $48.38 per year for an additional 10-40GL per year of recycled water by 2030, depending on the use of the recycled water;**
- **Sydney households are willing to pay an average of $0.87 per year for each extra GL per year of recycled water supplied by 2030 in Sydney (95% confidence interval $0.62 to $1.12 per year);**
- **Sydney households would most prefer extra recycled water to be used by business and industry in Western Sydney (for things like manufacturing and cleaning workspaces)**. On average, Sydney households would least prefer extra recycled water to be used by homes in Western Sydney (for things like flushing toilets and watering gardens).
- **Willing to pay more if extra wastewater is disposed in Sydney Rivers than if it is disposed into the Ocean.** Sydney households are willing to pay an average of $5.68 per year to have extra wastewater disposed into Sydney Rivers, rather than the ocean (95% confidence interval $0.46 to $11.11 each year). Households may prefer this outcome because of historical concerns over Sydney's ocean discharge, or because the survey noted that wastewater released into Rivers is treated to a higher (tertiary) standard than Ocean disposal, where water is primary treated.

Sydney households are willing to pay for these recycled water outcomes starting now, even though they were told that changes would occur between now and 2030, and will take time to happen. They are willing to pay extra in addition to existing charges and fees they already pay.

The WTP estimates in Table 2 are linear. Linearity means that, on average, households are willing to pay the same extra amount for every additional unit of an attribute gained – for example, households are willing to pay on average $8.69 per year for an extra 10 GL of wastewater to be recycled (95% confidence interval $6.19 to $11.15 per year). Linearity was tested using specification tests rejected the possibility that WTP was non-linear for any of the attributes.

The willingness to pay for the change from ocean wastewater disposal to river disposal is also additive. For example, on average, Sydney households would be willing to pay $28.00 each year for a 10 GL increase in recycled water supply to businesses and industry if this outcome is also accompanied by a change in wastewater discharge from the ocean to rivers.

Table 2: Annual Sydney household willingness to pay for recycled water attributes

Extra recycled water to…	WTP/extra GL	10 GL	20 GL	30 GL	40 GL	95% CI 40GL
Western Sydney homes	+0.87	2.65	11.34	20.02	28.71	16.02 - 41.10
Environment	+0.87	5.62	14.30	22.99	31.67	20.21 - 42.79
Council	+0.87	8.91	17.59	26.28	34.96	25.01 - 44.62
Business and Industry	+0.87	22.33	31.01	39.70	48.38	38.25 - 58.51
Change from ocean wastewater disposal to river wastewater disposal		+5.68	+5.68	+5.68	+5.68	+0.45 - 11.12

2.4.4 Drivers of willingness to pay differences amongst Sydney households

The household willingness to pay estimates in the last section show that, on average, Sydney households are willing to pay significant amounts to increase recycled water supply in Sydney in the future. They are also willing to pay different amounts to have this recycled water used by different end users – in particular they much prefer the recycled water being used by businesses and industry than Western Sydney households.

Many Sydney households' willingness to pay for future recycled water supply outcomes in Sydney will differ from this average. For policy and planning it is instructive to understand how and why willingness to pay differs across Sydney households, where possible.

Models used to test for household differences in willingness to pay are discussed in Annex 1. Statistical models were estimated using a range of socio-economic and demographic characteristics, and different specifications. Characteristics included household composition, number of children, household income, education, age of the respondent, gender, having a training or education in an environmental or related field, household location, whether the household now received recycled water and more.

Results of these evaluations show that the drivers of differences in household willingness to pay include:

- **Household income:** households with higher income have a stronger preference for shifting from the status-quo situation – that is, they are willing to pay more to increase recycled water supply in Sydney in the future. This outcome is consistent with economic theory and the findings of many stated preference studies valuing environmental outcomes and policies with public benefits.
- **Age:** older respondents have a stronger preference for shifting from the status quo – that is, older respondents are more likely to prefer more recycled water supply in the future. This finding is also consistent with many stated preference studies valuing public policy options.
- **Gender:** compared to women, men have a stronger preference for keeping the status quo. This outcome is consistent with the findings of many stated preference studies valuing environmental outcomes and public policy options.
- **Households connected to recycled water supply:** are more willing to pay for extra wastewater to be recycled in Sydney than households that are not receiving recycled water.
- **Households using Sydney's Rivers for recreation:** are more willing to pay for extra recycled water to be used to augment environmental flows in Sydney Rivers than households that do not recreate in Sydney Rivers. This outcome is consistent with many stated preference surveys, and suggests these households may have place a use-premium on improved River outcomes.

2.4.5 Distribution of willingness to pay amongst Sydney households – the willingness to pay calculator

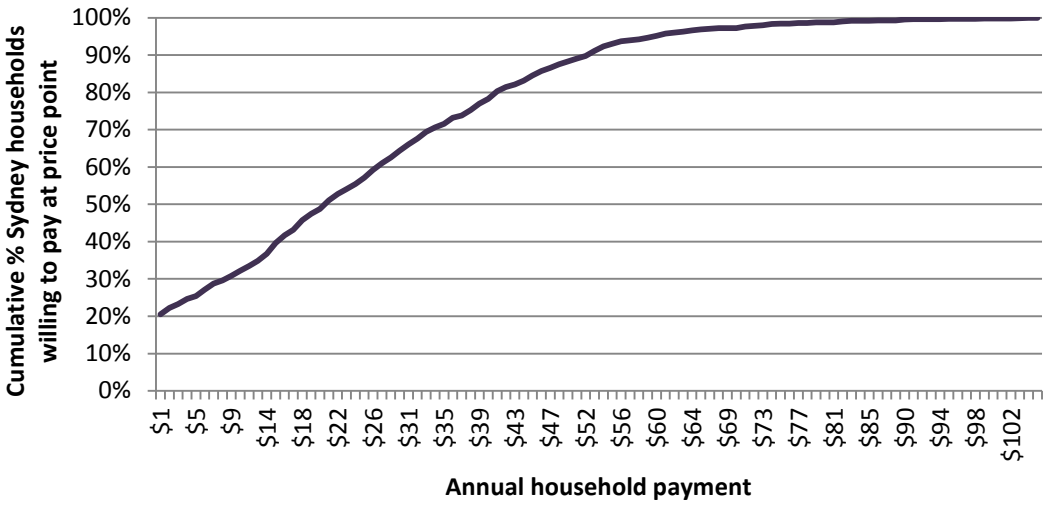
In addition to understanding the drivers of Sydney household differences in willingness to pay, for policy and planning it is also instructive to understand how willingness to pay distributes across Sydney households and changes with different attribute level combinations.

The distribution of willingness to pay shows how spread willingness to pay is across households, and shows the percentage of Sydney households who are willing to pay for extra recycling in Sydney at different price points – for example the percentage of Sydney households that are willing to pay more than $13 a year for 10 extra GL of recycled water supply to Western Sydney businesses and industry, with any extra wastewater going to Sydney Rivers (around 60% of Sydney households).

The distribution of Sydney household WTP for the scenario described above is shown in Figure 6. This distribution is based on a simulation of the survey data results that uses the parameters from the estimated statistical model of household willingness to pay, household specific characteristics, and households' unobserved preferences that are embedded in their willingness to pay values. Figure 6 shows:

- **significant differences between household willingness to pay for recycled water outcomes:** WTP ranges between the extremes of nil to around $90 each year for households for 10 extra GL of recycled water supply to Western Sydney businesses and industry, with any extra wastewater going to Sydney Rivers. These household differences in willingness to pay are driven by socioeconomic, demographic and other factors.
- **Some Sydney households will be unhappy if they have to pay anything at all:** this is the percentage of Sydney households that have zero willingness to pay – around 20% of Sydney households - these households' percentages are shown crossing the left axis on Figure 6.
- **70% of Sydney households are willing to pay:** in the order of $8 each year for 10 extra GL of recycled water supply to Western Sydney businesses and industry, with any extra wastewater going to Sydney Rivers.

Figure 6: Simulated cumulative distribution of annual WTP over Sydney households for 10 extra GL of recycled water supply to Western Sydney businesses and industry, with any extra wastewater going to Sydney Rivers



A "WTP calculator" Excel workbook has been created as part of this project. The workbook calculates, for any baseline scenario and change scenario defined by the user, the model estimate of mean WTP

for the change, the 95% confidence interval around this estimate, and the distribution of WTP over households (both with and without truncation at zero).

Figure 7 shows a hypothetical set of inputs to the WTP calculator, while Figure 8 shows the calculation results. The baseline is defined as the status quo as it was defined in the questionnaire. The change scenario involves 25 GL of extra recycled water being provided to the environment and disposal of extra wastewater in the ocean.

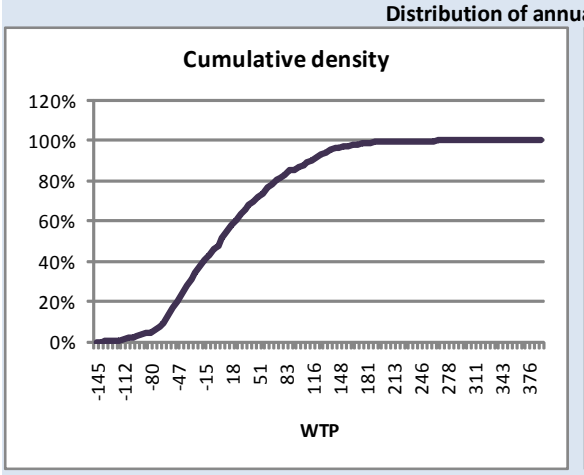
Figure 7: Hypothetical set of inputs to WTP calculator

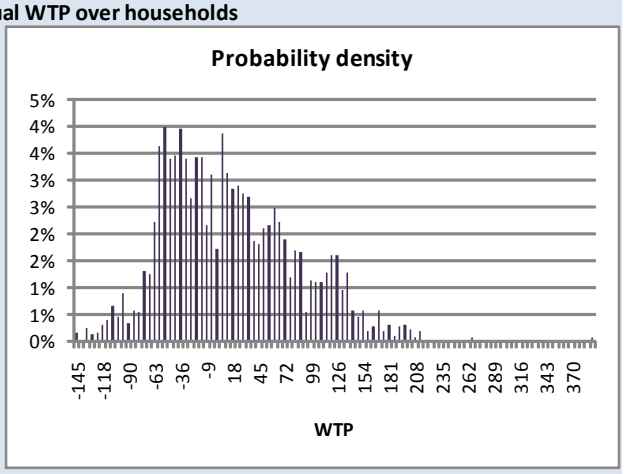
Inputs		
	Baseline scenario	**Change scenario**
Status quo or change?	Status quo	Change
Volume (billion litres extra recycled water)	0	25
Use	No extra recycled water	Extra recycled water to the environme
Wastewater disposal	Extra wastewater to rivers	Extra wastewater to ocean
Discount rate (per annum)		10.0%

Figure 8: Willingness to pay results for change defined in Figure 7, excluding preference for change

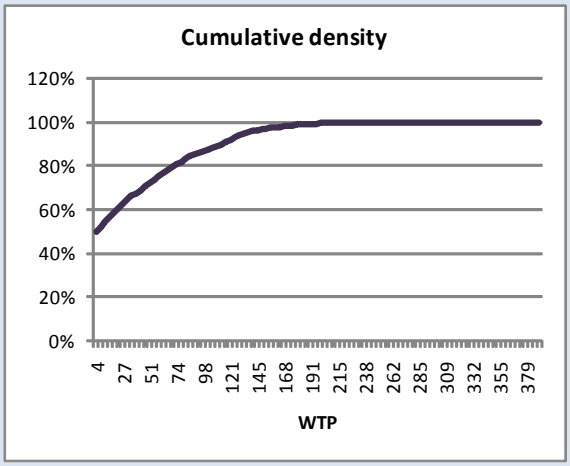
Willingness to pay (excluding preference for change)	
Weighted average WTP per household ($ per annum in perpetuity)	12.97
95 per cent confidence interval	
Lower bound	2.47
Upper bound	22.95
Present value of mean WTP ($ per household)	129.66
95 per cent confidence interval	
Lower bound	24.73
Upper bound	229.53

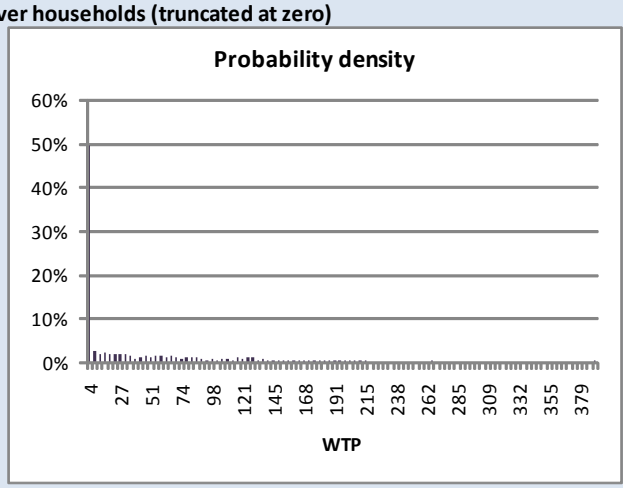
Distribution of annual WTP over households





Distribution of annual WTP over households (truncated at zero)





Annex 1. Project approach

This Annex sets out the Sydney recycled water choice modelling project's survey design, implementation and analysis approach.

The approach set out in this Annex builds on the approaches and experience that the project team members have accumulated over the past decade by delivering more than 50 choice modelling surveys, including more than 20 choice modelling surveys delivered by internet panel.

The project approach was tailored to meet the specific circumstances and requirements of the project.

The Annex outlines key agreed project specifications, and then provides Stage based details of the project approach.

Key agreed project specifications

Key project specifications were agreed at project outset. These key specifications were:

- the survey would be implemented by internet panel;
- the population to be surveyed is households in the Sydney Significant Urban Area. The survey population was to be stratified based on ABS household data to ensure the survey recruited a representative population, and obtained sufficient preferences from households in the Greater Western Sydney region;
- the total number of survey respondents was not less than 900, with a minimum valid sample size of 770 respondents;
- the focus of the choice modelling study was to value community preferences for extra recycled water supply between now and 2030. A longer timeframe was chosen recognising the significant time required for water supply infrastructure planning;
- the base case for the choice modelling evaluation was the existing Sydney water supply situation. Thus, Sydney population growth was to be modelled with the existing supply sources and constraints in place. These supply sources and constraints were identified from Sydney Water, and information included in the survey.

Project stage detail

The project was delivered in six sequential steps described below.

Stage 1: Formalise agreements and prepare Services Delivery Plan

During this stage, members from the MJA project team:

- confirmed project objectives and research questions;
- refined the proposed methodology and specify output requirements;
- clarified project expectations, understanding and confirm project timelines;
- confirmed stakeholder groups for consultation; and
- determined liaison arrangements and other protocols and reporting lines.

Stage 2: Review of background information and other analysis

During this stage the project team completed preliminary discussions with key stakeholders and reviewed background reports prepared to facilitate the completion of the consultancy. These discussions and reports included:

- holding initial discussions with representatives from Sydney Water to refine our understanding of Sydney water supply planning, including the status of recycled water projects; and
- reviewing other documentation provided to the consultancy by the Department.

During Stage 2 the project team held an initial project workshop with key project experts. Key project experts included representatives from Sydney Water, Sydney Catchment Authority and the Metropolitan Water Directorate.

Experts attending the workshop assisted the consultancy to:

- **define the baseline condition to be used in the choice modelling study**. We discussed and identified the most likely baseline for Sydney water supply, recycling targets and wastewater disposal between now and 2030;
- **clearly defining extra recycled water outcomes under feasible policy scenarios:** We built on understanding of the baseline scenario to develop a range of bounds specification of how recycled water supply could expand in Sydney between now and 2030 – where the recycled water would come from, how and where it could be used and how extra wastewater that was not recycled could be disposed of. Much of this discussion focussed on the future population growth areas of Western Sydney.

Stage 3: Draft the survey instrument

During this stage the project team drafted an initial choice modelling survey instrument. The choice modelling questionnaire was designed to aim for high content validity, in which the survey descriptions and questions are clear, reasonable and unbiased such that respondents are put in a frame of mind that motivates them to answer seriously, thoughtfully, and truthfully.

The initial survey focussed on potential recycling developments in the new growth areas of Western Sydney and emphasised that recycling impacts would mostly be observed in Western Sydney. This was done so that differences in values and preferences of people living in Western Sydney and outside of Western Sydney could be obtained, and differences between potential use and non-use values obtained.

Key design issues that will be addressed during the survey design phase are discussed in Annex 2.

While the centrepiece of the survey was the choice tasks, the questions preceding these tasks were designed to give an appropriate framing or context for the issue under investigation.

The key deliverable from this stage was be the initial draft survey questionnaire. The AWCoE project team and other stakeholders reviewed the draft survey questionnaire before it progressed to the qualitative research stage.

Stage 4: Trial and refine the survey instrument

Following stakeholder review of the draft survey instrument, during Stage 4 the project team undertook qualitative research to test and refine the draft choice modelling survey instrument. This qualitative research was conducted by involving people from a range of socioeconomic and

demographic areas to ensure that the questionnaire has been developed effectively, that the attributes are appropriate, and that the questionnaire has content validity.

Focus groups are an essential prerequisite to questionnaire development in non-market valuation studies. We completed four focus groups, including:

- two focus groups in inner Sydney in order to obtain responses from people who are living distant from Western Sydney where most extra recycled water supply will likely occur between now and 2030; and
- two focus groups in Penrith and Parramatta to obtain responses and input from the population of greater Western Sydney.

Focus groups were planned discussions involving eight to ten participants guided by Professor Jeff Bennett. The focus groups will held in a neutral, non-threatening environment.

The key qualitative assessment phase stages and findings are summarised below, as well as key revisions made to the questionnaire based on the key findings.

Qualitative assessment stage description	Key findings	Key revisions
Focus group 1 The first round of focus groups involved exploratory research. Two focus groups were completed. North Sydney (evening) and Penrith (day). There were 8-10 participants in each group. The focus groups involved a two-hour session per focus group. The focus group were used to identify and confirm attributes, as well as to determine the plausibility of scenarios presented in the draft choice sets.	▪ Participants had little knowledge about what happens with wastewater in Sydney and with the idea of recycled water supply option in Sydney; ▪ Identified that the survey contained too much information. Participants said the survey should be significantly shortened, and key messages and presentation simplified. ▪ Identified that participants wanted to see a volumetric attribute measure in the choice sets – preference was for GL of recycled water each year; ▪ Identified that respondents were confused by having too many water supply options. Focus group respondents recommended the survey focus on recycling only; ▪ Identified that focus group participants had strong preferences for not sending wastewater to Sydney's rivers and oceans, and different preferences for wastewater being released into rivers versus oceans. ▪ Wanted more information about the costs of alternative recycling and other water supply options; ▪ Issue of Sydney vs Greater Western Sydney confused people. Water Supply is a Sydney issue, the wastewater and recycled water issues have a GWS focus. As the focus groups were in the CBD, there was little knowledge of the western suburbs. ▪ Identified $50-100 cost range is popular.	The initial survey was significantly revised to: ▪ substantially reduce and simplify the background and choice information provided to respondents; ▪ increase the use of visual aids; ▪ included an attribute for the volume of water recycled each year; ▪ removed the water supply option attribute.
Focus group 2 The second round of focus groups piloted the revised draft choice modelling questionnaire.	▪ Many participants had little knowledge about what happens with wastewater in Sydney and with the idea of recycled water supply option in Sydney; ▪ Most respondents completed the survey within 20 minutes; ▪ Roughly half of the focus group respondents said that the survey still contained too	▪ The survey will be further developed to include more information that can be accessed if people want it – hover boxes and links. Hover boxes and links will include more information on wastewater disposal, where recycled water is now used, why most recycled

Qualitative assessment stage description	Key findings	Key revisions
Two focus groups were completed. Parramatta (day) and Parramatta (evening). There were 8-10 participants in each group. Group participants were asked to complete the questionnaire and were taken back through the survey and asked to comment on what they were thinking about when answering each question, what they understood the question to mean, and whether they found anything confusing or difficult. **Full write up in Annexes 2-3**	much information. The remaining half was split between people saying the information was 'just right' and others saying there was too little information. ▪ Many respondents were alarmed that the results of the survey would be used to implement Government water policies that focus group participants did not necessarily support (i.e. that the Government would use the information 'against them'). ▪ Respondents indicated 4 choice sets was too much, should be reduced to 3. ▪ Some participants sought further clarification why Western Sydney would get more recycled water but the rest would not. ▪ Participants did not trust the Government to use the funds for river management. Proposed that a specific trust is established. ▪ Respondents wanted some of the follow up questions removed, and some of the background questions brought forward to before the choice sets.	water will be used in Western Sydney in the future. ▪ Include a longer preamble talking about the objectives of the survey. Emphasise that while the work is consequential for Sydney, it is a research project, not Government policy. ▪ Include a cheap talk script to reduce hypothetical bias risk. ▪ Reduce text further, less verbose where possible. ▪ Work on stripping out the motherhood follow on questions. ▪ Bring forward warm up questions. Lead in questions on water use around the household – do you have a pool, etcetera. ▪ Reduce the number of options from 4 to 3 to reduce the burden.

Pre-testing

Following re-drafting, the questionnaire was set-up for internet deployment. The survey was pre-tested with a sample of just over 100 respondents to ensure that the experimental design was working, and that any other final problems with the survey could be rectified.

Stage 5: Administer the survey

During stage 5 the survey was administered by SSI. Since 2009, SSI has administered more than 200 internet surveys for commercial and academic clients, including more than 30 choice modelling surveys.

The survey was conducted online with the internet panel sample being sourced from MyOpinions, one of the research industry's leading online panel providers. Email invitations will be sent out by MyOpinions and respondents agreeing to undertake the survey will then be diverted to the SSI site where they will complete the survey. The email sent to potential respondents did not identify the survey's subject matter.

Households who were eligible to participate in the survey had to live in the Sydney Significant Urban Area region, responsible for paying household bills / rates, Australian citizens or residents, and over 18 years of age. Screening questions at the beginning of the questionnaire were used confirm respondents meet the recruitment criteria, and sample quotas based on ABS census stratification.

Step 6: Undertake the statistical analysis

During this stage we will evaluated the results of the survey, presented and discussed the preliminary results, and prepared the final report.

Our approach to analysing the data involved undertaking initial data exploration and screening, estimating the choice models, and the estimating and forecasting the economic value of river health outcomes. These steps are introduced below.

Initial exploration and screening

The first stage of data exploration involved an exploration of the data using simple methods such as tables. More advanced methods such as factor analysis were then used to gain an understanding of the structure of the attitudinal data.

The second stage of data exploration involved identifying the main segments within the community in terms of attitudes towards water recycling and wastewater disposal, and demographics.

During this stage of the analysis we also employed ex post approaches to identify and exclude problematic, disengaged, or otherwise invalid respondents from further analysis. The main approaches for identifying invalid respondents are described in Annex 2.

Weighting of survey data

The survey data was checked to see if the survey population was representative of the Sydney population. Statistical tests showed that the survey data over- and under-represented some parts of the Sydney population.

Because of this outcome, the survey data was re-weighed to align with the Sydney population using rim-weighting. Rim-weighting uses a mathematical algorithm to help provide an even distribution of results across the entire dataset while balancing certain categories such as age or gender to pre-

determined totals. It weights the specified characteristics simultaneously and disturbs each variable as little as possible.

Using ABS 2011 Census targets, data was reweighted for three rim parameters:

- household composition (couple with/without children, single parent with children, single, group, other) by household income (in broad groups).
- housing tenure (own or paying off, versus renting or other).
- SA4 geography.

Re-weighting was done using rim-weighting to produce an analysis in which the proportion of respondents in the survey sample were adjusted to match more closely to the proportion in the target Sydney SAU population. Re-weighting data means that descriptive statistics and model estimates presented in this report are representative for the overall Sydney population.

Selecting the sample

Our approach was to exclude respondents from the analysis only when there was a very strong case for doing so. It is common for respondents completing a survey within a threshold length to time to be judged as giving insufficient consideration to the survey questions and to be excluded from choice models. We excluded 15 respondents completing the survey in less than four minutes. Consideration was given to whether additional 43 respondents completing the survey in less than five minutes should also be excluded. A basic multinomial logit model suggested that these respondents evidenced lower willingness to pay (WTP) relative to the rest of the sample. However, only ten of the 58 respondents completing the survey in less than five minutes also chose the status quo option in every choice question.

Some 134 respondents chose the status quo option in all choice questions (sometimes referred to as serial non-participation). Consideration was given to the exclusion of 37 of these respondents who indicated that "I found making the choices too confusing, so I always chose Option 1". Excluding both quick responders (completing in less than five minutes) and serial non-participants indicating confusion did not result in any dramatic changes in coefficient estimates or statistical significance. Ultimately, it was judged that serial non-participants and those completing the questionnaire in at least four minutes should be retained in the final model.

Separate choice models were estimated for two main regions – the outer western suburbs of Sydney and the remainder of the sample. A pooled model with a region indicator variable interacted with the alternative-specific constant and the payment variable was also estimated. This investigation did not find statistically significant differences in preferences across the regions (after accounting for other respondent characteristics) consistently across the models, possibly due to the relatively small sample size of 240 respondents in the outer western suburbs region. It was therefore deemed unnecessary to include the region splits or variables in the final model.

Selecting the variables in the model

To select the variables included in the final model, models were estimated for a wide range of socio-economic and demographic characteristics including household composition, number of children, having a training / education in NRM or related field, being engaged in environmental management or farming, river-activities, age, respondent location (living in Great Western Sydney or not), working in GWS or not, and more.

Effects coded variables for the volume attribute levels were included as explanatory variables in exploratory models to investigate the potential for non-constant marginal utility over volume. The results did not reveal a consistent decline or increase in marginal utility over volume levels. The assumption of constant marginal utility over volume was judged to be appropriate, particularly since it would readily allow estimation of welfare effects from volume levels not included in the survey itself.

Exploratory models also included interactions between volume and effects coded variable indicating the use of the extra recycled water and between volume and an indicator variable for the location of wastewater disposal (ocean or river). Coefficients on these interactions were generally statistically insignificant. It was judged that these interactions would not be included in the final model.

Exploratory models included several respondent characteristics as covariates with various scenario attributes. These characteristics included personal income, household income, equivalised household income, age, gender, education, and whether the respondent was a recreational river user, an existing piped recycled water user, or involved in environmental conservation or management. These characteristics were interacted mainly with the alternative-specific constant and the payment attribute (and therefore WTP across the attributes), though a few were interacted with use and disposal attributes, where there was thought to be potential for an effect. Several of these interactions were retained in the final model.

Models were also run to checked whether there were significant differences between 'protest' respondents and other respondents, as noted above there was no evidence that the reasons respondents said to have chosen the SQ was a significant factor in explaining choice behaviour.

To facilitate WTP estimation, and to prevent positive estimates for the cost coefficient in the tail of the distribution, the cost parameter was fixed in the ML model specification.

The final model

The final model of household choice amongst recycling scenarios is presented in Table 6.

Household willingness to pay was estimated using a random parameter logit (RPL) model in utility space, estimated on the population weighted data using 600 Halton draws (for an accessible introduction to this type of model, see Hensher, Rose and Greene 2005). The RPL model accounts for correlation amongst the random parameters and weights observations in the log likelihood function to correct for under- and over-sampling across the 15 SA4 regions. The large number of t-statistics greater than 2 (which approximately indicates statistical significance at the 0.05 level) indicates that, in general, respondents considered their choices carefully and attended to the attribute levels presented.

An interpretation of these results is provided in the main body of this report.

Estimates of willingness to pay

Estimates of mean willingness to pay for marginal changes in scenario attributes are presented in **Table 2** in the main body of this report, where the mean is a weighted average correcting for sampling weights.

The estimates of mean WTP were obtained by taking a weighted average across conditional WTP estimates for each respondent, using the Krinsky-Robb method based on 10,000 simulation draws. These conditional WTP estimates were calculated as the product of conditional coefficient estimates and changes in non-monetary attribute levels, divided by the marginal disutility of payment. The results provide not only a mean estimate of WTP, but a distribution of WTP over households, shown in Figure 6 in the main report.

Annex 2. Survey design issues

Critical survey design issues that were addressed in the Sydney recycled water choice modelling survey are set out below.

How attributes and their levels were chosen

The attributes and levels used in the Sydney water recycling choice modelling survey were developed using a systematic process of design, drawing on the scoping work already undertaken by MJA on other water recycling projects, advice and guidance from the NSW Government, non-Government stakeholders and focus groups and pre-testing (project Stage 4).

The preliminary attributes and their levels were develop be based on the outcomes of Stage 2 of the project. Both the preliminary chosen attributes and their levels were be tested in focus group sessions and adjusted as required (Stage 4). The attributes chosen for the study were chosen to be relevant to respondents and well defined. This means the attributes and their levels were chosen:

- to be precise and measurable according to standards of engineering research;
- to be economically relevant;
- to include a comprehensive description of welfare dependent outcomes;
- to be precisely defined in terms of their duration and frequency, where relevant;
- where qualitative descriptors of outcomes were used, these descriptors were substantiated with accurate descriptions of what they meant, and quantified were possible;
- where attributes where expressed as percentages, they were substantiated by absolute values, where applicable;
- used points of clear comparison with the counterfactual situation throughout the survey; and that
- causally prior attributes were avoided where possible, so that the choice models estimated focus on the outcomes of the alternative water recycling strategies under consideration.

How the payment schedule and bid vector were chosen

The initial draft payment schedule and vehicle was defined based on expert opinion and literature review (Stage 2). The initial payment vehicle and schedule was then be tested in focus groups and re-defined as necessary (Stage 4).

The payment vehicle was designed to be incentive compatible. The approach taken identified a payment vehicle that had wide coverage across the population surveyed so that compulsory payment (required for incentive compatibility) was meaningful, deemed by respondents to be relevant to the e flows issue and realistic in that context. Minimising 'protest' against the payment vehicle was a primary goal in the selection process.

The choice of the optimal bid vector involves choosing the number and distribution of bids to offer.

The bid vector was chosen based on an understanding of the potential range of impacts, and based on feedback from the Stage 2 workshop and focus groups held in Stage 4, discussed below.

Open ended contingent valuation questions were posed in the focus group sessions to explore the range of willingness to pay for changes to wastewater recycling and supply scenarios being investigated. This approach provided insights particularly into the upper tail of the willingness to pay

distribution so that the top of the range of the payment bid vector could be set to define choice sets that will reduce choice probability to near zero and so truncate the distribution. To avoid the incentive issues associated with open ended contingent valuation questioning, extensive discussion regarding the reality of payments was encouraged in the focus group sessions.

Number of choice sets used

A simple orthogonal experimental design was used to set up the choice sets used in the focus group and pilot test questionnaires. The data collected from the focus groups and pilot survey was be analysed in rudimentary choice models, and the attribute parameters so derived were used in the development of a Bayesian D-efficient experimental design (Bliemer et al. 2008) to generate the choice sets. The final number of choice sets was determined based on the final choice of the attributes and their levels.

How the survey minimises hypothetical and other forms of response bias

Stated preference surveys of public goods (such as community benefits of recycled water supply) run a greater risk that respondents will give answers that do not reflect their real preferences than stated preference surveys of private goods. One reason that respondents may not give their real preferences is when they believe that they will not actually have to pay for the policy to be implemented that will secure the public good. This is called hypothetical bias. Stated preference surveys are also at risk of other forms of strategic response bias.

The Sydney recycled water choice modelling survey addressed the risk of hypothetical and other forms of response bias by:

- **satisfying four conditions for good design that are known to minimize hypothetical bias** (Cummings, et al. 1986: 104). These are (a) ensuring that subjects are familiar with the commodity being valued; (b) ensuring that subjects have had prior choice experience with the good; (c) minimising uncertainty in the survey's scenario, outcomes, and provision rules; (d) and eliciting willingness to pay (WTP) not willingness to accept (WTA) preferences;
- **using several *ex ante* approaches that have been developed to try and eliminate hypothetical response bias from stated preference studies, including:**
    - **employing a cheap talk script.** Cheap talk scripts tells a survey respondent that past surveys have shown that respondents overstate their willingness to pay for public goods, and instructs them not do so. Rather, they are reminded to report what they would actually do if this were, in fact, a real decision using with their own money.

      Evidence shows that cheap talk scripts can be effective at controlling for hypothetical bias. However, other work has shown that cheap talk scripts do not work at all on some types of respondents, and that other methods are more effective at reducing hypothetical bias than cheap talk scripts (Morrisson and Brown, 2009, Loomis, 2011). As a result, additional approaches to cheap talk scripts are needed to control for hypothetical bias;
    - **emphasising the incentive compatability of the payment vehicle by highlighting the probability of payment.** A process is said to be incentive-compatible if all of the participants fare best when they truthfully reveal any private information asked for by the mechanism. For a person to truthfully reveal their willingness to pay for an environmental good they have to believe that they are going to actually have to pay for it. If people do not think they will have to pay for the environmental improvement (that is, if the survey does not have a good incentive compatible design) then people again likely to overstate their willingness to pay.

Mitani and Flores (2010) show that hypothetical bias can arise when surveys do not discuss the public good provision decision rule and the realistic likelihood of payment. This can make the respondent uncertain about whether they will need to pay the full bid amount, and about the likelihood that of provision of the public good. It is hypothesized these uncertainties lead to hypothetical bias. Based on Mitani and Flores (2010) there will be no hypothetical bias if respondents are explicitly told that the good will be provided based on the results of the survey and that the probability that they will have to pay is exactly the same as the probability of the good's provision.

Mitani and Flores (2010) confirm this result in an induced valuation experiment where probability pairs of provision and payment are made explicit. Their results suggest implications for mitigation of hypothetical bias. First, it is essential to induce subjective probabilities so that the probability of payment equals the probability of provision. Second, in survey designs both payment and provision rules must be controlled in the same way.

We employed these design principles in our study of wastewater recycling and supply in Sydney.

- **using an incentive compatible payment vehicle that gives a precise understanding of payment.** Some choice modelling studies (for example (Hatton MacDonald and Morrisson, 2011)) have used levies paid through increased taxes and higher prices for consumables (food) as the payment vehicle.

  Recent evidence shows that changes to income-based taxes (and food prices) are generally not incentive compatible payment vehicles in stated preference surveys (Schläpfer, 2008). Changes to income-based taxes are not incentive compatible because people pay different tax rates. For example, if the survey respondent is a university student with no income and who pays no income tax, they may think they will not have to pay for the environmental improvement that is going to be paid for by increased taxes, and will therefore potentially overstate their willingness to pay for it.

  It is generally recommended that the payment vehicle in stated preference surveys is some type of levy that can be directly charged to individuals or households. While a levy based approach was not used in the current study, the payment vehicle was not tied to income-based taxes nor food prices.

- **using de-briefing questions and ex post approaches to identify respondents with response bias.** The survey included debriefing questions that asked respondents if they responded truthfully, whether they understood and believed the scenarios, and whether they thought they would have to pay for the outcomes if the policy is implemented. These debriefing questions were used to identify and remove respondents whose debriefing responses indicate that they do not believe the scenario being described, or believe they will not have to pay for the outcomes described in the survey (see Annex 1).

In addition to the ex-ante and ex post approaches described above, we used other approaches identified by Carson and Groves (2011) to ensure the survey is incentive compatible and to reduce the risk of response bias. These other conditions were be built into the questionnaire design and included:

- establishing the context of the choice so that the choice questions are set in a 'frame' that is appropriate to the policy decision making. Value estimates are dependent in part on context. Framing is thus important. This is relative to the scale of the changes involved and the relevant array of substitute actions and complementary options.
- reminding respondent that their ability to pay for outcomes was limited by budget constraints;
- reminding respondents of the availability of substitute sites and products;

- reminding respondents that spending money on water recycling would mean that less money was available for other Government programs;
- highlighting the importance of the study and its further use in the policy making process;
- establishing the credibility of the organisation conducting the study; and
- clearly describing the process by which the study's results are to be used in the development of policy so that it can be shown that respondent's preferences 'count' and the policy context is real.

Annex 3. Data tables

Table 3: Survey recruitment and completion statistics

Parameter	Total	Percent of respondents
Invited	18,888	100%
Not started	17,215	91%
Started	1,673	9%
Complete	1,255	74%
Disqualified	299	18%
Incomplete	132	8%

Table 4: Sydney population and survey completions and weighting by S4 Region

	2011 Census		CM survey		Weighted sample
S4 Region name	Population >19 years	%	Respondents	%	%
Central Coast	230,410	7%	138	11%	7%
Sydney - Baulkham Hills and Hawkesbury	156,936	5%	102	8%	5%
Sydney – Blacktown	219,397	6%	60	5%	6%
Sydney - City and Inner South	244,781	7%	85	7%	7%
Sydney - Eastern Suburbs	215,942	6%	56	5%	6%
Sydney - Inner South West	412,287	12%	117	9%	12%
Sydney - Inner West	221,615	6%	59	5%	6%
Sydney - North Sydney and Hornsby	302,785	9%	124	10%	9%
Sydney - Northern Beaches	188,455	5%	48	4%	6%
Sydney - Outer South West	170,487	5%	72	6%	5%
Sydney - Outer West and Blue Mountains	214,715	6%	71	6%	6%
Sydney – Parramatta	309,308	9%	131	11%	9%
Sydney – Ryde	131,711	4%	39	3%	4%
Sydney - South West	268,132	8%	62	5%	8%
Sydney – Sutherland	164,286	5%	76	6%	5%

Table 5: household population and survey descriptors: weighted and non-weighted datasets

Gender	Sydney SUA	Survey respondents	Weighted respondents
Male	49%	46%	48%
Female	51%	54%	52%
Age >19 years			
19-24 years	10%	5%	7%
25-34 years	21%	16%	18%
35-44 years	19%	18%	18%
45-54 years	18%	21%	20%
55-64 years	14%	23%	18%
65-74 years	9%	14%	12%
75 years +	8%	3%	6%
Median personal income (category)	$ 36,400	$ 36,800	$ 36,800
Median household income (category)	$ 77,480	$ 71,862	$ 72,722
Highest education level			
Year 10 or below	27%	24%	24%
Year 11	4%	6%	6%
Year 12	59%	60%	60%
Diploma or Certificate	25%	27%	26%
Undergraduate Degree	19%	24%	22%
Postgraduate Degree	6%	10%	9%

Table 6: Random parameter logit (RPL) model of household choice amongst scenarios, weighted model results

CHOICE		Coefficient	z		95% confidence interval
	Random parameters				
Volume	Mean	0.02***	5.68	0.01	0.03
	Standard deviation (diagonal element of Cholesky matrix)	0.06**	14.18	0.05	0.07
Council [a]	Mean	0.01	0.20	- 0.10	0.12
	Standard deviation (diagonal element of Cholesky matrix)	0.27*	1.66	- 0.05	0.59
Industry [a]	Mean	0.32***	5.44	0.20	0.43
	Standard deviation (diagonal element of Cholesky matrix)	0.67***	6.82	0.48	0.87
Rivers [a]	Mean	-0.14*	- 1.94	- 0.27	0.00
	Standard deviation (diagonal element of Cholesky matrix)	0.24	1.04	- 0.21	0.69
ASC	Mean		Constrained to zero		
	Standard deviation (diagonal element of Cholesky matrix)	3.24***	8.97	2.53	3.95
Ocean [b]	Mean	-0.069**	-2.12	- 0.13	- 0.01
	Standard deviation (diagonal element of Cholesky matrix)	0.49***	5.7	0.32	0.66
Non-random parameters					
Alternative-specific constant: status quo		-3.63***	-10.06	- 4.34	- 2.93
Annual payment ($)		-0.028***	-14.07	- 0.03	- 0.02
Use: Home x piped recycled water [c]		0.48**	1.99	0.01	0.96
Use: Environment x river recreation [d]		0.14	1.09	- 0.11	0.38
Interactions with "Alternative-specific constant: status quo"					
Equivalised household income ($'000s p.a.) [e]		-0.01**	-1.56	- 0.02	0.00
Age: 39 years or less [f]		1.69***	6.48	1.18	2.20
Age: 60 years or more [f]		-1.66***	-5.91	- 2.22	- 1.11
Gender: Male (1,-1)		0.72***	4.04	- 0.00	0.00
Involved in environmental conservation or management (1,0)		-0.20	-0.3	- 1.48	1.09
Interactions with "Annual payment"					
Equivalised household income ($'000s p.a.) [e]		0.0001***	2.38	.13D-04	.14D-03
Age: 39 years or less [f]		-0.002*	-1.69	- 0.01	0.00
Age: 60 years or more [f]		0.006***	4.23	0.00	0.01
Gender: Male (1,-1)		0.001	1.26	- 0.00	0.00
Model fit					
Choice observations					5935
Log likelihood					-468
McFadden pseudo R^2					0.279
AIC					1.59

Notes: ***, **, * indicates statistical significance at the 1, 5, and 10% respectively.

a Effects-coded variables taking value -1 when extra recycled water to the home. The implicit coefficient for home use is -0.0652

b Effects-coded variables taking value -1 when extra wastewater disposed in rivers.

c Takes the value one for alternatives with extra recycled water to the home for respondents using piped recycled water, otherwise zero.

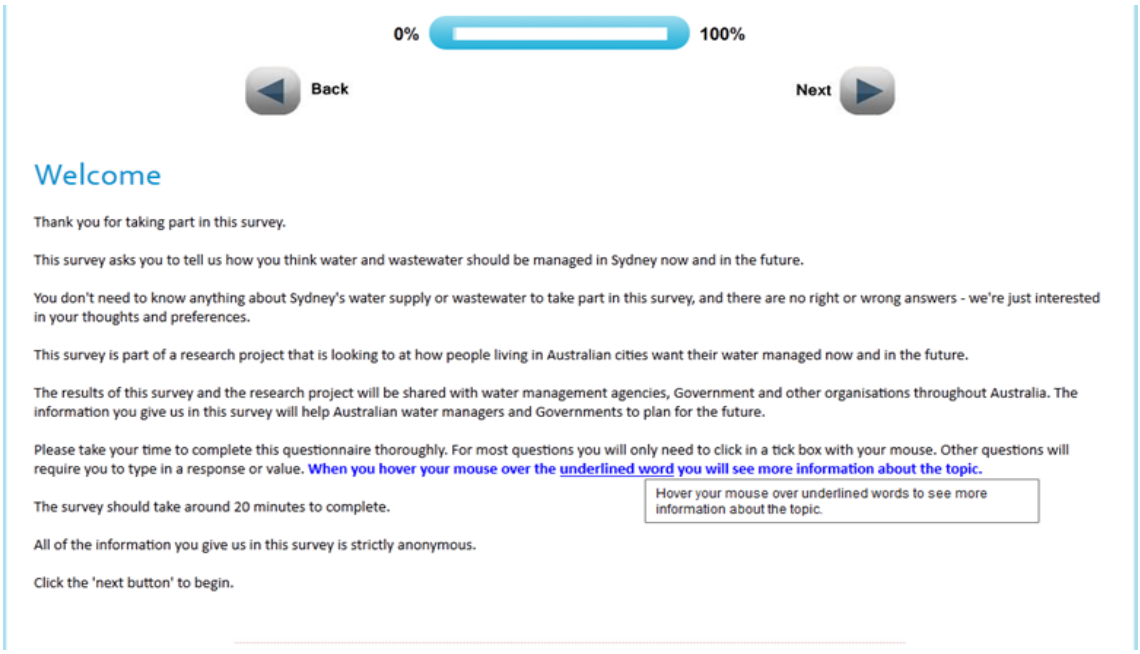
d Takes the value one for alternatives with extra recycled water to the environment for respondents that have used the Hawkebury-Nepean River for recreation, otherwise zero.

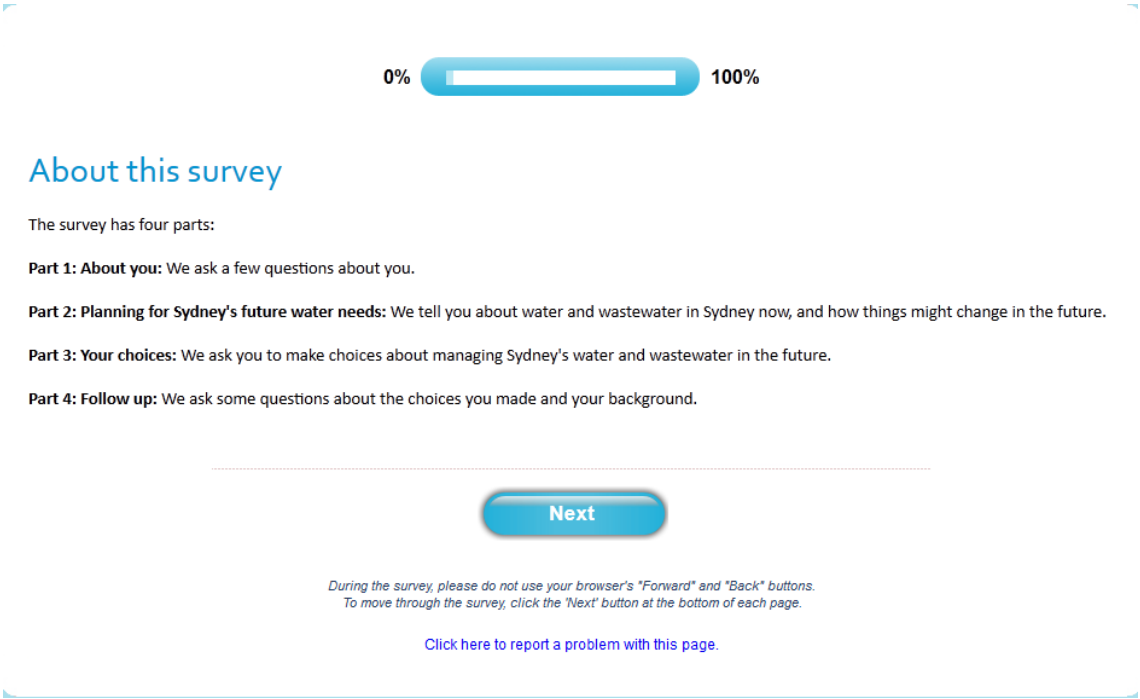
e Equal to the lower bound of the respondent's household income bracket divided by an index constructed as one plus 0.5 for each additional adult plus 0.3 for each person under 18 years of age.

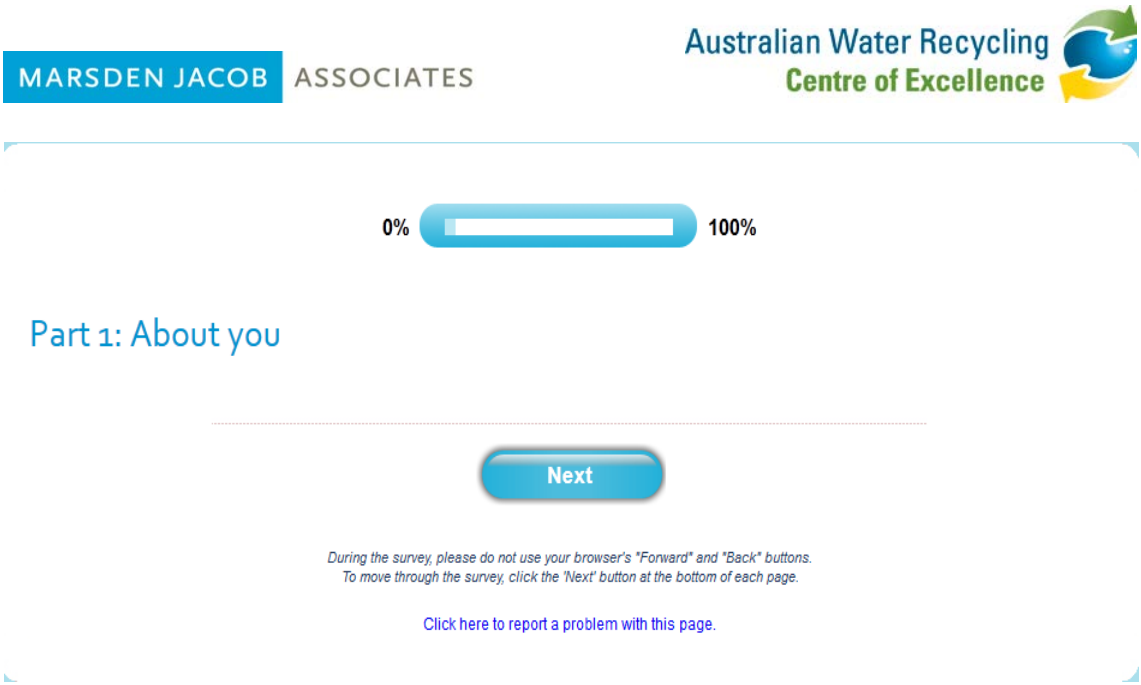
f Effects-coded variable taking value -1 when age is between 40 and 59, inclusive.

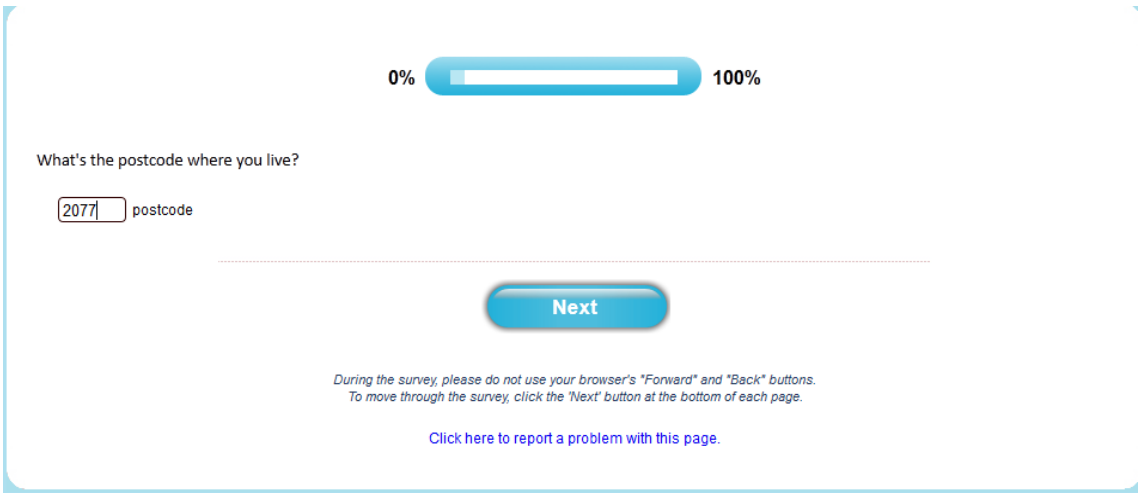
g Effects-coded variable taking value -1 when gender is female.

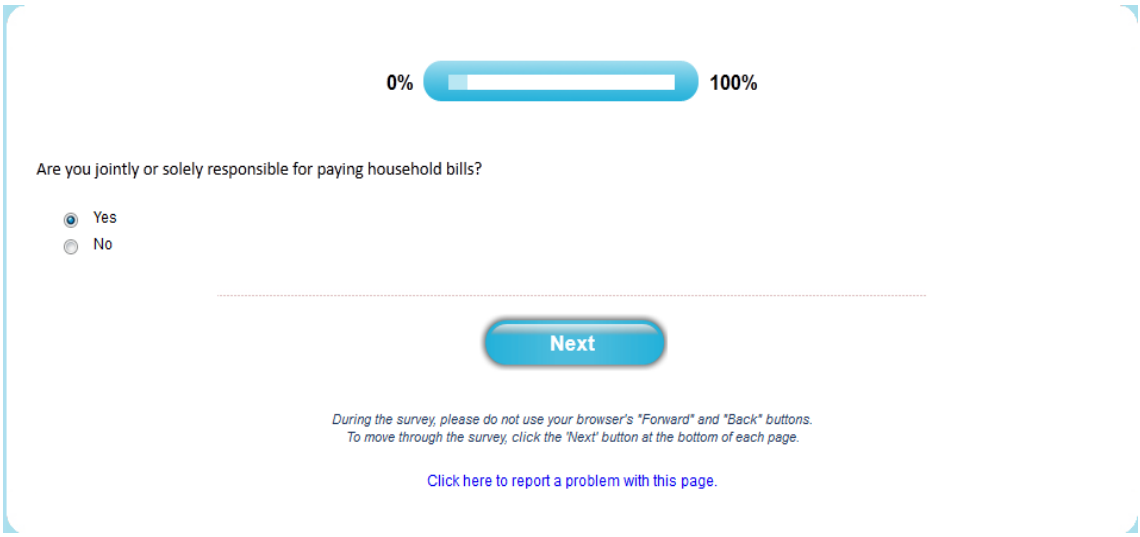
Annex 4. The survey instrument

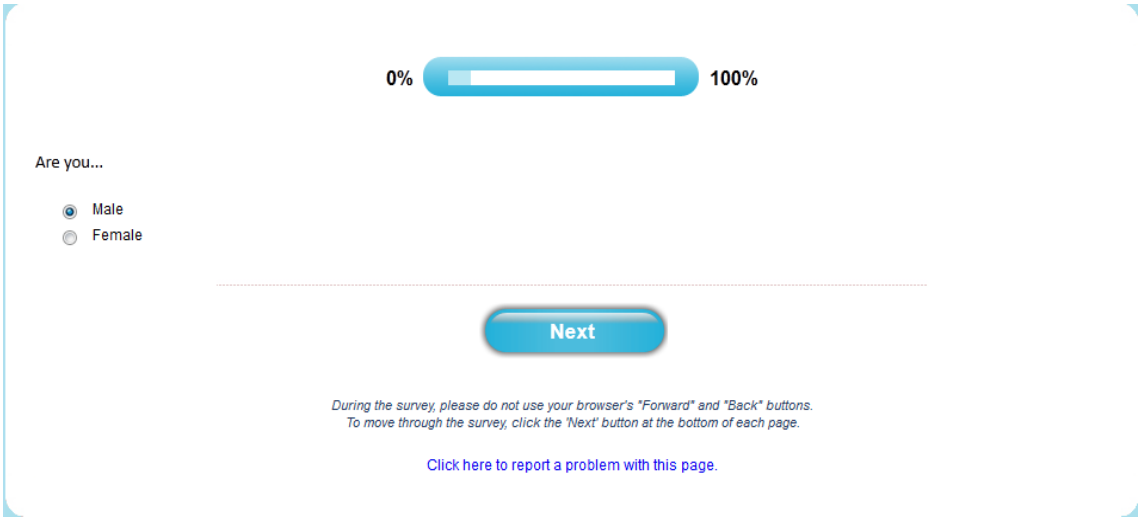


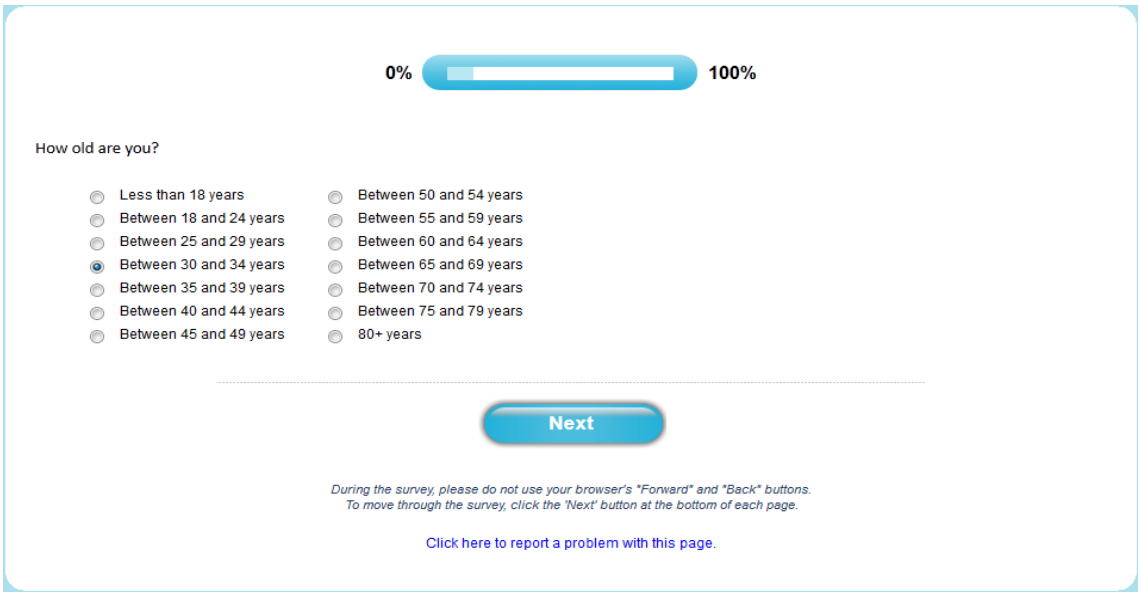


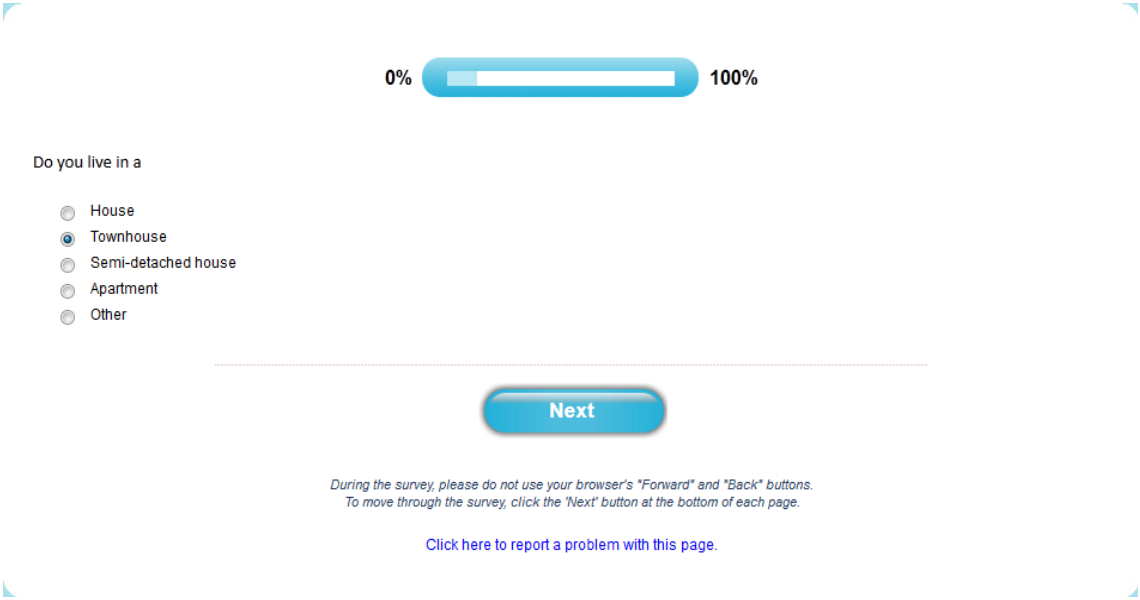

0%
100%
Part 1: About you
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
What's the postcode where you live?
2077
postcode
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

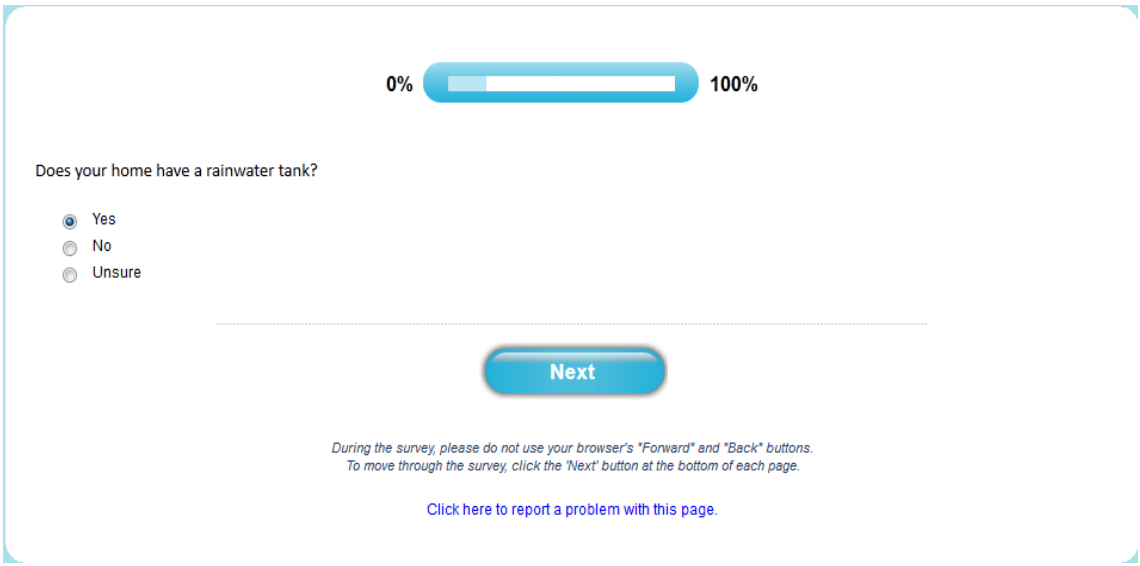

0%
100%
Are you jointly or solely responsible for paying household bills?
Yes
No
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

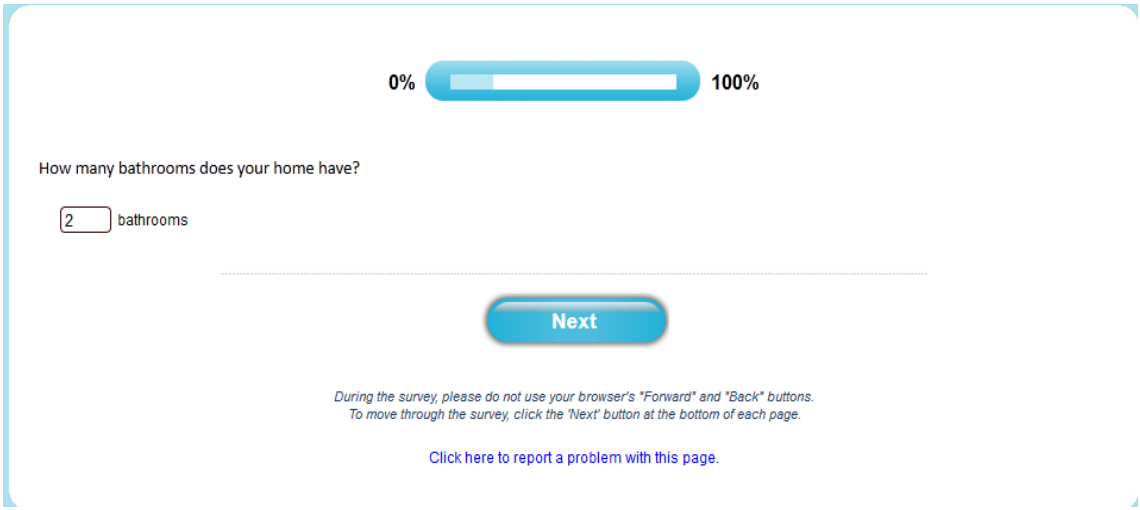

0%
100%
Are you...
Male
Female
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

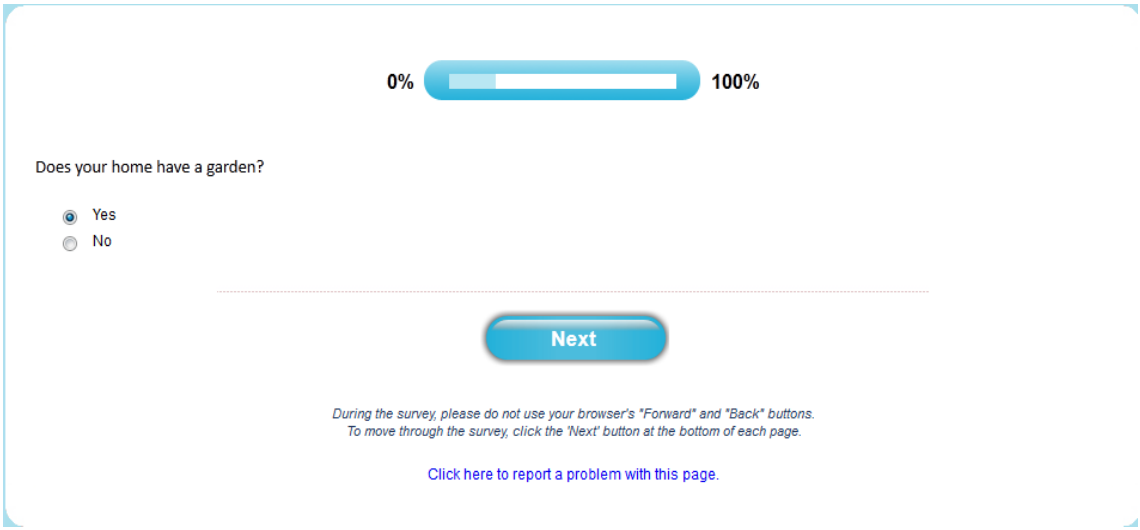

0%
100%
How old are you?
Less than 18 years
Between 18 and 24 years
Between 25 and 29 years
Between 30 and 34 years
Between 35 and 39 years
Between 40 and 44 years
Between 45 and 49 years
Between 50 and 54 years
Between 55 and 59 years
Between 60 and 64 years
Between 65 and 69 years
Between 70 and 74 years
Between 75 and 79 years
80+ years
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

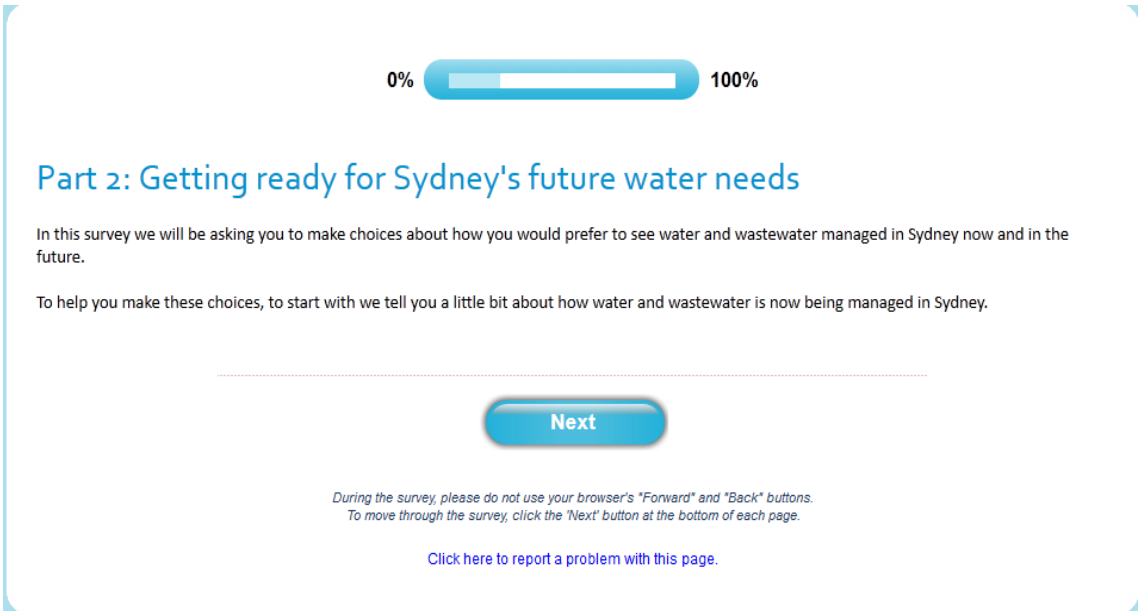

0%
100%
Do you live in a
House
Townhouse
Semi-detached house
Apartment
Other
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
Does your home use piped recycled water?
Yes
No
Unsure
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
Does your home have a rainwater tank?
Yes
No
Unsure
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
How many bathrooms does your home have?
2
bathrooms
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

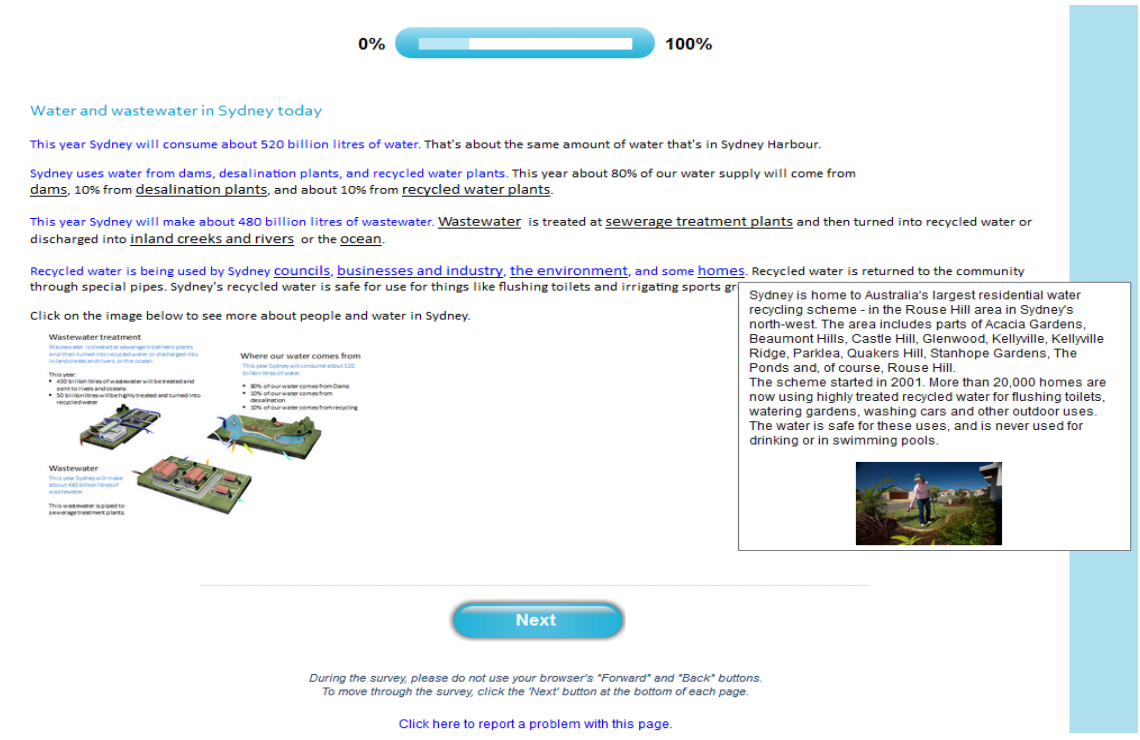

0%
100%
Does your home have a garden?
Yes
No
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.



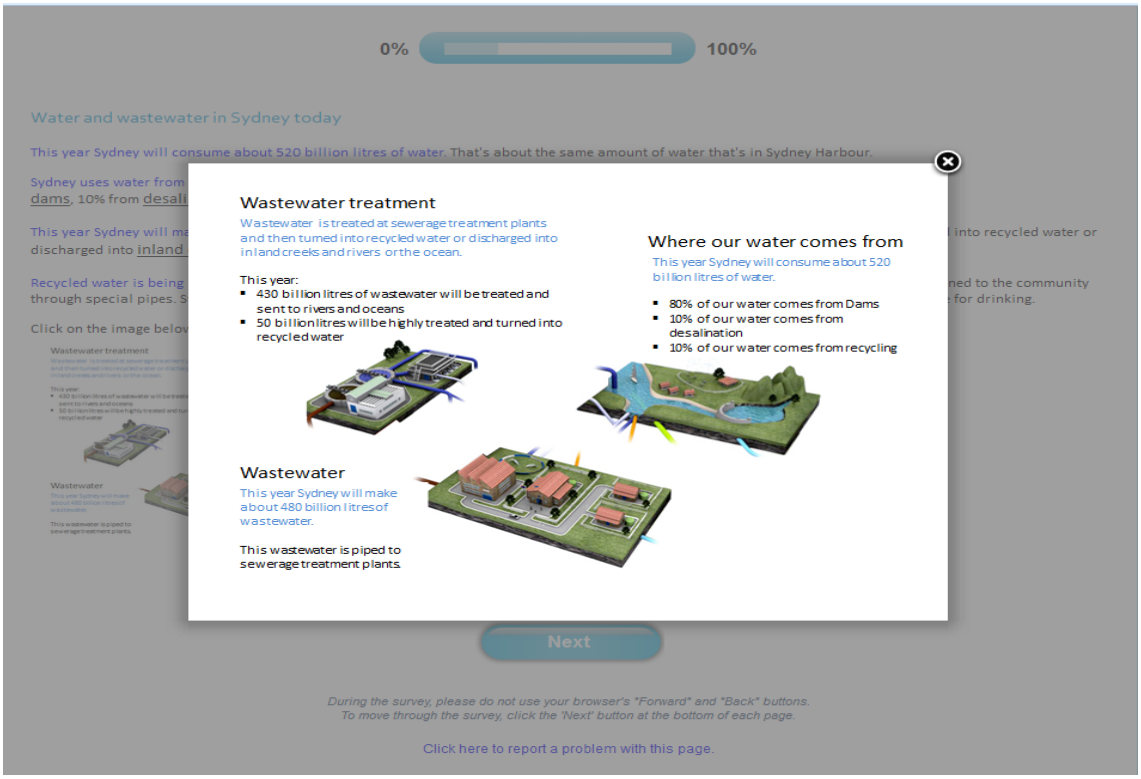
Example of hovering text box shown

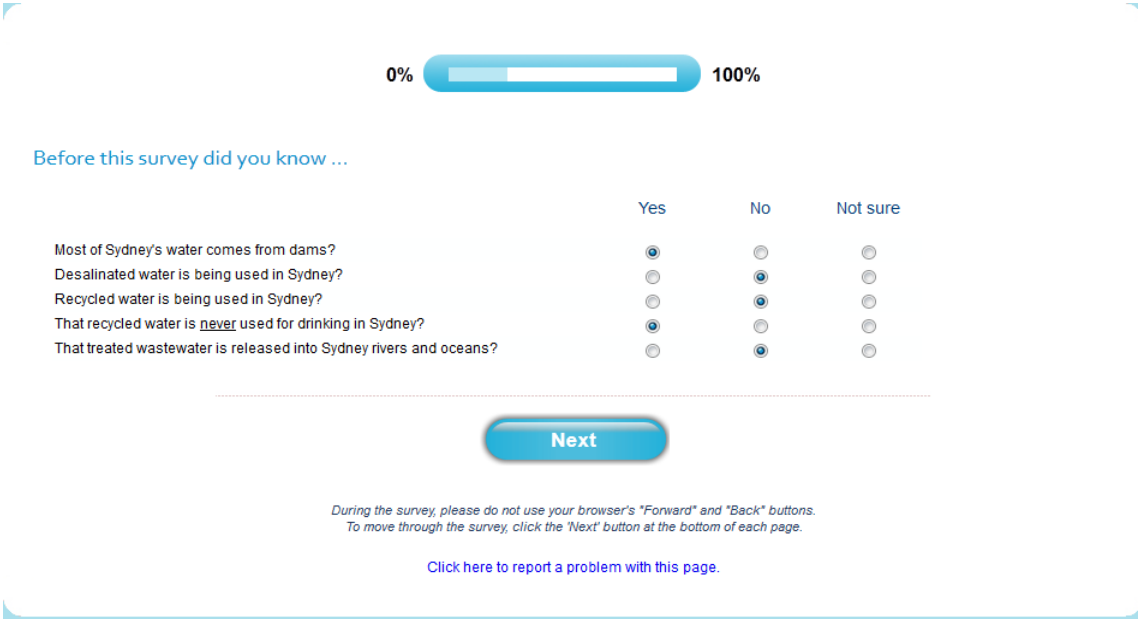
Example of hovering text and image box shown

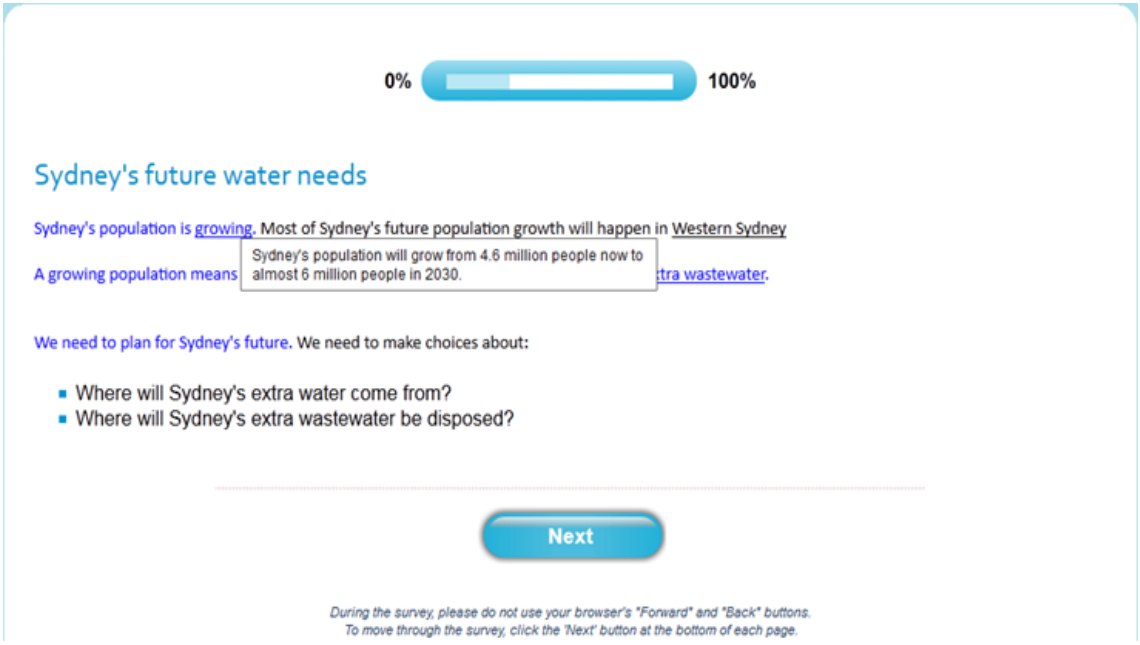
Screenshot showing text and image for household recycled water use



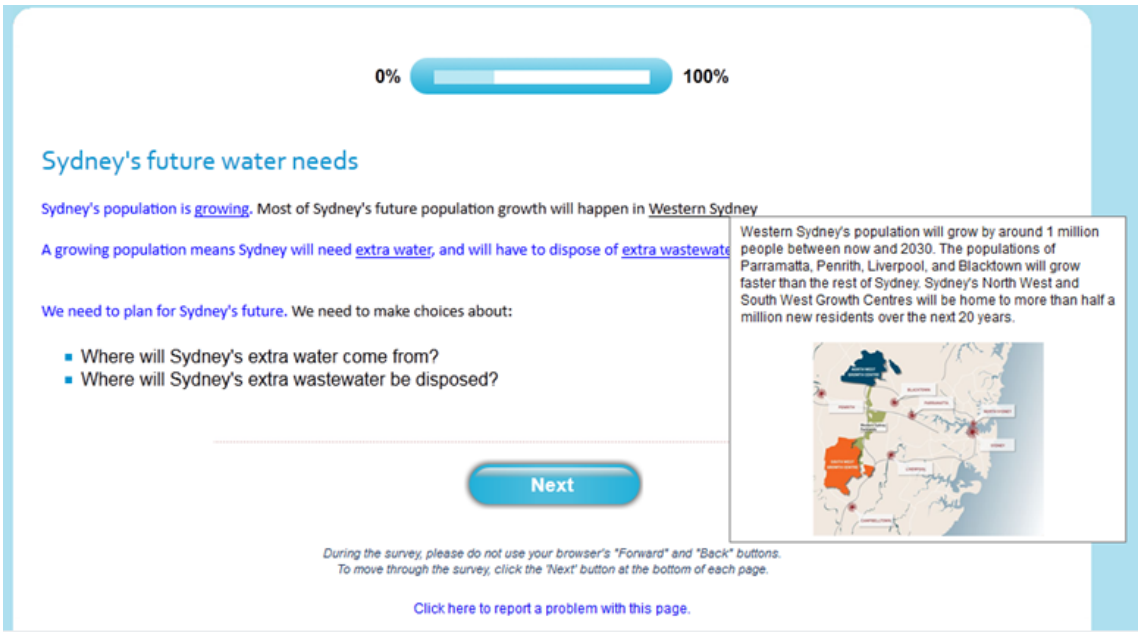
Screenshot of the enlarged Sydney water cycle information box

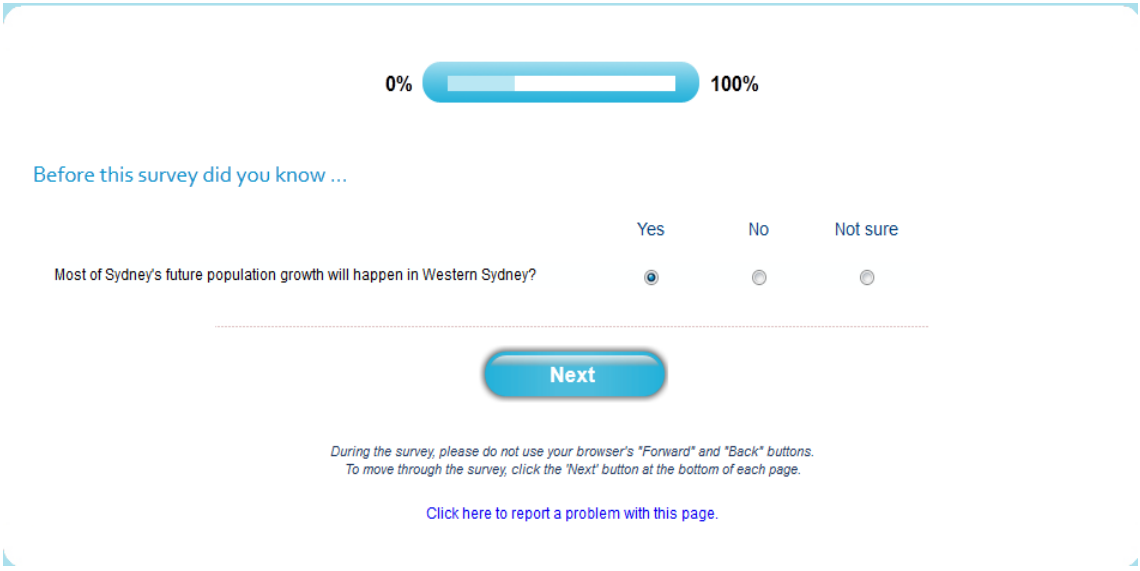

0%
100%
Water and wastewater in Sydney today
This year Sydney will consume about 520 billion litres of water. That's about the same amount of water that's in Sydney Harbour.
Wastewater treatment
Wastewater is treated at sewerage treatment plants and then turned into recycled water or discharged into inland creeks and rivers or the ocean.
This year:
430 billion litres of wastewater will be treated and sent to rivers and oceans
50 billion litres will be highly treated and turned into recycled water
Where our water comes from
This year Sydney will consume about 520 billion litres of water.
80% of our water comes from Dams
10% of our water comes from desalination
10% of our water comes from recycling
Wastewater
This year Sydney will make about 480 billion litres of wastewater.
This wastewater is piped to sewerage treatment plants.
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

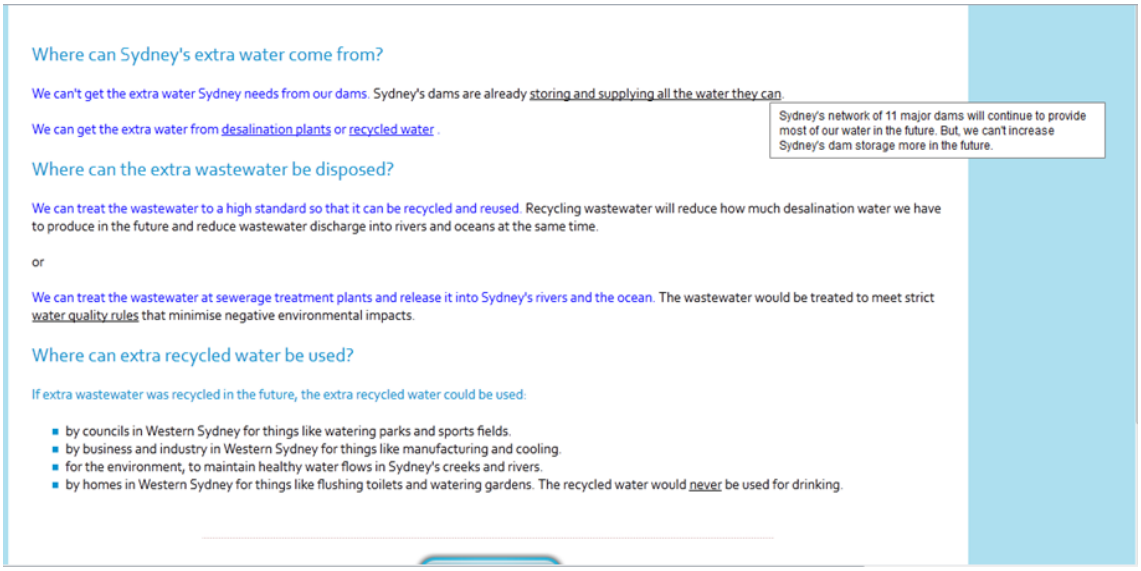

0%
100%
Before this survey did you know ...
Yes
No
Not sure
Most of Sydney's water comes from dams?
Desalinated water is being used in Sydney?
Recycled water is being used in Sydney?
That recycled water is never used for drinking in Sydney?
That treated wastewater is released into Sydney rivers and oceans?
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.



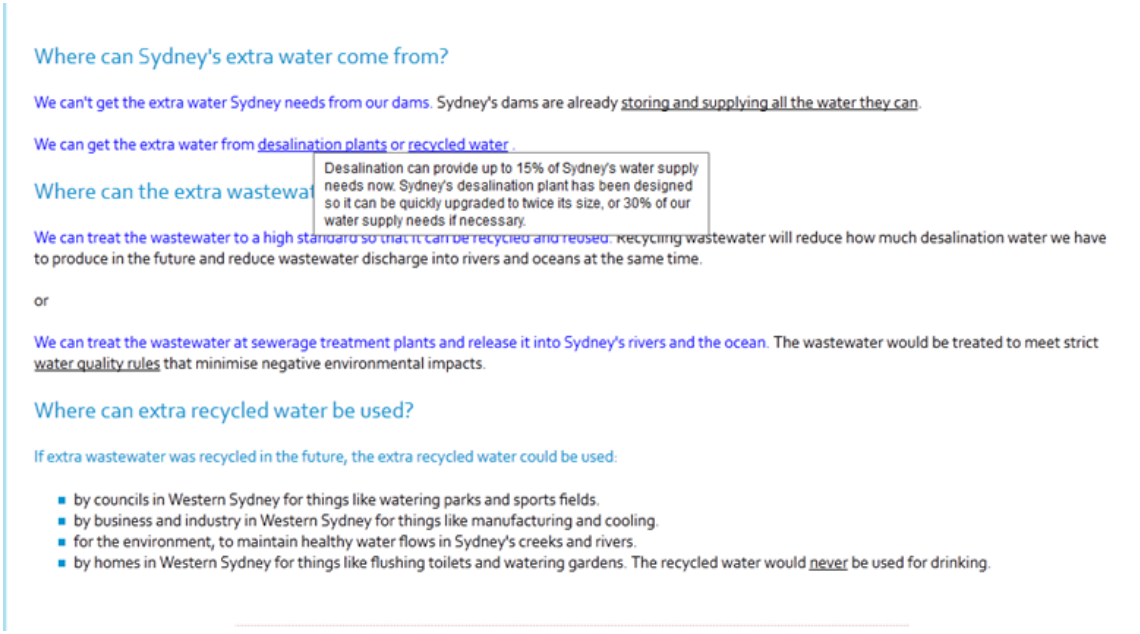
Screenshot showing text and image box for Western Sydney growth



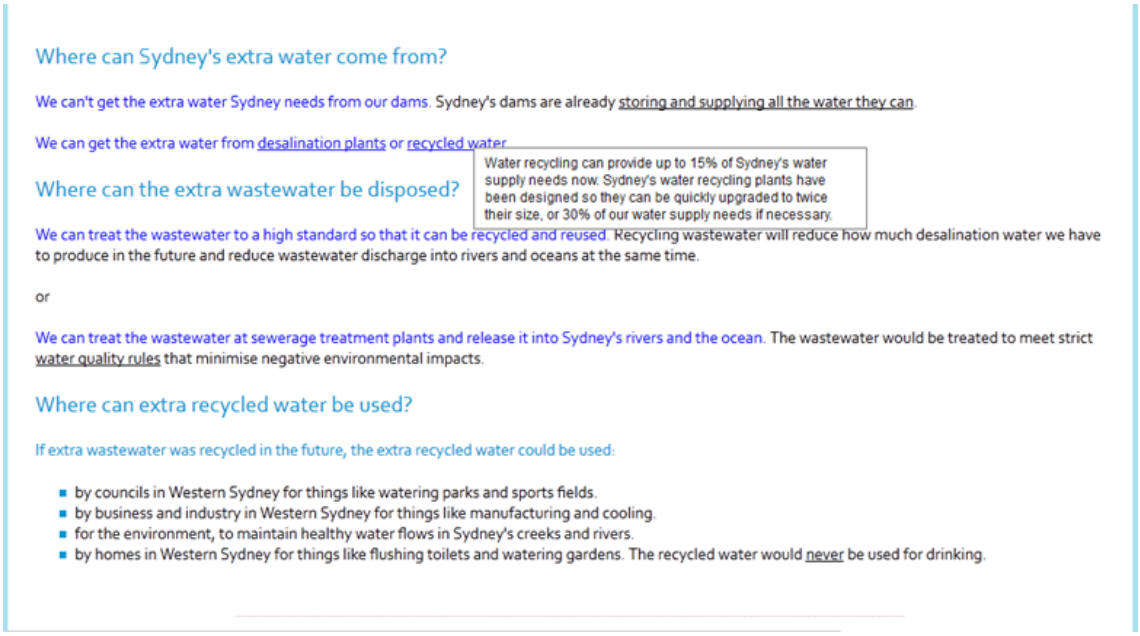


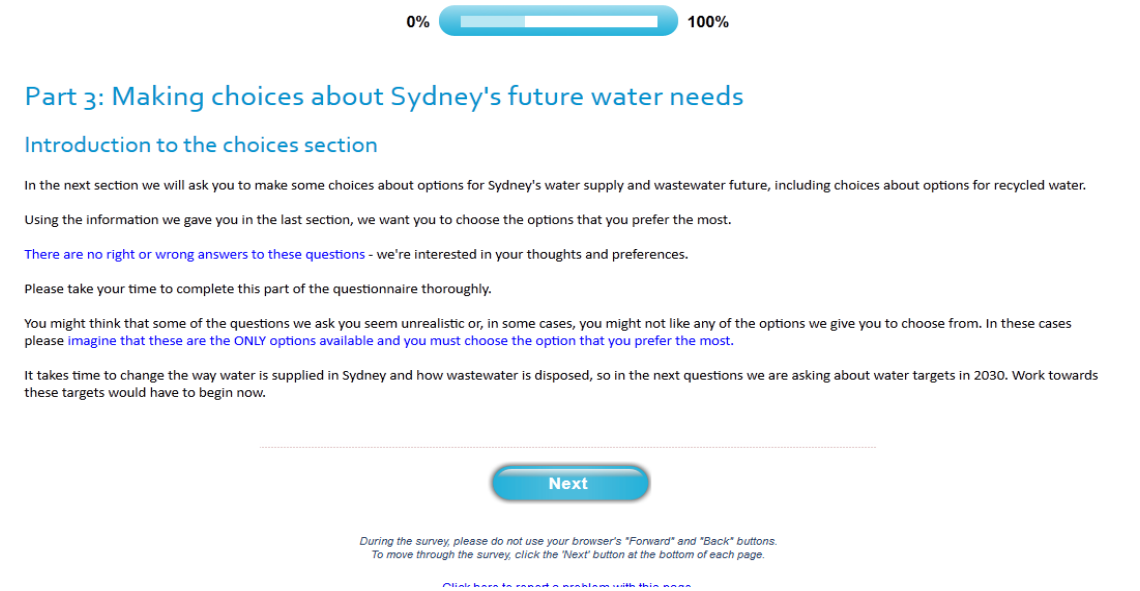


Screenshot showing desalination information



Screenshot showing recycled water information





0% 100%

Part 3: Making choices about Sydney's future water needs

Introduction to the choices section

In the next section we will ask you to make some choices about options for Sydney's water supply and wastewater future, including choices about options for recycled water.

Using the information we gave you in the last section, we want you to choose the options that you prefer the most.

There are no right or wrong answers to these questions - we're interested in your thoughts and preferences.

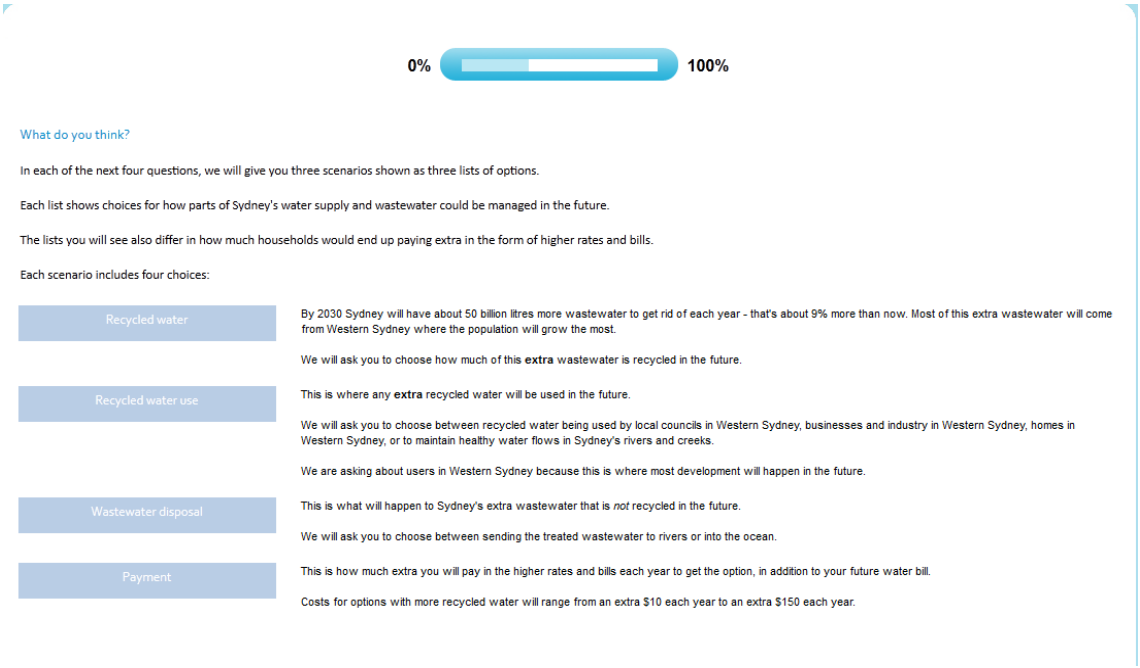
Please take your time to complete this part of the questionnaire thoroughly.

You might think that some of the questions we ask you seem unrealistic or, in some cases, you might not like any of the options we give you to choose from. In these cases please imagine that these are the ONLY options available and you must choose the option that you prefer the most.

It takes time to change the way water is supplied in Sydney and how wastewater is disposed, so in the next questions we are asking about water targets in 2030. Work towards these targets would have to begin now.

Next

During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.



0% 100%

What do you think?

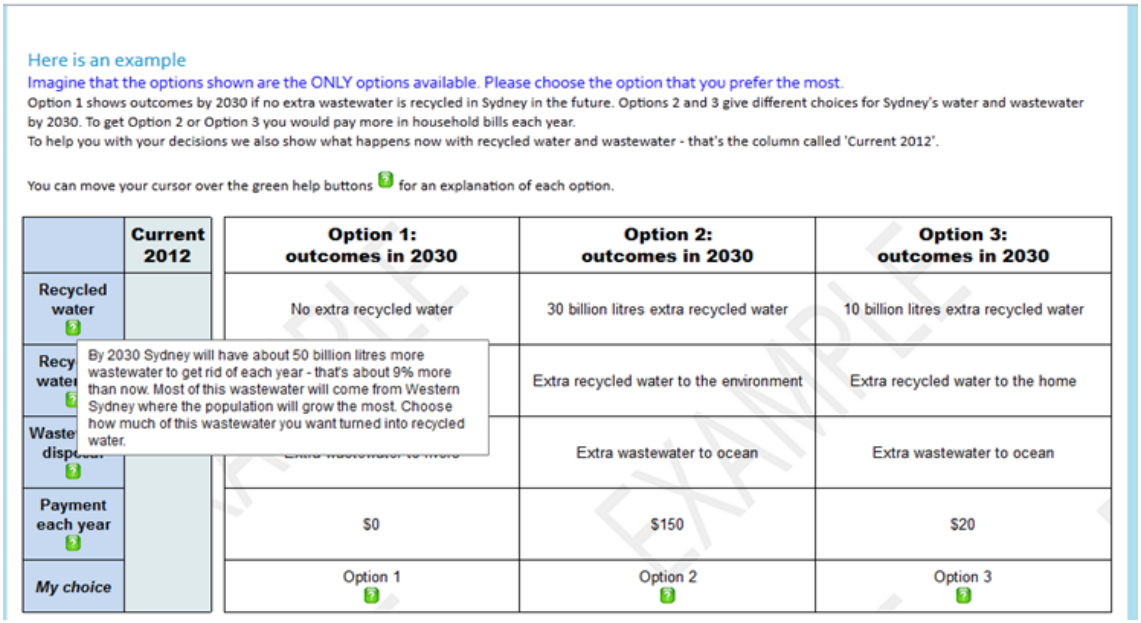
In each of the next four questions, we will give you three scenarios shown as three lists of options.

Each list shows choices for how parts of Sydney's water supply and wastewater could be managed in the future.

The lists you will see also differ in how much households would end up paying extra in the form of higher rates and bills.

Each scenario includes four choices:

Recycled water	By 2030 Sydney will have about 50 billion litres more wastewater to get rid of each year - that's about 9% more than now. Most of this extra wastewater will come from Western Sydney where the population will grow the most. We will ask you to choose how much of this **extra** wastewater is recycled in the future.
Recycled water use	This is where any **extra** recycled water will be used in the future. We will ask you to choose between recycled water being used by local councils in Western Sydney, businesses and industry in Western Sydney, homes in Western Sydney, or to maintain healthy water flows in Sydney's rivers and creeks. We are asking about users in Western Sydney because this is where most development will happen in the future.
Wastewater disposal	This is what will happen to Sydney's extra wastewater that is *not* recycled in the future. We will ask you to choose between sending the treated wastewater to rivers or into the ocean.
Payment	This is how much extra you will pay in the higher rates and bills each year to get the option, in addition to your future water bill. Costs for options with more recycled water will range from an extra $10 each year to an extra $150 each year.



Here is an example

Imagine that the options shown are the ONLY options available. Please choose the option that you prefer the most.

Option 1 shows outcomes by 2030 if no extra wastewater is recycled in Sydney in the future. Options 2 and 3 give different choices for Sydney's water and wastewater by 2030. To get Option 2 or Option 3 you would pay more in household bills each year.

To help you with your decisions we also show what happens now with recycled water and wastewater - that's the column called 'Current 2012'.

You can move your cursor over the green help buttons for an explanation of each option.

	Current 2012	Option 1: outcomes in 2030	Option 2: outcomes in 2030	Option 3: outcomes in 2030
Recycled water		No extra recycled water	30 billion litres extra recycled water	10 billion litres extra recycled water
Recy wate		By 2030 Sydney will have about 50 billion litres more wastewater to get rid of each year - that's about 9% more than now. Most of this wastewater will come from Western Sydney where the population will grow the most. Choose how much of this wastewater you want turned into recycled water.	Extra recycled water to the environment	Extra recycled water to the home
Waste disp			Extra wastewater to ocean	Extra wastewater to ocean
Payment each year		$0	$150	$20
My choice		Option 1	Option 2	Option 3

0% 100%

Some things to remember

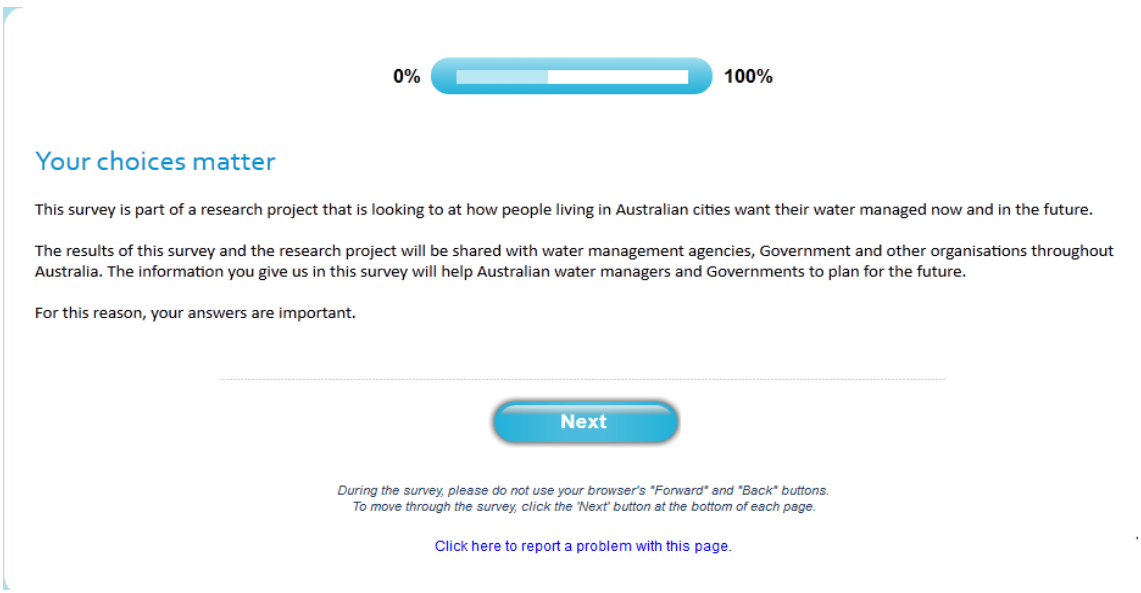
When making your choices please remember:

- The annual payments shown for the different management actions will be included in your rates and bills for each year, or passed through to your rent by your landlord.
- Your available income is limited and you have other expenses.
- You may be asked to fund other State and local Government initiatives.

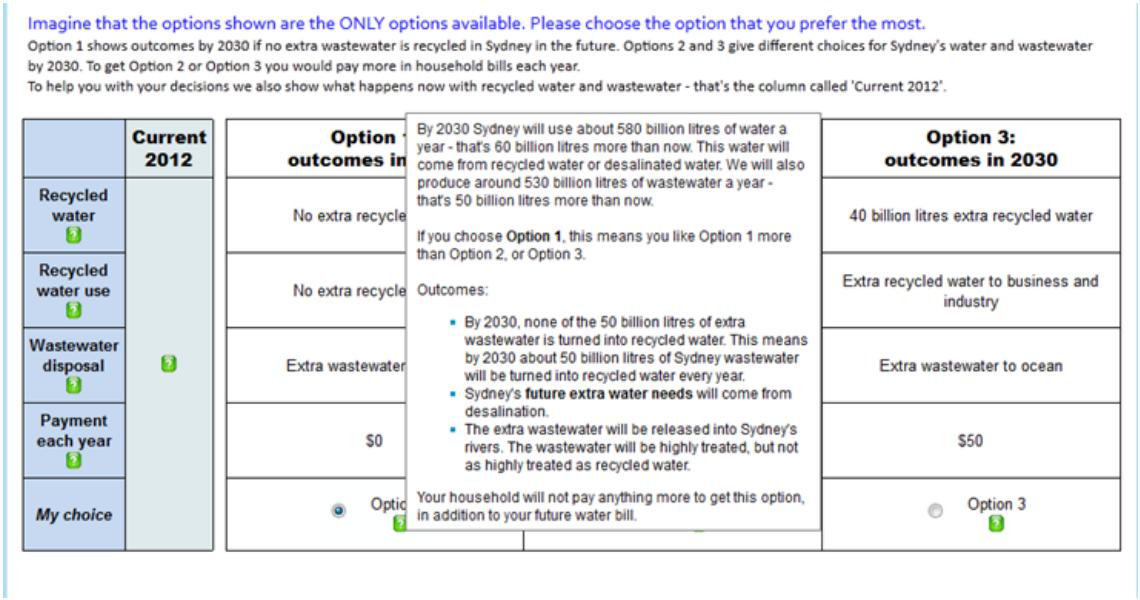
Next

During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.

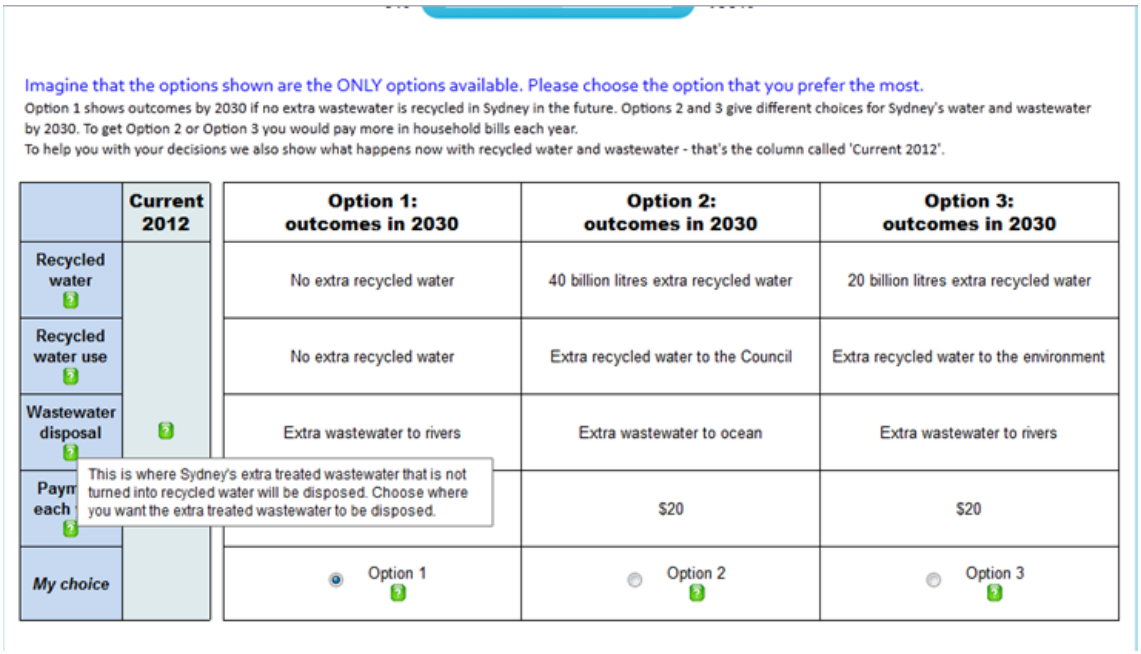
Click here to report a problem with this page.



Screenshot showing summary choice information



Screenshot showing example information in information box



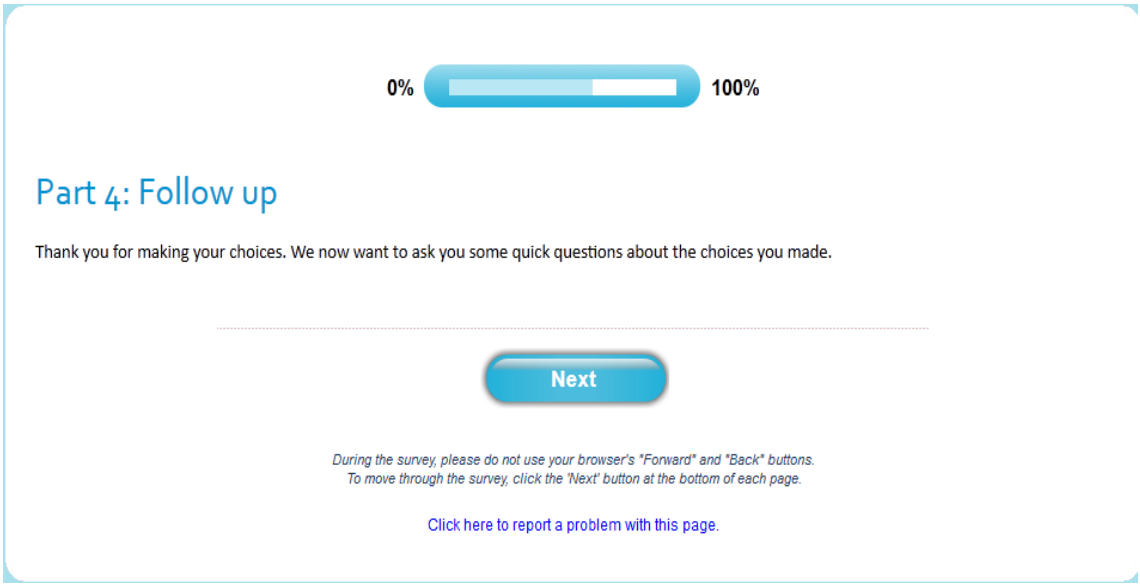
Imagine that the options shown are the ONLY options available. Please choose the option that you prefer the most.

Option 1 shows outcomes by 2030 if no extra wastewater is recycled in Sydney in the future. Options 2 and 3 give different choices for Sydney's water and wastewater by 2030. To get Option 2 or Option 3 you would pay more in household bills each year.

To help you with your decisions we also show what happens now with recycled water and wastewater - that's the column called 'Current 2012'.

	Current 2012	Option 1: outcomes in 2030	Option 2: outcomes in 2030	Option 3: outcomes in 2030
Recycled water		No extra recycled water	40 billion litres extra recycled water	20 billion litres extra recycled water
Recycled water use		No extra recycled water	Extra recycled water to the Council	Extra recycled water to the environment
Wastewater disposal		Extra wastewater to rivers	Extra wastewater to ocean	Extra wastewater to rivers
Paym each			$20	$20
My choice		Option 1	Option 2	Option 3

This is where Sydney's extra treated wastewater that is not turned into recycled water will be disposed. Choose where you want the extra treated wastewater to be disposed.



0% 100%

Part 4: Follow up

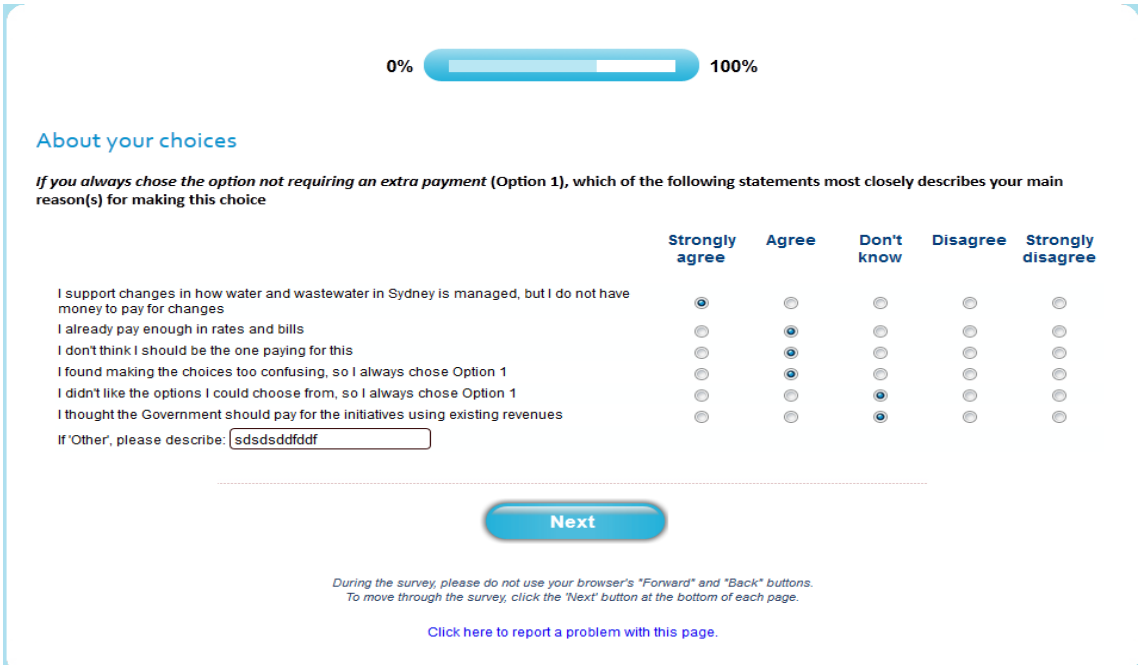
Thank you for making your choices. We now want to ask you some quick questions about the choices you made.

Next

During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.

Click here to report a problem with this page.

Screenshot showing zero WTP follow up questions. Only completed by respondents reporting nil WTP



0% 100%

About your choices

If you always chose the option not requiring an extra payment **(Option 1), which of the following statements most closely describes your main reason(s) for making this choice**

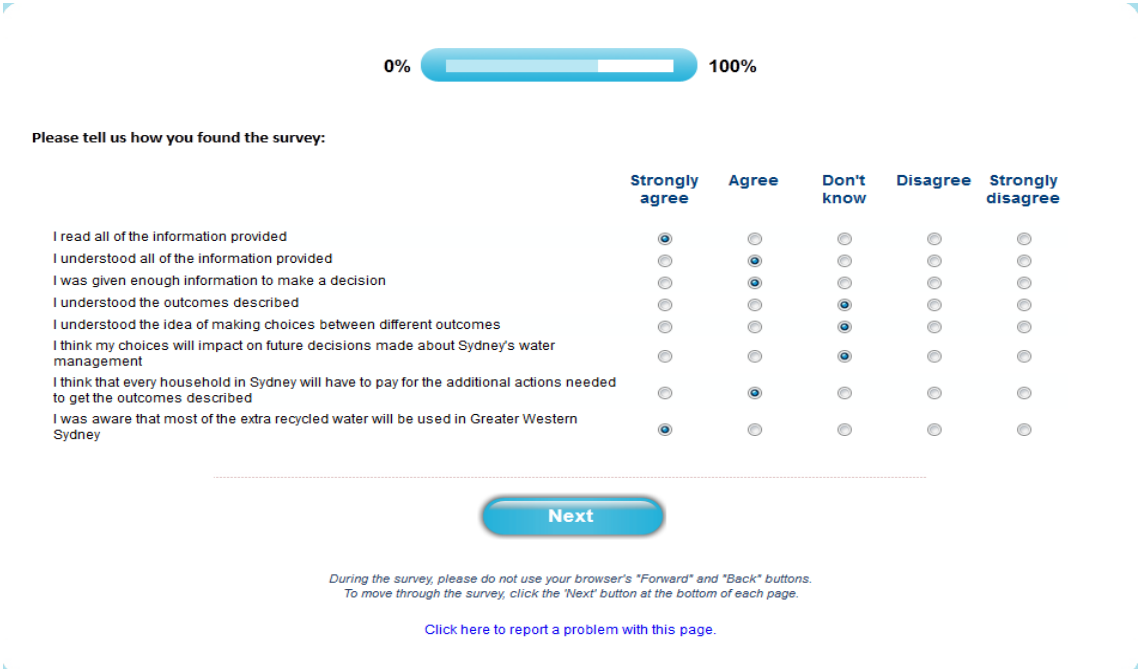
	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
I support changes in how water and wastewater in Sydney is managed, but I do not have money to pay for changes	●	○	○	○	○
I already pay enough in rates and bills	○	●	○	○	○
I don't think I should be the one paying for this	○	●	○	○	○
I found making the choices too confusing, so I always chose Option 1	○	●	○	○	○
I didn't like the options I could choose from, so I always chose Option 1	○	○	●	○	○
I thought the Government should pay for the initiatives using existing revenues	○	○	●	○	○

If 'Other', please describe: sdsdsddfddf

Next

During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.

Click here to report a problem with this page.



0% 100%

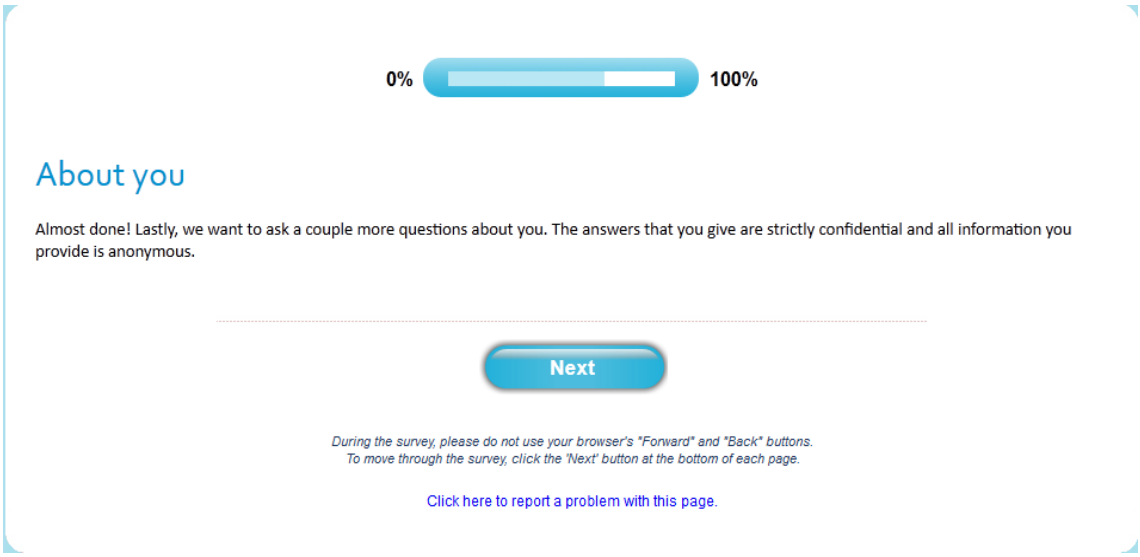
Please tell us how you found the survey:

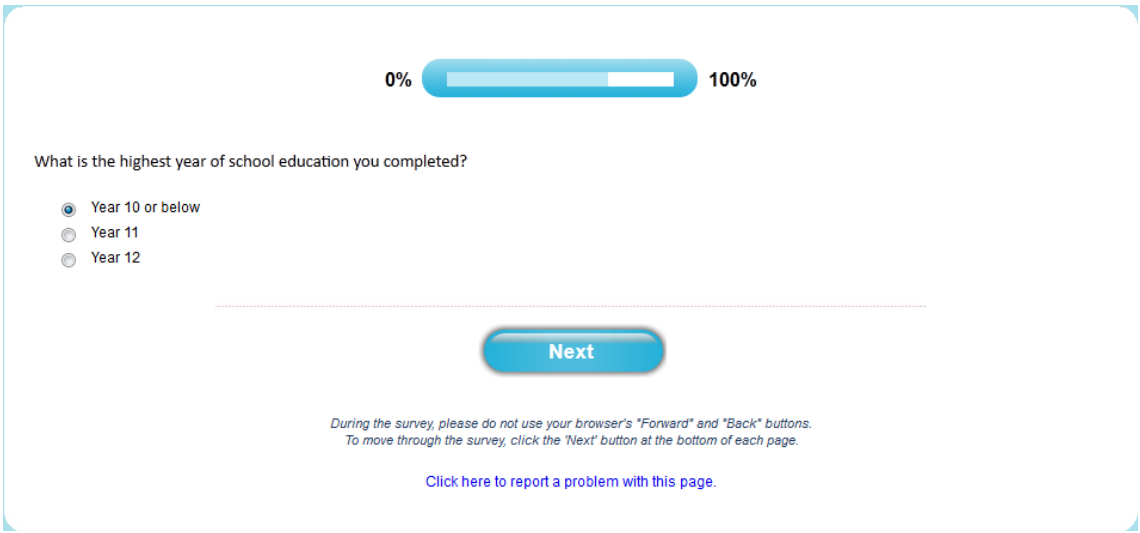
	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
I read all of the information provided	●	○	○	○	○
I understood all of the information provided	○	●	○	○	○
I was given enough information to make a decision	○	●	○	○	○
I understood the outcomes described	○	○	●	○	○
I understood the idea of making choices between different outcomes	○	○	●	○	○
I think my choices will impact on future decisions made about Sydney's water management	○	○	●	○	○
I think that every household in Sydney will have to pay for the additional actions needed to get the outcomes described	○	●	○	○	○
I was aware that most of the extra recycled water will be used in Greater Western Sydney	●	○	○	○	○

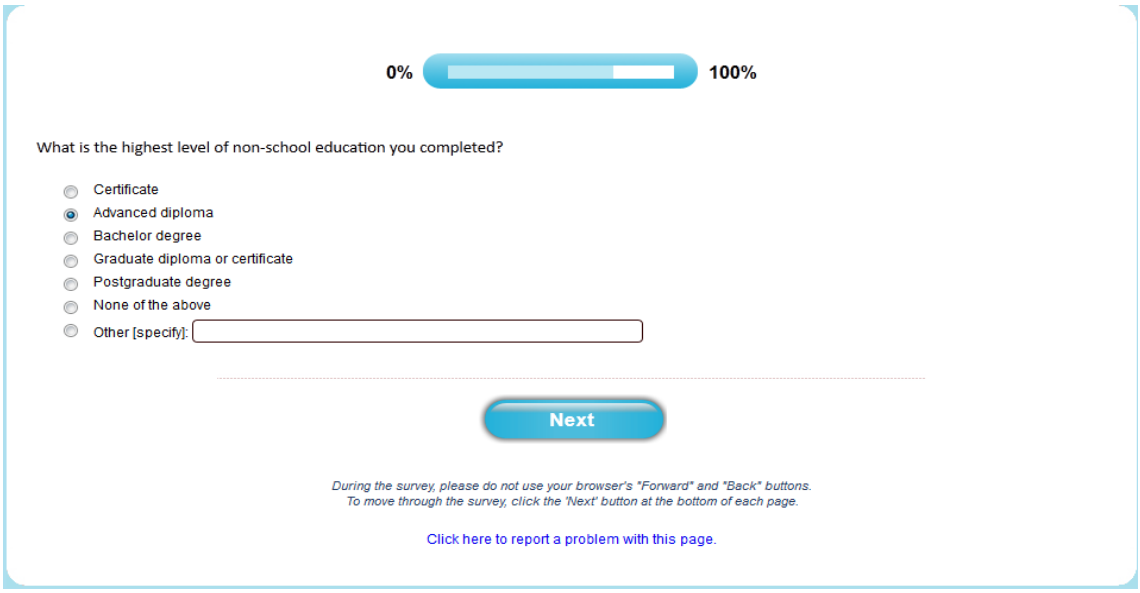
Next

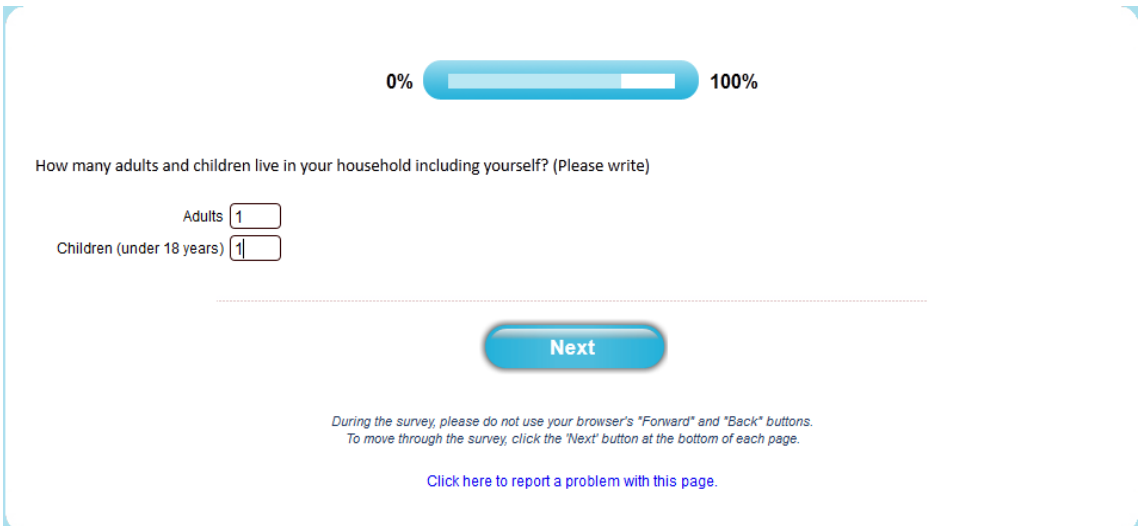
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.

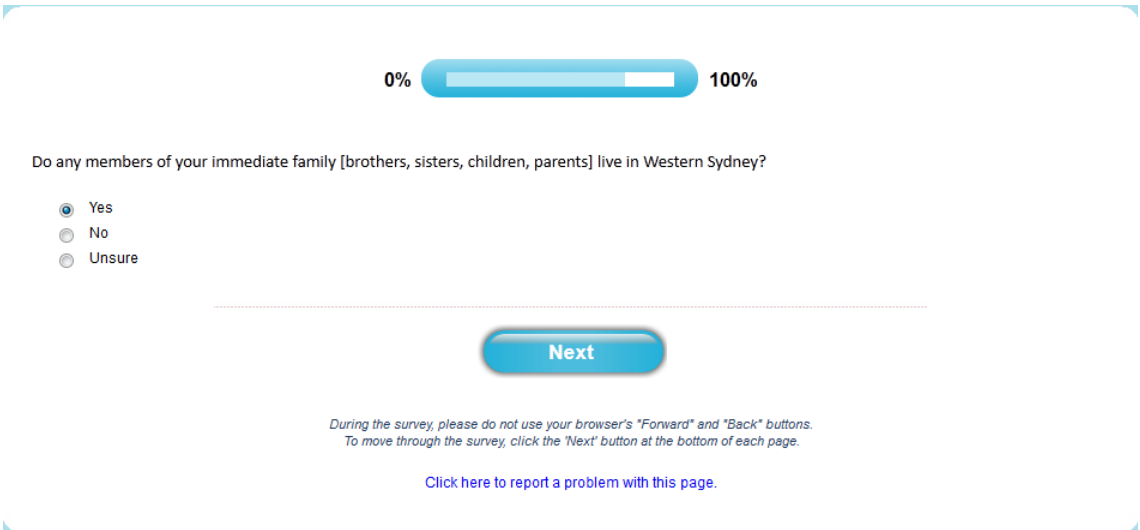
Click here to report a problem with this page.

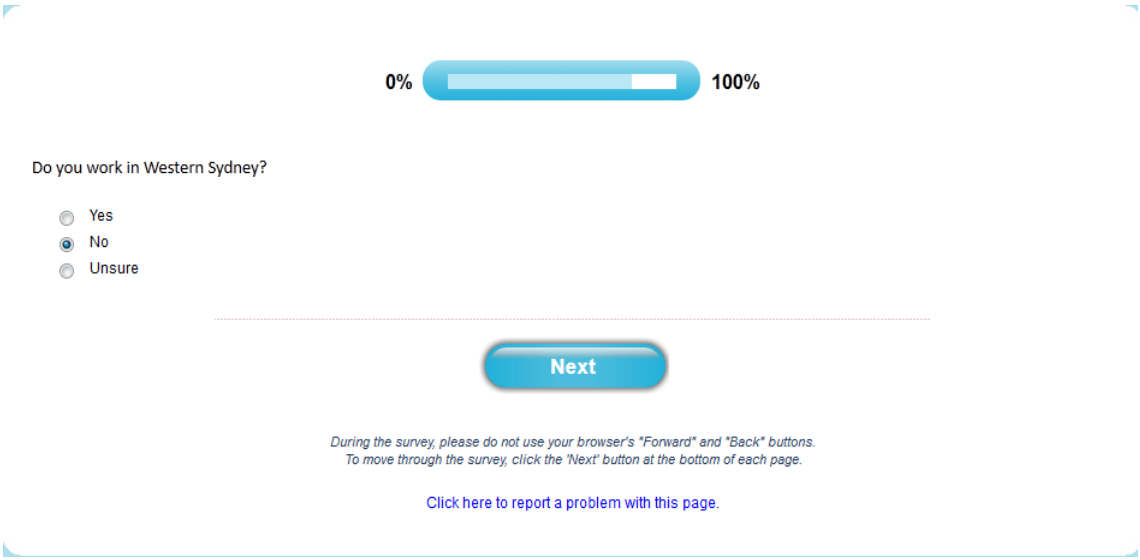

0%
100%
About you
Almost done! Lastly, we want to ask a couple more questions about you. The answers that you give are strictly confidential and all information you provide is anonymous.
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

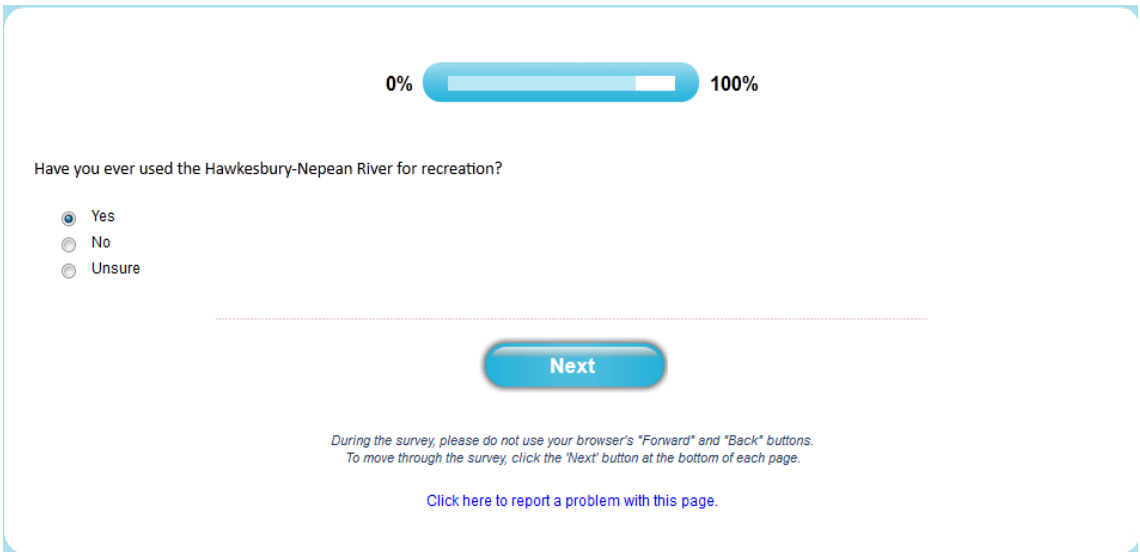

0%
100%
What is the highest year of school education you completed?
Year 10 or below
Year 11
Year 12
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

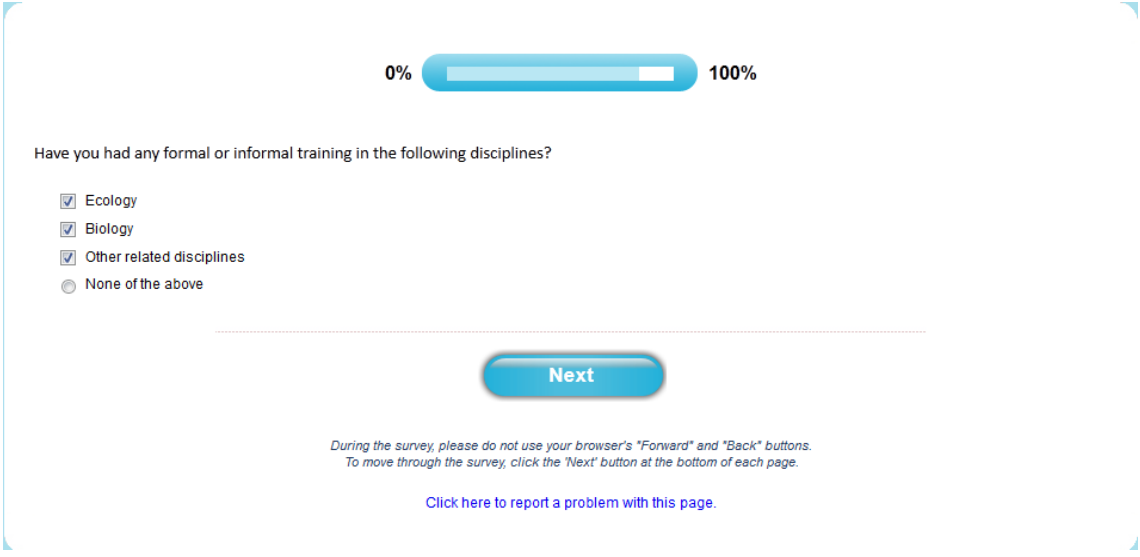

0%
100%
What is the highest level of non-school education you completed?
Certificate
Advanced diploma
Bachelor degree
Graduate diploma or certificate
Postgraduate degree
None of the above
Other [specify]:
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

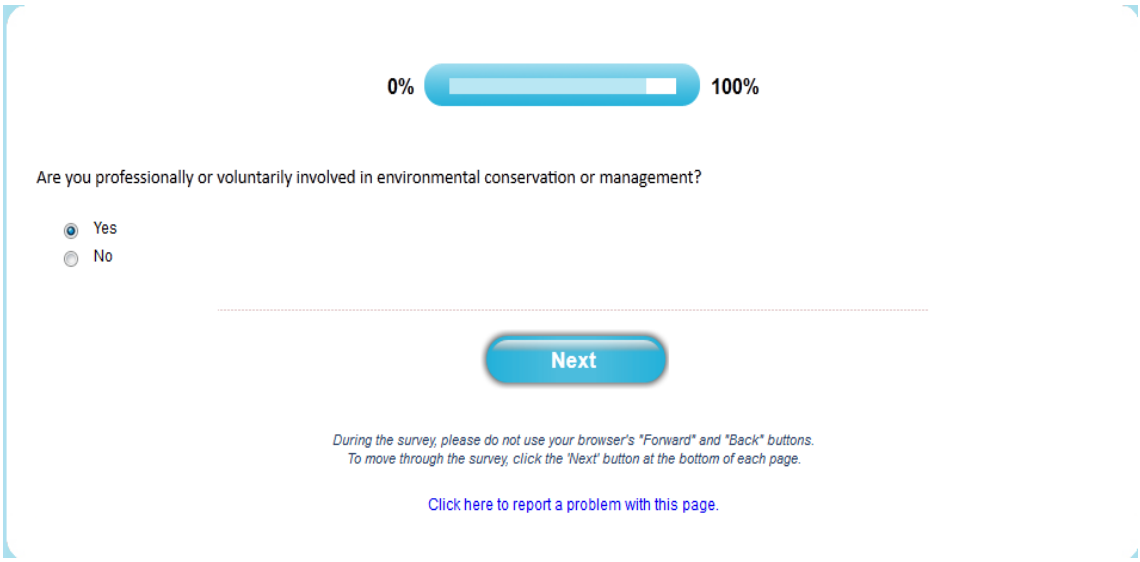

0%
100%
How many adults and children live in your household including yourself? (Please write)
Adults 1
Children (under 18 years) 1
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

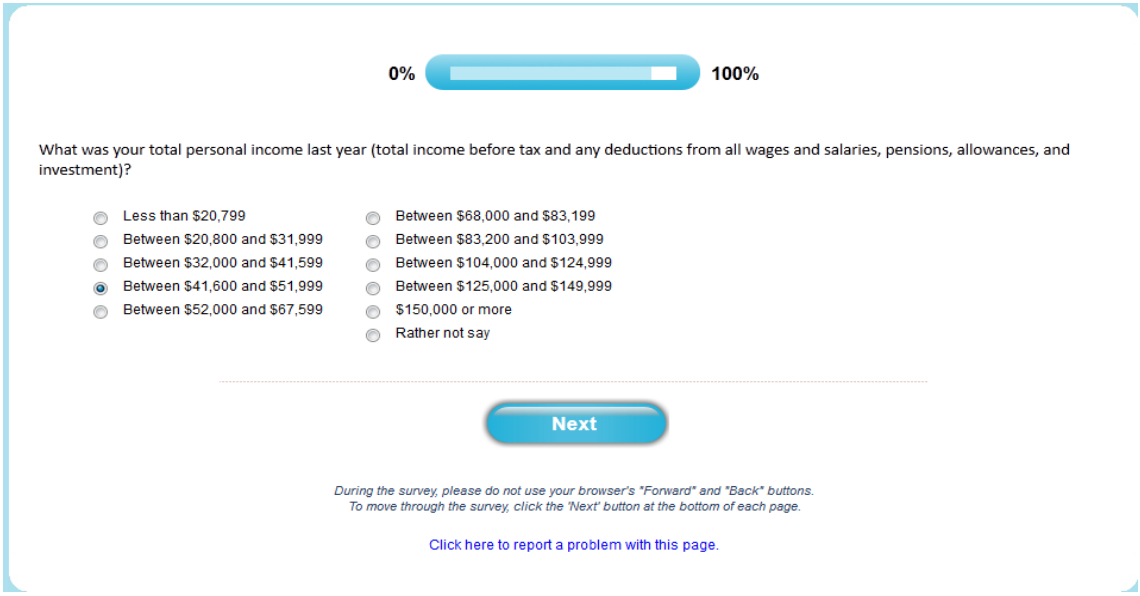

0%
100%
Do any members of your immediate family [brothers, sisters, children, parents] live in Western Sydney?
Yes
No
Unsure
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

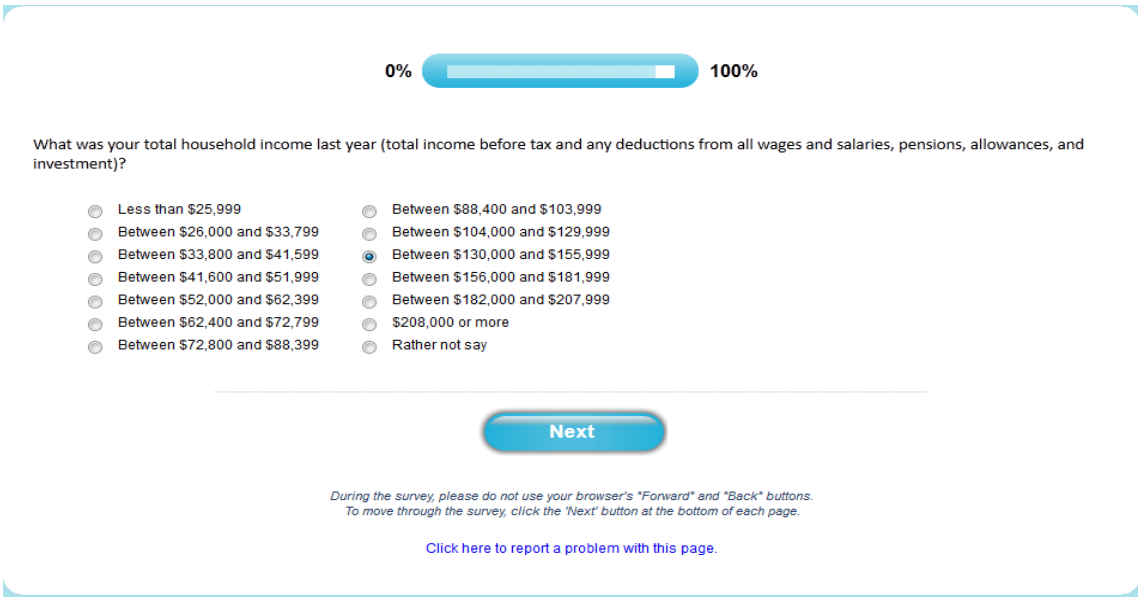

0%
100%
Do you work in Western Sydney?
Yes
No
Unsure
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.

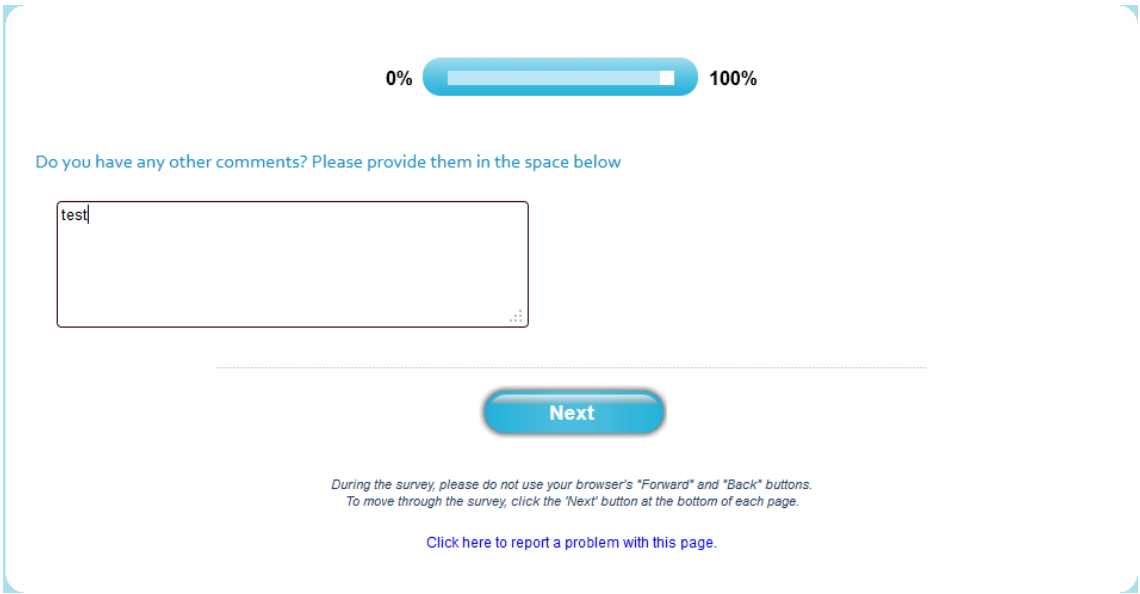

0%
100%
Have you ever used the Hawkesbury-Nepean River for recreation?
Yes
No
Unsure
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
Have you had any formal or informal training in the following disciplines?
Ecology
Biology
Other related disciplines
None of the above
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
Are you professionally or voluntarily involved in environmental conservation or management?
Yes
No
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
What was your total personal income last year (total income before tax and any deductions from all wages and salaries, pensions, allowances, and investment)?
Less than $20,799
Between $20,800 and $31,999
Between $32,000 and $41,599
Between $41,600 and $51,999
Between $52,000 and $67,599
Between $68,000 and $83,199
Between $83,200 and $103,999
Between $104,000 and $124,999
Between $125,000 and $149,999
$150,000 or more
Rather not say
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
What was your total household income last year (total income before tax and any deductions from all wages and salaries, pensions, allowances, and investment)?
Less than $25,999
Between $26,000 and $33,799
Between $33,800 and $41,599
Between $41,600 and $51,999
Between $52,000 and $62,399
Between $62,400 and $72,799
Between $72,800 and $88,399
Between $88,400 and $103,999
Between $104,000 and $129,999
Between $130,000 and $155,999
Between $156,000 and $181,999
Between $182,000 and $207,999
$208,000 or more
Rather not say
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


0%
100%
Do you have any other comments? Please provide them in the space below
test
Next
During the survey, please do not use your browser's "Forward" and "Back" buttons.
To move through the survey, click the 'Next' button at the bottom of each page.
Click here to report a problem with this page.


Thank you, that's all the questions we need to ask you today.
Done