Willingness-to-pay research to support PR19

Retest of WTP valuation and focus on retail attributes

Technical Report

This report was prepared by

Impact Utilities

Date: June 2018

Table of Contents

Glossary

Abbreviation	Term
HH	Household
NHH	Non-household (commercial)
Ofwat	The economic regulator of the water sector in England and Wales
PR14	2014 price review
PR19	2019 price review
PSR	Priority services register
SME	Small or medium enterprise
SP	Stated preference
SSC	South Staffordshire Plc
SSW	South Staffordshire Water
WTP	Willingness-to-pay

Executive summary

This report outlines the key findings from conducting 'follow-up' customer valuation research for South Staffordshire Plc (referred to as SSC) to support its 2019 price review (PR19) for Ofwat. This is referred throughout this report as 'wave 2', the previous research as 'wave 1'.

Extensive customer engagement was conducted in 2017 by Impact Utilities among South Staffordshire PLC (SSC) household (HH) and non-household customers (NHH). This first wave involved direct engagement to understand customer priorities and preferences for service charges and investments, with a focus on quality, environment and reliability attributes.

In 2018, 'follow-up' customer valuation research for South Staffordshire Plc was conducted to further explore results for specific attributes and refine the scope of attributes included. . Both waves of research involved large scale quantitative surveys assessing Willingness-to-Pay (WTP) via Stated Preference (SP) choice experiments. In wave 2, the levels of improvements displayed to respondents were amended, and new attributes relating to retail/community included. In addition, around one third of respondents completed the SP exercise in the context of a lower bill.

The main findings from the follow up study are:

- The WTP values that relate directly to the improvements shown in the trade-off exercises are almost all significantly lower than in wave 1, reflecting the lower (and perhaps more realistic) levels of service improvement.
- Among HH customers, the total WTP values for each group of attributes is about half of what it was in wave 1.
- For all customers (HH and NHH) quality attributes are the most valuable group, followed by environment (actually higher value than in wave 1), reliability and finally community.
- The new community attributes register a relatively modest value, with 'supporting customers facing difficult situations' the one attracting a higher WTP valuation.
- Presenting the attributes as a larger set of improvements identified a 'package' effect, where the sum of the individual attribute WTP values was less overall. This is consistent with earlier PR14 work, which tested all the improvements introduced at together, but the study added granularity by testing the effect on intermediate packages of improvements. This is closer to, where it is unlikely that all improvements will occur, certainly not with in the same period of investment.
- Noticeably lower WTP results were observed for those completing the discrete choice exercise in the context of a reduced bill value of £10 in 2020. This may suggest that people assess the bill changes as proportional to the base bill level and the +£ levels consequently seem larger to them. However, there has always been a concern that people can only realistically assess bill changes relative to what they pay now, not some future hypothetical level.

Background

Research objectives

The primary objective of this programme of research is to provide an enhanced understanding of customer's willingness and ability to pay for different service and investment levels for water services for the five year period 2020-2025. By understanding customers' priorities for service investment and the value they place on these investments, SSC can reflect their preferences in its plans.

The research and analysis to date has been carried out following best practice and in accordance with Ofwat's latest guidance. This notes the value of methods that were used in submissions for PR14 (most commonly, SP choice experiments) but encourages innovation to address the shortcomings identified with these.

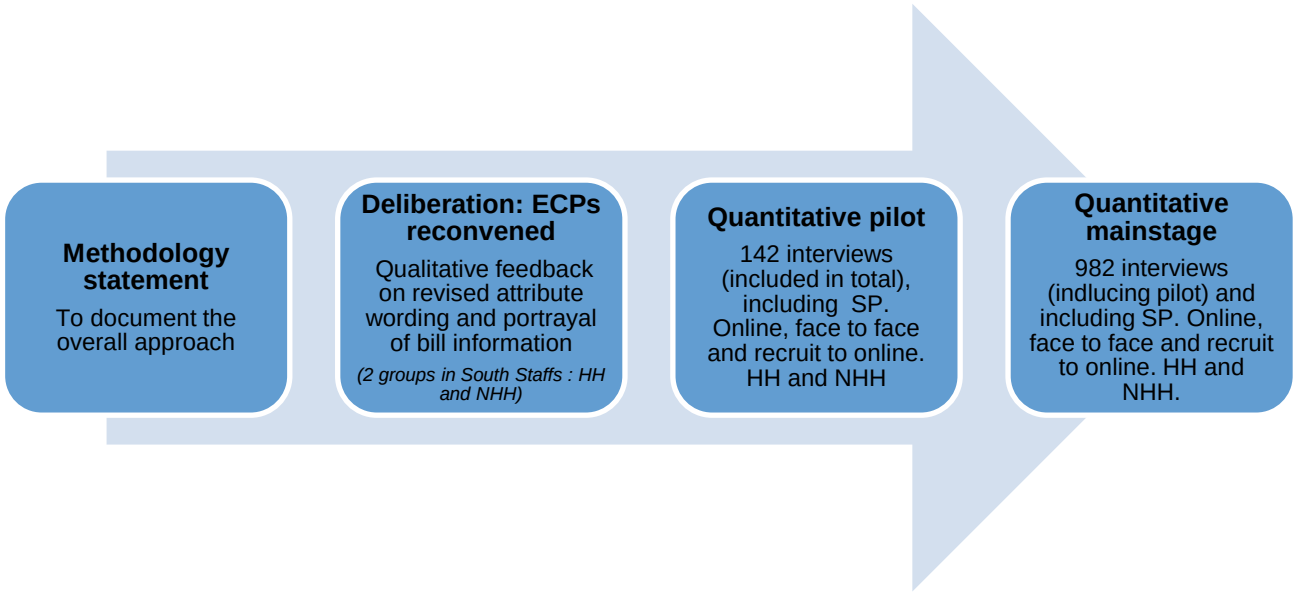
The most pertinent challenges were:

- To gain more insight in to why customers responded to the service improvement levels presented, the attribute wordings and the way they valued multiple improvements.
- How to build confidence in the valuations through the use of appropriate triangulation with data sources from within and external to the research.

These two themes translated into the following research objectives for this phase of follow-up research:

- To test the level of sensitivity of WTP attributes to alternative definitions.
- To identify customers' willingness for different *combined* service and investment levels for water services – both wholesale and retail.
- To identify if a lower bill starting point with an improved level of service alters the WTP values.

A four step approach was followed as documented below:



Summary of Deliberation Stage

The objective of this phase was to gather qualitative insights to further inform the design of the survey instrument, which was thoroughly tested in Wave 1 in both regions. Participants from the three South Staffordshire Water (SSW) Engaged Customer Panel (ECP) groups, who met twice in South Staffordshire in July and August 2017, were contacted and asked to take part in a further group discussion.

The original groups were comprised of two household (HH) groups and one non-household (NHH) group of SME businesses. In addition, customers who had taken part in qualitative depth interviews in summer 2017 were also contacted and offered the opportunity to attend these focus groups. This pool of customers had previously been educated about SSW having inputted into the survey design for wave 1. As such, these customers have an existing base of knowledge about SSW and were quickly able to contribute to further discussion.

One focus group of 10 HH customers and one focus group of 8 NHH customers (5 from the original NHH groups and 3 from depth interviews/HH ECP group with some responsibility for their company's utilities provider) were conducted on the 21st February 2018.

The discussion was a more 'focussed' discussion then is typical in qualitative sessions (which tends to be more discursive in nature). Specific feedback was sought on the following:

- Feedback on a summary infographic based on the findings of the first phase of WTP research.

- Reactions to results from the quantitative WTP survey (top level results emailed in advanced to panellists). Are the top priorities as they would expect? Any surprises?

- Feedback on potential changes to attribute wording or improvement levels for the following attributes from the initial WTP survey:

    - Water not safe to drink
    - Lead pipes
    - Water hardness
    - Unexpected temporary loss of water supply
    - Leakage levels
    - Protecting wildlife habitats
    - Managing impacts on rivers & streams

- Feedback on the wording of the three retail attributes, supportive explanatory text and requirement for any images

- Feedback on explanatory text to introduce the concept of a lower bill value yet associated improvements

A separate report is available which summarises the findings from these discussions in detail[1]. Key findings were:

- Greater detail to be included on the infographic, including how SSW will use the findings of the research and how this will affect customers.
- In the results from the wave 1 'water not safe to drink' was deemed to be lower than expected in the ranking, as was 'water leakage' for NHH customers.
- Surprise at the high values for lead and hard water. Some terms, such as 'children' and 'free' are more emotive and should therefore be avoided in the description and levels.
- Including an example location, such as the River Severn helps make the attribute more grounded in reality.
- The community/retail attributes were well received in terms of clarity and understanding and needed very little amendment.
- When explaining changes in bill levels, it was important to show actual values on the scales to aid understanding.

[1] Impact Research, 2018, Willingness-to-pay research to support PR19 - Focus on retail attributes, Report from the ECPs

Quantitative Survey

Approach

A large scale quantitative survey with HH and NHH customers was conducted. The same SP technique was used as in the previous willingness to pay survey for consistency, however, no max diff exercise was included due to very little differentiation being seen between attributes (please see previous reports for further details). This allowed for each participant to undertake two SP exercises.

Sample

The sampling approach ensured that the survey population is:

1. Statistically robust
2. Representative of the demographic and socio-economic profile of the region
3. Inclusive of the various geographical typologies (urban/rural) within the region
4. Reflective of the diversity within the population (inclusive of harder-to-reach customers).

982 interviews were conducted in April and May 2018 across South Staffordshire and Cambridge. The breakdown by region, customer type and survey cell is shown in Table 1. To determine the region that customers were from their postcode was taken at the beginning of the survey to match them to the correct region.

Table 1: Quantitative interviews by Region, Customer Type and Survey Cell

		South Staffs Water		Cambridge Water Company	
		Household	Non-household	Household	Non-household
Lower Prices	Main	199	-	49	-
	Pilot	24	-	18	-
	Total	223	-	67	-
Current Prices	Main	496	165	109	49
	Pilot	38	22	30	8
	Total	309	187	139	57
Total		532	187	206	57

Cambridge is a smaller and more rural area, meaning that the sample achieved was skewed towards South Staffs. The aim was to obtain, as far as possible, a robust sample in both regions to allow analysis to be completed for each subgroup. Unfortunately, only 67 NHH respondents were recruited in Cambridge. In itself, one might expect this to return reasonably precise results. However, each respondent saw only one of the three original attribute blocks (Quality, Security, Environment) and so there were, on average, less than 20 participants who completed each block of choice questions in this segment.[2] For this reason, while the results from Cambridge NHH may regarded as indicative, they are not sufficiently robust to take forward into the final modelling. However, they should be used as a sensitivity checkpoint.

For each respondent, the following key information was gathered:

Household

- Age
- Gender
- Households with children vs households without
- Social grade
- Hard to reach customers (including the elderly or disabled, those with a medical dependency or low income or on social tariffs or other customers who find themselves in vulnerable circumstances)
- Metered customers versus non-metered
- Urban, rural and suburban
- Region.

Quotas were set with this information, in line with the customer profile of SSC's regions to ensure a representative sample of customers (by age, gender and social grade for HH customers and by business size and sector for NHH customers) are interviewed. These quotas ensured that a statistically robust sample size was achieved in the key groups outlined above. To achieve the desired numbers in each region some quotas were loosened, and the data then weighted against the customer profile of each region, obtained from 2012 census data.

The majority of interviews were conducted online, however face to face, and recruit to online, methods were also used to be appropriate to the customers' situation. These techniques were specifically used for hard to reach and business customers.

The achieved figures of these key subgroups in each region are below.

[2] Observation from peer review

Table 2: Quantitative HH interviews

		South Staffs Water			Cambridge Water		
	Total	532			206		
		Number	%	Pop %	Number	%	Pop %
	Female	367	69	51	121	59	50
	Male	165	31	49	85	41	50
	18-29	85	16	22	21	10	25
	30-44	181	34	26	62	30	23
	45-59	159	30	24	66	32	27
	60+	107	20	28	57	28	25
	AB	79	17	21	46	26	40
	C1	163	34	29	46	26	28
	C2	108	23	22	29	16	16
	DE	128	27	28	59	33	16
	Rural	72	14	15	86	54	42
	Urban	460	86	85	72	46	58
WTP Bill	Lower (HH)	223	31		67	25	
	Current (HH+NHH)	496	69		196	75	

Survey methodology

As in the first wave of research, the primary method of data collection was online through online panels of respondents who are pre-registered and open to research of this kind. Panellists were targeted in the relevant SSC postcode areas and invited to complete the survey. This methodology means that the SP scenarios and associated educational materials were viewed on screen to inform the trade-off decisions; and the survey could be completed at a time and place convenient to the participant. Customers are also able to read the instructions and scenarios presented at their own pace, thereby increasing the likelihood of them fully understanding the scenarios presented.

It is acknowledged that certain customers are likely to be under-represented on an online-panel, therefore alternative techniques were used to recruit participants. Telephone interviews were not suitable as the necessary stimulus cannot be viewed. Therefore to ensure that the study engaged with the complete spectrum of customers, surveys were also completed face to face, with stimulus materials and the SP exercise shown on screen on a device carried by the interviewer. Between 25%-30% of interviews were completed face to face in each region. Participants were also recruited over the phone and then sent a link to complete the survey online, this was used predominantly in the Cambridge region due to less customers being part of panels and therefore made up 18% of Cambridge interviews. Table 3 provides an overview of the proportion of interviews completed via online panel members, and those via face to face or recruit to online approaches.

Table 3: Survey Methodology

Face to face/ recruit to online		Online interviews (PANEL)	
255	126	464	137
SSW	CW	SSW	CW
142	104	390	102
113	22	74	35

To ensure the correct NHH customer completed the survey, a set of screening questions ascertained their working status, company size and their responsibility for (at least) inputting into financial decisions within their organisation.

HH customers completing the survey face-to-face or recruited by telephone to complete online were given an incentive of £10 per person (paid as a voucher or charitable donation) to help increase response rates and encourage survey completion. NHH customers were harder to recruit, and therefore were given an incentive of £20 per person (paid as a voucher or charitable donation).

Survey instrument

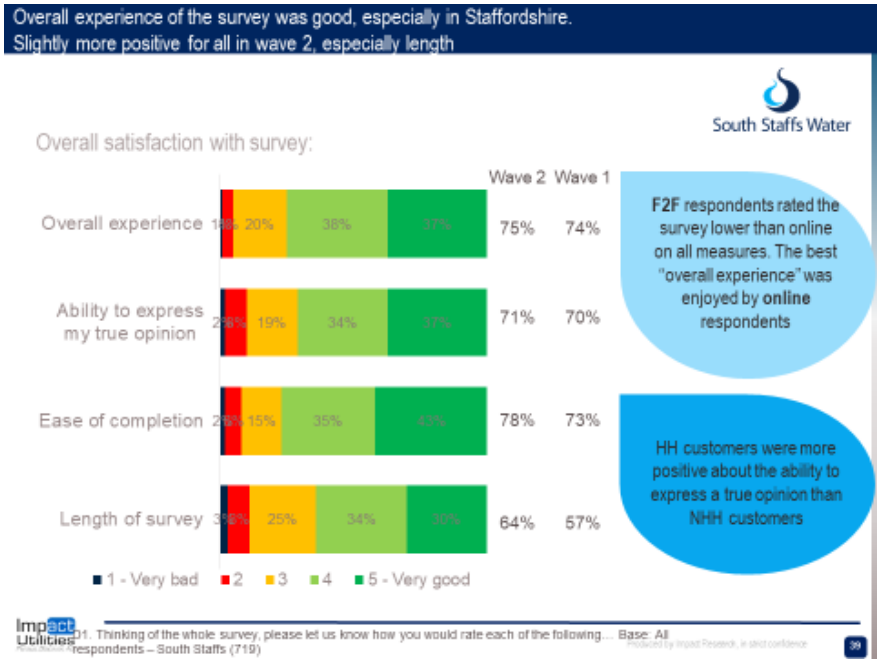
The survey instrument took between 20 and 25 minutes to complete, with half of the time being spent on the SP exercise. Interviews conducted face to face were typically longer than those completed online. The rest of the questionnaire included demographic and household composition information such as bill affordability and meter type in the case of the household interviews. For the commercial interviews appropriate firmographic information such as water consumption, business size and industry sector was collected. Both survey instruments included a question requesting permission to re-contact respondents for further research related to this survey if necessary.

Exercises were tailored to the services provided within the respondent's SSC regions to remain as relevant as possible, including relevant figures of current performance.

Feedback to the survey was generally positive, as in wave 1 (see figure 1 and figure 2 below). Customers felt the survey was interesting and informative "*it was interesting to me. I found out information that I didn't know about"* and generally found it easy to complete "*Easy to complete and help was available", "Easy to give my opinion and allowed me to say what I wanted".*

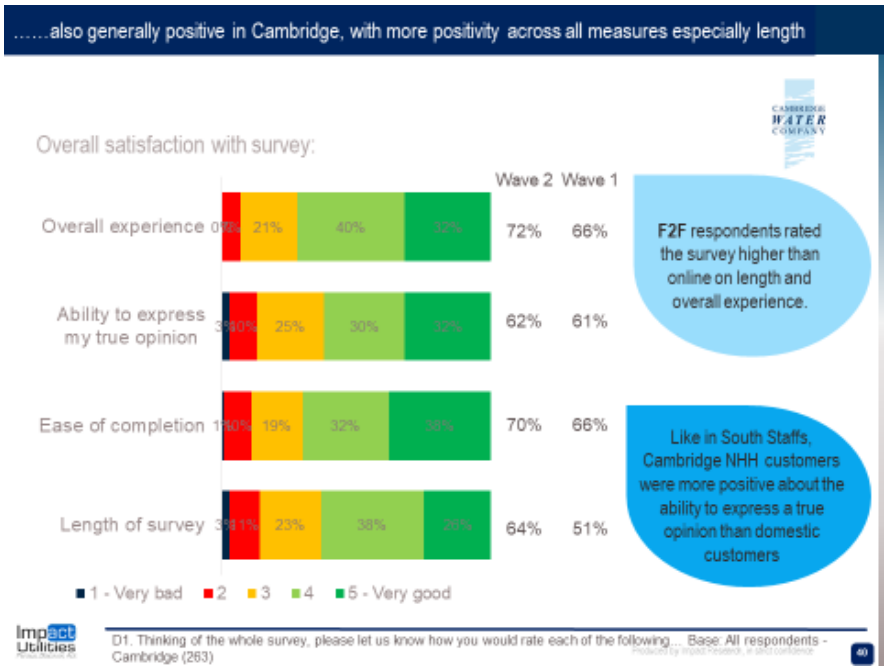
A handful of negative comments related to the length of the survey*, and* customers not wanting to pay more "*I didn't want to pay any more", "Such a lengthy survey".*

Figure 1: Survey feedback South Staffordshire Water



Figures under Wave 2 and Wave 1 are 'top 2 box' scores on the five point scale

Figure 2: Survey feedback Cambridge Water

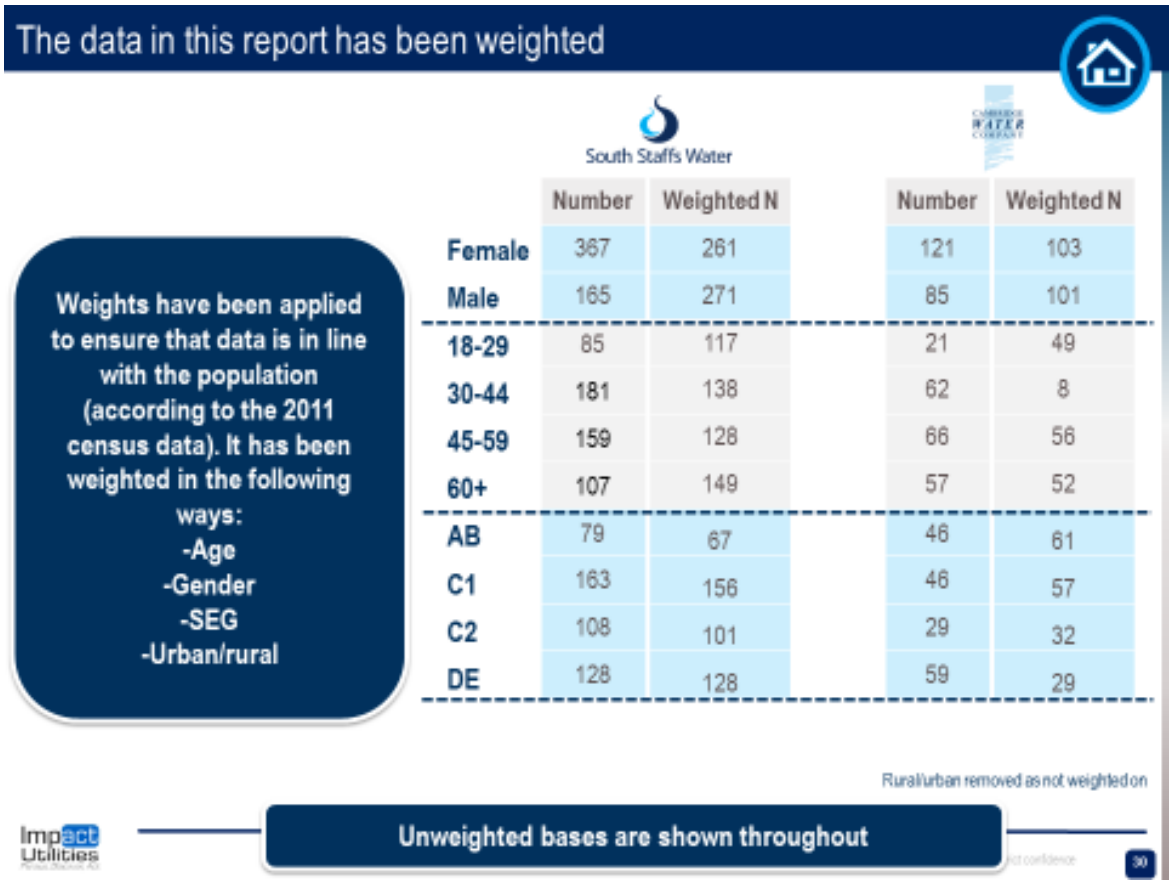


Figures under Wave 2 and Wave 1 are 'top 2 box' scores on the five point scale

Weighting

This second phase of the research tested revised versions of the attributes tested in the first phase. Details of these revisions are reported in the methodology statement[3]. The data was weighted to reflect the socio-demographic profile of the regions, in line with the approach taken in wave 1. The weights applied are documented in Table 4.

Table 4: Weights applied to HH data



Weighting for SMEs was not undertaken, because suitable region-specific target profile data was not available. However, we did take steps to ensure that we spoke to a sample that broadly reflected the total population: we aimed to achieve a mix of business sectors and company sizes that were broadly in-line with a random sample of NHH leads provided by SSC.

[3] Impact Research, 2018, Willingness-to-pay research to support PR19 - Focus on retail attributes, v5

Key findings

A range of sensitivities were tested and delivered around the values that came out of this second phase of research:

- Impact of new attribute definitions
    - We compared the new WTP values against the previous research to identify any significant differences – that is, would the final IO unit value remain fairly consistent or would the new forms of presentation significantly alter the results?
- Impact of ‘package’ effect
    - We compared the inferred WTP when a number improvements are introduced together and compare this with the sum of the individual attribute WTP values. The anticipated result was be a ‘scaling factor’ that represents the limit of actual bill increases that customers will accept. Experience from other studies suggested this could be substantial.
- Impact of lower bill base v results from the previous study
    - The main comparison was at an overall level (ie average WTP across the attributes), because of the small sample sizes
    - More detailed comparisons by attribute were also be made, but these were not expected to be significantly different (unless very large) due to the sample size.

Testing the level of sensitivity of WTP attributes to alternative definitions

Table 5 compares the results from the second wave with corresponding results from the first wave. The main observations from this comparison are:

- The WTP values that relate directly to the improvements shown in the trade-off exercises are almost all significantly lower than in wave 1, reflecting the lower (and perhaps more realistic) levels of improvement.
- 'Metering' and 'managing rivers and streams' are exceptions, with higher values for both among HH customers in South Staffordshire.
- NHH in Cambridge as a group are also an exception, showing generally higher values for quality attributes and considerable variation in environmental attributes.

As indicated earlier, a concern with the NHH Cambridge results is that they are based on a small sample (n=67), which becomes even smaller when broken down by the attribute groups (eg n=20 for the 'quality group'). These should therefore be interpreted with caution.

The new community attributes register a relatively modest value, with 'supporting customers facing difficult situations' the most important.

For many of the attributes, a comparison with the intermediate level tested in wave 1 is the most meaningful, although even where these levels are the same across the waves, the comparisons with the other levels will be different. For example, the intermediate level in some wave 1 attributes is compared against a strongly superior top level, whereas in wave 2 the same level is now the top level and compared against a less attractive level.

Table 6 shows the same comparison against 'public' values in wave 1, which are closer in definition to the levels used in wave 2. The differences are generally lower, but still significant.

Table 5: Comparison of WTP figures with intermediate (S1) and top level (S2) improvements (Wave 1 = All values)

		SST								CAM							
		HH				NHH				HH				NHH			
		Wave 2		Wave 1		Wave 2		Wave 1		Wave 2		Wave 1		Wave 2		Wave 1	
	Changes from wave 1 to wave 2	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*
Water not safe to drink	Wave 1 mid-point is now the best level	£0.89	**£1.11**	**£5.48**	£6.31	0.02%	**0.09%**	**1.86%**	2.03%	£1.05	**£2.46**	**£4.62**	£5.33	0.10%	**0.17%**	**2.43%**	2.84%
Discolouration of your tap water	Wave 1 mid-point is now the best level	£3.37	**£3.97**	**£1.18**	£4.59	1.94%	**1.99%**	**0.53%**	1.38%	£3.12	**£4.46**	**£3.43**	£5.04	5.64%	**5.66%**	**1.15%**	1.99%
Taste and smell of your tap water	Wave 1 mid-point is now the best level	£0.31	**£0.49**	**£1.36**	£3.55	0.37%	**0.37%**	**0.70%**	1.52%	£0.05	**£0.17**	**£2.20**	£4.54	4.26%	**5.35%**	**0.72%**	1.82%
Lead pipes	Different levels	£2.13	**£3.51**	£6.96	£11.04	0.41%	**0.74%**	2.98%	4.08%	£0.43	**£0.64**	£8.09	£11.66	5.02%	**5.39%**	3.61%	4.52%
Water hardness	Different levels	£5.29	**£5.90**	£8.05	£9.66	0.42%	**0.47%**	2.98%	3.33%	£2.64	**£3.15**	£5.33	£7.63	5.90%	**5.94%**	1.86%	3.55%
Unexpected temporary loss of water supply	Wave 1 mid-point is now the best level	£0.40	**£0.94**	**£1.46**	£4.24	0.02%	**0.06%**	**0.88%**	3.27%	£0.05	**£0.39**	**£0.31**	£2.23	0.03%	**0.03%**	**0.46%**	1.76%
Temporary use ban	Wave 1 mid-point is now the best level	£0.41	**£0.69**	**£0.45**	£2.72	0.10%	**0.17%**	**0.28%**	1.27%	£0.16	**£0.21**	**£1.46**	£1.94	0.14%	**0.25%**	**0.85%**	1.11%
Low water pressure	Wave 1 mid-point is now the best level	£0.78	**£1.15**	**£2.05**	£4.29	0.01%	**0.05%**	**0.95%**	2.01%	£2.14	**£2.98**	**£0.76**	£1.13	0.00%	**0.48%**	**0.37%**	0.68%
Flooding from a burst pipe	Wave 1 mid-point is now the best level	£1.43	**£1.63**	**£2.51**	£3.37	0.33%	**0.40%**	**2.10%**	2.63%	£1.31	**£1.83**	**£3.27**	£3.69	0.00%	**0.06%**	**2.08%**	2.34%
Leakage SST	Wave 1 mid-point is now the best level	£1.23	**£1.67**	**£2.24**	£4.01	1.84%	**2.51%**	**2.21%**	2.77%								
Leakage CAM	Wave 1 mid-point is now the best level									£3.13	£3.14	**£4.46**	£6.39	7.2%	10.69%	**0.68%**	2.27%
Metering	Different levels	£3.98	**£4.50**	£0.54	£0.96			0.00%	0.06%	£1.44	**£2.35**	£0.76	£1.35			0.00%	0.00%
Use of renewable energy (proportion of power use)	Different levels	£0.81	**£1.66**	£1.60	£2.89	1.21%	**1.60%**	1.40%	2.10%	£0.01	**£0.13**	£1.39	£5.56	0.02%	**0.30%**	4.40%	7.46%
Protecting wildlife habitats	Different levels	£0.31	**£0.44**	£0.43	£0.59	0.04%	**0.18%**	0.12%	0.16%	£0.17	**£0.19**	£0.07	£0.71	1.50%	**2.03%**	0.13%	0.15%
Restoring rivers and streams and the land around them	Different levels	£1.60	**£2.62**	£0.14	£0.52	0.05%	**0.77%**	0.79%	0.79%	£0.89	**£1.34**	£0.15	£0.80	7.02%	**7.03%**	2.53%	2.82%
Traffic disruption				£0.07	£0.53			0.09%	0.29%			£0.21	£0.80			0.17%	0.55%
Investing in community projects		£0.29	£1.44			0.33%	0.51%			£0.05	£0.39			0.15%	0.16%		
Educating future generations		£0.17	£0.24			0.29%	0.34%			£0.01	£0.25			0.00%	0.83%		
Supporting customers experiencing difficult situations		£1.21	£2.26			1.74%	2.69%			£0.37	£1.49			2.55%	2.56%		

Wave 2, level 2 levels are compared against the most relevant wave 1 levels and if the difference is significant at 95% level of confidence, the number is highlighted in red. In most cases wave 2, level 2 is compared with wave 1, level 1, except those labelled 'different levels', where the comparison is with wave1, level 2 (the best level). Table 4 summarises the changes in wave 2 compared to wave 1.

Table 6: Comparison of WTP figures with intermediate (S1) and top level (S2) improvements (Wave 1 = Public Values)

COMPARISON OF WTP VALUES FROM SP EXERCISES	SST								CAM							
	HH				NHH				HH				NHH			
	Wave 2		Wave 1		Wave 2		Wave 1		Wave 2		Wave 1		Wave 2		Wave 1	
	S1	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*	*S1*	*S2*
Water not safe to drink	£0.89	**£1.11**	**£3.34**	£4.18	0.02%	**0.09%**	**1.21%**	1.35%	£1.05	**£2.46**	**£2.22**	£2.97	0.10%	**0.17%**	**0.89%**	1.23%
Discolouration of your tap water	£3.37	**£3.97**	**£0.93**	£3.26	1.94%	**1.99%**	**0.54%**	1.65%	£3.12	**£4.46**	**£3.51**	£4.57	5.64%	**5.66%**	**0.76%**	1.04%
Taste and smell of your tap water	£0.31	**£0.49**	**£1.23**	£2.94	0.37%	**0.37%**	**0.77%**	1.20%	£0.05	**£0.17**	**£2.36**	£5.28	4.26%	**5.35%**	**0.46%**	0.73%
Lead pipes	£2.13	**£3.51**	£5.78	£9.02	0.41%	**0.74%**	2.78%	3.69%	£0.43	**£0.64**	£6.30	£8.95	5.02%	**5.39%**	1.73%	2.17%
Water hardness	£5.29	**£5.90**	£5.45	£6.53	0.42%	**0.47%**	3.03%	3.50%	£2.64	**£3.15**	£4.39	£6.05	5.90%	**5.94%**	1.08%	1.61%
Unexpected temporary loss of water supply	£0.40	**£0.94**	**£1.24**	£4.71	0.02%	**0.06%**	**0.79%**	2.35%	£0.05	**£0.39**	**£0.39**	£2.77	0.03%	**0.03%**	**0.27%**	1.77%
Temporary use ban	£0.41	**£0.69**	**£0.38**	£2.39	0.10%	**0.17%**	**0.08%**	0.80%	£0.16	**£0.21**	**£1.44**	£1.99	0.14%	**0.25%**	**0.86%**	1.10%
Low water pressure	£0.78	**£1.15**	**£2.20**	£4.51	0.01%	**0.05%**	**0.73%**	1.68%	£2.14	**£2.98**	**£0.92**	£1.31	0.00%	**0.48%**	**0.31%**	0.53%
Flooding from a burst pipe	£1.43	**£1.63**	**£2.11**	£2.92	0.33%	**0.40%**	**0.82%**	1.42%	£1.31	**£1.83**	**£2.75**	£3.12	0.00%	**0.06%**	**2.98%**	3.31%
Leakage SST	£1.23	**£1.67**	**£2.00**	£3.80	1.84%	**2.51%**	**0.49%**	1.08%								
Leakage CAM									£3.13	£3.14	**£7.22**	£10.31	7.2%	10.69%	**0.22%**	1.40%
Metering	£3.98	**£4.50**	£0.58	£1.01			0.00%	0.07%	£1.44	**£2.35**	£1.21	£2.16			0.00%	0.00%
Use of renewable energy (proportion of power use)	£0.81	**£1.66**	£1.51	£2.91	1.21%	**1.60%**	2.21%	2.35%	£0.01	**£0.13**	£2.18	£10.49	0.02%	**0.30%**	0.65%	0.66%
Protecting wildlife habitats	£0.31	**£0.44**	£0.42	£0.57	0.04%	**0.18%**	0.11%	0.16%	£0.17	**£0.19**	£0.09	£1.13	1.50%	**2.03%**	0.06%	0.07%
Restoring rivers and streams and the land around them	£1.60	**£2.62**	£0.16	£0.51	0.05%	**0.77%**	0.75%	0.75%	£0.89	**£1.34**	£0.19	£1.45	7.02%	**7.03%**	2.55%	2.55%
Traffic disruption			£0.06	£0.52			0.11%	0.23%			£0.21	£0.72			0.26%	0.79%
Investing in community projects	£0.29	£1.44			0.33%	0.51%			£0.05	£0.39			0.15%	0.16%		
Educating future generations	£0.17	£0.24			0.29%	0.34%			£0.01	£0.25			0.00%	0.83%		
Supporting customers experiencing difficult situations	£1.21	£2.26			1.74%	2.69%			£0.37	£1.49			2.55%	2.56%		

Wave 2, level 2 levels are compared against the most relevant wave 1 public levels and if the difference is significant at 95% level of confidence, the number is highlighted in red. In most cases wave 2, level 2 is compared with wave 1, level 1, except those labelled 'different levels' in Table 7 below.

Table 7 summarises the changes in wave 2 compared to wave 1.

Table 7: Changes made to attributes in wave 2

Measure	Changes from Wave 1 to wave 2		
Water not safe to drink	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in 120 yrs'*	Attribute definition changed from 2 week to 4 week period
Discolouration of your tap water	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in 25 yrs'*	
Taste and smell of your tap water	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in 90 yrs'*	
Lead pipes	Different levels	*- eg was 'removed from all properties' to '1 in 5 have lead pipes'*	Children removed from level wordings Attribute definition altered from no health risk to almost none
Water hardness	Different levels	*- eg was 'all properties' to '4,000 properties'*	Damage removed from level wordings Attribute definition altered to say hard water good for health
Unexpected temporary loss of water supply	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in 105 yrs'*	
Temporary use ban	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in 60 yrs'*	
Low pressure	Wave 1 mid-point is now the best level	*- eg was '1 in 20 years' in SST, now '1 in 15 yrs'*	
Flooding from a burst pipe	Wave 1 mid-point is now the best level	*- eg was 'never' in SST, now '1 in120 yrs'*	
Leakage SST	Wave 1 mid-point is now the best level	*- eg was 6% in SST, now 12%*	
Leakage CAM	Wave 1 mid-point is now the best level	*- eg was 5% in CAM, now 10%*	
Metering	Different levels	*- eg was 50% in SST, now 18%*	Lower % levels tested
Use of renewable energy (proportion of power use)	Different levels	*- eg was 90% in SST, now 50%*	Lower % levels tested
Protecting wildlife habitats	Different levels	*- eg was '+30 Ha' in SST, now '50 Ha'*	Attribute definition now mentions % of land managed in context of whole region
Restoring rivers and streams and the land around them	Different levels	*- Reduction in run-off instead of area*	Attribute definition now also in context of actively managing land with landowners

Application to the Cost Benefit Analysis

The WTP values derived from the discrete choice exercises can be converted into a 'per unit' value by relating each result to the approximate number of customers affected. Tables 6 and 7 summarise the values derived from this process. Compared to wave 1, some values increase and others decrease, reflecting not only the changes in WTP but also in the ranges used to calculate the 'per unit' value.

Some of the 'public' measures descriptions of the middle level of improvement for Wave 1 were different from those in wave 2, resulting in different % improvements from the current service. This leads to some variations, eg 'Unexpected temporary loss of water supply' for HH in Staffordshire, which has a lower WTP value of £0.94 in Wave 2 v £1.24 in Wave 1, but expressed the top improvement as 0.95% of households affected in Wave 2 v 0.72% in Wave 2. The result is a higher unit cost in Wave 2, despite the lower WTP.

Table 8 below highlights the main differences ('--' indicates a much lower value in wave 2, '++' indicates much higher value). Cambridge NHH is marked in grey as the sample sizes here are small.

Table 8: Summary of differences in attribute values - wave 2 v wave 1

	South Staffordshire		Cambridge	
	HH	NHH	HH	NHH
Water not safe to drink	--	--	.	--
Discolouration of your tap water	++	++	+	++
Taste and smell of your tap water	--	++	--	++
Lead pipes	-	--	--	++
Water hardness	--	--	--	+
Unexpected temporary loss of water supply	.	--	+	--
Temporary use ban	+	++	--	--
Low pressure	.	--	++	++
Flooding from a burst pipe	-	--	-	--
Leakage	-	++	--	++
Metering	++	n/a	-	n/a
Use of renewable energy (proportion of power use)	++	+	--	.
Protecting wildlife habitats	--	-	.	++
Restoring rivers and streams and the land around them	++	-	++	.

This presents a mixed picture across the measures. The measures that are generally lower in Wave 2 across all groups are:

- ‘Water not safe to drink’, ‘Lead pipes’, ‘Water hardness’, ‘Flooding from a burst pipe’ and ‘Protecting wildlife habitats’

Measures that are generally higher in Wave 2 are:

- ‘Discolouration of your tap water’ and ‘Restoring rivers and streams and the land around them’.
- ‘Temporary use ban’, ‘Metering’ and ‘Use of renewable energy’ are also higher in Staffordshire.

Table 9: WTP values converted to 'per unit' values

					Wave 1 SSC Mean WTP (unweighted)	
Measure	**Unit**	**Working range (Wave 2)**	**Working range (Wave 1)**	**Wave 2 SSC CURRENT BILL ONLY Mean WTP**	S1 (mid level)	S2 (top level)
Water not safe to drink	per prop affected	*0-6,008 props*	*0-9125 props*	£382	*£3,216*	*£1,195*
Discolouration of your tap water	per prop affected	*0-23,969 props*	*0-48600 props*	£977	*£343*	*£279*
Taste and smell of your tap water	per prop affected	*0-7,519 props*	*0-12100 props*	£1,100	*£591*	*£562*
Lead pipes	per prop affected	*0-168,533 props*	*0-243000 props*	£62	*£114*	*£79*
Water hardness	per prop affected	*0-4000 props*	*0-730000 props*	£10	*£44*	*£22*
Unexpected temporary loss of water supply	per prop affected	*0-9,274 props*	*0-12,000 props*	£194	*£630*	*£943*
Temporary use ban	per 1% risk change	*0-0.83% reduction*	*0-2.5% reduction*	£623,557	*£1,294,587*	*£1,519,645*
Low pressure	per prop affected	*0-42,949 props*	*0-54750 props*	£99	*£121*	*£158*
Flooding from a burst pipe	per prop affected	*0-6,008 props*	*0-9125 props*	£603	*£2,781*	*£1,082*
Leakage SST	per Ml/d reduction	*0-35.25 Ml/d reduction*	*0-53 Ml/d reduction*	£142,516	*£139,944*	*£128,995*
Leakage CAM	per Ml/d reduction	*0-7 Ml/d reduction*	*0-10 Ml/d reduction*	£871,448	*£176,350*	*£239,607*
Metering	per new metered prop	*0-135000 new metered props*	*0-410000 new metered props*	£23	*£3.08*	*£2.59*
Use of renewable energy (proportion of power use)	per 1% increase	*0-9% increase*	*0-39% increase*	£411,112	*£170,415*	*£138,432*
Protecting wildlife habitats	per additional hectare	*0-50 additional hectares*	*0-30 additional hectares*	£31,656	*£22,035*	*£20,021*
Restoring rivers and streams and the land around them	per additional hectare	*0-50% reduction in run-off*	*0-200 additional hectares*	£18,198	*£12,432*	*£9,581*
Traffic disruption	per roadwork		*0-365 roadworks improvemer*	-	*£3,216*	*£1,195*
Investing in community projects	per person-day			£8,991		
Educating future generations	per 1% of schools visited			£47,942		
Supporting customers experiencing difficult situations	per property affected			£534		

Table 10: Unit values, Wave 2 v Wave 1: All Wave 1 levels are 'Public' level S1 (mid level)

		South Staffordshire				Cambridge				Total			
		HH		NHH		HH		NHH		HH		NHH	
Measure	Unit	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1
Water not safe to drink	per prop affected	£250	£752	£57	£807	£548	£495	£146	£777	£308	£703	£76	£800
Discolouration of your tap water	per prop affected	£140	£28	£207	£48	£606	£305	£3,004	£277	£229	£81	£802	£97
Taste and smell of your tap water	per prop affected	£83	£171	£185	£68	£37	£205	£4,537	£165	£74	£178	£1,111	£89
Lead pipes	per prop affected	£24.65	£32.48	£15.46	£46.37	£4.48	£35.14	£146.89	£37.74	£20.78	£32.99	£43.42	£44.53
Water hardness	per prop affected	£5.53	£12.23	£1.30	£19.44	£2.93	£11.24	£21.57	£11.70	£5.03	£12.04	£5.61	£17.79
Unexpected temporary loss of water supply	per prop affected	£184	£160	£43	£306	£43	£28	£12	£83	£157	£135	£37	£259
Temporary use ban	per 1% risk change	£396,645	£254,004	£326,771	£150,337	£16,195	£453,525	£190,218	£1,060,712	£323,674	£292,272	£297,717	£344,034
Low pressure	per prop affected	£45	£41	£6	£40	£171	£18	£108	£24	£73	£36	£27	£36
Flooding from a burst pipe	per prop affected	£366	£474	£270	£547	£408	£612	£55	£2,597	£374	£501	£224	£983
Leakage	per Ml/d reduction	£26,174	£31,355	£116,342	£33,359	£60,941	£140,165	£810,506	£70,980	£32,843	£52,225	£264,036	£128,948
Metering	per new metered prop	£26.49	£1.82		£0.00	£9.42	£12.06		£0.00	£23.22	£3.78	£0.00	£0.00
Use of renewable energy (proportion of power use)	per 1% increase	£130,680	£43,735	£373,030	£190,761	£2,472	£15,021	£21,830	£17,531	£106,089	£38,228	£298,307	£153,903
Protecting wildlife habitats	per additional hectare	£4,904	£12,238	£5,979	£9,419	£2,728	£2,011	£115,707	£5,457	£4,486	£10,277	£29,325	£8,576
Restoring rivers and streams and the land around them	per additional hectare	£7,224	£579	£6,299	£8,204	£1,749	£492	£35,976	£26,115	£6,174	£562	£12,613	£12,015
Traffic disruption	per roadwork	-	£752	-	£807	-	£495	-	£777	-	£703	-	£800
Investing in community projects	per person-day	£5,301	-	£5,522	-	£511	-	£830	-	£4,382	-	£4,523	-
Educating future generations	per 1% of schools visited	£10,027	-	£41,218	-	£2,410	-	£31,736	-	£8,566	-	£39,201	-
Supporting customers experiencing difficult situations	per property affected	£227	-	£238	-	£558	-	£263	-	£290	-	£243	-

These figures are added together, in proportion to the number of customers in each region and type, to create the single figures reported in Table 9.

Review of differences between wave 1 and wave 2 values

To summarise our observations on this, Table 8 indicates the possible explanations for the observed differences between waves 1 and 2, and an indication of which in our view are likely to be strongest reasons.

Table 11: Proposed reasons for the observed differences in Wave 2 v Wave 1 Results

Proposed Reason	Comment	Impact on Wave 2 values
Changes in the levels and in particularly the fact that wave 2 has no 'never occurs' levels.	Although some customers are sceptical that SST could ever get to zero (evidence from the ECP groups), this was not expressed at any stage in the survey and indeed a number of customers expressed the view that they would highly value the complete removal of lead or the elimination all interruptions	**Likely**
No Max Diff exercise preceded the Choice exercises	The completion of the Max Diff in wave 1 may have made customers think more about the value of these improvements to them; the pilot suggested that those who went straight into the choice exercises produced more consistent (better fitting) models – ie they appeared to have a clearer idea of what they were choosing	**Likely**
Wave 1 results are a blend of 'private' and 'public' values, whereas Wave 2 only covered public values.	This does accentuate the difference, but as Table 4 indicates, the differences when compared against 'public' values in wave 1 are still generally large	**Likely**
In wave 2, respondents completed two DCEs (choice exercises); they completed only one in wave 1	The design covering 'Community' attributes was always the second DCE, so in that sense the two waves were the same for the three other attribute groups – that is, any fatigue or other effect would not apply	Unlikely
No greywater question was included	This would have no influence on the results as it was shown after the choice exercises in wave 1	Unlikely

‘Lead pipes’ and ‘Water hardness’ show consistently lower values, which may reflect specific changes in the descriptions, where potentially emotive references to children in the format and damage to appliances in the latter were removed. This could have had the effect of making improvements to these particular measures less urgent to customers.

The generally higher values for ‘Restoring rivers and streams and the land around them’ and the lower values for ‘Protecting wildlife habitats’, could also reflect the changes in the wording for these measures. For the former, the description now mentioned management of land by landowners, which may have come over to customers as a more specific level of improvement; for the latter, the more regional nature of the description may have lessened the impact.

The increase in metering may reflect a change in attitudes over the time between the two surveys, reflecting the extensive roll out of ‘Smart meters’ in the Electricity sector at the end of 2017 and into 2018.

The remaining differences are harder to explain, given that they vary in direction from wave 1 to wave 2, across the different customer groups. This may therefore reflect changes in the methodology. There are no major differences in the profile of two samples and the discrete choice exercises (DCE) were similar (each respondent saw only one of the three topic areas tested in wave 1, before then seeing the new retail or ‘community’ measures). The major difference was the lack of a ‘Max Diff’ exercise preceding the DCE and the use of ‘more extreme’ levels in wave 1, where the inclusion absolute improvements (eg zero lead piping) may have raised general interest in all the potential improvements in wave 1.

Testing whether a lower bill starting point alters the WTP values

Figure 3 below illustrates how the context for a lower bill was shown to a random sub-group of HH. The purpose of this was to determine whether customers would have a different willingness to pay if operating from a lower base bill level.

Figure 3: Explanation to respondents of how a decrease in bills will affect them

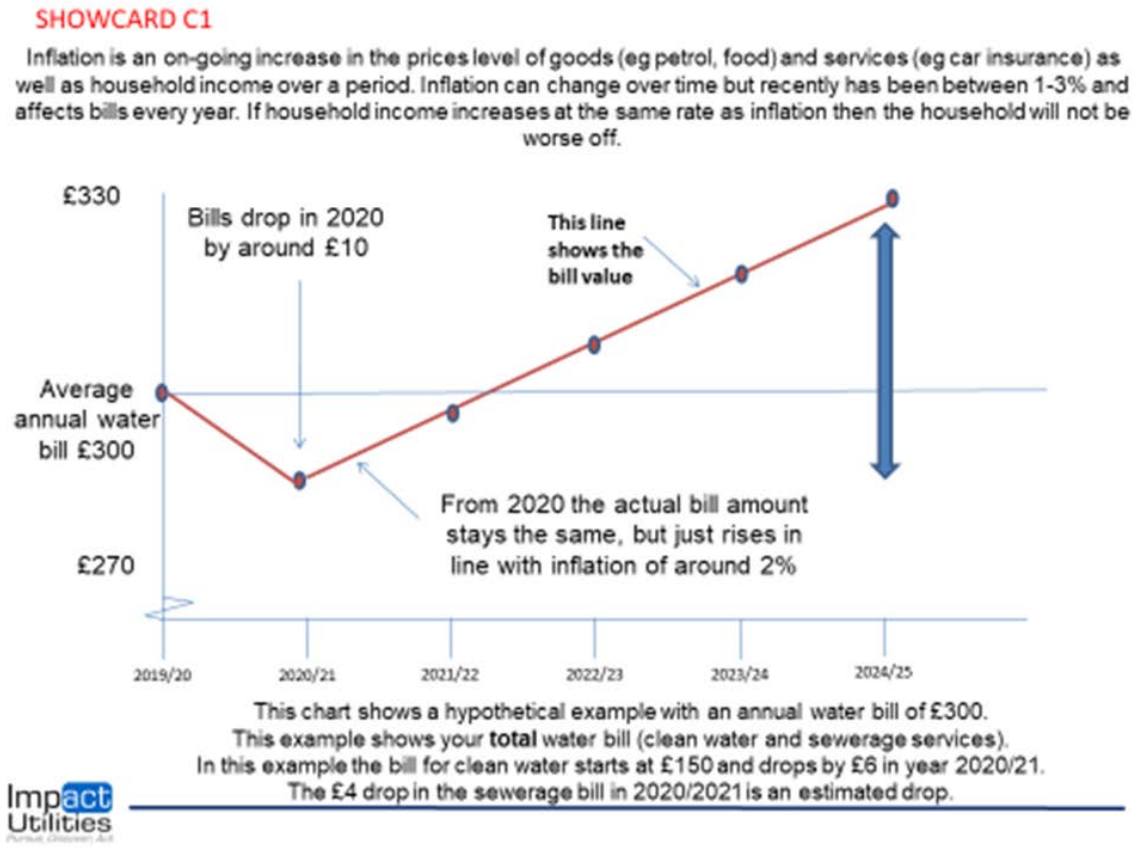


Table 12 below compares the WTP values for HH who were told that their bill would reduce by £10 in 2020 and then rise with inflation.

Table 12: Comparison of Lower Bill WTP and Current Bill WTP (values converted to 'per unit' values

Measure	Unit	Working range (Wave 2)	Wave 2 SSC LOW BILL ONLY HOUSEHOLDS Mean WTP	Wave 2 SSC CURRENT BILL ONLY HOUSEHOLDS Mean WTP
Water not safe to drink	per prop affected	*0-6,008 props*	£271	£308
Discolouration of your tap water	per prop affected	*0-23,969 props*	£206	£229
Taste and smell of your tap water	per prop affected	*0-7,519 props*	£50	£74
Lead pipes	per prop affected	*0-168,533 props*	£17	£21
Water hardness	per prop affected	*0-4000 props*	£4	£5
Unexpected temporary loss of water supply	per prop affected	*0-9,274 props*	£118	£157
Temporary use ban	per 1% risk change	*0-0.83% reduction*	£279,788	£323,674
Low pressure	per prop affected	*0-42,949 props*	£65	£72
Flooding from a burst pipe	per prop affected	*0-6,008 props*	£426	£374
Leakage SST	per Ml/d reduction	*0-35.25 Ml/d reduction*	£10,576	£26,174
Leakage CAM	per Ml/d reduction	*0-7 Ml/d reduction*	£43,192	£60,941
Metering	per new metered prop	*0-135000 new metered props*	£20	£23
Use of renewable energy (proportion of power use)	per 1% increase	*0-9% increase*	£68,787	£106,089
Protecting wildlife habitats	per additional hectare	*0-50 additional hectares*	£3,787	£4,486
Restoring rivers and streams and the land around them	per additional hectare	*0-50% reduction in run-off*	£3,765	£6,174
Traffic disruption	per roadwork		-	-
Investing in community projects	per person-day		-	£4,382
Educating future generations	per 1% of schools visited		-	£8,566
Supporting customers experiencing difficult situations	per property affected		-	£290
		HH Sample	290	447
		NHH Sample	-	-

It might have been anticipated that a low bill would encourage HH customers to spend more as the bill reduction gives them more available to spend (£10). Instead, the opposite is true, with noticeably lower WTP results for those seeing low bills. This may suggest that people assess the bill changes as proportional to the base bill level and the +£ levels consequently seem larger to them.

However, there has always been a concern that people can only realistically assess bill changes relative to what they pay now, not some future hypothetical level. The careful introduction of how price reductions work over time may also have made them more sensitive to the topic and possibly more reluctant to sacrifice what could be seen as a discount.

Our recommendation is to give priority the results based on current bill levels, because we cannot be confident that respondents are truly expressing their willingness to pay for improvements relative to the bill – they are instead expressing their desire to keep hold of an unexpected discount. Nevertheless, these results could be used as a particularly cautious sensitivity test.

Testing for a 'package' effect

A criticism of the wave 1 approach is that it did not include an approach to measuring the likely 'packaging effect' that is expected to reduce the overall WTP values when more improvements are introduced than were actually tested at any one time in the discrete choice exercise[4]. This second wave sought to rectify this.

In South Staffordshire's willingness-to-pay research for PR14[5], it was noted that:

"…significant package effects are observed when large improvements to multiple water services are valued. The results from the package tests included in the survey design have produced a range for the scaling factors. At a high level this range is 28% to 44% for domestic customers and 15% to 29% for non-domestic customers."

These results were for all attributes being presented all at once and feedback from SSC's Customer Advisory Panel raised concerns as to whether the 'package' exercise should cover all blocks and whether it was possible to test more than one package level (in the pilot this was 1 block or 3 blocks only). It was considered that showing 4 blocks of attributes is, firstly, too much information for customers to take in and make a meaningful trade off, and also goes beyond what would actually be implemented in reality by SSC. To obtain an extra measurement point, the 'Budget effect' question was modified in the main survey so that some respondents only saw the two 'blocks' of attributes while some respondents continued to see these and an additional, randomly selected, block.

A further question was also added for the 'package' test. The approach described above was considered appropriate because it is a simple extension of the Choice Exercise. However, the method used in PR14 for this packages test was a contingent valuation (CV) question (ie a direct 'how much would you be willing to pay extra for these improvements?') Including this after the package choice question in the current survey allowed a further point of comparison with the PR14 results.

Method 1: Package Choice Task

This question presented respondents with a choice between one service defined in terms of 2 or 3 blocks of attributes, one set (A) all at current levels and one set (B) all at the best levels. The price increase for (B) varied from +£10 to +£50 for HH customers, +10% to +50% for NHH.

In our analysis of this question, we:

- Plotted a 'demand curve' for each customer type in each region, for each price point tested.

[4] Dr Paul Metcalfe, PJM economics, 2018, Review of Impact Utilities (2018) 'Willingness to Pay Research to Support PR19'

[5] South Staffs Water PR14 Stated Preference Study: Final Report, 2013, p69

- Identified the price at which take up is 50% of respondents. This represents the collective point of indifference for the utility of the improvements v the disutility of the bill increase. If necessary this would have to be extrapolated from the levels used.

- We compared this with the aggregate WTP value for the corresponding attributes tested in the SP exercises (again representing the point of indifference between the utility of the improvements and the disutility of the price increase)

- We then took the ratio of the two to establish a scaling parameter.

Because the number of questions had to be limited to one per respondent, results had to be aggregated across regions to represent HH and NHH customers only:

Table 13: Percentage take up for 2-package and 3-package improvements v Discrete Choice Results

	Two-part packages				Three-part packages			
HH Price	+£10	+£20	+£30	+£50	+£10	+£20	+£30	+£50
NHH Price	+5%	+15%	+20%	+35%	+5%	+15%	+20%	+35%
HH	41%	31%	29%	23%	44%	35%	35%	26%
NHH	39%	37%	27%	13%	49%	43%	43%	14%

When plotted on a chart, trend lines were then fitted. Applying these trend formulas to the 50% point (ie where half of respondents would choose the improvements at that price), the following results were obtained:

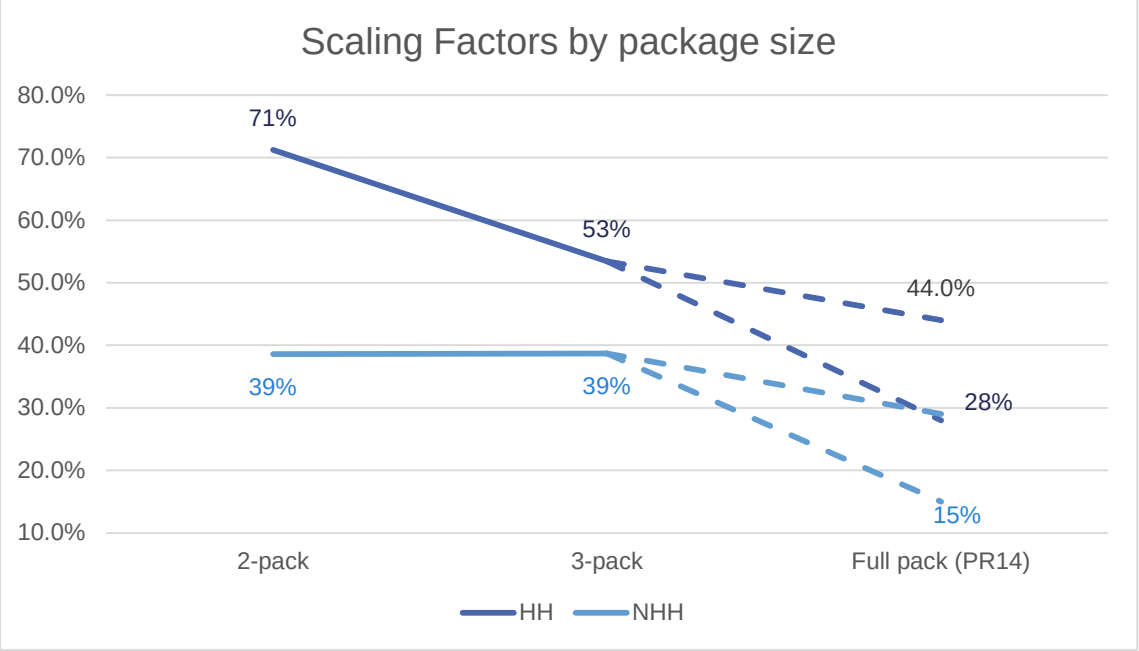
Table 14: Estimated average WTP for 2-package and 3-package improvements v Discrete Choice Results

	Package question		Results from Discrete Choice Exercises		Implied scaling factor	
	2-pack	3-pack	2-pack	3-pack	2-pack	3-pack
HH	+£4.21	+£6.23	+£5.91	+£11.66	71%	54%
NHH	+4.4%	+8.6%	+11.5%	+22.2%	39%	39%

The results under ‘Package question’ are the average values estimated for each pack using this method. The results from the discrete choice exercises are the average total WTP values for each of the groups of attributes tested (ie Quality, Reliability and Environment, each with Community), taken from the results of the main modelling work. The implied scaling factor is the ratio of the two. For example, the ‘package value’ for three groups of attributes together is about half that of the separate group WTP values added together, a scaling factor of 0.54.

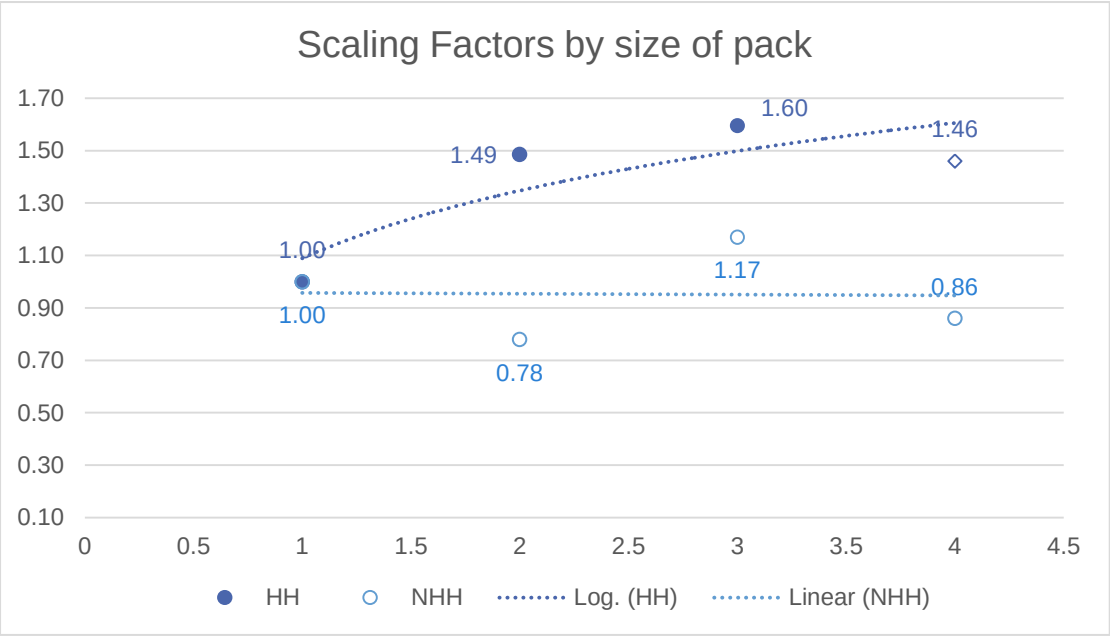
The scaling factors are broadly in line with those of PR14, which were for all improvements introduced together. The chart below shows these results with the lowest and highest values of the PR14 range.

Figure 4: Package Scaling Factors



If we then plot this information against the number of attribute groups in each package, we can establish a relationship between the scalar and the broad number of attributes (we have taken the average of the PR14 'Full pack' results to provide an indicative figure for presenting all attributes). Figure 9 below shows the package values as an index relative to the average single group value.

Figure 5: Scaling factors by number of attributes



For HH customers, the relationship suggests a tailing off of total value as packages get larger. For NHH customers, the results are less consistent, but the effect is to scale additional value back to that of the first group of attributes, suggesting that these customers already express their full willingness to pay when assessing a single group of improvements. From this information we can recommend a level of scaling as shown in the table below.

Table 15: Indicative scaling factors by number of attributes.

No. of Attributes	HH	NHH
Up to 5	1.00	1.00
6	0.90	For packs of more than 5 improvements set the value as the 5 highest valued attributes in the pack
7	0.85	
8	0.80	
9	0.75	
10	0.70	
11+	0.65	

These figures are very broad indicators and need to be applied with caution, but they provide a basis for calculating cautious estimates of the overall WTP for wide ranging improvements. For more than 11 attributes the scalar should remain at 0.65 for HH.

Method 2: CVM question

Immediately following the choice question, respondents were then asked an open-ended question:

SHOW THE SAME CHOICE AGAIN
In the final task that you just saw, what is the maximum increase in the annual water bill that you would be willing to pay for all these improvements to your service (on top of your current bill of QHIDBILLVALUE) £_ _ per year

This question was introduced after the pilot and was intended to be similar to the approach taken in PR14. The results are summarised below:

Table 16: Stated WTP by Cumulative % of respondents

Stated WTP	HH (n=485)	NHH (n=196)
£0	19%	25%
£5	24%	30%
£10	43%	35%
£15	47%	37%
£20	65%	38%
£30	78%	39%
£50	89%	43%
£75	90%	45%
£100	91%	56%
Mean WTP (2-pack)[6]	£13	£149
Mean WTP (3-pack)	£15	£187

[6] Mean values exclude top 10% WTP values and respondents who gave responses that were inconsistent with their response to the choice scenarios

The responses were surprising. Many respondents gave a higher stated WTP value compared to the results from the discrete choice exercise and do not appear to have distinguished greatly between the 2=pack and 3-pack versions. Analysis by sub-groups did not suggest any particular pattern (ie there was not a clearly identifiable characteristic correlated with the size of the stated WTP value).

We conclude that respondents interpreted this question differently from what was intended. Although it was couched in the context of the specific package of improvements just presented to them, many appear to have interpreted it as a hypothetical maximum for improvements in general. This may have been accentuated by not presenting a closed scale (ie with an upper limit).

On this basis, we recommend the use of results from method 1 only as a basis for scaling the aggregated WTP results. Further information on the analysis of the packaging effect is given in the Annex to this report.

Next steps

The samples from each wave were designed to be as similar as possible to one another and in the case of HH respondents, weighted to the same demographic profile. Nevertheless, large differences were observed for many of the WTP values across the two waves, with a generally lower willingness to pay in wave 2.

We suggest that these results indicate that the WTP values are very sensitive to the way in which service improvements are presented, both in terms of the actual service levels offered and the range (in wave 1, the range of improvement was much larger than in wave 2, which may have had the effect of raising the value of intermediate improvements in the first wave and not in the second). This suggests that customers discern the value of different levels of service, but the absolute £ values are susceptible to context (the range of improvements within which they are introduced) and possibly the time of year in which the survey is conducted.

It would be appropriate for SST to use the results of both waves as sensitivity tests when using the figures for economic evaluation and to take an average of the two as a central value.

When specific service improvement plans are made by SST, there would be value in follow-up consultation work with customers. This could take the form of qualitative research, such as further discussions with consultation groups of customers, and quantitative work, exploring willingness to pay for specific packages of improvements.

Appendix

This Appendix summarise the service attributes and levels that were tested in the stated preference (SP) element of the research. The method was identical to the approach taken in Wave 1. The only changes were to some of the descriptions of attributes tested in wave 1, the omission of some others (eg traffic) and the introduction of a new set of attributes related to community services.

Figure A.1: Households attributes (italics indicate main Stafford / Cambridge differences)

	Attribute	Full definition of attributes				Current Position		Some improvement		Significant improvement	
		HH SSW	HH CC	HH Public		HH SSW	HH CC	HH SSW	HH CC	HH SSW	HH CC
WATER QUALITY	Taste and smell of your tap water	Your tap water tastes and smells different (e.g of chlorine) for a period of 3 days. (You do not know whether it is safe to drink or not until you contact your water company)		Households' water TASTES AND SMELLS DIFFERENT for a period of 3 days	This occurs….	once in every 60 years (once in a lifetime)	once in every 70 years (once in a lifetime)	once in every 75 years (once in a lifetime)	once in every 85 years (once in mine or my children's lifetime)	once in every 90 years (once in mine or my children's lifetime)	once every 100 years (Once in mine or my children's lifetime)
	Discolouration of your tap water	The tap water at your property is discoloured for 24 hours. Running the tap for a few minutes will not remove this discolouration. (You do not know whether it is safe to drink or not until you contact your water company)		Households experience DISCOLOURED TAP WATER for a day	This occurs….	once in every 15 years	once in every 45 years (twice in a lifetime)	once every 20 years	once in every 55 years (once in a lifetime)	once every 25 years	once in every 65 years (once in a lifetime)
	Water not safe to drink	Due to contamination, you are unable to drink the water at your property for a period of 3 weeks.		Due to contamination households are UNABLE TO DRINK THE WATER for a period of 3 weeks	This occurs….	once in 80 years (once in a lifetime)	once in 80 years (once in a lifetime)	once every 100 years (Once in mine or my children's lifetime)	once every 100 years (Once in mine or my children's lifetime)	once every 120 years (not in either mine or my children's lifetime)	once every 120 years (not in either mine or my children's lifetime)

	Attribute	Full definition of attributes				Current Position		Some improvement		Significant improvement	
		HH SSW	HH CC	HH Public		HH SSW	HH CC	HH SSW	HH CC	HH SSW	HH CC
	Lead pipes	Approximately every 3rd property in your water company's area is served by a lead pipe, most of these are pipes are owned by the customer. (A harmless additive is added to the water supply to significantly reduce any risk to health from lead pipes)		Households served by LEAD PIPES	Your water company…	maintains the current level (1 in 3 properties)	maintains the current level (1 in 3 properties)	reduces the number of properties with a lead pipe to 1 in every 4 properties	reduces the number of properties with a lead pipe to 1 in every 4 properties	reduces the number of properties with a lead pipe to 1 in every 5 properties	reduces the number of properties with a lead pipe to 1 in every 5 properties
	Water hardness	Hard water is proven to be good for your health as it has a high mineral content, but it can lead to limescale forming on taps and appliances. Softening the water using a device is an option, but this can also alter the taste of your water and water companies recommend customers still have an unsoftened supply for drinking and cooking.		Households have HARD WATER	Your water company…	does not do anything	does not do anything	supports 2,000 properties with installing a water softening device, supplying the salt needed to run it and an annual maintenance check	supports 650 properties with installing a water softening device, supplying the salt needed to run it and an annual maintenance check.	supports 4,000 properties with installing a water softening device, supplying the salt needed to run it and an annual maintenance check.	supports 1,350 properties with installing a water softening device, supplying the salt needed to run it and an annual maintenance check.
SECURITY AND RELIABILITY OF SUPPLY	Unexpected temporary loss of water supply	There is an unexpected problem with the network, such as a burst main, that means you are without water at your property for 1-5 hours / 6-12 hours. .		Households are WITHOUT WATER for 1-5 hours / 6-12 hours	This occurs….	once in every 70 years (once in a lifetime)	once in every 40 years (twice in a lifetime)	once every 90 years (once in mine or my children's lifetime)	once every 50 years (once in a lifetime)	once every 105 years (once in mine or my children's lifetime)	once every 60 years (once in a lifetime)
	Temporary use ban	There is a hosepipe ban in your area for 5 months from May to September. .		A TEMPORARY USE BAN for many households	This occurs….	once in every 40 years (twice in a lifetime)	once in every 20 years (4 times in a lifetime)	once in every 50 years (once in a lifetime)	once in every 25 years (3 times in a lifetime)	once in every 60 years (once in a lifetime)	once in every 30 years (twice in a lifetime)
	Low water pressure	The water at your property loses pressure a number of times throughout the day and night which reduces the water flow to a slow trickle.		LOW WATER PRESSURE at many households	This occurs….	once every 10 years	once every 11 years	once every 12 years	once every 13 years	once every 15 years	once every 15 years
	Flooding from a burst pipe	A pipe owned by your water company that supplies water to your property bursts and floods the ground floor of your property		FLOODING FROM A BURST PIPE for a number of households	This occurs….	once every 80 years (once in a lifetime)	once every 80 years (once in a lifetime)	once every 100 years (once in mine or my children's lifetime)	once every 100 years (once in mine or my children's lifetime)	once every 120 years (not in either mine or my children's lifetime)	once every 120 years (not in either mine or my children's lifetime)

	Attribute	Full definition of attributes				Current Position		Some improvement		Significant improvement	
		HH SSW	HH CC	HH Public		HH SSW	HH CC	HH SSW	HH CC	HH SSW	HH CC
ENVIRONMENT	Leakage levels	Around 24% /20% of the water supplied by your water company is lost through leaking pipes. The majority of this is from the water company's pipe network and the rest from the supply pipe that serve customers' properties (which is the responsibility of the property owner). As new leaks are always appearing they can't be reduced to 0.		WATER LEAKAGE from households or the water company's water pipes	The level of leakage is…	24%	20%	18%	15%	12%	10%
	Water metering	The vast majority of business customers and 36% / 70% household customers have a water meter fitted in this region which means they pay just for the water they use. The remaining properties pay a fixed amount per year depending on the rateable value of their property.		WATER METERS fitted in customers' homes	The proportion of properties (domestic) fitted with a water meter is ….	33%	70%	40%	80%	50%	95%
	Protecting wildlife habitats	All water companies have a legal duty to protect and improve areas for wildlife and plants in the places where they operate and ensure no land they operate on is permanently damaged. They currently protect and improve *99 / 17* hectares in the region – which is the same area as *138 /24* football pitches. This is less than *7% / 12%* of the area of land in the region that is known to need specific protection from the impacts of all human activity.		Protecting WILDLIFE HABITATS	Your water company…	meets their duties by continuing to protect and improve 99 hectares in the region (which is 138 football pitches)	meets their duties by continuing to protect and improve 17 hectares in the region (which is 24 football pitches)	protects and improves an additional 25 hectares (32 football pitches) for wildlife and plants	protects and improves an additional 4 hectares (5 football pitches) for wildlife and plants	protects and improves an additional 50 hectares (65 football pitches) for wildlife and plants	protects and improves an additional 9 hectares (12 football pitches) for wildlife and plants

Attribute	Full definition of attributes				Current Position		Some improvement		Significant improvement	
	HH SSW	HH CC	HH Public		HH SSW	HH CC	HH SSW	HH CC	HH SSW	HH CC
Managing impacts on rivers & streams	Around 50% of the water used in your region is drawn from the River Severn and the Blithefield reservoir which is fed by the river Blithe. Taking water can impact on rivers and streams and the land around them.	Your water company draws all the water needed by customers from underground water sources. This can impact on rivers and streams and the land around them	Managing impacts on RIVERS & STREAMS	Your water company…	in all cases meet their duties to protect the River Severn and Blithe	in all cases meet their duties to protect the rivers, streams and the land around them they affect.	in all cases meet their duties to protect the River Severn and Blithe and also work actively with farmers and other land owners to reduce harmful run-off by a quarter along these rivers and any other water sources used to supply customers in the region	In all cases meet their duties to protect the rivers, streams and the land around them and also work actively with farmers and other land owners to reduce harmful agricultural run-off by a quarter in areas in the region where they operate.	In all cases meet their duties to protect the River Severn and Blithe and also work actively with farmers and other land owners to reduce harmful run-off by half along these rivers and any other water sources used to supply customers in the region	In all cases meet their duties to protect the rivers, streams and the land around them and also work actively with farmers and other land owners to reduce harmful agricultural run-off by half in the areas in the region where they operate.
	(eg floodplains) and your water company has a legal duty to restore the river and the wildlife around it. Your water company also works actively with farmers/big business to protect water taken by your water company from any harmful run-off (e.g. pesticides and fertilisers being picked up by water into the rivers).									
Use of renewable energy	To pump water to customers' homes your water company uses a lot of electricity. Currently, 11% of the electricity used by your water company comes from renewable sources - eg solar panels, wind power Note - 1% of its electricity comes from renewable energy sources that the company owns and 10% via the energy provider they are with		Use of RENEWABLE ENERGY	Your water company…	maintains their current level of 11% from renewable sources	maintains their current level of 11% from renewable sources	ensures at least 14% comes from renewable sources	ensures at least 14% comes from renewable sources	ensures at least 18% comes from renewable sources	ensures at least 18% comes from renewable sources

	Attribute	Full definition of attributes				Current Position		Some improvement		Significant improvement	
		HH SSW	HH CC	HH Public		HH SSW	HH CC	HH SSW	HH CC	HH SSW	HH CC
COMMUNITY	Investing in community projects	Your water company currently provides paid time off for all employees so they can give their time for free to support a range of community projects – such as painting buildings, helping to create green spaces, or charity volunteering days. Your water company could go further and employ a team of people whose job role is to support community projects on a daily basis and provide additional support for those who are in most need of extra help.		Investing in community projects	Your water company provides…	325 days a year of support to community projects	200 days a year of support to community projects	400 person-days a year of support to community projects	225 person-days a year of support to community projects	475 person-days a year of support to community projects	300 person-days a year of support to community projects
	Educating future generations	Your water company currently employs one education officer who goes in to schools (primary and secondary) in your area to help educate young people on how to use water more responsibly at home to help ensure there is always enough water to go around for everyone in the future. Your water company could employ more staff to ensure more people are educated on a more regular basis to help ensure attitudes towards water use change and help to reduce consumption		Educating future generations	Your water company provides…	a team that can visit 1 in 5 schools/groups in your region every year. There are 200 schools and groups the region	a team that can visit 1 in 5 schools/groups in your region every year. There are 100 schools and groups in the region	a team that can visit 1 in 4 schools/groups in your region every year	a team that can visit 1 in 4 schools/groups in your region every year	a team that can visit 1 in 3 schools/groups in your region every year	a team that can visit 1 in 3 schools/groups in your region every year
	Supporting customers experiencing difficult situations	Your water company currently provides extra support with water related services for 11,000 customers who have some form of disability (permanent or temporary) and/or are struggling with paying their bills. Examples of support include home visits to fill out forms, or advise on where they can get more help from charities, offering bill payment advice and options, to providing bottled water in the event of a supply interruption. Your water company could go further and pro-actively identify and support even more customers who are experiencing genuine hardship.		Supporting customers experiencing difficult situations	Your water company…	continues to provide extra support for 11,000 customers - about 2% of SSW customers	continues to provide extra support for 750 customers - about 0.5% of CW customers	provides extra support for 14,000 customers - about 2.5% of SSW customers	provides extra support for 925 customers - about 0.75% of CW customers	provides extra support for 16,500 customers - about 3% of SSW customers	provides extra support for 1,100 customers - about 1% of CW customers

Annex: Further information on the package exercise

The blocks covered in the Discrete Choice Exercise (Quality, Security, Environment and Community) determined what was shown to respondents in the 'Package' exercise. In the DCE, all respondents would have seen one of the first three blocks and then 'Community'. In the Package exercise, they would have then been randomly assigned to a two-tier package or a three tier package

A respondent who was shown the two-tier package saw the two blocks they had seen in the DCE; a respondent who was shown the three-tier package had a third block randomly assigned to the package. Finally, a single bill change level was assigned randomly from the set of bill changes included in the DCE design (eg £10, £20, £30, £50 for HH).

The random allocations resulted in the following combinations

Table A.1: Allocation of respondents in the Package exercise

	QUALITY		✓												✓				✓								
	SECURITY						✓								✓								✓				
	ENVIRONMENT									✓								✓					✓				
	COMMUNITY		✓				✓			✓				✓				✓				✓					
Price increase	HH	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50		
	NHH	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35		
South Staffordshire	HH	17	15	24	16	28	40	27	35	26	14	15	15	24	24	30	21	16	11	14	12	27	20	21	26		
	NHH	5	7	4	6	10	8	14	6	5	7	12	9	9	11	7	9	2	3	3	3	10	20	16	7		
Cambridge	HH	9	10	6	10	7	10	9	6	9	7	9	11	5	6	9	7	4	4	5	4	7	8	6	9		
	NHH	1	1	5	1	3	1	1	4	2	5	4	1	2	4	2	2	2	1	0	1	5	1	4	0		
	Total	137				210				153				173				87				188					

This shows that all combinations were covered, but the spread was not even, due to the random allocation. This could have contributed to the inconsistency of some of the results, notably NHH, as shown by block allocation are shown below.

Table A.2: Percentage take up for 2-package and 3-package improvements by Block

	QUALITY		✓												✓				✓								
	SECURITY						✓								✓								✓				
	ENVIRONMENT									✓								✓					✓				
	COMMUNITY		✓				✓			✓				✓				✓				✓					
Price increase	HH	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50		
	NHH	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35		
South Staffordshire	HH	56%	36%	25%	16%	37%	23%	27%	31%	41%	62%	54%	29%	48%	32%	33%	30%	56%	31%	29%	29%	34%	41%	45%	26%		
	NHH	29%	74%	0%	39%	26%	0%	29%	16%	42%	53%	31%	4%	46%	38%	52%	19%	38%	0%	33%	0%	59%	51%	38%	6%		
Cambridge	HH	56%	20%	17%	10%	29%	20%	22%	0%	22%	43%	22%	27%	20%	33%	22%	43%	75%	50%	60%	0%	43%	25%	17%	11%		
	NHH	0%	100%	20%	0%	67%	0%	0%	0%	100%	20%	50%	0%	50%	25%	100%	50%	0%	100%	-	0%	60%	0%	25%	-		
	HH	56%	30%	23%	14%	35%	22%	26%	27%	36%	55%	42%	28%	43%	32%	31%	33%	60%	36%	37%	22%	36%	37%	39%	22%		
	NHH	24%	78%	12%	33%	36%	0%	27%	10%	59%	39%	36%	4%	47%	34%	63%	25%	20%	24%	33%	0%	59%	49%	36%	11%		
	Total n	137				210				153				173				87				188					

As described in the report, these results were aggregated into overall figures for two-tier and three-tier packages, irrespective of block content. The reason for this is that at the block level there are a number of inconsistencies in the percentage take up for each price point, particularly for NHH, suggesting that the results are not reliable at this level.

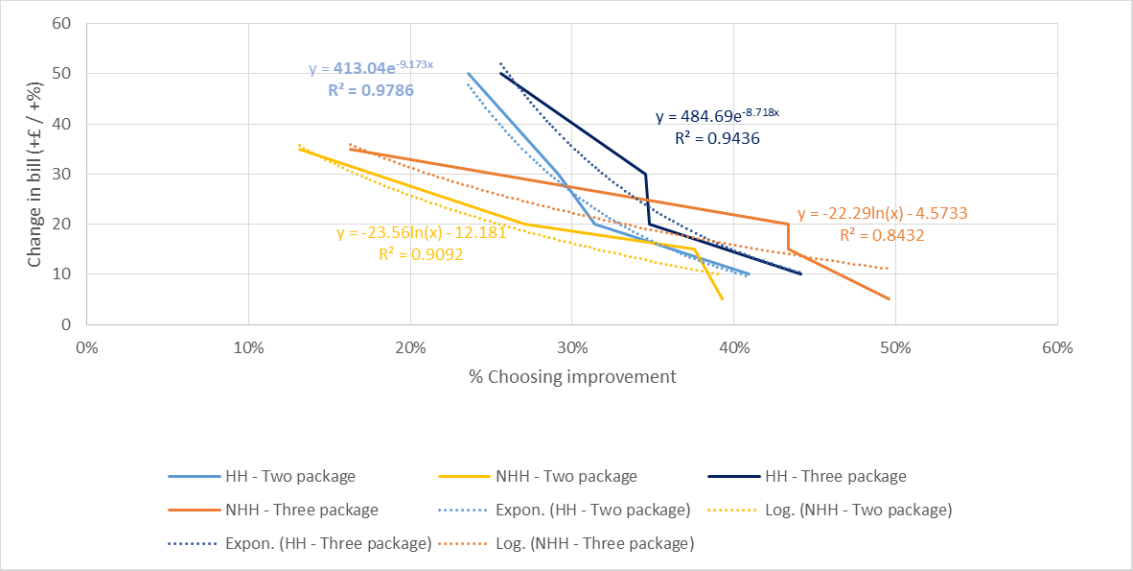
The aggregation was based on the combined numbers of respondents, so did not adjust for the uneven allocation across blocks, which would have been an alternative approach. The table below shows how the aggregated percentages would change if equal weight was given to each block, suggesting that the impact on HH would not be great, but for NHH, inconsistencies in the order of percentage take up would have been amplified if equal weight had been given to each block.

Table A.3: Aggregated Percentages, Sample Size v Equal Weight Calculations

		Aggregated (on sample sizes)								Aggregated (equal weight to each block)							
		Two-part packages				Three-part packages				Two-part packages				Three-part packages			
	HH Price	10	20	30	50	10	20	30	50	10	20	30	50	10	20	30	50
	NHH Price	5	15	20	35	5	15	20	35	5	15	20	35	5	15	20	35
South Staffordshire	HH	43%	34%	32%	27%	44%	35%	36%	28%	45%	40%	35%	25%	46%	35%	36%	28%
	NHH	31%	40%	26%	17%	51%	42%	41%	11%	32%	43%	20%	20%	48%	30%	41%	8%
Cambridge	HH	36%	26%	21%	15%	44%	33%	30%	20%	35%	28%	20%	12%	46%	36%	33%	18%
	NHH	67%	29%	30%	0%	44%	33%	50%	33%	56%	40%	23%	0%	37%	42%	63%	25%
	HH	41%	31%	29%	24%	44%	35%	35%	26%	42%	37%	31%	22%	46%	35%	35%	25%
	NHH	39%	38%	27%	13%	50%	40%	43%	16%	38%	42%	21%	15%	45%	33%	41%	8%

As indicated in the report, simple trend lines were fitted to the aggregated data points to infer a value at the 50% take up point of indifference. Exponential transformations of the bill changes gave the best fit for HH, Log transformations for NHH:

Figure A.1: Price sensitivity curves



The WTP values inferred from this analysis were then compared with the average WTP derived from the DCE, as summarised in the table below.

Table A.3: Mean DCE WTP values by Block

	QUALITY	✓			✓	✓		Mean Values	
	SECURITY		✓		✓		✓		
	ENVIRONMENT			✓		✓	✓	Two tier	Three Tier
	COMMUNITY	✓	✓	✓	✓	✓	✓		
South Staffordshire	HH	£13.00	£4.44	£0.64	£17.22	£13.42	£4.86	£6.03	£11.83
	NHH	4%	1%	2%	5%	6%	3%	3%	5%
Cambridge	HH	£11.10	£5.90	£0.59	£16.87	£11.55	£6.35	£5.86	£11.59
	NHH	23%	2%	18%	24%	40%	18%	14%	28%
HH		£11.63	£5.49	£0.60	£16.97	£12.07	£5.93	£5.91	£11.66
NHH		18.9%	1.6%	14.0%	19.7%	32.1%	14.7%	11.5%	22.2%

The mean values for the two-tier and three tier packages were calculated across the blocks and these were used to compare against the results from the package exercise, as

summarised in Table 8 of the report. Use of the mean is a major simplifying step, as it ignores the substantial variation in WTP values across the blocks. However, the corresponding results from the package question do not show the same range of variation by block, as summarised below:

Table A.4: Average Percentage Take Up by Block

	QUALITY	✓			✓	✓	
	SECURITY		✓		✓		✓
	ENVIRONMENT			✓		✓	✓
	COMMUNITY	✓	✓	✓	✓	✓	✓
South Staffordshire	**HH**	33%	29%	46%	36%	36%	37%
	NHH	36%	18%	33%	39%	18%	39%
Cambridge	**HH**	26%	18%	29%	30%	46%	24%
	NHH	30%	17%	43%	56%	33%	28%
HH		31%	27%	40%	35%	39%	33%
NHH		37%	18%	34%	42%	19%	39%

For this reason we carried out the analysis at the most aggregate level, using the mean DCE WTP values across all two-tier and three-tier blocks as the basis of comparison.

As suggested in the peer review[7], the Turnbull method could be a suitable alternative to calculating the WTP for the package question. The Table below shows the results of this analysis. For HH, the effect is to produce a factor greater than 1.0, which runs counter to expectations for package scaling parameter. For NHH, the result is more reasonable, the scaling being less severe and stronger for the three-tier package. Nevertheless, because of the inconsistent results for HH, this approach has not been taken forward.

Table A.5: Results based on the Turnbull method

Reported results	Package question		Results from Discrete Choice Exercises		Implied scaling factor	
	2-pack	3-pack	2-pack	3-pack	2-pack	3-pack
HH	£4.21	£6.23	£5.91	£11.66	71%	53%
NHH	4.40%	8.60%	11.50%	22.20%	39%	39%

Turnbull (Lower)	Package question		Results from Discrete Choice Exercises		Implied scaling factor	
	2-pack	3-pack	2-pack	3-pack	2-pack	3-pack
HH	£8.41	£14.87	£5.91	£11.66	142%	127%
NHH	5.24%	9.04%	11.50%	22.20%	46%	41%

[7] Review of Impact Utilities (2018) 'Willingness to Pay Research to Support PR19 – Retest + Focus on Retail Attributes', A Note by Dr Paul Metcalfe, PJM economics, June 2018