Updating the National Water Environment Benefit Survey values: summary of the peer review

Policy context

River basin management planning means society needs to choose measures that can be taken to improve water bodies towards Good Status and which are not disproportionately costly. This involves three steps. The first is to identify the most cost-effective measures that are likely to have benefits that outweigh their costs. To do this we need a set of average benefit values to help us identify options that are a) clearly cost-beneficial b) clearly not cost-beneficial and c) where costs and benefits are sufficiently close to merit further investigation. The second part of the process is to decide whether the cost-beneficial measures are affordable or not – a political decision made by Defra ministers. Those that are affordable then need, in the third step, to be prioritised according to their costs, benefits and other factors.

Background

In spring 2012 we commissioned independent consultant, Paul Metcalfe, to update the benefit values produced for the first cycle of river basin management planning – the National Water Environment Benefit Survey (NWEBS) values[1] – to take account of any changes in population, price year and any recent developments in stated preference valuation in order to give the most robust estimate of value. See the tables in the Annex for these updated values at the WFD 100 management catchment scale. The NWEBS provided values for recreation, amenity and non-use benefits from improving the water environment. The update by Paul Metcalfe resulted in an increase in the benefit values, primarily due to the way the results from the original survey were used to produce the benefits range.

The original survey used three different methods for eliciting people's willingness to pay value: two contingent valuation (CV) methods – 'payment card' (PC) and 'dichotomous choice' (DC) – and the discrete choice experiment (DCE) method. In the first river basin planning cycle the values were weighted heavily towards the results of the payment card method. The

updated benefit range now weights the values more towards the dichotomous choice results. This is because, following recent research[2], DC methods are preferred by leading authorities in the field.

Looking across the range of these three sets of results, the dichotomous choice contingent valuation (DCCV) lies between the payment card contingent valuation (PCCV) at the lower end and the DCE at the top end of the range. This means that values based on PCCV and DCCV will still be towards the lower end of the range.

Results of the peer review

Earlier this year we commissioned three independent peer reviewers[3] to comment on the update of NWEBS. One of the reviewers stated that the current approach demonstrates 'a defensible trade-off between scientific uncertainty and the need for a practical tool to apply the results to evaluate policies', whereas the other two were more critical. The main points raised by the reviewers were as follows:

1. One reviewer argued that it is not valid to combine the different willingness to pay (WTP) values and recommended instead that one or other of the values should be chosen, and that the choice should be based on which results had the best statistical fit.

2. One reviewer argued that, if there is no strong technical reason for weighting the values more heavily towards the PCCV or the DCCV values, we should use the full range, that is, the lower value is the PCCV and the higher value is the DCCV.

3. Previous research has found that, in an experiment, values obtained using the PCCV method were closer to 'actual' willingness to pay, and so this could be a reason to use the PCCV results. However, other research has shown that PCCV methods can underestimate

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[1] Defra Collaborative Research Programme 2007 Project 4c.

[2] UKWIR (2011), Carrying Out Willingness to Pay Surveys, Report Ref. 11-RG-07-22/94186

[3] Professor Nick Hanley of the University of Stirling, Professor Ståle Navrud of the Norwegian University of Life Sciences and Robin Smale of Vivid Economics

benefits. See Box 1 at the end of this document for a summary of the limitations of the two approaches.

4. NWEBS values can be considered lower-bound estimates because they are assumed to include the potentially important benefits from improving wetlands and low flow. Because wetlands are closely linked and wholly dependent on their associated rivers, lakes and groundwaters, we assume that respondents valued improvements to wetlands in their WTP estimates even though this was not explicitly stated in the survey. Similarly for low flow alleviation, the survey described more natural flow levels only in the text and not in pictures, and so may have only partially captured people's value of improving flow levels. Therefore we would not in an appraisal add separate values for improving wetlands or low flows onto the NWEBS values.

5. The reviewers suggested future research that could improve the robustness of the values in the longer term, for example, new primary research to provide updated benefit values which better account for local differences in the water environment.

Conclusions and recommendations

The literature suggests that the DCCV approach may result in an overestimate of willingness to pay (WTP) and that the PCCV approach may underestimate it. So choosing one of these estimates over the other means we would be either under- or overestimating WTP. Payment card estimates are known to be statistically more precise than dichotomous choice estimates and so choosing the statistically more precise estimate implies using the payment card method, despite the fact that it is widely understood to understate true WTP.

Whether one estimate is closer to 'the truth' than another is only partly shown by statistical precision, cognitive effects are also important. The difference between the PC and DC estimates was statistically significant, which means that the estimates were almost certainly not of the same measure. This confirms that there are non-statistical cognitive effects causing a difference between PC and DC estimates.

We therefore disagree that we should select either the payment card or dichotomous choice estimates. Instead our approach to addressing these issues is to use a proportion of each of these estimates to create a practically useful best estimate and range, thereby reducing the biases from the two approaches.

In principle, the approach recommended in point 2 above is sensible. However, the range that would result from this approach is too wide to be useful in practice for policy appraisal. The need for a narrower range can be accommodated by reducing the proportion of the payment card estimate in the range –

given its theoretical shortcomings which have caused it to lose favour among practitioners.

In conclusion, the updated NWEBS values provide the best and most practical way to use the currently available evidence on monetary values for non-market benefits for implementation of the Water Framework Directive.

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Box 1: Summary of the strengths and weaknesses of the payment card and dichotomous choice approaches

- One aspect of the difference may lie in how the methods deal with individuals' certainty over their bids. One study shows that respondents are less certain about their bids under dichotomous choice (DC) than payment card (PC) due to the nature of the methods (Ready et al. 2001).

- In terms of mental (cognitive) biases, DC focuses on money being presented as a 'take it or leave it' sum, concentrating the respondents' minds on the money more than the other characteristics – this is known as the focusing illusion (Schkade and Kahneman 1998, Kahneman et al. 2006). Also, in particular comparison with PC, the value is presented as a binary decision each time, that is, respondents are faced with 'take it or leave it' choices. This has the benefit of allowing respondents to focus each time on whether they think the decision is 'worth it', but can end up evaluating responses against their first offer – the anchoring effect. It has been shown that the anchoring effect can be very strong and so best practice should be followed when using DC, for example, ensuring that the DC elicitation should happen before other values are shown or sought, otherwise the DC decisions will be anchored to these earlier values.

- Another study considers the ways in which strategic responses from respondents may mean that PC gives lower WTPs than DC (Carson and Groves 2007). In particular, PC has more of a structural incentive for under-bidding since the flexible nature of the bidding may encourage respondents to state a value they believe would be the minimum needed to achieve the objective rather than their own valuation of the objective. That is, they may have a higher valuation of the objective, but reason they could under-bid and achieve the objective but have to pay less. This is known as the 'fair amount', and is not necessarily a true reflection of the respondent's WTP. This problem can arise because, although plausibility is necessary for the valuation exercise to be robust, it may also encourage respondents to strategically distort the outcome to achieve their desired goal at lowest cost to themselves. Similarly, PC may encourage more zero bids if respondents do not want the policy to go ahead, which again causes PC estimates to be biased downwards.

References

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Annex – Updated NWEBS values for Surface Waters

Rivers

National Water Environment Benefits Survey (NWEBS): Annual per km values, £000s, 2012 prices, for rivers.										
Catchment		**Bad to Poor**			**Poor to Mod**			**Mod to Good**		
	Length (km)	Low	Central	High	Low	Central	High	Low	Central	High
Adur and Ouse	326	19.2	23.3	27.5	22.4	27.2	32.1	26.2	31.9	37.6
Aire and Calder	956	17.2	21.0	24.8	20.0	24.4	28.8	23.3	28.5	33.6
Alt or Crossens	148	19.7	24.1	28.4	23.1	28.1	33.2	27.1	33.0	39.0
Arun and Western Streams	431	20.6	25.1	29.6	24.1	29.3	34.6	28.3	34.5	40.7
Bristol Avon and North Somerset Streams	1080	14.4	17.5	20.7	16.5	20.2	23.8	19.2	23.4	27.6
Broadland Rivers	869	13.0	15.9	18.7	14.9	18.2	21.4	17.2	21.0	24.8
Cam and Ely Ouse (including South Level)	964	13.0	15.9	18.8	14.9	18.2	21.5	17.3	21.0	24.8
Cherwell	381	13.6	16.6	19.5	15.6	19.0	22.4	18.1	22.1	26.0
Colne	284	40.0	48.7	57.4	47.7	58.0	68.3	56.7	69.1	81.4
Combined Essex	1018	19.1	23.3	27.4	22.3	27.1	32.0	26.1	31.8	37.5
Conwy and Clwyd	438	11.8	14.3	16.9	13.4	16.3	19.3	15.4	18.8	22.2
Cotswolds	629	12.3	15.0	17.7	14.1	17.1	20.2	16.2	19.7	23.2
Cuckmere and Pevensey Levels	169	15.1	18.4	21.6	17.4	21.2	25.0	20.2	24.6	29.1
Darent	59	42.2	51.4	60.5	50.3	61.2	72.2	59.9	73.0	86.0
Derbyshire Derwent	374	17.8	21.7	25.6	20.7	25.3	29.8	24.2	29.6	34.9
Derwent (Humber)	1063	11.2	13.7	16.1	12.7	15.5	18.3	14.6	17.8	21.0
Derwent (NW)	493	9.3	11.3	13.4	10.4	12.6	14.9	11.8	14.3	16.9
Don and Rother	757	17.4	21.2	25.0	20.2	24.6	29.1	23.6	28.8	34.0
Dorset	890	12.0	14.6	17.3	13.7	16.7	19.7	15.8	19.2	22.7
Douglas	220	21.7	26.4	31.2	25.4	30.9	36.5	29.9	36.4	43.0
Dove	372	17.1	20.9	24.6	19.9	24.2	28.6	23.2	28.3	33.4
East Devon	1047	10.7	13.1	15.4	12.1	14.8	17.4	13.9	16.9	19.9
East Hampshire	166	16.7	20.3	23.9	19.3	23.5	27.7	22.6	27.5	32.4
East Suffolk	472	13.1	15.9	18.8	15.0	18.3	21.5	17.3	21.1	24.9
Eden and Esk	1482	8.9	10.9	12.8	9.9	12.1	14.3	11.2	13.7	16.2
Esk and Coast	291	10.4	12.7	15.0	11.7	14.3	16.9	13.4	16.3	19.3
Hampshire Avon	566	13.5	16.5	19.5	15.5	18.9	22.3	18.0	22.0	25.9
Hull and East Riding	559	12.2	14.9	17.6	14.0	17.0	20.1	16.1	19.6	23.2

National Water Environment Benefits Survey (NWEBS): Annual per km values, £000s, 2012 prices, for rivers. *Cont.*									
Idle and Torne	528	15.6	19.0	22.5	18.0	22.0	26.0	21.0	25.6	30.3
Irwell	351	20.9	25.5	30.1	24.5	29.8	35.2	28.8	35.1	41.4
Isle of Wight	139	15.8	19.2	22.6	18.2	22.2	26.2	21.2	25.9	30.5
Kennet and Pang	370	14.4	17.5	20.6	16.6	20.1	23.7	19.2	23.4	27.6
Kent or Leven	500	9.7	11.8	14.0	10.9	13.3	15.7	12.4	15.1	17.8
Loddon	211	20.7	25.2	29.7	24.2	29.5	34.7	28.5	34.7	40.8
London	316	43.0	52.2	61.5	51.2	62.3	73.4	61.0	74.2	87.5
Loughor to Taf	988	10.5	12.8	15.1	11.9	14.5	17.1	13.6	16.6	19.6
Louth Grimsby and Ancholme	333	12.8	15.6	18.5	14.7	17.9	21.1	17.0	20.7	24.4
Lower Trent and Erewash	841	15.5	18.9	22.3	17.9	21.9	25.8	20.9	25.5	30.1
Lune	613	10.4	12.7	15.0	11.7	14.3	16.9	13.4	16.3	19.3
Maidenhead to Sunbury	181	38.5	46.9	55.2	45.8	55.8	65.7	54.5	66.4	78.2
Medway	554	28.3	34.4	40.5	33.4	40.6	47.9	39.5	48.1	56.7
Mersey Estuary	257	21.4	26.1	30.8	25.1	30.6	36.1	29.5	36.0	42.5
Middle Dee	266	14.9	18.2	21.5	17.2	21.0	24.8	20.0	24.4	28.8
Mole	202	37.5	45.7	53.8	44.6	54.3	64.0	53.1	64.6	76.1
Nene	618	14.0	17.0	20.1	16.1	19.6	23.1	18.6	22.7	26.8
New Forest	234	16.3	19.9	23.4	18.9	23.0	27.1	22.0	26.8	31.6
North Cornwall, Seaton, Looe and Fowey	598	10.4	12.7	14.9	11.7	14.3	16.8	13.4	16.3	19.2
North Devon	997	9.8	12.0	14.2	11.1	13.5	15.9	12.6	15.4	18.1
North Kent	20	23.6	28.8	33.9	27.8	33.8	39.8	32.7	39.9	47.0
North Norfolk	83	11.6	14.1	16.6	13.2	16.0	18.9	15.1	18.4	21.7
North West Norfolk	219	11.4	13.8	16.3	12.9	15.7	18.5	14.8	18.0	21.3
North West Wales	1133	9.3	11.3	13.4	10.4	12.7	15.0	11.8	14.4	17.0
Northumberland Rivers	901	11.6	14.1	16.7	13.2	16.1	19.0	15.1	18.5	21.8
Ogmore to Tawe	541	13.4	16.4	19.3	15.4	18.8	22.2	17.8	21.8	25.7
Old Bedford including the Middle Level	138	12.7	15.5	18.3	14.5	17.7	20.9	16.8	20.5	24.1
Ribble	703	16.3	19.9	23.5	18.9	23.0	27.2	22.0	26.9	31.7
Roding, Beam and Ingrebourne	162	39.9	48.6	57.2	47.5	57.8	68.1	56.5	68.8	81.1
Rother	362	16.3	19.8	23.4	18.8	22.9	27.0	22.0	26.8	31.6
Severn Uplands	923	9.6	11.7	13.7	10.7	13.0	15.4	12.2	14.8	17.5
Severn Vale	550	12.8	15.6	18.4	14.7	17.9	21.1	16.9	20.7	24.4
Shropshire Middle Severn	323	13.4	16.3	19.2	15.3	18.7	22.0	17.7	21.6	25.5

National Water Environment Benefits Survey (NWEBS): Annual per km values, £000s, 2012 prices, for rivers. *Cont.*										
Soar	549	16.6	20.2	23.9	19.2	23.5	27.7	22.5	27.4	32.4
South Devon	687	11.3	13.8	16.3	12.9	15.7	18.5	14.8	18.0	21.3
South East Valleys	500	14.4	17.5	20.7	16.5	20.2	23.8	19.2	23.4	27.6
South Essex	47	39.5	48.1	56.6	47.0	57.2	67.4	56.0	68.1	80.3
South West Lakes	439	9.5	11.6	13.6	10.6	12.9	15.3	12.1	14.7	17.4
South West Wales	1074	9.2	11.2	13.2	10.3	12.5	14.8	11.6	14.2	16.8
South and West Somerset	1113	12.0	14.7	17.3	13.7	16.7	19.7	15.8	19.3	22.7
Staffordshire Trent Valley	425	17.6	21.5	25.4	20.5	25.0	29.5	24.0	29.2	34.5
Stour	215	19.9	24.3	28.6	23.3	28.3	33.4	27.3	33.3	39.2
Swale, Ure, Nidd and Upper Ouse	1982	11.0	13.4	15.9	12.5	15.2	18.0	14.3	17.5	20.6
Tamar	801	10.6	13.0	15.3	12.0	14.6	17.3	13.7	16.7	19.7
Tame Anker and Mease	575	20.6	25.1	29.6	24.1	29.3	34.6	28.3	34.5	40.7
Tees	994	11.8	14.5	17.1	13.5	16.4	19.4	15.5	18.9	22.4
Teme	546	11.8	14.4	17.0	13.5	16.4	19.4	15.5	18.9	22.3
Test and Itchen	414	16.4	20.0	23.5	19.0	23.1	27.3	22.2	27.0	31.8
Thame and South Chilterns	565	17.6	21.4	25.2	20.4	24.8	29.3	23.9	29.1	34.2
Tidal Dee	40	16.0	19.5	23.0	18.5	22.5	26.6	21.6	26.3	31.0
Till	219	8.8	10.7	12.7	9.8	11.9	14.1	11.1	13.5	15.9
Tweed	5	8.6	10.5	12.3	9.5	11.6	13.7	10.7	13.1	15.4
Tyne	1005	11.2	13.6	16.1	12.7	15.5	18.2	14.5	17.7	20.9
Upper Dee	447	11.0	13.5	15.9	12.5	15.2	18.0	14.3	17.5	20.6
Upper Lee	324	32.2	39.1	46.1	38.1	46.4	54.7	45.2	55.0	64.9
Upper Mersey	582	20.4	24.8	29.3	23.8	29.0	34.3	28.0	34.1	40.3
Upper and Bedford Ouse	990	15.9	19.3	22.8	18.3	22.4	26.4	21.4	26.1	30.7
Usk	508	12.9	15.7	18.6	14.8	18.0	21.2	17.1	20.8	24.6
Vale of White Horse	290	13.0	15.8	18.6	14.8	18.0	21.3	17.1	20.9	24.6
Warwickshire Avon	1008	16.6	20.2	23.8	19.2	23.4	27.6	22.4	27.4	32.3
Waver or Wampool	175	9.1	11.1	13.2	10.2	12.4	14.7	11.6	14.1	16.6
Wear	594	14.6	17.8	21.0	16.8	20.5	24.2	19.5	23.8	28.2
Weaver and Gowy	749	18.2	22.2	26.2	21.2	25.8	30.5	24.8	30.2	35.7
Welland	563	12.8	15.6	18.4	14.7	17.9	21.1	16.9	20.6	24.4
West Cornwall and the Fal	737	10.7	13.1	15.5	12.1	14.8	17.5	13.9	17.0	20.0
Wey	330	29.8	36.3	42.8	35.3	42.9	50.6	41.8	50.9	60.0

Wharfe and Lower Ouse	618	13.6	16.6	19.6	15.6	19.0	22.5	18.1	22.1	26.0
Witham	1033	11.7	14.3	16.9	13.3	16.3	19.2	15.4	18.7	22.1
Worcestershire Middle Severn	518	17.0	20.7	24.4	19.7	24.1	28.4	23.1	28.1	33.2
Wye	1556	10.3	12.5	14.8	11.6	14.1	16.7	13.2	16.1	19.0
Wyre	230	14.7	17.9	21.1	16.9	20.6	24.3	19.6	24.0	28.3
England & Wales		14.3	**17.4**	20.5	16.4	**20.0**	23.6	19.1	**23.2**	27.4

Coastal, Lake or Transitional

National Water Environment Benefits Survey (NWEBS): Annual per km2 values, £000s, 2012 prices, for coastal, lakes and transitional waters									
	Bad to Poor			**Poor to Mod**			**Mod to Good**		
	Low	Central	High	Low	Central	High	Low	Central	High
Anglian	4.7	5.7	6.7	5.3	6.5	7.7	6.2	7.5	8.9
Dee	4.7	5.8	6.8	5.4	6.6	7.8	6.3	7.6	9.0
Humber	5.7	7.0	8.2	6.6	8.1	9.5	7.7	9.4	11.1
North West	6.2	7.5	8.9	7.2	8.7	10.3	8.4	10.2	12.0
Northumbria	4.7	5.7	6.8	5.4	6.5	7.7	6.2	7.6	8.9
Severn	4.7	5.8	6.8	5.4	6.6	7.8	6.3	7.6	9.0
Solway Tweed	3.3	4.1	4.8	3.7	4.5	5.4	4.2	5.1	6.1
South East	5.7	6.9	8.1	6.5	8.0	9.4	7.6	9.3	10.9
South West	4.2	5.1	6.0	4.7	5.7	6.8	5.4	6.6	7.8
Thames	8.5	10.3	12.1	9.9	12.1	14.2	11.7	14.3	16.8
Western Wales	3.7	4.5	5.3	4.1	5.0	5.9	4.7	5.7	6.8
E&W	5.2	**6.4**	7.5	6.0	**7.4**	8.7	7.0	**8.5**	10.1