The 4th Periodic Review of the UK Water Industry: A large-scale practical application of environmental cost-benefit analysis

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Abstract
The Environment Agency, the main environmental regulator for England and Wales, conducted an in-depth cost-benefit analysis of nearly 500 environmental water quality and water resource improvement schemes. The purpose was to inform the Agency's advice to government ministers in preparation for the 4th Periodic Review of the UK water industry, which sets industry standards and prices for a five-year period (2005-2010). We assessed the benefits of the schemes using a common and consistent methodology, based on applied benefits transfer. The water companies provided the costs of schemes. The benefits and costs were then discounted and made comparable by economists at the Environment Agency and Ofwat (Office of Water Services), the water industry regulator.

This paper describes what is thought to be the largest practical application of environmental cost-benefit analysis in the UK to date. As a result of our assessments, the Environment Agency proposed for implementation water quality and water resource improvement schemes that would yield environmental benefits in excess of £1bn. This would achieve in the region of 80% of the total benefits at 37% of the total costs of that part of the Agency's environment programme where ministers indicated that 'choices will be made'. We further proposed that schemes costing more than £1bn in total should be deferred. The cost benefit process therefore considerably enhanced the value for money of the Agency's proposed programme.

Keywords
Cost-benefit analysis, benefits transfer, water, discounting, Water Framework Directive,

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1 Background

As part of the 4th periodic review of the UK water industry (PR04), the Office of Water Services (Ofwat) will determine the programme of water infrastructure and environmental improvements to be funded in the period 2005-2010 and the water bill price rises that will be allowed to fund these. The Environment Agency (EA), English Nature and the Countryside Council for Wales advise the Secretary of State for the Department for Environment, Food and Rural Affairs (Defra) in England and the Minister for Environment, Planning and Countryside in the Welsh Assembly Government (WAG) on the environmental requirements for the review.

To inform this process, the EA drew up a list of around 6,000 potential water quality and water resource improvement assets (the National Environment Programme). In January 2003, Ministers specified the following types of schemes relating to the types of decisions that had to be made and the extent of discretion that Ministers had on them (Defra, 2003):

- 'Essential and clear' (Defra) or 'established requirements' (WAG)
- 'Essential when clarified' (Defra) or 'expected requirements' (WAG)
- 'Choices will be made' (Defra) or 'subject to policy decisions' (WAG)

Table 1 outlines the types of economic appraisal techniques we have carried out for different types of scheme, in accordance with the principles set out in Defra's Initial Guidance. Further details can be found in Environment Agency (2003a).

Table 1: Economic appraisal techniques for types of schemes

Type of Scheme set out in DEFRA/WAG Guidance	Economic appraisal technique applied		
	Cost-effectiveness	Non-compliance risk assessment	Assess costs and environmental benefits
'Essential and clear' (Defra) or 'established requirements' (WAG)	X		
'Essential when clarified' (Defra) or 'expected requirements' (WAG)	X	X	
'Choices will be made' (Defra) or 'subject to policy decisions' (WAG)	X		X

We have assessed the *overall* benefits of all schemes in the programme (Environment Agency, 2003b). Here, we present the findings of the EA's detailed assessment of the costs and benefits of the 'choices will be made' (CWBM) schemes, for which ranking is based on both their benefit:cost ratios and other non-monetised factors, which was submitted to Defra as part of the EA's overall advice to Ministers in November, 2003.

2 Methodology for assessing the costs and benefits

The EA prepared detailed guidance to enable the benefits of CWBM schemes to be assessed consistently across England and Wales (Environment Agency, 2003c). This Benefits Assessment Guidance (BAG) was developed for use by both Agency and Water Company planners, most of whom were non-economists. It was used to assess the environmental benefits and costs of schemes impacting upon groundwater, river ecosystems, freshwater fisheries, habitats, bathing waters, shell fish waters, low flow alleviation in rivers, and local priority schemes (e.g. eutrophication). The benefits assessment process involved the following steps:

- Identification of the environmental driver the scheme related to and estimation of the environmental outcome of a water quality or water resource improvement scheme (e.g. km of water body improved by a RE level [1]).

[1] The RE (river ecosystem) classification is used by the EA to assess the chemical quality of water bodies and has five categories, from RE1 (very high) to RE5 (very poor).

- Identification of the relevant benefit categories associated with the improvement (recreation, angling, non-use, etc) and the type of water body affected.
- Qualitative description of impacts and assessment of whether they were likely to be significant enough to affect a scheme's justification.
- Quantitative assessment of impacts where they were significant, involving calculation of the area affected, number of users and visits per annum, etc.
- Monetary valuation of benefits (dis-benefits) where possible.

Since almost 500 schemes had to be assessed, the basis of the BAG had to be benefits transfer. Carrying out original valuation studies for each of the schemes would not have been feasible within the resource and time constraints of PR04. Benefits transfer (BT) involves taking an estimate of the value of an environmental attribute from an existing study or studies at one or many sites, and transferring it to a new site. It is a relatively recently developed method but recognised as appropriate for valuing non-market benefits, especially where the number of schemes would preclude original valuation surveys for each.

The BAG was based in part on a review of all available and relevant studies that value the kind of environmental outcomes and attributes affected by the PR04 schemes (Eftec, 2003). The BAG used the best and most appropriate of these studies to suggest a value for each environmental attribute that can be applied in different contexts. It also set out how to derive average or typical estimates of the number of people or households who would gain from a particular type of benefit in a particular type of location. It provided summaries of appropriate valuation studies, together with detailed instructions on how best to apply the different valuations. This included both sensitivity testing and how to aggregate across the relevant populations.

The BAG was thoroughly peer reviewed and tested. Peer reviewers included the relevant policy stakeholders (the EA, Defra, Ofwat, and English Nature), academics and a water company economist. In addition, the Agency held a seminar with 40 leading economists to discuss our work and the BAG (Environment Agency, 2003d), which concluded that the BAG made optimal use of available data and was the best that could be done within the PRO4 timeframe. A further workshop discussed and reviewed some of the most important valuation studies used to assess the environmental benefits of schemes (Environment Agency, 2003e).

Water companies provided estimates of the financial (capital and operating) and environmental costs of 'CWBM' schemes in their draft business plans. Company reporters analysed and reviewed these estimates and Ofwat applied low and high sensitivities. To ensure that the costs and benefits were in a comparable format, the present values of both over a common time horizon of 25 years were then calculated using the HM Treasury recommended discount rate for public project appraisal of 3.5%.

An illustrative worked example of the benefits assessment and cost-benefit process for a scheme is shown in Annex A.

3 Results and findings

We assigned the CWBM schemes to one of six categories on the basis of their Benefit:Cost (BC) ratio and additional benefits not (adequately) covered in the monetary benefits assessments and factors of particular importance to local stakeholders:

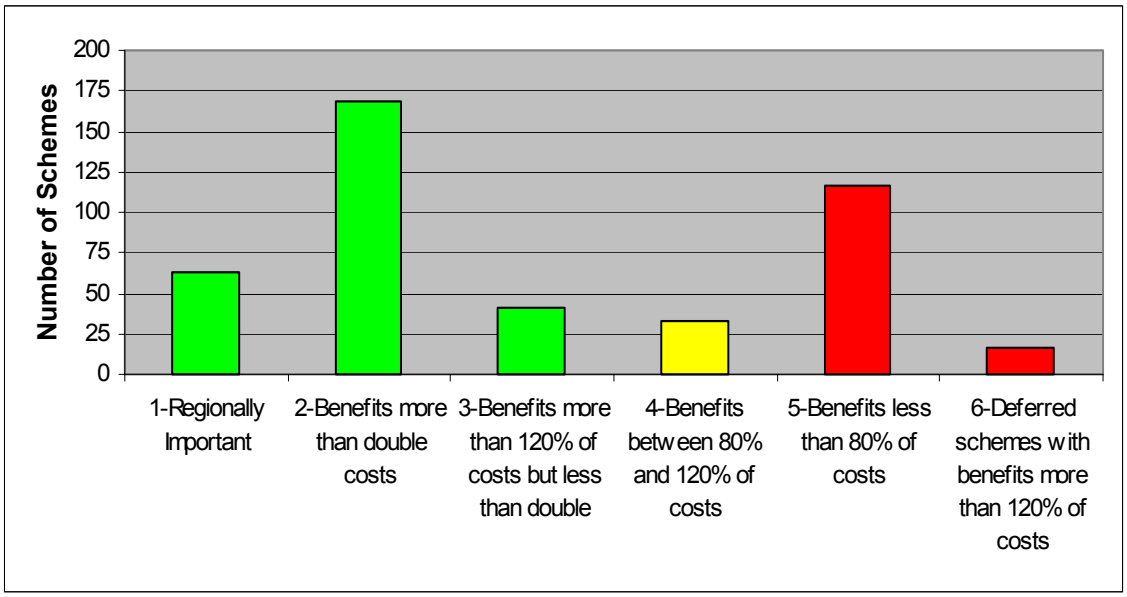
1. Schemes identified by the EA or local stakeholders as being of high regional priority but which had a BC ratio of <1.2. Such schemes might, for example, be important in regional economic development or regeneration strategies, or there might be other significant non-monetary benefits associated with the scheme that the BAG was not able to capture[2];

[2] These included important ecological benefits such as the water body being able to support diverse species, improvements at estuaries that enable migratory fish to pass upstream which yield benefits upstream or aesthetic improvements from reduced discharges at coastal sites.

2. Monetary benefits at least twice as great as costs;
3. Monetary benefits less than double but >1.2 times costs. This latter 'bound' was selected to take account of the level of uncertainty in the benefit assessment methodology;
4. Monetary benefits < 1.2 times but > 0.8 times costs. The Agency paid particular attention to this category and provided additional information and justification for those borderline cases that were local or regional priorities – these were included in category 1 above. We recommended that the remaining borderline cases in category 4 should be deferred;
5. Monetary benefits < 0.8 times costs;
6. Monetary benefits > 1.2 times costs but which the EA recommended should be deferred.

Categories 1-3 comprised the CWBM schemes that the EA recommended for implementation in PR04. Categories 4-6 comprised the schemes recommended for deferral. Figure 1 shows the total number of water quality and water resource schemes across England and Wales falling into each of six categories. Figure 2 shows the total cost of schemes in each category.

Figure 1: Number of CWBM schemes in each cost-benefit category



Note: Regionally important schemes are those schemes with benefits less than 120% of costs (yellow or red schemes) which have been identified as being of regional importance

Figure 2: Total cost of CWBM schemes in each category

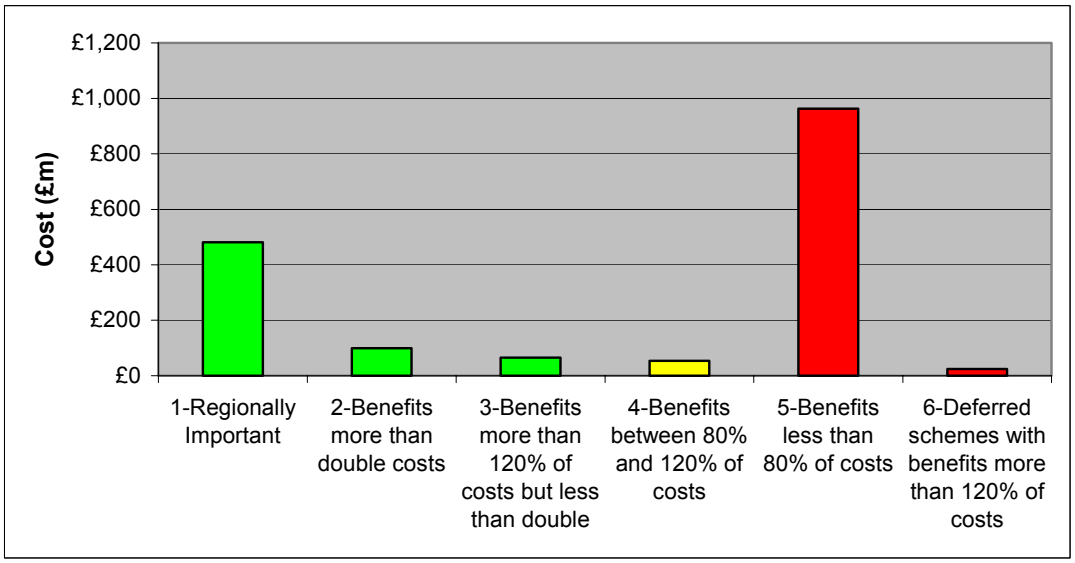


Table 2 shows the overall number of schemes and their total costs and benefits for categories 1-3 (recommended for implementation) and categories 4-6 (recommended for deferral).

Table 2: Summary findings of costs and benefits of CWBM schemes

	Categories 1 to 3 (% of total)	Categories 4 to 6 (% of total)	All categories
Total number of schemes	272 (62%)	166 (38%)	438
Total costs	£645m (38%)	£1,040m (62%)	£1,685m
Total benefits	£1,154m (80%)	£289m (20%)	£1,443m

Figures 1 and 2 and Table 2 show that the EA proposed that 272 schemes (62% of the total) be implemented under PR04, which would yield benefits with a capitalised net present value of £1.2bn. This significantly exceeds the cost of £645m. Figure 2 shows that most of these schemes had benefits that were double their costs. The EA proposed that schemes costing more than £1bn be deferred. Our proposed CWBM schemes would therefore deliver about 80% of the total environmental benefits at 38% of the total costs. Figure 3 shows the proportion of all (water quality and water resources) scheme benefits by benefit category.

Figure 3: Total benefits by category

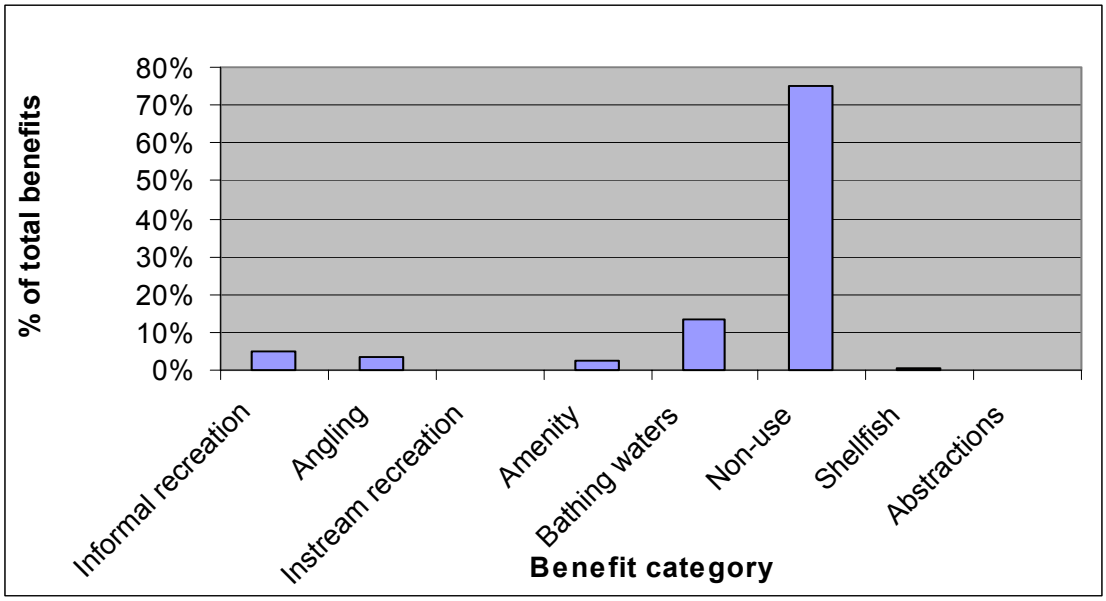


Figure 3 clearly shows that non-use benefits dominated the calculated benefits for water quality and water resources schemes. This high proportion is in line with other study and survey findings showing that people attach most importance to the ecological benefits of improved aquatic ecosystems and natural habitats. Other important categories were bathing waters, informal recreation, angling and amenity.

4 Conclusions and lessons

In this paper, we have set out what is thought to be the largest practical application of environmental cost-benefit analysis in the UK to date. As a result of our assessments and the comparison of benefits with costs, the EA recommended for deferral schemes costing over £1bn. Our proposed streamlined programme achieves about 80% of the total environmental benefits at 38% of the total costs of the CWBM schemes. It has therefore helped us to achieve good value for money from our proposed programme.

However, simultaneously carrying out almost 500 cost-benefit assessments raised a number of issues, which we are addressing in our research programme on economic appraisal for the Water Framework Directive (WFD). The EA has devoted about £350k to this programme between 2004 and 2008. We would hope that this could be a collaborative exercise and would welcome contributions from others.

i) It will be essential to ensure that this research focuses on providing valuable information that will best aid the appraisal and decision-making processes needed for the WFD. A first requirement is therefore to set out the nature of these processes in detail.

ii) The key priority is then to specify clearly the schemes needed and improve methods for assessing costs and effectiveness of options for the WFD. In particular, this needs to provide even-handed assessments of costs and economic impacts for sectors such as agriculture versus the water industry, which are distinctly different in terms of their ability to pass through any cost increases.

iii) We then need to scope the extent and nature of likely undecided cases on which assessment of costs and benefits will be needed to determine whether or not their costs are disproportionate. We then need to determine carefully how these assessments should be carried out and what new studies are needed to improve estimation of numbers of beneficiaries for specific types of environmental benefits and the valuation of these benefits.

iv) There are likely to be many contentious cases in the WFD where the measures required to meet good ecological status (GES) might be 'disproportionately expensive'. It will be too expensive and impractical to carry out original benefits valuation surveys for each of these cases. Consequently, there is a need to make best use of the existing studies, supplemented by carefully targeted new studies, to be able to transfer their findings to all the contentious cases likely to be encountered. New studies should therefore incorporate a BT function and fit the key characteristics of the likely cases where costs might be disproportionate so that they are readily usable outside of their original context.

v) Key features of new studies are that they will need to:

- Be based on a sound methodology (best practice guidance)
- Be peer reviewed
- Report methodology and findings in a clear and transparent fashion
- Be interdisciplinary (e.g., incorporating economics, psychology and science)
- Be carefully designed and provide clear information on the context and purpose of the study to minimise protest votes
- Address carefully the issue of income constraints and the opportunity costs for a respondent of their valuations. This will be particularly important where a number of substitute sites may be available

- Provide clear and full information on the environmental benefits in question as defined by the analysis of people's specification of these benefits and their concerns
- Explicitly take account of uncertainties
- Use GIS to facilitate development of distance decay functions for the values and estimates of beneficiaries at various distances from the sites and for the application of the transferred values to alternative sites and schemes
- Be achievable within the resources that we can obtain through our collaborative research programme.

Our review of the existing valuation studies highlighted major limitations of the existing literature. In general, they do not relate well to the types of marginal environmental change relevant to PR04 and the WFD. Moreover, the main problem encountered in deriving the values to use in the BAG related to understanding the valuations given by the existing studies and the circumstances to which they relate. There was considerable lack of clarity in the reporting of some of the available studies. Consequently it will be essential that the findings and supporting analyses and methodologies be very clearly spelt out in the documentation of the new studies. Time and resources will need to be allocated to ensuring that this is carried out in any new studies.

References

Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Ozdemiroglu, E., Pearce, D.W., Sugden R. and J. Swanson (2002) *Economic Valuation With Stated Preference Techniques: A Manual*, Edward Elgar Publishing, Cheltenham.

Defra (2003) *Initial Guidance from the Secretary of State to the Director-General of Water Services – 2004 Periodic review of water price limits*.

Eftec (2003) *Valuations for Water Resource and Water Quality Schemes: A Literature Review*, report to Environment Agency, Bristol.

Environment Agency (2003a) *Economic Appraisal for the Environment Programme in PR04*, Environment Agency, Bristol.

Environment Agency (2003b) *Overall Benefits of the Environment Programme for the Periodic Review of the Water Industry (PR04)*, Environment Agency, Bristol.

Environment Agency (2003c) *Benefits Assessment Guidance for Water Quality and Water Resources Schemes*, Environment Agency, Bristol.

Environment Agency (2003d) *Economic Appraisal and Assessment of Benefits in the PR04 Environment Programme: Findings of an Environment Agency seminar*, January 2003, Environment Agency, Bristol.

Environment Agency (2003e) *The Benefits Assessment Guidance for PRO4: Review of Non-use Values for Water Quality and Water Resources and Values for Bathing Water Improvements, Report of an Expert Workshop in Peterborough*, May 2003, Environment Agency, Bristol.

Annex A Worked example

Below is an example of the benefit assessment appraisal undertaken by the Environment Agency and the results of the subsequent cost-benefit process. The illustrative scheme, Happy Valley has a BC ratio of 1.95.

Table A1 shows the appraisal summary table (AST) used to assess the environmental benefits of the scheme.

Table A1: Appraisal Summary Table for Happy Valley scheme

Site Name	**Happy Valley**							
Scheme ID	*A0185801*							
Scheme Description	*Improvement of wastewater treatment works in order to forestall future risk of failure to meet 1997 RQOs (driver R2)* *Improvement of wastewater treatment works in order to correct marginal failures with imperative standards of FFD (driver F2)*							
Site Specific Assumptions	*Length of affected stretch of river = 5.8km* *Aiming to ensure water quality of Happy river meets Imperative standards of FFD and continues to achieve RE3*							
Category	**Benefit/ Disbenefit Likely?**	**Qualitative Description**	**Quantitative Assessment (1)**	**Transfer Value Taken (2)**	**Reasons for Taking Transfer Value**	**Monetary Valuation (1 x 2) (annual benefits)**	**Results of Sensitivity**	**Category Specific Assumptions**
Informal recreation	Yes	Access is GOOD with several points of access and footpaths along the entire length. Facilities are GOOD as the stretch runs through the village of Happy. Site is likely to be of regional importance. Part of Happy Valley Nature reserve runs adjacent to the site with parking and a visitor centre close by. Devils Ditch, an	***Site count data***: None available ***Default data***: <u>Upper</u> On the basis that of stretch is of Regional significance, estimate possible numbers from a 30km radius area (from table 2.7) if mid importance. 3.14 x (30 x 30) = 2826 km2 Applying assumption from this table that 20% of pop visit and pop density of 150 / km2 for Happyshire, the no of visitors = 84,780. If	Green and Tunstall (1991): £0.13 per visit	Considers a move from RE4/RE3 to RE3, this is similar to the deterioration that this driver aims to prevent	Using upper bound of 84780 visits per year (based on reality check) and value of £0.13 per visit gives benefits to informal recreation of: **£11021 per year**	Taking 55107 visits per year and £0.13 per visit gives benefits of £7163 per year Taking 84780 visits per year and £0.65 per visit (Green and Tunstall, 1991 – move	Qualitative descriptions based on Table 2.3 Adult population based on density data (Annex 3) Water quality improvement, therefore, considering benefits

		important chalkland ecosystem, national monument and SSSI is close to the watercourse. Although water quality will not have an impact upon these sites they are likely to attract visitors to the area. Site is likely to be regionally important and attract visitors from 30 km (HIGH / MODERATE) Water quality in the affected stretch is MODERATE (RE3)	two visits per year (from Table 2.7), total visits = 169,560. <u>Lower</u> On the basis that of stretch is of Regional significance, estimate possible numbers from a 10 km radius area (from table 2.7) if lower importance. 3.14 x (10 x 10) = 314 km2 Applying assumption from this table that 26% of pop visit and pop density of 150 / km2 for Happyshire (from Annex 3), the no of visitors = 12,246. If nine visits per year (from Table 2.7), total visits = 110,214. ***Alternative sites***: 1 alternative site of similar quality/ importance nearby reduces estimated visits to <u>Upper</u> 84780 per year <u>Lower</u> 55107 per year				from RE4/RE5 to RE3) gives benefits of £55107 per year	transfer values given in Table 2.9
Angling	Y	Access to the river is good. There is an established fishery that is regularly used for matches.	Advice from fisheries staff is that the use of the bank area is "high", with 50% fished. Using an estimate of angler density of 1 per 25 metres of bank	From table 3.14, WTP figure of £0.23	The fishery has a biomass of 1530g/100m 2 which using table	Benefit Value = 13,222 x £0.23 = £3041	If were able to improve the fishery to "good", the transfer value of	Changes in river water quality if sewage works discharges to full capacity will result in

			(Fisheries Estimate) for 5800m of bank (5.8km stretch) calculated angler numbers are 232 per day. Applying the factors provided in the Guidance Tables 3.6 and 3.7, based on the assumption of peak visits being on a weekend in July the figure translates to 232/0.39 = 595 per week or 2380 per month. Annual estimate = 2380 / 0.18 = 13,222 visits.		3.14 translates as a moderate fishery. A marginal change from a moderate to a poor fishery could occur if driver R2 is not implemented		£2.34 per visit could apply. This would increase benefit to £30,939. However, there is no evidence that this change would follow.	deterioration in the fishery
Commercial fisheries	N	None						
In-stream recreation	N	None						
Amenity	Y	There are an estimated 16 detached houses that overlook the river and which may attract a property price premium from their location. There are a number of housing estates that are located close to the river, but these are not expected to attract any additional price premium since they are separated from the river by walls, fences and/or	Total value of the 16 houses is £3,342,960 (based on land registry Internet site) Only changes expected to be seen are clearness (13) and algae (9) and odour (4) giving a total score of 26 and a property price premium of 3.9% (from table 6.12)	Property price premium of –3.9% if driver R2 is not implemented	Based on table 6.12 and changes in clearness, odour and algae scores (colour, debris not affected).	£130,375 (capital/once-off benefit)	If odour is discounted and the scores for clearness and algae are changed to 4 and 2 respectively this gives a price premium of 2.4% which gives amenity benefits of £80,231. However	Numbers of properties counted from 1:10,000 OS maps Driver R2 will prevent deterioration in water quality from RE3 to RE4, which will have a perceptible change for people living near to the river

		roads.					consider original scores used are more representative of the change if deterioration to RE4 occurred.	
Abstractions	N	There is one abstraction for spray irrigation on the stretch, but a change in water quality from RE3 to RE4 will not impact upon this.						
Heritage, archaeology and landscape	N	Devils Dyke runs from Happy, close to the stretch of the happy river. It is a national monument, a SSSI and provides some of Happyshire's few remaining chalk grassland ecosystems. However change in water quality is unlikely to change the historic context of the Dyke and the features themselves will not be affected. Impacts are likely to be neutral. The location of this site is likely to attract						

		more visitors but this can be accounted for in 'informal recreation'						
Non-use (conservation value / biodiversity	Y	River stretch is not SSSI or European Site. However, Conservation staff stated that spined loach are present. This is a BAP species. Quality change if allowed to deteriorate could be significant. A small part of the watercourse runs adjacent to Happy Fen, A SSSI and National Nature Reserve. However after speaking to conservation staff this was not considered as part of the assessment as the only time water quality will impact on this site is if the river floods. Additionally it is nutrients, not BOD and Ammonia that would have the most impact on the site. River *may* fulfil other functions in ecosystem maintenance and food	Based on presence of BAP species have classed as local because not SSSI site (from table 9.3). Have considered circles of radius 30 km and 60 km as 'lower' and 'upper' bound. **Lower** area to be considered = 3.14 x (30 x 30) = 2,826 km2 Cambs pop density = 150/km2. Estimated Pop = 423,900 which equates to 423900/2.3 = **184,304 households.** **Upper** area to be considered = 3.14 x (60 x 60) = 11,304 km2 Cambs pop density = 150/km2 Estimated Pop = 1,695,600 which equates to 1,695,600/2.3 = **737,217 households.**	From table 9.10 (revised guidance) gives range of £0.03 which for the stretch of 5.8km equates to £0.17 per household per year.	Apply WTP value for RE4 to RE3 as maintaining RE3.	£125,327	Willis & Garrod £54000*5.8 = £313,200	Watercourse has no designation for conservation but may support BAP species. Changes in water quality may influence the survival of these species by changing habitat or food availability.

		web support. Impact of deterioration in ammonia estimated as 'minor' to 'intermediate negative.' This translates to 'small or moderate cost.' (Table 9.6)						
TOTAL								
Notes on wider benefits:								
Notes/comments on assessment: ***Informal recreation***: - *default data*: facilities (from qualitative assessment) ranked as good, therefore, upper bound likely to be more appropriate - *alternative sites*: visits per year are divided by two (one alternative sites, plus site) - *reality checks*: 84780 visits ÷ 5.8km = 14617/km - *sensitivity analysis*: a value of £0.65 per visit is expected to give an over-estimate of potential benefits, hence, this is considered to be an upper limit on potential benefits to informal recreation# *Angling*: Assessment has been based on Fisheries Dept estimates of activity rather than default data because the latter, even after allowing for alternative sites, gave higher number of visits than thought to be reality.								
Notes: * include adjustment factors where required and note site specific assumptions								

Table A2 shows the way in which the benefits identified above were aggregated, discounted and converted into present values.

Table A2: Timing of benefits for Happy Valley scheme

Site Name	**Happy Valley**						
Scheme Description	*Improvement of wastewater treatment works in order to forestall future risk of failure to meet 1997 RQOs (driver R2) Improvement of wastewater treatment works in order to correct marginal failures with imperative standards of FFD (driver F2)*						
Category	**Annual or Capital Benefits**	**Year Benefits Expected to Start**	**Year Benefits Expected to End**	**Calculated Discount Factor (3.5%)**			**PV Monetary Benefits**
				Discount Rate in Year Benefits Start (1)	**Discount Rate in Year Benefits End (2)**	**Discount Factor (2-1)**	
Informal recreation	£11,021 per year	2	24	1.9	16.06	14.16	£156,048
Angling	£3,041	2	24	1.9	16.06	14.16	£43,057
Commercial fisheries	-	-	-	-	-	-	-
Water sports	-	-	-	-	-	-	-
Amenity	£130,375 Capital	2	24	0.93	16.06	0.93	£121,707
Abstractions	-	-	-	-	-	-	-
Heritage, archaeology and landscape	-	-	-	-	-	-	-
Non-use (conservation value/biodiversity)	£125,327	2	24	1.9	16.06	-	£1,774,462
TOTAL PV MONETARY BENEFITS (to two significant figures)							£2,095,275

Table A3 shows the results of the cost-benefit assessment obtained by bringing the discounted costs and benefits of the scheme together.

Table A3: Bringing the results together

Site Name	**Happy Valley**		
Scheme Description	*Improvement of wastewater treatment works in order to forestall future risk of failure to meet 1997 RQOs (driver R2) Improvement of wastewater treatment works in order to correct marginal failures with imperative standards of FFD (driver F2)*		
Scheme Costs (Capital and Operating)	**£1,073,498**		
Environmental Benefits/Disbenefits			**Total PV Monetary Benefits (sum of all PV benefits - where more than one environmental category has been assessed)**
Part 2 (Rivers and Groundwater)	**Part 3 (Reservoirs, Lakes and Broads)**	**Part 4 (Coastal Waters and Estuaries)**	
£2,095,275	-	-	£2,095,275
Total PV Costs			**£1,073,498**
BENEFIT:COST RATIO			1.95
NET PV BENEFITS OR COSTS (Total PV monetary benefits - Total PV costs)			£1,021,777