

Joint Defra/EA Flood and Coastal Erosion Risk
Management R&D Programme

Annex A:

Preliminary guidance on the use of benefits transfer
for riverine recreation and angling and coastal
recreation

R&D Project Record FD2013/PR2

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Statement of use

This report provides guidance on the use of MCA and ASTs to assist in the appraisal of flood and coastal erosion risk management projects, strategies and policies. It should be noted that it does not constitute official government policy or guidance, which is unlikely to be available until work to develop the methodology and identify appropriate sources of data has been undertaken through pilot studies.

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A1. Introduction

In this Annex we provide an example of preliminary guidance on the use of benefits transfer (BT) for the following impact categories:

- **rivers:**
 - informal recreation
 - angling
- **coastal:**
 - recreation.

The above impacts categories have been selected on the basis of the transferability of the studies to the flood management and coastal defence context. Overall, recreation benefits (both formal and informal), depending on the nature of the problems and the options chosen to address them, will have the following components (based on Penning-Rowse *et al.*, 2003):

1. The prevention of further deterioration: **losses** associated with the 'do-nothing' option when compared to the existing scenario. Almost all coastal protection projects and some riverine and coastal flood defence ones will have this component. Options that only prevent further deterioration and simply reinstate the site to its current condition will involve this component. Note, however, that benefits can also arise under the 'do-nothing' option if, by walking away for instance, the river is restored to a more natural state and, as a result, attracts more visitors.
2. The improvement of the condition of the site from the current state to a better one: **gains**. For example, the replacement of hard river flood defence structures reaching the end of their life with more soft engineered defences may enhance the recreational value of a river site. Beach nourishment for coastal protection purposes may result in a 'better' beach in recreational terms. In coastal defence and river management schemes, for example off-shore reefs, new sea walls with promenades or river flood banks or retention lakes, may also change sites in ways that may provide new recreational opportunities and thus may enhance the recreational potential of the sites.

The BT approaches for river and coastal sites are described in turn. The AMP4 Guidance (RPA, 2003) distinguishes between recreational users for river and coastal sites. For fluvial flood defence, studies from the AMP4 Guidance have been deemed applicable.

Angling is considered separately, because of the special nature of this type of users. For coastal sites the applicability of most existing valuations is much more limited. The most relevant are the values from the Multi-Coloured Manual (Penning-Rowse, *et al* 2003), although coastal recreation for the more specialised user has also been looked at.

Other impacts categories are being further investigated (we are currently reviewing the scope for BT for valuation of landscape impacts and in-stream recreation for rivers. We also expect to include a section on the valuation of stress related effects in the future).

A2. Rivers

A2.1 Informal recreation

Overview

The term informal recreation covers a wide range of different activities, such as:

- walking and hiking;
- picnicking;
- dog-walking; and
- nature appreciation related activities such as birdwatching and photography.

Flood management and coastal defence schemes could potentially impact upon informal recreational users. For example, the construction of a concrete floodwall could lead to the loss of footpaths whereas soft engineering defences or a carefully designed hard defence could enhance the recreational value of a site. Options that provide habitat creation in addition to flood defence (such as managed set back or washlands) can also provide additional recreation benefits for users such as birdwatchers.

Qualitative description of impacts

Identifying the impacts on recreation from flood management and coastal defence options involves identifying the impacts of changes to the physical environment under the 'do-nothing' and the 'do-something' options. The qualitative description of impacts should be recorded in the AST, with this including the following aspects:

- is there access to the river? Is this good, moderate or poor? (identify possible access sites, car parks, footpaths, etc.)?
- does informal recreation take place along the river or within the wetland area now (look at provision of facilities, aesthetic quality of the site, etc.)?
- would the option result in significant changes, e.g. visual intrusion, loss of footpaths, new walks, etc. such that they would be perceived by informal recreation users?

The decision to proceed with the monetary valuation of informal recreation related impacts should thus include consideration of the degree to which users would perceive the impacts arising from the different options to be important. If impacts are not likely to be perceived as important by users, then they should be considered negligible. If the opposite happens, i.e. impacts are expected to be important, the number of users needs to be estimated. The approach set out below is based on the AMP4 methodology for calculating participation rates, and has been adjusted for the flood management and coastal defence context.

Calculating the population affected

In preparing the monetary valuation, it is important to estimate the number of users likely to be affected by the options. Sources of information on participation rates include:

- **Site visits or visitor surveys:** counts of visitors along the affected stretch or at a given site at different times during the day and year to give the basis for an estimate of annual number of visits;
- **Consultation-based estimates:** number of trips to the affected site per year or as a point estimate based on consultation with recreation officers, District Council car park officers, tourist offices and ramblers club, etc; and
- **Default data:** reliance on standard formulae of estimates.

The most robust approach is to collect site-specific data based on visitor counts. The least robust approach to developing estimates of likely visitor numbers is the use of default values as site specific factors are less likely to be taken into account. Note that this assessment is based on estimating current levels of use. Reliable methods do not exist for predicting changes in informal recreation visitor numbers.

Site visits or visitor surveys

The results of counts carried out during site visits or as part of visitor surveys can be used directly to calculate annual visitor rates to informal recreation sites. The approach to take will depend upon the format that the site count is in. If the site count is given as a spot count, or number of visitors per day, the steps below should be followed in order to derive an estimate of the annual number of visitors. If the count is of weekly visitors, then this should be multiplied by four, to estimate monthly trips and then Steps 2 and 3 should be followed. Where the site count gives monthly visitors, Step 3 will have to be followed. If the count is of car park numbers, this will need to be converted into number of visitors by multiplying by 2.3 (as 2.3 is the number of adults per household, from National Statistics); if the site count gives annual number of visits, there is no need to make any adjustments.

Visitors (from car park numbers) = number of cars parked x 2.3

Where several different counts have been undertaken both the mean and median values can be taken. If these are similar, estimates are likely to be fairly robust. If these two values differ significantly, then both values should be carried forward as a lower and upper bound, as they will provide a range and an indication of the uncertainty surrounding the visitor rates estimates.

Step 1: Converting a daily count into weekly visit numbers

The most appropriate adjustment factors are given in Table A2.1.

Table A2.1 Proportion of visits made on weekdays and weekend days

Day of Week	Percentage of Trips Made
Weekday (per day)	12%
Weekend (per day)	20%

Source: CRN (1996), in Environment Agency (2003)

The daily estimate should be divided by the appropriate percentage to give a weekly estimate. Multiplying the weekly estimate by four will then provide the number of visits per month.

$$\text{Weekly estimate of visits} = \text{daily estimate} \div \frac{\text{percentage (from Table 5.1)}}{100}$$

$$\text{Monthly estimate} = \text{weekly estimate} \times 4$$

Step 2: Converting a monthly estimate into an annual estimate

Factors for typical monthly variations in informal recreation activities are given in Table A2.2. The Table shows participation rates by month and by importance of a site. In using these, the characteristics of the site as described in the qualitative assessment should be considered.

Once it has been selected which level of importance best reflects the site, the monthly estimate should be divided by the percentage of visits made in that month. For example, if 2,300 visits are made in May to a site with good accessibility and some facilities, which is expected to be of 'moderate' importance, the monthly adjustment factor is 16%, which gives an estimate of annual visits of 14,375 (from 2,300 divided by 0.16).

$$\text{Annual visits} = \text{monthly visits} \div \frac{\text{percentage (from Table 5.2)}}{100}$$

Table A2.2 Adjustment factors for monthly variations in visit patterns

Month	Importance of site		
	HIGH ¹ (likely to draw visitors from >30 km)	MODERATE ² (likely to draw visitors from 15-30 km)	FAIR ³ (likely to draw visitors from up to 15 km)
January	3%	9%	14%
February	3%	3%	9%
March	8%	6%	7%
April	10%	8%	7%
May	16%	16%	9%
June	10%	11%	7%
July	17%	13%	6%
August	16%	7%	10%
September	5%	10%	8%
October	4%	8%	9%
November	4%	3%	7%
December	4%	6%	6%

Source: Environment Agency (2003)

Consultation-based estimates

A range of different organisations may hold data on the number of visitors to a given river or wetland site. Some of these organisations may have undertaken their own site surveys, or may hold data on car park usage, etc. that can be used to form the basis for developing visitor estimates. This includes:

- District Councils, which may hold data on levels of car park usage or which may have undertaken some counts of users of local parks;
- British Waterways, which hold data on average visit rates to different canals and navigable rivers;
- Wildlife Trusts, which may hold data on visitor numbers to different wetland sites
- Tourist Offices, which may have carried out surveys of the activities undertaken by visitors to an area and the location of those activities;
- Ramblers' Clubs, where a footpath runs along or across a site that is used for longer walks and hiking; and
- other local clubs, such as birdwatching clubs, who may regularly visit.

Club secretaries may only be able to give an indication of the number of visits likely to be made by their members, or may be able to provide guesstimates of visit rates more generally.

The format in which the data is provided will determine the steps to derive an annual estimate of number of visits. This may involve following the appropriate step(s) above.

One other factor that may affect the accuracy of consultation-based data relates to member and non-member activities. For example, clubs may be able to provide good estimates of numbers of member trips to the site, but have no data on non-member trips. Table A2.3 gives an indication of the number of trips that may be made by members to rivers or canals that provide good sites for informal recreation (this is based on only a few studies and, hence, may introduce uncertainty).

Table A2.3 Adjustment figures for taking non-member visits into account

Club/activity type	Percent of trips made up by members
Birdwatching (RSPB)	12%
Nature conservation	6%
Waterways associations	1%

Source: British Waterways (1994), in Environment Agency (2003)

$$\text{Total number of visits} = \frac{\text{number of member trips} \div \text{percentage (from Table 5.3)}}{100}$$

Default data

If no site specific data are available, the alternative is to use default data to estimate visitor numbers. In using the default data provided below, the qualitative assessment concerning accessibility, the provision of facilities and the general attractiveness of the site should be taken into account. Two different sets of default assumptions have been developed by Green *et al.* (1992). These are set out in Table A2.4 overleaf, with the definitions of a local park and honeypot site being as follows (FWR 1996):

- **Local Park:** visitors travel mainly by foot and the site has no special attractions. Relevant population in terms of a multiplier is that living within 1 km of the site; and
- **Honeypot Site:** visitors travel by car, there is some special attraction and there are facilities such as a car park and toilets at the site. The relevant population (in terms of a multiplier) lives within 3 km of the site.

These definitions apply to local sites only. The use of the population within these distances as a multiplier takes into account the fact that not everyone within these distances will visit the site, but also that people further away will visit the site; the two are assumed to balance each other out. Regional and national sites are likely to attract visitors from much greater distances. Such sites may include long distance footpaths, be connected to tourist sites or be in National Parks, Areas of Outstanding Natural Beauty (AONB), etc. However, only a proportion of the population is considered likely to make such trips each year.

The standard values presented in Table A2.4 are based on research on a series of rivers in the Thames Region of the Agency and from the Day Visits Survey undertaken by the Countryside Recreation Network.

In order to use the above equations, estimates on the appropriate visitor population should be obtained by:

- drawing a circle around the river with a radius equal to the most appropriate distance shown in Table A2.4. GIS-data, census data or an OS map could help determining the population (number of adults) within the circle (for regional/national sites the appropriate proportion of the population expected to visit that site each year should be applied):

population = number of people living within the circle drawn x percentage of population expected to visit the site (regional/national sites only)

- or, using population density data, calculate the affected population using the following formula:

population¹ = 3.14 x distance (in km) squared (from Table 5.4) x population density x percentage of population expected to visit the site (regional/national sites only)

¹ population = π x (distance)² x population density (where π = 3.14).

Table A2.4 Standard data for estimating informal recreation visitor numbers

Site type	Importance	Visit rate		Total visits per annum	
		Per adult per year	Average distance from site	Total visits per annum	Likely site characteristics
Local ('Fair' importance)	Upper	27.6	1 km	30,000	access: good facilities: good/moderate
	Mid	21.3	1 km	20,000	access: moderate facilities: moderate/fair
	Lower	17.1	1 km	10,000	access: fair facilities: fair/poor
Honeypot ('Fair' to 'Moderate' Importance)	Upper	17	3 km	250,000	urban area access: good facilities: good/moderate
	Mid	17	3 km	125,000	suburban area access: good/moderate facilities: moderate/fair
	Lower	17	3 km	60,000	rural area access: moderate facilities: fair/poor
Regional/national site ('moderate' to 'high' importance)	Upper	2	60 km	540,000	10% of population within 60 km visit site each year access: good facilities: good
	Mid	2	30 km	270,000	20% of population within 30 km visit site each year access: good/moderate facilities: good/moderate
	Lower	9	10 km	180,000	26% of population within 10 km visit site each year access: moderate/fair facilities: moderate/fair

Source: based on Green *et al.* (1992); and CRN (1996), in Environment Agency (2003)

Availability of alternative sites

A key issue that arises in estimating informal recreation benefits (and other recreation benefits) concerns the existence of alternative sites and the degree to which this will impact on visitor numbers to the site in question. When deciding whether a site is likely to be an alternative site, it should be considered whether the level of access, facilities and quality are likely to be similar to the site. This is particularly important for regional/national sites, where potential

alternatives must also be of regional/national importance to be considered appropriate alternatives.

If there are alternative sites within the same distance as considered above, the total number of adult visits per annum should be divided by the number of alternative sites plus one (to account for the site in question).

$$\text{Number of visits to site in question} = \frac{\text{total number of visits (estimated above)}}{\text{number of alternative sites plus one}}$$

Reality checks

The estimation of participation rates is normally associated with a high degree of uncertainty. The following checks are suggested to examine whether the calculated figures are of the right order of magnitude (especially when using default data).

The first check is to divide the estimate of annual visits by 365 to calculate the implied number of visitors per day to see whether this figure seems right in the context of the site, access to it and its characteristics. The default data in particular may lead to overestimates in rural areas or for poor quality sites.

$$\text{Reality check 1: daily number of visits} = \frac{\text{number of visits to your site}}{365}$$

Table A2.5 provides an indication of the number of visits made to different rivers, with details given on the type of river, level of access, facilities and importance provided. These can then be compared with the descriptions given in Table 6.4 and the site to determine whether the estimates are likely to be realistic.

Table A2.5 Number of trips per year to different rivers/canals

River/canal	Description	Number of visits per year
River Nene	Long distance footpath (regional/national importance) Moderate facilities and good access Alternatives available (e.g. Cam, Ouse)	1,800/km
Caen Hill Locks near Devizes, Kennet and Avon Canal	Nationally important site with feature of locks Popular attraction with good access Count taken by infra-red pedestrian counter	94,000 (68,000 visitors plus 26,000 locals)
Maidenhead Ditch	Runs through Maidenhead town before joining the Thames at Bray Access good, but attracts mainly local residents (within 3 km), few facilities Number of alternative sites available (including the Thames)	41,000
Ravensbourne River	Queen's Mead recreation ground, Bromley, Kent Many visits to park rather than specifically to river; river of poor quality, access good, few facilities, mainly used for sporting activities	125,000
River Skerne	River running through Darlington prior to restoration Access fair to moderate with no facilities, very poor water quality, visited by local residents only (those living within no more than 1 km from the river)	7,800

Source: Environment Agency (2003)

Benefits transfer

Once the number of visitors has been calculated, it is necessary to find a best fit value in order to value the impacts on recreation. The choice of value will depend on the type of impacts arising from the different options. Different transfer values are provided in Table A2.6, these are based on WTP values. The transfer values should be multiplied by the number of visits, when the value is given as a 'per visit' value, or by the number of households, where the transfer value is given as a 'per household' value.

Table A2.6 Suggested transfer values for changes in quality and recreation (2001 prices)

Study	From	To	Transfer value	Required adjustments
<i>Rivers</i>				
Coker <i>et al</i> (1990)	Channel partly filled with water (also litter within river channel and along river banks)	Channel filled with water (litter removed from channel and river banks)	£1.35 per visit	Study relates to Maidenhead residents and visitors from the surrounding area. Adjustment for wealth may be deemed appropriate
Tapsell <i>et al</i> (1992)	Channelised river system	Creation of new meanders, bankside planting and some habitat	£2.91 to £3.61 per user (dependent on degree of habitat creation)	No adjustment suggested when assessing local schemes
Garner <i>et al.</i> (1995)	Straightened river channel with some adjoining park area	River restoration through channel modifications, habitat creation and landscaping	£8.75 per adult per visit	No adjustment suggested when assessing local schemes. Adjustment for wealth may be deemed appropriate.
Jacobs Gibb (2002)	Low flows every 4 or 5 years out of 20 years	Full restoration to low flows once every 20 years	<0.5 km: £0.34 per household per km per year 0.51-3 km: £0.25 per household per km per year 3-12 km: £0.07 per household per km per year 12-60 km: £0.03 per household per km per year	Adjustments are proposed for different site characteristics. These are still under development, but users may want to examine the implications. WTP values adjusted for high income of respondents
ERM and Willis (1992)	Low flow conditions	Environmentally acceptable flow regime in River Darent	£8.20 per visitor household per year	Apply unit of measurement depending on information available
<i>Wetlands</i>				
Woodward and Wui (2001)	Wetland providing little habitat and no value of single service provision of birdwatching	Wetland of value for birdwatching	£3,944 per hectare per annum	Is an international value and must be treated as being indicative only
O'Neill (2001)	No birdwatching	Provision of birdwatching at different inland wetland sites	£0.08, £1.72 and £2.85 per visit to Tudeley Woods, Weir Wood and	Values vary across sites so site characteristics should be considered in

Study	From	To	Transfer value	Required adjustments
			Pulborough Brooks	choosing a value
Klein and Bateman (2001)	Current site quality and characteristics	Protection against future damage to the site and loss of birdwatching and habitat	£1.69 per visit or £51.42 per household per annum (assumes 13 visits per adult/annum and 2.3 adult/household)	Apply unit of measurement depending on information available. Adjustment for resident household visitors may be needed

Source: Environment Agency (2003)

A3. Angling

Overview

This section looks at the valuation of angling impacts from the implementation of flood management and coastal defence options. The rationale for considering these impacts separately is that anglers are normally deemed as a special type of recreational users (as for example, in the Multi-Coloured Manual) (Penning-Rowse et al. 2003); other methodologies do also consider anglers as a separate user category.

When it comes to valuation, though, the Multi-Coloured Manual does not distinguish between anglers and more general/informal users, that is to say, there is not a different set of values for the valuation of angling impacts. The AMP4 methodology, on the contrary, gives different values for valuing angling impacts. This section looks at the AMP4 methodology for inferring the number of anglers visiting rivers and valuing impacts on recreational fisheries in the flood management and coastal defence context.

Qualitative description

The first step is to determine whether an impact on angling is expected and, if so, to describe it in qualitative terms. The qualitative description of impacts should be included in the AST with this answering the following:

- is there access to the river? Will access to the site to be improved under any of the options?
- is there a fishery in the river now? What is the current fishery type (no fishery, coarse fishery, trout fishery or salmon fishery)? Is the fishery 'natural', or 'stocked', is the river natural or modified? What are the characteristics of the fishery (upstream, middle reaches, pool and riffle, lowland, etc.)?
- will the option result in the creation of a new fishery, i.e. the creation of a game fishery where a river is currently only capable of supporting a coarse fishery or the creation of a fishery where no fishery currently exists? Could these result from the removal or introduction of structures, pools and riffles, side ponds, etc.?
- how long is it expected to take before the impact is noticeable in the river (in years)? This will be influenced by including bankside planting, introduction of gravel beds, etc.
- what length of river will see this change (in km)?
- how many anglers are likely to benefit from the option?

The current constraints on the quality of the fishery or the creation of a new fishery should also be considered, e.g. are there other constraints such as the river type or any barriers to fish movements that would prevent creation of a new fishery?

The influence of river type is summarised in Table A3.1. This shows whether a river with a particular gradient (and, hence, flow speed) could be expected to support a coarse fishery only, coarse and game fishery or game fishery only and the probable maximum quality of fishery that may be obtained. The table should be taken as a guide to whether it is theoretically feasible to create a new fishery or to improve the quality of a current fishery.

Table A3.1 River gradient and maximum fishery types that can be supported

River Gradient (m/km)	Coarse	Game
0 to 1 (very slow)	Good	-
1 to 2 (slow)	Good-moderate	Moderate-poor (possible, but unlikely)
2 to 4 (moderate)	Moderate-poor	Moderate-poor
4 to 8 (rapid)	Poor (possible, but unlikely)	Good-moderate
>8 (very rapid)	-	Good-moderate

Source: Environment Agency (2003)

Quantitative assessment

One of the key variables in determining benefits from the option is the number of anglers that may be affected. Table A3.2 sets out the different types of information that can be obtained on participation rates. The 'best' information is given towards the top of the table; this is the most site-specific. Default values are given where the other sources of information are not available or where time constraints mean such information cannot be obtained.

Table A3.2 Information sources for participation rates

Source(s)	Type of Information Required
Site visits or visitor surveys	Counts of anglers along the affected stretch at different times during the day and year to give the basis for an estimate of annual number of visits (but remember the close seasons)
Consultation with angling clubs/owner of the fishery	Number of trips made to affected river per year (or per week if per year is not available) (by members and, where available, through day tickets to non-members/general public). Numbers of members of angling clubs could also be used with their views on average number of times they fish
Environment Agency rod licence data	Number of rod licences in local area by postal code zone
Default data	Information provided in tables given below

Site visits or visitor surveys

The result of a count made during a site visit and/or visitor survey will give a direct estimate of the number of anglers at that particular time. It is then necessary to aggregate up this count so that an estimate of the annual number of anglers can be obtained. Close season must be taken into consideration. These run from 15 March to 15 June for coarse fishing. The close season for salmon and trout (game) fishing varies from three to six months according to the river in question, with close seasons being 31 October to 1 February for salmon and 30 September to 1 March for sea trout (unless otherwise stated in local byelaws).

Where direct information on the annual number of trips is unavailable, it is necessary to aggregate up from the site count to estimate annual number of visits. A review of studies and surveys has been undertaken as forming the basis for the division of trips into weekdays and weekend days. This is given in Table A3.3.

Table A3.3 Proportion of visits made on weekdays and weekend days

Day of Week	Percentage of Trips Made
Weekday (per day)	4.4%
Weekend (per day)	39%

Source: CRN (1996), in Environment Agency (2003)

$$\text{Weekly trips} = \text{daily estimate} \div \frac{\text{percentage (from Table 5.9)}}{100}$$

$$\text{Monthly trips} = \text{weekly trips} \times 4$$

Using this information, a site count taken on a Saturday, which saw 25 anglers along 3 km of accessible banks would be converted to 64 weekly trips (from 25 divided by 0.39). This then needs to be multiplied to a monthly total. Multiplying it by four gives 256 trips per month. An estimate of the annual number of trips can then be made by using the figures given in Table A3.4. The table also highlights the close season months by type of fishery. Continuing the example, the count was taken in July, which represents 18% of all trips; this gives estimated annual number of trips of 1,425.

$$\text{Annual trips} = \text{monthly trips} \div \frac{\text{percentage (from Table 5.10)}}{100}$$

Table A3.4 Monthly variations in visit patterns as percentage visiting each month by activity

Month	Percentage of angling trips	Coarse	Sea Trout	Salmon
January	6%	Open season	Close season: ends 1 March – no sea trout fishing	Close season: ends 1 February – no salmon fishing
February	3%			
March	3%		Close season: mid-March to mid-June – no coarse fishing	Open season
April	8%			
May	6%			
June	14%			
July	18%			
August	10%	Open season	Close season: starts 1 October – no sea trout fishing	Close season: starts 1 November – no salmon fishing
September	15%			
October	8%			
November	8%			
December	1%			

Notes: Percent of visits per month taken from RPA (1997)
 Close seasons for sea trout and salmon may vary according to local byelaws
 Source: Environment Agency (2003)

Consultation with angling clubs/owner of the fishery

Angling club secretaries and/or the owner of the fishery are often a good source of information on the number of anglers that visit a particular stretch of river. In many cases, this will be limited to the number of visits to stretches of river owned (or leased) by their club, but it may cover members of the angling club and day tickets purchased by non-members to give a good estimate of participation. Where there are also lengths of river with open access, angling clubs may be able to give an indication of the number of trips made by club members but may not include trips made by the general public.

The NRA Angling Survey 1994 gives the following estimates of club membership by fishery type. This is shown in Table A3.5 and can be used to estimate the number of trips made by non-members to a fishery when you have obtained an estimate of member trips.

Table A3.5 Attendance at different fishery categories according to membership status

Fishery type	% Members	% Non-members
Coarse fishery	51% to 56%	44% to 49%
Trout (non-migratory salmonid) fishery	55%	45%
Salmon (migratory salmonid) fishery	62%	38%

Source: based on information given in NRA (1995): *National Angling Survey 1994*, and supporting information from the FWR Manual (1996); in Environment Agency (2003)

Environment Agency rod licence data

Obtaining the number of rod licences within the local area (by postal code zones) will give the basis for estimating the potential number of anglers that visit the affected river. To do this, it is necessary to determine what distance from the river is likely to include those anglers who would visit the river being assessed. This will be determined by the quality of the fishery and the existence of other fisheries in the area that are of a similar (or better) quality (alternative sites). The proportion of rod licence holders that will visit a coarse, trout and salmon fishery are given in Table 6.12, along with the most appropriate distances that they will travel to a particular site. These figures have been generated through a review of specific data on anglers and their visit characteristics.

Number of licence holders visiting the river = number of licence holders within given distance (from Table A3.6) x % of licence holders visiting the fishery type (from Table 6.15)

Table A3.6 Proportion of rod licence holders that may fish the affected river

Fishery type	Few (<2) alternative sites	>2 alternative sites
Coarse fishery	35% within 30 km	35% within 15 km
Trout (non-migratory salmonid) fishery	46% within 60 km	46% within 30 km
Salmon (migratory salmonid) fishery	29% within 60 km	29% within 30 km

Notes: Given as a guide as to the distance that anglers may be willing to travel to visit a particular river. For very high quality fisheries (e.g. nationally, regionally known), larger distances may be appropriate.

Source: Based on a number of sources including Spurgeon *et al* (2001), NRA (1995), in Environment Agency (2003).

The total number of angling visits being made to the affected river can be estimated by using the average number of trips made by anglers to different fishery types (Table A3.7, overleaf).

Table A3.7 Number of trips made per year to different fisheries

Fishery type	Number of angling trips per year	
	Lower bound	Upper bound
Coarse fishery	17	32
Game fishery	3	11

Source: based on information given in Spurgeon *et al* (2001) and NRA (1995) for percent of trips made to the regular site and number of trips made to each fishery type, in Environment Agency (2003)

Number of angling trips = number of licence holders visiting the river x number of trips made per year

Default data

Where no site counts, visitor survey, angling club or rod licence data are readily available, it will be necessary to use default data to estimate the potential number of anglers. When selecting the most appropriate figures the following should be considered:

- level of access to the fishery: is it privately owned with restricted access? Is it privately owned with access through angling clubs? Is it a day ticket or open access fishery?
- how many alternative fisheries are there likely to be in the local area that are of similar (or better) quality?
- what is the current level of angling activity and the potential to attract new anglers or encourage existing anglers to make more trips to the river?

Table A3.8 provides a summary of the distances anglers may be willing to travel combined with the percentage of the population that may visit each fishery type (by Agency region).

Table A3.8 Proportion of the total population that may visit a fishery type

Fishery type	Distance	% of Population							
		Anglian	Northumbria & Yorkshire	North West	Severn Trent	Southern	South Western	Thames	Wales
Coarse fishery	30 km	6%	4%	4%	4%	5%	4%	3%	4%
Trout fishery	60 km	7%	5%	5%	5%	7%	5%	4%	6%
Salmon fishery	60 km	5%	3%	3%	3%	4%	3%	3%	3%

Notes: Given as a guide as to the distance that anglers may be willing to travel to visit a particular river. For very high quality fisheries (e.g. nationally, regionally known), larger distances may be appropriate.

Source: Environment Agency (2003)

There are two methods to infer the number of population affected:

- drawing a circle around the river with a radius equal to the most appropriate distance shown in Table 5.14 and either using GIS-data, census data or an OS map determine the population (number of adults) within the circle:

population = number of people living within the circle drawn x percentage of population expected to visit the fishery type

- or, using the population density data, to calculate the affected population by using the following formula:

population = 3.14 x distance (in km) squared x population density

Table A3.7 shows the average number of trips made to fisheries of different type and quality. Two values are given (an upper and lower bound) to highlight uncertainty within the estimates.

Number of angling trips = population x average number of trips (Table A3.7)

Alternative sites

The estimated number of angling trips made to each fishery type each year is calculated by multiplying the appropriate population by the number of trips made to each fishery type. However, this needs to be corrected for the number of alternative sites that may be available. The adjustment is made by estimating the number of alternative sites of better or similar angling opportunities and dividing the total number of angling trips made each year by the number of alternative sites plus one (to account for the site in question).

Number of angling trips to site in question = $\frac{\text{total number of angling trips (from above)}}{\text{number of alternative sites plus one}}$

Reality checks

The estimation of participation rates can often be associated with a high degree of uncertainty. The following checks are designed to give an indication of whether the obtained participation rate estimates are likely to be appropriate for the affected length of river in question. There are two approaches given here:

- comparison with maximum angler densities; and
- comparison with expected number of visitors to different types and qualities of fishery.

These comparisons are not designed to estimate participation rates, but rather to provide an indication of the expected number of visitors.

Comparison with maximum angler densities

For coarse fishing, there is generally one angler per 25m of bank², while for game fishing, there is (at most) one angler per 50 m of bank. To test whether the participation rate estimates are appropriate, it is assumed that 78% of angling trips are made at weekends, i.e. Saturday and Sunday, and this is the basis for determining if the participation rates are unreasonably high. For a coarse or salmon fishery, there are around 76 ‘weekend days’ and for a sea trout fishery 62 ‘weekend days’ within the open season. Thus in order to calculate the number of anglers per km bank the following is applied:

Coarse/salmon fishery: daily number of visits = no. of angling trips x 0.78 ÷ 76

Sea trout fishery: daily number of visits = number of angling trips x 0.78 ÷ 62

Number of anglers per bank = length of accessible river bank ÷ daily no. of visits

For example, if there are 3,200 angling trips made annually to a coarse fishery, the number of ‘weekend days’ trips is estimated at 2,500 (3,200 multiplied by 78%), which gives an average of 33 trips per weekend day. If the affected length of accessible riverbank is 5 km, the average density on a weekend day can be estimated at 1 angler per 150m. Therefore, the estimated annual number of trips does not appear to be unreasonably high.

Comparison with expected number of angling trips

Table A3.9 provides a number of sites where the number of angling visitors has been counted. These figures may provide a useful comparison against the estimates.

Table A3.9 Visitor numbers to selected angling sites

Location	Fishery type and description	Number of anglers
Mawddach (Dolgellau)	Regionally important salmon river, access through angling club/day ticket and/or for visitors to accommodation with privately owned stretches	1,980/km bank per year
River Waveney	Locally important coarse fishery (with day tickets available for visitors/tourists)	2,100/km bank per year
Rutland Water	Stillwater trout fishing, regionally important lake stocked with trout	1,400/km bank per year
Grafham Water	Stillwater trout fishing, regionally important lake stocked with trout	1,100/km bank per year
12-acre lake in North West	Non-migratory trout in lake with access by day ticket	280/km bank per year

Source: Based on consultation undertaken by RPA when assessing impacts on angling for a number of river/lake schemes, plus published visitor numbers (where available), in Environment Agency (2003)

² It could be expected, however, that this average density may be higher in urban areas owing to higher levels of demand.

Benefits transfer

The contingent valuation studies undertaken as part of the development of the *FWR Manual* (FWR, 1996) derived a range of values relating to the improvement of the quality of a fishery, where this includes moving from no fishery to a high-class fishery. These values are presented in Table A3.10 for coarse angling. These are the best estimates currently available for use in BT. They were derived specifically for use in a BT context. The surveys were undertaken in a number of different locations across England and Wales with the aim of generating mean estimates that would be broadly correct within any regional context, in terms of variations in river types and characteristics and in socio-economic characteristics.

Table A3.10 Benefit per angling trip for improvements in a coarse fishery (2001 prices)

Quality of fishery to be created	Willingness to pay per angling day	Marginal value of improvement in fishery quality
'Poor' (assumed average fish biomass <600g/100m ²)	£4.30 per person per trip	No fishery to poor = £4.30
'Moderate' (assumed average fish biomass 600-2000g/100m ²)	£4.53 per person per trip	Poor fishery to moderate = £0.23
'Good' (assumed average fish biomass >2000g/100m ²)	£6.87 per person per trip	Moderate fishery to good = £2.34

Source: Green and Willis (1996) in Environment Agency (2003)

The study undertaken by Green and Willis (1996) for the *FWR Manual* also determined willingness to pay (WTP) values for the creation of different quality trout fisheries, with the resulting values set out in Table A3.11.

Table A3.11 Benefit per angling trip for improvements in a trout fishery (2001 prices)

Quality of fishery to be created	Willingness to pay per angling day	Marginal value of improvement in fishery quality
'Poor' (assumed average fish density of fish >20 cm, <0.8 fish per 100m ²)	£9.81 per person per trip	Coarse to poor trout =£1.94
'Moderate' (assumed average fish density of fish >20 cm, 0.8 - 2 fish per 100m ²)	£11.43 per person per trip	Poor to moderate = £1.62
'Good' (assumed average fish density of fish >20 cm, >2 fish per 100m ²)	£17.91 per person per trip	Moderate to good = £6.48

Source: Green and Willis (1996); *FWR Manual: Assessing the Benefits of Surface Water Quality Improvements*, in Environment Agency (2003).

Only two surveys have been identified which have derived estimates of the value of a salmon angling day. The first was undertaken by Radford (1984) and found a value of roughly £17.30 per angler per day. The second study is that undertaken for the *FWR Manual*. A value of £28.20 per person per trip was found for the creation of a new, good quality site, where an average angler had a 1 in 10 chance of catching a salmon each day³. Both values could be carried forward as a lower and upper bound, as they will provide a range and an indication of the uncertainty surrounding the estimates.

³ The figure of £28.20 is supported by research undertaken on salmon fisheries in Northern Ireland (Davis and O'Neill 1992). This study found WTP values of between £20 and £28.50 (depending on experience) for maintaining access to angling licences and permits in Northern Ireland

A4. Coastal sites

A4.1 Recreation

Overview

This section discusses the valuation of recreational benefits from coastal protection and draws on the multi-coloured manual with regard to transfer values. This is because the values used in other methodologies are of more limited transferability, being linked with water quality changes. There is another advantage from using the values provided in the multi-coloured manual, this being that they include more specialist users. For aggregation, the methodology proposed in the AMP4 methodology has been adjusted in order to integrate informal and more specialist recreational users.

Qualitative description of impacts

The first step in the assessment is to determine whether recreation activities take place along the beaches/shoreline that will be affected by the scheme. To do this, the following questions are to be considered:

- how long is the relevant shoreline that will be affected and what is the extent of the access to the shoreline? Are there car parks, promenades, footpaths, etc. providing access?
- does recreation take place along the shoreline now? Are there any data on visitor numbers to the shoreline area? To what extent is the shoreline likely to be used for recreation purposes throughout the year?
- would it be likely to develop new recreational opportunities or change existing recreational activities in the future if the option is implemented (e.g. increasing the length of the promenade)? In answering this the decision maker should think about whether there is a nearby population centre and whether there are already nicer areas nearby that draw more local residents.

The answers to the above questions should be summarised and incorporated into the AST. If benefits to recreational users are expected to arise, then the next step is to move on to the quantitative assessment.

Quantitative assessment for recreation

There are a number of different methods available for estimating the number of people that may visit a particular beach for recreation purposes. The 'best' method will depend upon (i) the amount of information that is readily available and (ii) the amount of time you have to obtain and/or calculate potential participation rates.

Table A4.1 sets out two different approaches for estimating the number of beach users. The first relates to actual counts that have been made on the

beach by lifeguards, the local council (including car park counts) or a count taken on a site visit. Default values are given where the other sources of information are not available or where time constraints mean site-specific information cannot be obtained.

Table A4.1 Information sources for participation rates

Source(s)	Type of Information Required
Site visits or visitor surveys	Counts of number of beach/shoreline visitors on the beach over a specified period of time Car park data can also be used to give an indication of the potential number of beach/shoreline visitors
Default data	Information provided in tables given below

Source: Environment Agency (2003)

Site visits or visitor counts

Counts of the number of visitors to a particular beach may be available from lifeguards (where present), local councils/authorities and/or other counts taken such as for Garber Data. These counts can take a number of forms. Depending on the type of data, the following adjustments will be necessary.

Adjustment for number of people travelling by car

The estimate of number of beach visitors should only include those over 16 (since these are the only visitors assumed to hold willingness to pay). Therefore, the number of adults travelling by car is based on the number of adults per household. This is estimated as 2.3 adults per household (the average number of adults per household as given by National Statistics 2002). Therefore, to convert number of cars to number of beach visitors, the number of cars counted should be multiplied by 2.3.

Adjustment for day of the week that the count was taken

Where counts are given for a specific day, it is necessary to convert this into a weekly total. Table A4.2 sets out the proportion of beach users that use beaches on specific days. These figures are based on the Countryside Recreation Network's *Day Visits Survey 1994* (CRN, 1996) as reported in RPA (2003). Different values are provided for England and Wales, as a review of studies considering numbers of beach visitors has found significant differences between the two countries. To adjust a daily count to a weekly count, the daily count should be divided by the appropriate percentage shown in Table 6.19. For example, if a count shows 134 beach visitors on a Friday in England, practitioner should divide this by 10% (0.10) to give 1,340 weekly visitors. Multiplying this weekly total by four will give an estimated monthly total.

Table A4.2 Adjustment for day of the week count was taken

Day	Adjustment	
	England	Wales
Weekday (per day)	8% - 10%	10%
Weekend (per day)*	16 % - 44%	15% - 33%

* range reflects variation according to bathing visits;
Source: based on CRN (1996), in Environment Agency (2003)

Adjustment for month in which count was taken

As with the daily counts, the number of trips made to a beach varies by month, with the peak months tending to be July and August in England and August and September in Wales. Table A4.3 provides an indication of the proportion of beach visits that are made each month. The practitioner should adjust the monthly totals by dividing by the percentage given for the month in which the count was taken. For example, if a monthly count of 275 beach visitors was taken in October in England, the practitioner should divide this by 6% (0.06) to give an annual estimate of beach visitors of 4,600. The user should compare this figure with the reality checks.

Table A4.3 Adjustment for month in which count was taken

Day	Adjustment factors	
	England	Wales
January	6%	8%
February	3%	2%
March	3%	4%
April*	6% - 23%	8% - 10%
May*	11% - 19%	2% - 13%
June*	6% - 19%	9% - 12%
July*	9% - 22%	10% - 15%
August*	14% - 23%	14% - 21%
September*	7% - 11%	16% - 31%
October	6%	5%
November	5%	6%
December	6%	12%

* range reflects variation according to bathing visits (for large sandy coastal sites, visits will increase in summer time, towards the upper end of the range).
Source: based on CRN (1996), in Environment Agency (2003)

Default data

Where count data are not readily available, the number of recreation trips to the beach can be estimated using default data. To estimate the number of recreational trips, the following steps should be followed:

Step 1: determination of the appropriate distance from which visitors are likely to travel to the affected beach. Table A4.4 sets out some default distances, which are based on the specific properties of different beach types. A review of the literature has shown significant differences between England and Wales, hence different assumptions are used for beaches in these countries.

Table A4.4 Distances from which a visitor may travel to visit a particular beach

Beach type	Estimated distance	
	England	Wales
Small beach, little access, valued for 'peace and quiet'	30 km	15 km
Small resort, good access, some beach facilities available	50 km	25 km
Large resort (long beach), facilities and entertainment available	130 km	65 km

Source: Environment Agency (2003)

Step 2: estimation of the adult population living within the distance identified from Table A4.4. To use population densities the practitioner will need to multiply the square of the distance from which a visitor may travel to the beach by 3.14 and by the population density to obtain the visitor population⁴. For example, the population density in Lincolnshire is 100 people/km². For a small resort, we would expect visitors to travel from up to 50km away. This gives a total potential visitor population of 785,000.

Step 3: not all of these potential visitors are likely to visit a beach. The estimated number of beach visitors is obtained by multiplying by 3% for beaches in England and 8% for beaches in Wales (based on CRN 1996, as reported in RPA 2003). For the small resort in Lincolnshire, the number of beach visitors can be estimated at 24,000.

Step 4: visitors may make more than one visit to the beach each year. Table A4.5 sets out the number of trips made by visitors to the beach/seaside each year. Using Table 6.26, the number of visits to the beach in Lincolnshire can be estimated at between 140,000 and 350,000 per year.

⁴ The formula to be applied is: $\pi (3.14) \times (\text{distance a visitor may travel})^2 \times \text{population density}$.

Table A4.5 Number of trips made to the beach/seaside each year

Beach Type	Number of trips per person per year	
	England	Wales
Recreation trips	9.75 - 14.5	15.7 - 24

Source: CRN (1996), in Environment Agency (2003)

Step 6: where there are alternative sites of a similar type and quality within the distance that a visitor may travel, only a proportion of all trips are likely to be made to the affected site. Thus, the number of visits to the site will be obtained by dividing the total number of visitors by the number of alternative sites plus one.

Number of households

Some of the BT values use willingness to pay per household per annum rather than per visit. Where there is a site count, the total count represents the number of household groups. The number of household visits is obtained by dividing the count by 2.3. The next step is to follow the approach set out above to adjust for the day and month in which the count was taken. Finally, the number of household visits needs dividing by the number of trips made per year (see Table A4.5).

Reality checks

Table A4.6 provides an indication of the number of recreational visitors estimated for different beach types (as reported in RPA, 2003). Note that not all these types of visitors are included, and thus figures may under or over-estimate the total number of visitors. The figures are offered for comparison purposes only, i.e. for checking whether the estimates are of the right order of magnitude, thus they do not aim to replace estimates for the number of visitors to the site.

Table A4.6 Numbers of users at different beach types

Beach location	Number of recreation trips per year	Beach/site description
Pembrokeshire Coast Path ¹	1,500,000 (4,300/km of path)	Coastal path is main site for walking in area, running for 300km from Amroth to Poppit
Whitmore Bay, Wales ²	210,000	Large sandy beach with easy access and good facilities
Llandudno North Shore ²	34,000	Resort town with wide promenade. Good access and facilities
Llandanwg ²	23,000	Less of a resort beach with mixed sand, shingle and rock. Attracts active visitors rather than sunbathers. Good access and some facilities

Beach location	Number of recreation trips per year	Beach/site description
Pendennis Head, Cornwall ²	26,000	On South West Coast Path, important visitor attraction, car park
St Anthony Head, Cornwall ²	9,200	On South West Coast Path, car park
South West Coast Path ²	1,100/km of path	Estimate taken from South West Coast Path Survey; important and well-used footpath around the coastline
Blackpool, central ²	130,000	Large resort with wide beach and promenade
Mablethorpe, Lincolnshire ³	166,000	Large resort on Lincolnshire coast, includes dog walking, walking, games by holiday makers, day trippers and local residents
Heysham, North West ²	48,000	Sandy, popular beach
Sutton-on-Sea, Lincolnshire ³	71,000	Spacious beach, with peace and quiet one of its main attractions
Haverigg, North West ²	9,000	Sand dunes, high amenity
Huttoft, Lincolnshire ³	11,000	Small resort, peace and quiet an important attraction, people can drive onto car terrace to look at sea
Allonby South, North West ²	600 to 2,300	Sand and rock, slightly muddy, popular beach

¹ Includes water sport participants

² Informal recreation only

³ Includes bathers

Source: based on Environment Agency (2003)

BT for coastal recreation benefits

In 1992, the Flood Hazard Research Centre developed and tested a variant of the CV method, based on the value of enjoyment (VOE) per adult visit. This is one of the recommended approaches for use in coastal recreation benefit assessment in the Multi-Coloured Manual (Penning-Rowse *et al.*, 2003) and is also accepted by FCDPAG 3 at the pre feasibility stage. In the VOE approach, respondents are asked to put a value on their enjoyment of a day's visit under varying options in £'s and pence, therefore measuring use value alone. Visitors are classified as follows:

- **local visitors:** those living within a 3 mile radius of a site, which is deemed to be possible walking distance;
- **day visitors:** anyone starting and finishing their trip from their permanent home, including some who may define themselves as locals but who live more than three miles away from the site; and

- **staying visitors:** anyone staying away from home for one or more nights. This includes visitors not staying at or near the site but making a day trip there while staying away from home.

The annual recreation benefits can then be determined as:

Annual benefits = £ value of the option (VOE gains and/or losses or WTP valuations) x number of visits per annum (VOE) or number of beneficiaries/visitors (WTP).

Table A4.7 shows average losses under the 'do-nothing' options. Table A4.8 shows average gains under the 'do something' options, including a description of the change with the option.

Table A4.7 £ losses per adult visit with erosive changes at coastal sites – 'do-nothing'

Site	Change with erosion	% expecting less enjoyment	£ loss mean per adult visit – updated to 2001			
			Local	Day	Staying	All
<i>Beach and promenade erosion</i>						
Yellow Manual Standard data: 4 sites	Deterioration in beach and promenade	85%	2.36	3.53	8.28	5.36
Lee-on-Solent	Shingle beach erosion	NA	3.05	2.12	3.74	2.74
Herne Bay Visitors survey	Deterioration in beach, seawall and promenade collapsed in parts	-	2.72	2.55	10.61	5.25
Cliftonville	Cliff erosion, deterioration in beach, cliff top promenade closed in parts	83%	6.46	6.32	5.65	5.91
Corton (Residents staying visitors)	Cliff erosion, deterioration in beach and seawall very reduced access to, and along beach and seawall	81%	2.08	-	1.82	1.89
St Mildred's Bay	Severe damage to esplanade wall, esplanade unsafe and closed in parts	92%	6.92	7.84	8.25	7.71
Hastings	Beach deterioration	NA	NA	NA	NA	5.43

Site	Change with erosion	% expecting less enjoyment	£ loss mean per adult visit – updated to 2001			
			Local	Day	Staying	All
<i>Breach scenarios</i>						
Hengistbury Head	Breach, boat access only to Head, reduced cliff top area and paths	62%	4.44	3.26	3.55	2.80
Hurst Spit	Breach to shingle spit, access by boat only	98%	2.41	6.36	3.60	4.90

Source: Penning-Rowse *et al* (2003)

Table A4.8 £ gains per adult visit with coastal protection scheme options at coastal sites – ‘do-something’

Site	Change with scheme options	£ gain mean per adult visit – updated to 2001			
		Local	Day	Staying	All
<i>Beach and promenade erosion</i>					
Yellow Manual Standard data: 4 sites	Nourished beach and promenade	1.55	2.69	1.95	2.22
Lee-on-Solent	(a) Shingle beach renourishment	1.29	1.23	1.26	1.26
	(b) Rock groynes	1.24	1.18	0.75	1.24
Herne Bay Visitors survey	(a) Reef or jetty with no boat facilities	2.88	2.46	5.53	3.82
	(b) Reef or jetty with boat facilities	2.74	1.87	1.73	1.98
	(c) Higher seawall, and promenade, rock groynes	1.74	2.46	2.81	2.45
Cliftonville	(a) Concrete lower promenade	1.75	1.59	4.19	3.36
	(b) Rock lower promenade	0.89	1.37	2.47	1.97
Corton	(a) Hold the line for a limited period Short term protection to cliff, limited access to beach and along seawall	1.99	-	1.84	1.88
	(b) Hold the line for a longer period >50 years. Full access along renewed seawall and onto all the beach from village	13.64	-	6.83	8.40
	(c) Managed retreat. Sea defences and seawall removed to leave a ‘natural’ seafront’, direct access from village to beach	-0.20	-	1.81	1.30
St Mildred’s Bay	Improved beach and promenade	2.39	1.73	1.98	2.10
Hastings	Beach improvement	NA	NA	NA	
<i>Breach scenario</i>					
Hengistbury Head	(a) five rock groynes full cliff protection	-0.01	0.53	-0.22	0.04
	(b) three rock groynes partial protection	-2.16	-1.07	-2.72	-2.13
	(c) beach nourishment Annual disruption	-1.96	-3.18	-4.69	-3.22

Site	Change with scheme options	£ gain mean per adult visit – updated to 2001			
		Local	Day	Staying	All
Hurst Spit	Slightly enlarged shingle spit	0.83	0.33	0.59	0.51

Source: Penning-Rowsell *et al.* (2003)

WTP values for coastal protection are given in Table A4.9. The problem with these, however, is that they do not allow for option comparison between ‘do something’ options, thus limiting their applicability to the appraisal of different flood and coastal defence standards of protection.

Table A4.9 Willingness to pay for coastal protection

Site	Survey date	Sample size and type	Payment vehicle	WTP format	% WTP	£ Mean WTP: Updated to 2001	
Peacehaven cliff top	1988	214 Residents	Increased rates and taxes p.a.	WTP diagram	55% overall		
						50p starting point	2.92
						£1 starting point	4.52
Herne Bay	1990	189 Residents	Extra national and local taxes p.a.	WTP diagram	3% overall		
						40p starting point	7.48
						80p starting point	8.94
Herne Bay	1990	143 Visitors	Extra national and local taxes p.a.	WTP diagram	55% overall		
						40p starting point	4.81
						80p starting point	6.33
Hurst Spit	1991	550 Visitors	Additional taxes p.a.	WTP payment ladder	74% overall		
						25p starting point	12.14
						£32 starting point	53.52
St Mildred's Bay	1992	462 Visitors	Extra national and local taxes p.a.	WTP payment ladder and two starting points: 25p and £128	61% overall	39.70	

Site	Survey date	Sample size and type	Payment vehicle	WTP format	% WTP	£ Mean WTP: Updated to 2001
Cliftonville	1993	528 Visitors	Small increase in national and local taxes p.a.	WTP payment ladder with two starting points: 50p and £64	62% overall	23.79
Caister (1)	1997	452	Extra taxes every year	Open question	NA	
		Visitors				34.84
		Local residents				28.47

Source: Penning-Rowsell *et al.* (2003)

A5. Sensitivity analysis

Sensitivity analysis is an important part of the economic appraisal of impacts as a means of checking the robustness of the valuation of impacts. It is recognised as a paramount step in the different appraisal methodologies, including flood management and coastal defence appraisals, but also more general government guidance. The Green Book (HM Treasury 2003), for instance, notes that where there is significant uncertainty about values assigned to outputs and outcomes, or to their probabilities, sensitivity analysis can establish how vulnerable the conclusions of the appraisal are to alternative plausible assumptions (HM Treasury 2003).

Within the flood management and coastal defence context, FCDPAG 3 notes that, for major projects, it is particularly important to identify 'switching points' where a change in the assumptions would change the option choice (MAFF 1999).

The purpose of the sensitivity analysis should thus be to assess the impact that changing the values of parameters would have on the benefits of the option, that is, the impacts of changing assumptions on calculating the number of users affected, when applicable, and/or benefits transfer values. FCDPAG 3 also lists other possibilities for inclusion within the sensitivity analysis, and those more applicable to benefits transfer are:

- timing of benefits/dis-benefits, that is, when impacts are expected to arise and cease; and
- threshold of flooding (for instance, sensitiveness about the level and frequency of flooding affecting recreation and angling under different management options).

It is important, however, to undertake a sensitivity analysis in a reasonable manner. The Green Book stresses that although sensitivity analysis can be carried out on all parameters associated with uncertainty, it is essential that this is undertaken for those factors that have the most significant impacts on the NPV. Thus, we recommend sensitivity analysis only when there is a high degree of uncertainty to the benefits and any changes in parameters could prove important to the end-results.

A6. References

FWR (1996) *Assessing the Benefits of Surface Water Quality Improvements – Manual*, Foundation for Water Research, Marlow.

Penning-Rowsell E, Johnson C, Tunstall S, Tapsell S, Morris J, Chatterton J, Coker A and Green C (2003): *The Benefits of Flood and Coastal Defence: techniques and data for 2003 (Multi-Coloured Manual)*, Middlesex University, Enfield.

RPA (2003) *Assessment of Benefits for Water Quality and Water Resourced Schemes in the PRO4 Environment Programme – Guidance*, Report prepared for the Environment Agency.

RPA (2003) *Evaluating a Multi-Criteria Analysis (MCA) Methodology for Application to Flood Management and Coastal Defence Appraisals – Issues Report*, Report prepared for the Environment Agency.

Also refer to the Case study report.