

Development of a Methodology to Determine the Cost-Effectiveness of Measures and Combinations of Measures for the Water Framework Directive (WFD)

Combined CEA Methodology Report

A: Introduction

for

The Collaborative Research Programme on River Basin Management Planning Economics

***RPA* Consortium**



MWH



SISTech

Scottish Institute of
Sustainable Technology



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prepared for

**The Collaborative Research Programme
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by

Risk & Policy Analysts Limited,
Farthing Green House, 1 Beccles Road, Loddon, Norfolk, NR14 6LT
Tel: 01508 528465 Fax: 01508 520758
Email: post@rpaltd.demon.co.uk

and

MWH,
Craigievar House, 77 Craigmount Brae, East Craigs, Edinburgh, EH12 8XF
Tel: 0131 339 0777 Fax: 0131 339 0888

in association with:

Atkins, TRC Economics, Ecologic, ABPMer, Policy Research Consultants,
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Report Prepared by:	M Postle, T Fenn, A Foottit, R Salado, S Reid, C Namazie, J Leslie, A Thornton, D Hunt, J Thorne, E Interwies, P Strosser, B Görlach, S Hull, S Freeman, A Johnson, J Wishart, S Gillman, M Shepherd
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PREFACE

This report acts as Part 2 of the Final Report to Project 2b on ‘Developing Methodologies to Assess Costs and Economic Impacts Even Handedly for the Main Types of Measures’. Although this report has been produced as an output of Project 2b, it also incorporates the effectiveness methodology produced under Project 2a (SNIFFER Project WFD54), which is also subject to separate reporting requirements.

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1. PROJECT CONTEXT

1.1 Background to the Project

The *UK Collaborative Research Programme (CRP) on River Basin Management Planning Economics*, has been set up to develop the methodologies needed to undertake the Water Framework Directive (WFD) economic analysis and to provide the guidance on these methodologies in the UK. The Collaborative Research Programme (CRP) involves fourteen parties and is chaired by Defra¹.

The CRP will run from April 2004 to March 2008. It comprises six sequential projects, with these presented in Table 1, focused on the progressive development of the approaches and data required to assess the costs and benefits of Programmes of Measures (PoMs) proposed under the WFD.

Table 1: Sequential Programme of Work for ‘UK Collaborative Research Programme (CRP) on River Management Economics’
<ul style="list-style-type: none"> • Project 1: developing a better understanding of how economic analysis can best be used to support the decision making processes; • Project 2: developing a methodology and guidance to assess the cost effectiveness of measures and combinations of measures for the WFD; • Project 3: guidance on the evidence required to justify disproportionate cost decisions under the WFD; • Project 4: specifying the environmental benefits of concern in the cases identified in Project 3; • Project 5: developing and trialling guidance on benefits assessment for River Basin Management Plans (RBMPs); and • Project 6: carrying out original studies to provide new valuations of the major environmental benefits of RBMPs.

This report relates to work being undertaken on Project 2, which has four components:

- Project 2a (SNIFFER funded project WFD 54) is focused on developing a methodology for assessing the effectiveness of measures and combinations of measures;
- Project 2b is focused on developing a methodology for an even-handed assessment of the costs and economic impacts of measures and led on the combining of the methodologies to produce a cost effectiveness methodology;

¹ Parties to the CRP are: Department of Environment, Food and Rural Affairs (Defra), Scottish Executive, the Environment Agency, Scottish and Northern Ireland Forum for Environmental Research (SNIFFER), Scottish Environment Protection Agency (SEPA), English Nature, Department of Trade and Industry (DTI), UK Water Industry Research (UKWIR), Royal Society for the Protection of Birds (RSPB), Welsh Assembly Government (WAG), Department of Environment Northern Ireland (DOENI), British Ports/UK Major Ports Group (UKMPG), Countryside Landowners and Business Association (CLBA), National Farmers Union (NFU), and Joint Environment Programme (JEP).

- Project 2c requires the development of a benchmark costs database and will produce and test guidance for the application of the cost effectiveness analysis (CEA) methodology; and
- Project 2d requires the development and testing of tailored proformas for obtaining local specific cost information for different sectors.

Projects 2a and 2b build on *Cost Effectiveness Analysis (CEA) and Developing a Methodology for Assessing Disproportionate Costs* (RPA et al, 2004)², which provides an overarching theoretical framework for undertaking cost-effectiveness analysis under the WFD and for assessing disproportionate costs.

This report brings together the outputs of Projects 2a and 2b to highlight the combined CEA methodology.

1.2 Overview of the Overall Methodology

The proposed overarching methodology for determining the most cost-effective programme of measures and determining whether or not these would be disproportionately expensive has been divided into a number of stages. The first stages relate to the CEA component of the assessment (assessing both costs and effectiveness), while the final stage is concerned with determining disproportionality and is based on extended CBA. The stages are as follows:

- i) identification of general measures and/or local measures: covered by the effectiveness methodology (Part B of this combined methodology report); this includes assessing the effectiveness of individual measures and screening to reduce the number of measures considered when developing combinations of measures;
- ii) development of combinations of measures: covered by the effectiveness methodology (Part B);
- iii) predicting the effectiveness of combinations of measures: covered by the effectiveness methodology (Part B);
- iv) estimating costs, with this starting with the estimation of direct financial and economic costs, with only qualitative and quantitative descriptions of non-water (indirect) costs and wider economic costs, and moving to the full monetary valuation of all costs and benefits (to the degree possible), covered by the costs methodology (Part C of this report);
- v) assessing cost-effectiveness (based on expected values) to identify the most cost-effective programmes of measures, which forms Part D of this report; and
- vi) assessing disproportionate costs, affordability and distributional issues, based on economic and financial considerations, consideration of economic viability and the extent to which the polluter pays: with this to be covered by subsequent projects (CRP Project 3) and is therefore not included in this report.

² Report available from: www.defra.gov.uk/environment/water/wfd/economics/pdf/ceafreport.pdf.

Figure 1.1, overleaf, shows how these components fit together to form the structure of the overall framework, into which this CEA methodology fits. The methodology for assessing effectiveness has been developed by Project 2a, while the methodology for costs has been developed by Project 2b.

It is important to note that although this methodology is focused on assessing measures designed to achieve good status, the principles also apply to other related requirements of the WFD. For example, the same principles and basic approach as set out here is being applied to the assessment of measures in relation to Article 16 of the WFD.

The methodology has been designed to be applicable at different geographic scales: local/sub-regional, regional and national.

1.3 Links Between Effectiveness and Costs Assessments

As cost information is developed, the combinations of measures will need to be revisited and adjusted to ensure that the most (cost) effective combinations are being considered. In essence, this may involve examining the impact that different levels of effort have on both the effectiveness and costs of combinations of measures.

This will include screening out some measures and/or combinations of measures that appear to be dominated across most effectiveness attributes and costs. The aim is not to screen out measures that are less effective but also of lower cost, but to screen out those measures that are clearly less effective and likely to be of equal/higher cost or that are not feasible for technical or legal reasons.

1.4 Structure of the Combined Methodology Report

The Methodology report is divided into four parts, A to D. This introductory section forms Part A, with the effectiveness methodology set out in Part B, the costs methodology in Part C, and the cost-effectiveness analysis methodology in Part D. The steps covered by each Part of the report are also shown in Figure 1.1, overleaf.

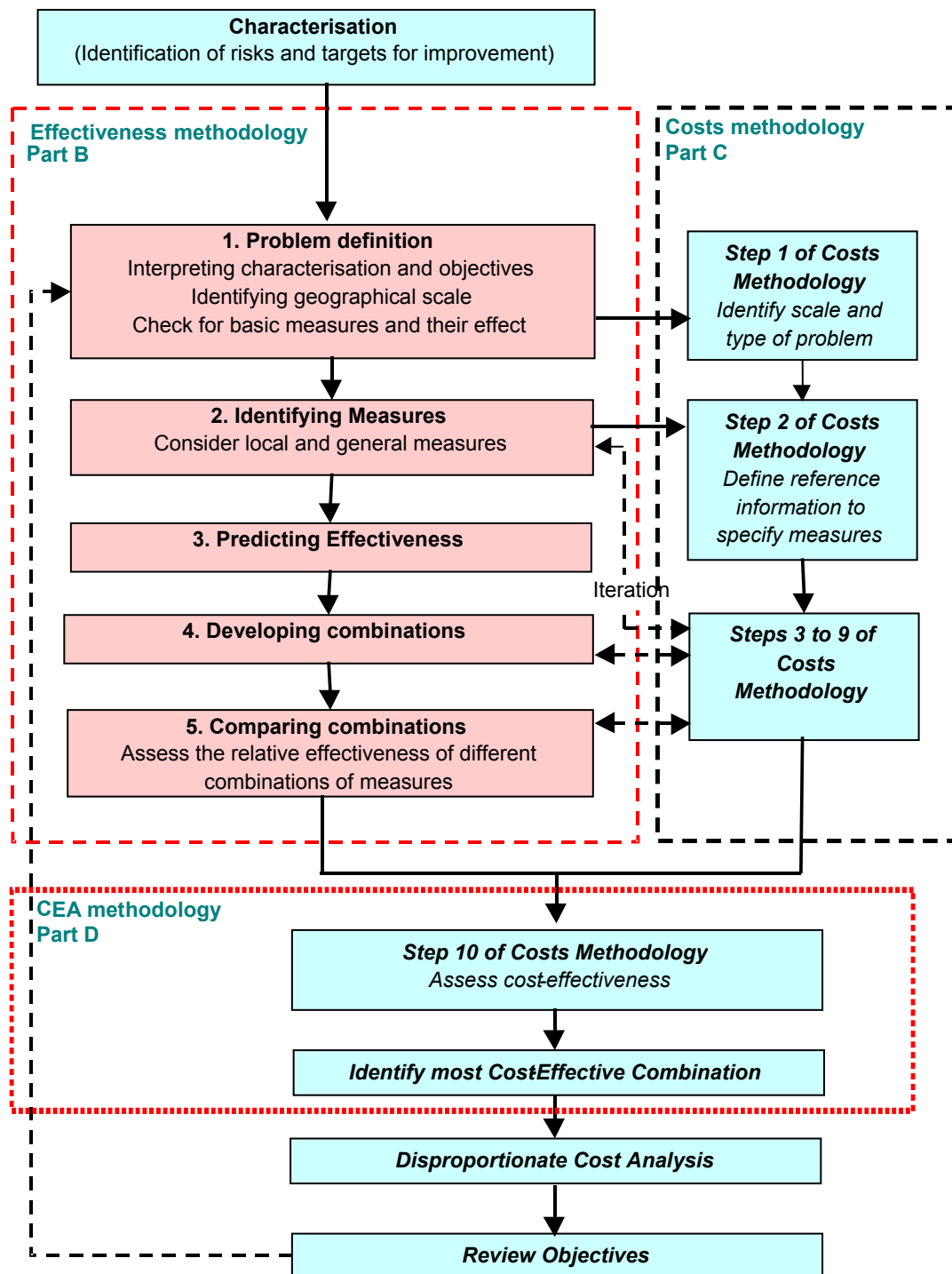


Figure 1.1: Overview of Structure of the Cost-Effectiveness Methodology

2. PRE-REQUISITES FOR THE CEA METHODOLOGY

2.1 Application of the Methodology

A first pre-requisite for application of the methodology is the identification of the risks to the water bodies under consideration, as determined from the characterisation. It is understood that risks identified by the initial characterisation are being reviewed during a second stage characterisation process.

A second pre-requisite is knowledge of the default targets for the type of water body under consideration (e.g. good ecological and chemical status for surface water bodies) expressed in measurable terms. It is understood that this classification work is still to be completed.

Even once default targets are known, objectives for the water bodies under consideration cannot be confirmed until an initial cost-effectiveness and disproportionate cost analysis has been completed. Alternative objectives may be set on the basis of considering costs and benefits of measures, although this derogation is not always available, for example in protected areas.

A third critical pre-requisite of the methodology is to confirm the need to undertake cost-effectiveness analysis. By its very nature, application of the effectiveness methodology demands a rigorous consideration of the problem and of measures to address the problem. This is to ensure that comparison of the effectiveness of combinations of measures is robust and auditable. Therefore, it is desirable to screen out those problems which do not warrant cost-effectiveness analysis. This is discussed further in the next section.

2.2 Problem Screening and Sign-posting

There will be a number of cases where a full CEA is not required. These include:

- problems that will be solved by implementing obligatory measures specified in other Community legislation (e.g. UWWTD);
- problems that are due to a single pressure or set of pressures caused by the activities of one water user and where there is an existing delivery mechanism for ensuring action by that water user³;
- problems that will be fixed by measures already agreed; and
- problems that can be solved by a combination of measures that stakeholders are willing and able to implement.

³ In this case, the water user responsible for the pressure can decide how they wish to most cost-effectively solve the problem. It is up to them to consider their options and innovate if appropriate. In doing so, it may be in their interests to follow an approved methodology if they later wish to claim disproportionate expense.

This is because the effect of existing measures should already be taken into account in the analysis of pressures. If, after allowing time for all existing measures to take effect, characterisation has shown that there is still a problem (a gap to close), then by definition new measures will be required to ensure WFD objectives are achieved, and the assessment of any new measures is potentially subject to CEA.

Problems that will require CEA include:

- multiple significant water management issues where there are different options for addressing a type of problem that occurs widely within a River Basin District. In such cases, increased efficiency in applying the methodology could be achieved by using the methodology to identify combinations of measures at a generic level. The CEA methodology allows for the identification of economies of scale; and
- individual significant water management issues that are of such importance as to warrant detailed case-specific analysis.

Notwithstanding the above, there may be circumstances where the problem is sufficiently straightforward so as not to warrant the time and resources associated with carrying out a full CEA. For example, where the cost-effective solution to certain problems may be self-evident or where preliminary work has already been carried out on identifying a range of possible measures. In these circumstances it may be possible to take a simplified approach, which either does not require all of the steps of the methodology to be employed in strict sequence (e.g. assessment of costs is not required) or allows relaxation of the analysis within individual steps (e.g. limiting the number of effectiveness attributes). Determination of the criteria under which it is acceptable to adopt a simplified approach to the CEA needs further investigation⁴.

In addition to examining these pre-requisites for entering the methodology, there are a number of ‘signpost’ features embedded in the individual steps. These include:

- highlighting problems where potentially useful measures can be identified but for which there are currently no delivery mechanisms; and
- highlighting problems where there are potentially more cost-effective new delivery mechanisms (e.g. product and process controls; economic instruments; etc.). These are usually likely to be national mechanisms, but not necessarily exclusively so.

⁴ The Urban Pollution Management (UPM) methodology is an example of a complex methodology where simpler options can be employed when appropriate. Reference to this methodology may provide guidance on the criteria to be used for selecting between different levels of analysis.

2.3 Recommendations for Use of the Methodology

Whilst the steps of the methodology are designed to be applied in succession, the user is encouraged to adapt use of these steps to suit the particular circumstances of the problem under consideration.

- **Simple application:** Apply each of the steps in succession from problem definition to the comparison of combinations. This approach is best suited to the simpler and less contentious problems where the default objective for achieving good status can be met without disproportionate cost. Where the problem is high profile, or particularly complex involving multiple stakeholders, care will be needed to ensure that approach provides a robust outcome;
- **Repeated iterations of individual steps:** Use the steps as the foundation but repeat individual steps as necessary, with further refinement and inclusion of more detailed data, as many times that it takes to reach agreement with stakeholders. For instance, if it is easy to agree what measures are required, based on very little detail - then complete the methodology on that basis. Only go into lots of detail with a large volume of data where there is considerable uncertainty about which measures will work/are acceptable to stakeholders;
- **Selected application:** Apply individual steps to suit the problem under consideration. This may be particularly relevant where multiple problems of a similar type are being considered together. For example, Steps 1, 2 and 3 of the effectiveness methodology may be applied for a selection of cases to build up a generic set of potential measures and combined with the derivation of initial cost estimates following Steps 1 to 9 of the costs methodology using readily available cost data. Steps 4 and 5 of the effectiveness methodology, and the development of more detailed cost estimates would then be applied to the cases where further analysis is required to determine cost-effective combinations.; and
- **Repeated application of complete methodology:** Although the standard for good status will be known, it may be necessary to determine alternative objectives if it is judged technically infeasible and/or disproportionately expensive to achieve good status. (Alternative objectives may take the form of applying extended deadlines or less stringent objectives than good status). This judgement can only be made after an initial assessment of cost-effectiveness and whether costs would be disproportionate and so in some cases more than one application of the methodology will be required to secure a satisfactory cost-effectiveness outcome. The first application is likely to be most detailed with any subsequent applications limited to updating the combinations of measures to meet an agreed set of objectives.

With respect to the point on ‘repeated application’, derogation according to extended deadlines or less stringent objectives will only be considered in exceptional circumstances. The European Commission expects only a small number of cases to qualify for derogation. Hence the need for repeated applications of the methodology is likely to be the exception to the rule.

2.4 Engagement with Stakeholders

Whilst the methodology provides a framework for the identification of effective combinations of measures, the successful application of the methodology is dependent upon appropriate engagement with stakeholders. Whilst the responsible agency will carry out the initial screening process and will administer the overall process, cost-effectiveness analysis will need to be carried out in conjunction with the specific actors giving rise to the pressures and other interested stakeholders.

3. MEASURES AND MECHANISMS

3.1 Measures and Mechanisms

A measure is an action to be taken while a mechanism is the delivery process for implementing that action. This means that a measure could have a number of different delivery mechanisms. For example, a measure could be to reduce use of fertilisers. This could be implemented through a number of different mechanisms such as a ban on fertilisers, a tax, or a code of practice. This is pertinent to the evaluation of costs and also in assessing some effectiveness attributes such as the certainty of outcome. In theory a measure could have more than one mechanism; this is also discussed in more detail within the methodology in Section 2.2.2 of Part B (effectiveness methodology).

3.2 General Measures

The identification of new general (regional or national level) measures or delivery mechanisms that could be applied to multiple water bodies is a desirable objective since their successful implementation will reduce the magnitude of risks to be addressed at local level.

Because the methodology incorporates a careful distinction between measures and mechanisms to deliver them; it is therefore possible to:

- examine the effectiveness and costs of delivering the same measure using different delivery mechanisms. This could be used to support a case for moving from an existing mechanism to another more effective one (e.g. turning a voluntary code into a set of binding rules); and
- demonstrate the cost-effectiveness of a new measure through the establishment of a new delivery mechanism.

Ideally, the process of identifying new general measures needs to be carried out separately from and in advance of devising combinations of measures for local risks. However, the methodology recognises that this may not always be possible. Therefore, it includes steps that would enable users to identify where new general measures might be a viable alternative to local measures, even if they cannot be implemented within the scope or timescale of the WFD six year river basin planning cycle.

4. THE COMBINED CEA METHODOLOGY

4.1 The Effectiveness Methodology

The effectiveness methodology incorporates a number of key features:

- **Rational method:** The underlying philosophy to the effectiveness methodology is that it is a rational method that brings structure to a complex problem with multiple stakeholders. The methodology is not intended to be applied mechanistically and in order to minimise the potential complexities certain aspects inevitably entail some value judgements;
- **Transparent and auditable approach:** The methodology promotes a transparent and auditable approach that ensures a move away from decision-making based on intuition towards a more informed approach where uncertainties are better understood and outstanding risks effectively managed. To whatever level of detail the methodology is applied, the structured approach, where the user is encouraged to record the output of each step, will always provide a good audit trail. Maintaining a full record of the assessment process will also facilitate review over future planning cycles and contribute to more consistent and even-handed approaches between sectors and different geographical areas;
- **Staged approach:** There are five steps to the methodology, which provide the foundation for defining the problem, the identification of potential measures and selection of combinations of measures to address the problem. The five steps are useful staging posts for stakeholder interactions both at the level of individual problems and across programmes of measures;
- **Flexibility to suit the detail of the problem:** The level of detail at which the method can be applied is determined by the complexity of the problem (multiple pressures and stakeholders) under consideration, the availability of data, and constraints on resources. This will allow the methodology to be used by various parties, from investment planners to agency operations personnel. Once experience of use of the methodology develops, it will be easier for users to select the appropriate level of detail at which to work. This flexibility is crucial given the current uncertainties associated with the River Basin Management Process and other aspects of WFD implementation (e.g. Classification) as it allows for the refinement of the process in the light of improved knowledge. This adaptive management approach will also be critical in relation to further refinement for future planning cycles;
- **Time required depends on level of detail in application:** Following on from the above point, the time required to apply the methodology is proportional to the level of detail at which it is applied. A high level application with estimated data and a lower level of consultation will take less time than a detailed application with extensive stakeholder engagement. Inevitably the more sensitive the problem, the more time will need to be expended to deliver a robust assessment; and

- **A tool for decision-making:** The methodology provides a map to the decision-making process. It ensures that data collation and analysis are kept separate from decision-making, highlights when decisions are needed, it allows critical dependencies to be managed in the process, it promotes co-operation between stakeholders involved in River Basin Management, and provides a firm basis from which costs can be determined.

4.2 The Costs Methodology

The assessment of costs requires identification of a range of different cost types and their aggregation to provide an overall estimate of the net costs of adopting combinations of measures over the long run. A general formula has been developed to reflect the cost types that need to be brought together to estimate the total costs of a measure (with further explanation of the terms and the overall sum given below):

$$PVMC_0^x = \sum_{\substack{t=0..n \\ i=1..m}} \beta \cdot \left(\sum_i \left\{ C_{it}^{NR} + C_{it}^R - T_{it} + [NW_{it}^c - NW_{it}^b] + [W_{it}^c - W_{it}^b] \right\} \right)$$

where: PVMC = present value of total incremental costs of adopting a measure

i = businesses/organisations affected

x = the measure under examination

t = time (in years)

C^{NR} = non-recurring costs/savings of measure

C^R = recurring costs/savings of measure

T = transfers associated with the measure

NW^c/NW^b = non-water environment costs/benefits and any resource effects

W^c/W^b = wider economic effects, as measured by changes in producer surplus and consumer surplus in related markets and not captured by estimation of direct non-recurring and recurring costs/savings

β is the discount factor $(1+r)^{-t}$

Thus, the total costs of a measure are the sum of the recurring and non-recurring financial costs (i.e. the capital, operating and maintenance costs) minus any cost savings and net transfers plus the additional costs that are not traditionally captured in capital, operating and maintenance costs occurring in the directly affected market. It will not always be necessary to put a money value on all of these cost elements; the level of quantification is linked to the scale at which the assessment is being undertaken. Furthermore, there may well be cases where the methodology does not need to be applied in full, for example, where there is only one real option or the choice between options is clear-cut in cost-effectiveness terms. In line with standard appraisal guidance, however, there will always be at least one alternative in terms of the do nothing or do minimum.

It will be most important to apply the methodology in full where there are several different options requiring expenditure by different stakeholders and where there are disputes as to whether the costs could be disproportionate (in such cases, costs will

need to be estimated even if there is only one measure under consideration as this information will be required for the CBA component of the assessment). Where decisions are likely to be more straightforward (e.g. where the technically best solution is also considered to be the most cost-effective), it may be possible to identify the most cost-effective measures through discussions with the sectors that will be required to implement them.

The methodology provides a basis for recording the decision process such that it is transparent and auditable. It will be of most value, therefore, when there is likely to be a need to demonstrate how a decision was undertaken and the data and assumptions upon which the decision was based. A cut-down version of the methodology could be used to prioritise actions, where the level of information required is less than that which would be provided by application of the full methodology.

Costs are to be calculated in both financial and economic terms. Economic values are the most appropriate to assessing the implications of measures from society's perspective. Financial estimates will be important to assessing who pays and also in terms of any follow-on assessment as to whether measures are disproportionately expensive. Developing financial costs will involve estimating the cashflow implications of a measure, with discounting undertaken using the time preference or opportunity cost of capital of the sectors incurring costs. Developing economic costs will require that transfers and other costs that do not reflect the real opportunity cost of resources to be excluded from the analysis. Discounting for economic costs is to be undertaken using the Treasury rate of 3.5% (reducing⁵). Dual reporting of financial and economic costs also facilitates transparency in terms of the incidence of costs.

To reflect the difference between measures applied at the local, sub-regional, regional and national levels, the methodology for costing impacts has been separated into a local/sub-regional component and a regional/national component. At the local/sub-regional level, the assessment may focus on only a few companies or operators, while at the regional or national levels the focus is likely to be more at the sectoral level.

This separation is considered appropriate as some types of cost (or benefit) impacts will not become significant until they occur at a larger geographic or economic scale than implied by a measure adopted only at a very local level, or when a number of local measures are aggregated together at the regional/national level. For example, wider economic impacts may not arise unless a whole sector is affected at a regional level, and in some cases at the national level. However, this will depend on the geographic extent of the primary and related markets, both of which might be local.

There are also different levels within both the local/sub-regional and regional/national methodologies as the overall design follows a tiered approach. This means that each of the steps can be applied at one of three different levels, where the amount of detail required increases from level one (the 'broad level') to level two (the 'detailed level')

⁵ The Treasury discount rate is 3.5% from years 0 to 31, 3% from years 30 to 75 and 2.5% from year 75 onwards.

and then to level three (the ‘in-depth level’). Thus, the amount of detail and quantification of impacts required and, hence, data to be collected increases from the broad to the in-depth level. However, each component is designed to be independent in that any one analysis can move to the appropriate level of detail. In this way, the assessment can be focused such that more time is spent on assessing those factors that are driving the decision and to addressing uncertainty within them.

4.3 Assessing Cost-Effectiveness

The final component of the combined methodology brings together the results of the effectiveness assessment and the cost assessment to provide an overall indication of cost-effectiveness in a way that will inform decision-making.

In bringing together the effectiveness and costs methodologies, the following are of key importance:

- the information presented must be in a simple enough form that a decision can be made, without the influence of too much ‘noise’; but
- key information, particularly concerning those attributes that cannot be expressed in money terms (for costs) or numeric terms (for effectiveness), must not be lost such that it is not taken into account at the decision-making stage.

Given the above, the project teams have concluded (with this view supported by the peer reviewers) that presentation of the results as a single numeric indicator of cost-effectiveness (i.e., costs ÷ effectiveness) would result in a loss of too much information and would oversimplify the actual trade-offs involved in choosing between combinations of measures. For example, any costs that are not expressed in money terms and additional effectiveness considerations are difficult to include in such a metric. There are also issues regarding the fact that this type of approach can hide or obscure key information, for example, on the uncertainty surrounding costs, the percentage of gap addressed and/or the area over which the pressure has been reduced.

Given the importance of ensuring that the decision making process is open to stakeholders, the information underlying the choice of the most cost-effective combination should be transparent. The use of a summary table also allows non-monetised impacts such as those related to sustainability and synergies/conflicts between policies to be brought forward to the decision-making stage.

5. GLOSSARY AND ACRONYMS

Term	Definition
Agri-environment subsidies	Payments made to farmers to encourage methods that maintain or enhance environmental quality.
Analytical Hierarchy Process (AHP)	An approach to decision making that involves structuring multiple choice criteria into a hierarchy, assessing the relative importance of these criteria, comparing alternatives for each criterion, and determining an overall ranking of the alternatives. It provides a means to deal with complex decision making and can assist with identifying and weighting selection criteria, analyzing the data collected for the criteria and expediting the decision-making process.
Artificial water body	A body of surface water created by human activity.
Assets	Items owned by an individual or firm that have financial value.
Attribute	A characteristic of a measure. Some attributes can be assigned quantitative values; others require descriptive entries.
Benefits transfer	The method of transferring benefit estimates from past valuation studies to the present study, in order to reduce appraisal costs. The validity of the approach depends on the degree of similarity between the various studies, e.g. the environmental good or service being valued, the characteristics of the population and the robustness of the previous benefit estimates.
Broad level assessment	The initial level of assessment undertaken when following the costs methodology, focused mainly on estimating the financial costs of measures.
CAP	Common Agricultural Policy
Capacity constraints	Limits on how much money a given strategy can support without creating market distortions.
Capital costs	Relate mainly to the purchase of new capital, but more generally are the additional one-off costs or savings generated by a new measure/change in policy. They include the purchase of any necessary equipment, the costs associated with site preparation and installation, legal fees, and any other one-off requirements (transitional costs) arising from implementation of a measure, savings through the use of cleaner technologies or decommissioning of redundant equipment, etc.. These will take the form of fixed or semi-fixed costs.
Cause	General term used to refer one or more of the origins or drivers, activities and pressures that contribute to the water body state and impact
CEA	Cost Effectiveness Analysis
Coastal water	Surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of terrestrial waters is measured, extending where appropriate up to the outer limit of transitional waters
Commodity	A product commonly traded on world markets with prices determined globally.
Compensation payments	Payments from one organisation to another as part of gaining approval of a new development.
Compliance costs	The costs of complying with regulation for those being regulated.
Consumer demand	The demand for goods by households as distinct from firms or the government.
Consumer surplus	The difference between the amount currently paid for a good or service and the maximum amount that an individual would be willing to pay.
Contingent Valuation	Determination of willingness to pay for a specified environmental resource or a change in the resource, through use of structured questionnaire in which respondents answer yes/no to suggested prices (dichotomous choice or payment ladder) or provide a willingness to pay number themselves (open ended).
Cost function	Built up from static cost data by considering a range of attributes that may affect costs.

Combined Cost-Effectiveness Methodology: Part A: Background and Introduction

Term	Definition
Cost variables	The types of costs included when estimating the total costs of a measure.
Cost-benefit analysis	A form of economic analysis in which costs and benefits are converted into money values for comparison over time.
Cost-effectiveness analysis (CEA)	A technique which seeks to identify the least cost option for meeting a particular objective. It enables prioritisation between options, but ultimately cannot assess whether an option is economically worthwhile.
Cross-price elasticities of production	The responsiveness of demand for good X in response to a change in the price of good Y.
CRP	Collaborative Research Programme
Decision analysis	An approach to decision making under conditions of uncertainty that involves modelling of the sequences or pathways of multiple possible strategies to determine which is optimal. It is based upon available estimates (drawn from the literature or from experts) of the probabilities that certain events and outcomes will occur and the values of the outcomes that would result from each strategy. A decision tree is a graphical representation of the alternate pathways.
DEFRA	Department for the Environment, Food and Rural Affairs
Delphi approach	An iterative group judgement techniques in which estimates or opinions are obtained from experts, whose responses are collated and recirculated in multiple rounds for further modification to produce a final group response.
Design costs	Costs of engineering studies, site investigations, modelling work, etc. required as part of determining capital requirements.
Detailed level assessment	The second level of assessment which requires collection of more detailed cost data than for the broad level assessment.
Direct benefits	These stem from the reduction in risk, for instance, reduced incidence of occupational diseases in workers in the company/sectors of concern.
Direct costs	1 st round of impacts. In other words they are the costs that would be incurred by those applying for an authorisation or subject to restrictions, or compliance costs. A key issue in considering the costs here is the issue of availability of substitutes and discounting.
Discount Rate	The annual percentage rate at which the present value of a future pound is assumed to fall away through time.
Discounting	The technique of applying a discount rate to convert future monetary amounts to their equivalent value in today's terms, (based on the premise that people prefer to receive benefits in the present rather than in the future).
Disproportionate costs	Refers to 'beneficial objectives being achieved by other means' in the context of designations, derogations and new modifications. Designation of heavily modified water bodies, new modifications and (again) less stringent objectives can be justified when the current needs and socio-economic benefits accruing from an activity cannot be achieved by other means not entailing disproportionate costs. Whether an improvement is found to be disproportionately expensive or 'other means' disproportionately costly will be decided by individual Member States on a case-by-case basis. Ultimately, disproportionality is a political judgement informed by economic information.
Distributional issues	A discussion of the allocation of resources between social groups, regions, individuals, organisations and or other groups. Also incorporates the idea of fairness in allocation.
DOENI	Department of the Environment, Northern Ireland
EA	Environment Agency
Ecological status	Is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, classified in accordance with Annex V of the WFD.
Econometric analysis	The use of statistical techniques to represent quantitative relationships between economic variables in the form of an equation or set of equations.

Term	Definition
Economic analysis	A type of analysis that aims to establish the opportunity costs of a policy or project, that is, the total resource implications of that option in terms of forgone opportunities and benefits gained (refer also to opportunity costs). The economic value of an input can be also referred to as its shadow price.
Economic appraisal	An appraisal that takes into account a wide range of costs and benefits, generally those that can be valued in money terms.
Economic costs	The monetary measure of the welfare associated with the change in the provision of some good. It is not to be confused with monetary value, unless the latter is explicitly designed to measure the change in welfare, nor with financial value, which may reflect market value or an accounting convention.
Economic instrument	Financial reward, incentive and punishment that operates automatically via market forces, to encourage beneficial behaviour.
Economic rent	The sale value of a resource less the cost of harvesting it.
Economic value	The value of a good (or service) equal to the full value of the resources that have been used in its production (or consumed as a consequence of a particular action).
Economies of scale	Reductions in the per unit costs of production that arise as the quantity produced increases. Within the context of the WFD, companies with larger production levels may be able to introduce measures at a lower per unit cost than smaller companies owing to economies of scale. Where such economies of scale exist, then there is the potential to over-estimate compliance costs if averages across the sector are used.
Effectiveness	A judgement of the success in achieving the desirable effects of a measure. Effectiveness is a composite attribute which is expressed in terms of other attributes that describe different aspects of the effects a measure.
Effort	The application of resources to achieve a desired effect. It may be possible to apply some measures with different degrees of effort to achieve corresponding different degrees of effect.
Elasticity of supply and demand	The responsiveness of the quantity demanded or supplied of a product to a change in price. It is expressed as the percentage change in quantity demanded or supplied of a good as the result of a 1% change in price.
Environmental impacts	Environmental impacts may also be classified as direct or secondary (and even tertiary, quaternary effects), depending on the endpoint on the cause-effect chain one is referring to.
Equity	Just, fair, and impartial treatment of all people and population groups, including low-income, cultural, and ethnic populations potentially more affected by pollution.
Equivalent Annual Values (EAV)	The discounted value of a stream of future costs or benefits presented as annualised values.
Expected value	The sum of individual outcomes multiplied by their probability of occurrence.
Externalities	Goods which remain unpriced and thus are external to the market (i.e. 'free' goods such as those relating to the environment). An externality exists when the actions of one individual affect the wellbeing of other individuals without any compensation taking place. For example, the discharge of a CSO (combined sewer overflow) will be a negative externality to informal recreational users of a river corridor, to the extent that it will lead to an aesthetic degradation of the river, for which they will not receive any financial compensation. You can also have positive externalities, for example, an industry which uses a better waste treatment process will improve the river quality.
Financial analysis	The determination of the cash flow implications of a policy or project.
Financial costs	The private costs faced by a company in producing a good and carrying out its operations. Although financial costs are often used within economic analyses as a proxy for economic costs, there may be important differences between them.

Combined Cost-Effectiveness Methodology: Part A: Background and Introduction

Term	Definition
Fixed costs	Costs such as rents on land or buildings or costs that arise as a result of changes in the scale of activity.
GDP	Gross Domestic Product.
General equilibrium model (GE)	Type of analysis that looks at the economic systems as a whole and observes all changes in prices and quantities simultaneously. Usually relies on complex mathematical techniques.
Good ecological potential	Is the status of a heavily modified or an artificial body of water, so classified in accordance with the relevant provisions of Annex V of the WFD.
Good ecological status	Is the status of a body of surface water, so classified in accordance with Annex V of the WFD.
Good groundwater chemical status	Is the chemical status of a body of groundwater, which meets all the conditions set out in table 2.3.2 of Annex V of the WFD.
Good groundwater status	Means the status achieved by a groundwater body when both its quantitative status and its chemical status are at least 'good'.
Good quantitative status	Is the status defined in table 2.1.2 of Annex V of the WFD.
Good surface water chemical status	Means the chemical status required to meet the environmental objectives for surface waters established in Article 4(1)(a), that is the chemical status achieved by a body of surface water in which concentrations of pollutants do not exceed the environmental quality standards established in Annex IX and under Article 16(7) of the WFD, and under other relevant Community legislation setting environmental quality standards at Community level.
Good surface water status	Means the status achieved by a surface water body when both its ecological status and its chemical status are at least 'good'.
Groundwater	All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
Groundwater body	A distinct volume of groundwater within an aquifer or aquifers.
Groundwater status	Is the general expression of the status of a body of groundwater, determined by the poorer of its quantitative status and its chemical status.
Heavily modified water body	A body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II of the WFD.
Hedging and flexing	These assume that either the worst, or the best, outcome will occur for each measure and then to choose the measure which gives the least bad outcome, or the best possible outcome; these criteria essentially capture 'regret' based approaches using minimax and maximin criteria. These type of criteria are most appropriately used together with a scenario based analysis, which defines upper and lower bounds.
Hidden costs	The direct costs of implementing an option that are not immediately related to a change in technology or a change in inputs, such as the costs of institutional and human resource capacity changes, changes in information requirements, changes in market size and structure. These may be fixed, semi-fixed, variable or semi-variable costs.
Human resource capacity	Maximum productivity of human capital (labour), used to describe the utilisation of labour within a firm or market.
Impact	The change in the water environment caused by a pressure. (The initial characterisation studies identified water bodies that are at risk of impact)
In-depth level assessment	The third level of assessment within the costs methodology and the most detailed. It involves collection of considerable amounts of cost data and monetary estimation of most (if not all) of the cost variables.
Indirect costs	These are the 2 nd round of costs; for instance, costs on suppliers or downstream users as a result of changes in costs from the failure to gain an authorisation or by any restrictions.
IPPC	Integrated Pollution Prevention and Control.
Lake	A body of standing inland surface water

Term	Definition
Linear cost function	Where any increase in size/scale of a measure will result in a proportional increase in costs.
Local measure	A measure typically implemented at the waterbody or catchment scale.
Maintenance costs	The costs of maintaining an asset so it continues to function as intended.
Marginal benefit	The additional benefit gained from the last unit of a good or service consumed, or a resource used in production.
Marginal cost	The cost corresponding to the last unit of an output produced, or any other activity carried out.
Market distortions	Factor(s) that lead to a market performing imperfectly, (i.e. less efficiently than it might possible do). Can include market failure but mainly refers to less severe distortions.
Market price	The price for which a good is bought and sold in a market.
Measure	An action that may be applied to prevent, reduce or remove an impact
Monte Carlo analysis	A numerical technique for assessing the probability of different outcomes from two or more variables.
Multi-market analysis	Analysis of a firm or market selling, producing or buying in completely unrelated markets (e.g. conglomerates, two sided markets).
National measure	A measure typically implemented at the national or regional scale, or determine by national policy.
Non-linear cost function	Where any increase in size/scale of a measure will result in a change in costs, but in a way that cannot be predicted without knowledge of the shape of the cost function.
Non-market goods and services	Non-marketed goods are often environmental goods such as ecosystems and biodiversity, or environmental bads such as pollution and noise. They are goods that do not have a market price, due to their position outside the market system.
Non-quantified costs	Those costs that could not be expressed in numeric or money terms.
Non-recurring costs	Costs that only occur once and do not recur.
Non-use valuation	Non-use values, also referred to as passive use values, are those associated with the knowledge the resource exists in an improved state whereas bequest values are associated with values for future generations and altruistic values for others' enjoyment of the resource.
Non-water environment costs and benefits	Costs and benefits arising as a result of implementation of a measure that are not directly related to the water environment. They could include: creation/loss of habitat, impacts on landscape, noise, odour, global warming, air quality, congestion, accident risks, changes in risk of flooding or erosion, disruption, inconvenience, soil quality, use of non-renewable resources, etc.
Operating costs	The additional on-going costs that may occur on an annual basis or be more periodic in nature (e.g. arising every five years); for example, staff costs or time, raw material costs and other consumables (energy, utility costs, chemical inputs), waste treatment and disposal, maintenance activities, operations-related sampling, testing and monitoring costs, and reporting. These will take the form of variable or semi-variable costs.
Opportunity costs	The value of the resource in its most valuable alternative use.
Optimism bias	HM Treasury's Green Book notes that appraisers tend to overstate benefits and understate timings and costs. As a result, it indicates that explicit adjustments should be made by increasing estimates of costs and decreasing and delaying estimates of benefits. The arguments made in the Green Book apply to optimism bias in relation to public works (civil engineering) projects. It is less clear that they should also apply to estimates of the costs to the private sector of new environmental regulations. In this regard, they may be more relevant to measures that would involve large civil engineering works and less relevant to measures that involve the installation of pollution control equipment, changes in management practices, etc.

Combined Cost-Effectiveness Methodology: Part A: Background and Introduction

Term	Definition
Origin or driver (of a pressure)	The economic, regulatory or social driver for an activity that may have an environmental effect. An example driver is the market demand for a particular product or service.
Partial equilibrium analysis	Analysis in isolation of the market for a particular good, assuming that the markets for all other goods allocate resources efficiently. Thus, partial equilibrium models constitute highly detailed, sector-based models that focus on the impact of a tax or policy change in one sector, and assume that all other sectors are held constant.
PoM	Programme of Measures
Present Value (PV)	The discounted value of a stream of future costs or benefits.
Pressure	A pressure is something that is the cause of an impact on the water environment – that is a use of the water environment (e.g. abstraction for public water supply, polluted runoff from agriculture)
Primary market	The initial market for any item or service.
Private sector	That portion of the economy composed of businesses and households, and excluding government.
Probabilistic analysis	Use of probabilities to derive the likelihood of potential known outcomes from occurring. In essence, this tries to structure and then model the uncertainty surrounding outcomes.
Production resource capacity	A quantification of the utilisation of resources in production.
Public sector	That portion of the economy composed of all levels of government, whether national, regional or local, and excluding businesses and households.
Pure economic rent	Pure profit
Quantitative status	Is an expression of the degree to which a body of groundwater is affected by direct and indirect abstractions.
RBD	River Basin District
RBMP	River Basin Management Plan
Recurring costs	The additional on-going costs that may occur on an annual basis or be more periodic in nature (e.g. arising every five years). These will take the form of variable or semi-variable costs.
Regulator costs	Costs associated with the need to implement, enforce and monitor a new measure or change in policy.
Replacement costs	The cost of replacing lost assets, including environmental assets.
Revenues earned	Incomes received for the sale or abatement of goods and or services.
River	A body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course
River basin	The area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta.
River basin district	The area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, which is identified under Article 3 (1) as the main unit for management of river basins.
SE	Scottish Executive
Secondary markets	Markets related to a specific primary market in such a way that the actions of the primary market affect the secondary market (e.g. labour/capital markets, downstream users, complementary markets).
Sector activity (responsible for a pressure)	A specific anthropogenic activity that may have an environmental effect (e.g. public water supply, livestock farming).
Semi-variable costs	Costs associated with maintenance works, administration, monitoring activities, enforcement activities, etc.
Sensitivity Analysis	The analysis of how an appraisal will be affected by varying the projected values of the important variables.

Term	Definition
SEPA	Scottish Environment Protection Agency
SFP	Single Farm Payment
SIC	Standard Industry Codes
SNIFFER	Scotland and Northern Ireland Forum For Environmental Research
Social impacts	These refer to job security and employments and health and safety impacts in terms of that components not associated with the costs of treatment or hospital costs, i.e. the loss of utility associated with the loss/gain in health status, or burden of disease. These also include distribution and equity issues.
Social rate of time preference	The practice of discounting arises because individuals attach less weight to a benefit or cost in the future than they do to a benefit or cost now. Impatience, or time preference, is one reason why the present is given more weight than the future.
Stakeholder	Any interested or affected party as a result of a policy or project.
State	The condition of the water body resulting from both natural and anthropogenic factors (e.g. pressures)
Sub-basin	The area of land from which all surface run-off flows through a series of streams, rivers and, possibly, lakes to a particular point in a water course (normally a lake or river confluence).
Sunk cost	A cost incurred in the past and which cannot be recovered whatever decision is taken now.
Supernormal profits	Profit exceeding the normal profit. Normal profit equals the opportunity cost of labour and capital, while abnormal profit exceeds the normal return from these input factors in production.
Surface Water	Inland waters except groundwater, transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters.
Surface water body	A discrete and significant element of surface water such as lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water. The different types of surface water bodies identified in the Directive are shown in the list below.
Surface water status	Is the general expression of the status of a body of water, determined by the poorer of its ecological and chemical status.
Switching points	The value of an uncertain cost or benefit at which the best way to proceed would be to switch from including or excluding some extra expenditure.
Technological innovation	Improvements/advances in technology that reduce the costs of dealing with a particular problem.
Time horizon	The number of years over which an economic appraisal is undertaken.
Transfers	Payments from one sector to another. Failure to account for transfers in economic estimates of costs will result in over or underestimation of the real resource costs of a measure and may affect the end-ranking in terms of cost-effectiveness.
Transitional water	A body of surface water in the vicinity of a river mouth which is partly saline in character as a result of its proximity to coastal waters but which is substantially influenced by freshwater flows
Transitional/ transaction costs	Costs that are incurred as a result of a change in policy but that do not in themselves provide any value. An example might be compliance monitoring undertaken by a regulator, which arises from a market failure. Some measures may have higher transaction costs than others, making their separate identification important.
UKTAG	UK Technical Advisory Group
Uncertainty	Stems from a lack of information, scientific knowledge or ignorance and is characteristic of all predictive assessments.

Term	Definition
Value of information analysis (VOI)	Value-of-information techniques provide an analytic framework for deciding whether it is better to make a decision now based on an inherently uncertain risk assessment or to collect additional information first and then decide.
Variable costs	Costs that vary with changes in levels of production, such as energy, labour, raw materials (water, chemicals, feed, fertilisers, etc.), waste disposal, etc.
Vertically integrated markets	Where a single firm or market participates in multiple stages of the production supply chain of a particular good or service. Often done to maintain control of price and quality of inputs upstream and conditions of sale downstream (e.g. automotive).
WFD	Water Framework Directive
Wider economic effects	Any knock-on effects that are passed on or through to other sectors, organisations, etc.
Willingness to pay	'Willingness to pay' for the continued provision of an environmental good or service or for a change in the good or service.