Assessing affordability of measures to meet Water Framework Directive requirements in England

Final Report

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Author(s)	Meg Postle, Rocio Salado, Yvette Le Crom, Michele Palladino, Chloe Elding, Sophie Upson Stephen Hull, Richard King, Pierre Strosser
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Glossary of common balance sheet terms and their applicability		
Term	**Description**	**Sector/ enterprise level**
Gross Value Added (GVA)	The difference between the value of goods and services produced and the cost of raw materials and other inputs used up in their production.	Sector level
Total Income from Farming (TIFF)	The income generated by production within the agriculture industry and represents business profits plus remuneration for work done by owners and other unpaid workers (or GVA after deduction of consumption of fixed capital, taxes, labour costs, interest and rent but including all subsidies).	Sector level
Cash flow to capital expenditure	The ratio of a company's cash from operations to its capital expenditures for acquiring or upgrading assets, such as buildings or equipment. Cash flow to capital expenditure is an important measure for determining a company's ability to fund operations and, as such, could provide a useful indicator of a company's ability to pay for new capital investments.	Enterprise level
Debt ratio	The ratio of total debt to total assets, expressed as a percentage. The debt ratio can be interpreted as the proportion of a company's assets that are financed by debt. The higher this ratio, the more leveraged the company is, and the lower its ability to pay for measures under the WFD.	Enterprise level
Farm Business Income	Farm Business Income (FBI) is the preferred measure for comparisons of farm type and represents the return to all unpaid labour (farmers, spouses and others with an entrepreneurial interest in the farm business) and to all their capital invested in the farm business including land and farm buildings.	Enterprise level
Gearing – net debt to capital value	A company's net debt expressed as a percentage of its capital. A company with high gearing (high leverage) would be less able to afford new investment in measures than a company with a lower gearing – this is because the company has to continue to service its existing debt as well as any new debt. A high level of equity provides a cushion and is seen as a measure of financial strength.	Enterprise level
Net debt	Net debt shows a company's overall debt situation by netting the value of a company's liabilities and debts with its cash and other similar liquid assets. The higher a company's net debt, the less able the company would be to afford to invest in measures under the WFD.	Enterprise level
Operating profit	The profit earned from a company's normal core business operations. This value does not include any profit earned from the company's investments (such as earnings from firms in which the company has partial interest) and the effects of interest and taxes. If the share of expenses for water management / environmental protection in the profit of a firm exceeds a certain threshold, the cost of measures could potentially be considered unaffordable.	Enterprise level
Return on assets	An indicator of how profitable a company is relative to its total assets. ROA gives an idea as to how efficient management is at using its assets to generate earnings. Calculated by dividing a company's annual earnings by its total assets, ROA is displayed as a percentage. Sometimes this is referred to as "return on investment".	Enterprise level

Glossary of common balance sheet terms and their applicability		
Term	**Description**	**Sector/ enterprise level**
Return on capital	Return on capital (ROC or ROCE – capital employed) is the ratio of after-tax operating income (NOPAT) to the book value of invested capital.	Enterprise level
Turnover	The amount of money earned by a business in a particular period. If the share of expenses for water management / environmental protection in the turnover of a firm exceeds a certain threshold, the cost of measures could potentially be considered unaffordable.	Enterprise level

Executive Summary

Context

Under the standard approach to appraisal of government policies and actions, policy makers consider not only the balance between costs and benefits, but also who would have to bear the costs and how they might be affected.

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy or, in short, the EU Water Framework Directive (WFD) is aimed at meeting good status objectives across waterbodies in England. When identifying the programme of measures to be included in the river basin management plans for meeting these objectives, the WFD promotes the application of economic principles, methods and instruments. This includes the assessment of whether costs and expenses are "disproportionate", and EU guidance suggests that decision makers may want to consider information on ability to pay, or affordability, as part of this assessment.

Purpose of the project

The objective of this project is to guide Defra and their Ministers in decisions on updating river basin management plans, in particular assessing whether measures to improve the quality of the water environment are affordable. Affordability is to be considered for each sector or group which may have to bear the costs, and at the national level and potentially the river basin district level. The sectoral definitions to be followed are those that were adopted by the Environment Agency (EA).

As the decision to implement environmental measures can affect a large variety of economic agents, there is a need to consider the affordability of measures across different sectors (and hence economic agents) in a consistent and equitable manner.

The objectives of this project are to:

1. Highlight approaches applicable to the different sectors in relation to affordability as one aspect relevant to disproportionate cost decisions whilst:

    a. being applicable at an appropriate level of disaggregation;
    b. maintaining even handedness across the sectors;
    c. observing the principles of WFD; and
    d. being grounded in sound economic theory.

2. To complement the information on the draft programmes of measures which will be presented for consultation by EA in the process of updating river basin management plans.

Approach to the study

The study approach has consisted of a review of existing literature, data analysis and stakeholder engagement, the latter involving telephone and face-to-face interviews; two workshops were also organised, with interested Government departments and bodies in October and broader stakeholders in November 2014.

Summary of key findings from stakeholder engagement

As noted above, stakeholder engagement was undertaken through telephone interviews and face-to-face meetings, followed by a workshop where the main findings of the report and indicators were presented and discussed in further detail. The stakeholders included members from the agricultural sector, water industry, manufacturing and chemicals sectors, ports and harbours and NGOs, as well as representatives of customers of the water industry. There was a high degree of interest in the issue of affordability and the feedback from stakeholders has been important to the development of the affordability framework presented below. This does not mean that stakeholders will agree with all aspects of the framework presented here. Some would have preferred a much more disaggregated and detailed operator specific approach, while others would have preferred the clear definition of thresholds constituting what is and is not affordable. Both of these approaches were outside the terms of reference for this study.

Other main points from the discussion with stakeholders are that:

- differences in cost pass-through should be considered as they may have implications for the indicators to be used at sectoral level
- sequencing and financial planning timeframes are very important for measures that entail capital investment
- differences between operators within the same sector group can be so large that a sectoral average may not represent the "typical company". Although median values may be more appropriate than sector averages, the data are generally not available to enable median values to be derived, and
- generally, affordability is not an issue for non-government organisations, as some of these organisations will only undertake works if they are funded to do so by Defra or the EA while others will only do so if the works are consistent with meeting their own objectives.

Some stakeholders also noted that although a sectoral analysis based on national average or sector aggregates can be a useful starting point for assessing affordability, but that it also should be recognised that there are significant variations within the sector groups. This is a limitation of what can be achieved through a high level national assessment. They would therefore hope that this issue was considered when implementing the programmes of measures.

The affordability framework

The findings from the literature review and discussions with stakeholders fed into the development of the affordability indicators identified for individual sectors. The indicators are summarised in Table 1, and stem from the application of the accounting balance sheet concepts relevant to each of the sectors.

Table 1: Proposed indicators of Affordability by aggregate sectors			
Sector	**Basis**	**Indicators**	**Other**
Agriculture and rural land management	Industry level accounts and profitability, resilience and liquidity	• Total Income from Farming (TIFF) • Gross Value Added • Farm Business Income • Liabilities / Debt • Investment levels	• Cost-pass through • Past investment • Burden of other regulation • Subsidies
Industry, services and other (i.e. manufacturing and infrastructure)	Industry level accounts and profitability, resilience and liquidity	• Gross operating surplus • Gross investment / capital employed • Liabilities / Debt • Long term payments • Gross Value Added	• SME adjusted average versus average across all firms – with and without thermal energy generation • Past investment levels • Burden of other regulation
Water industry	Household accounts indicators of affordability	• Cost of measures as a % of household income • Water bill as a % of household income • Self-reported problems -> as acceptability of future water bills	• Non-affordability indicators related to water debt and water poverty – but outside scope of this study
Central government (and NGOs)	Total project public expenditure (budget) and Departmental expenditure limits	• Changes in government revenues • Changes in DEL to Defra & DECC • WFD related funding compared to costs of measures allocated to NPDBs	• Importance of funding to NGOs ability to assist in delivery of WFD objectives

For the "agriculture and rural land management" and "industry, services and other" sectors, this entailed a two stage analysis based on the framework presented in Figure 1 below. The first stage of the analysis provides the main focus for this study – the national, sector level assessment of affordability. The second stage has been carried out to highlight the fact that there is significant intra-sectoral variation and thus that consideration may also need to be given as to how the programmes of measures are delivered in practice. The aim of this enterprise level analysis has not been to argue that there is a case for exempting any particular set of operators from meeting their environmental responsibilities. Businesses that are poor economic performers should not be allowed to use their poor performance as a justification for polluting or otherwise imposing significant environmental externalities on others.

Instead, the aim of the enterprise level analysis has been to highlight where policy mechanisms may need to reflect the identified variability in economic performance within a sector or, for example, where the EA may wish to consider site-specific needs in terms of, for example, the timing of works to ensure that the costs of measures are affordable.

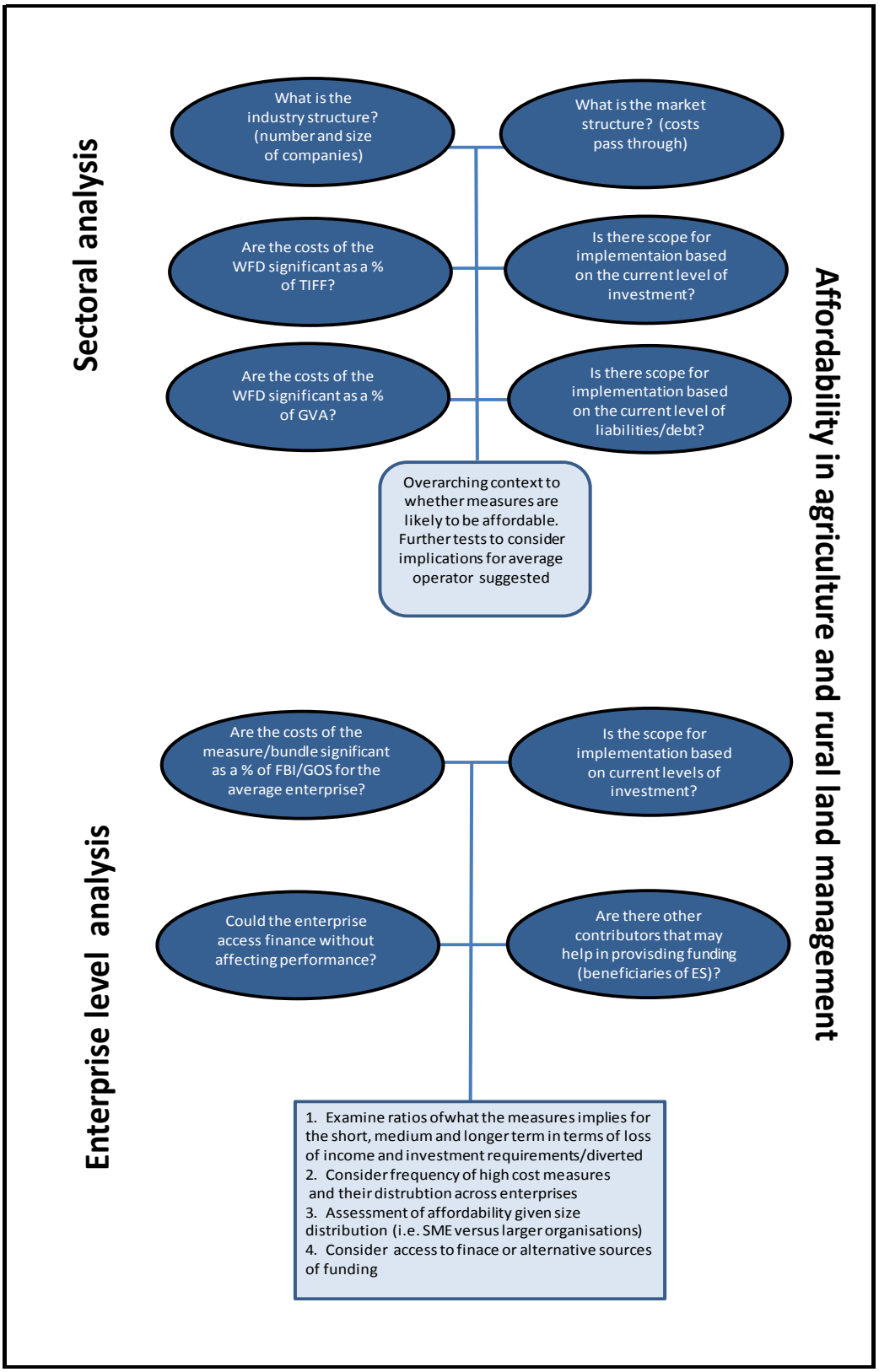

Figure 0: Assessment framework – affordability across sectors

The costs of the measures relative to sectoral performance

The consultation documents produced by the EA set out five different scenarios. It was agreed at the first workshop, held with members of Defra, the EA and Ofwat, that discussion with stakeholders should focus on **Scenario 4**. This Scenario includes the costs and benefits of achieving Protected Area objectives, no deterioration and improvements towards good status in all water bodies where measures are technically feasible and where benefits justify the costs. Under Scenario 4, no measures are ruled out on the basis of affordability or the availability of funding[1].

The total costs for Scenario 4 for England are provided in Table 2. This includes the distribution of costs by sector where actions would occur. The total PV costs for Scenario 4 are estimated at £12.1 billion. The greatest costs are expected to arise in the agriculture and rural land management sector followed by the water industry sector. It is also important to note that no sector has yet been identified as being responsible for some of the measures.

Table 2: Scenario 4 - Summary of costs (£million) to prevent deterioration, achieve protected area objectives and improvements in status where benefits exceed cost (undiscounted and discounted)*

Sector	Government	Agriculture and rural land management	Industry, services & other	Water industry	No sector identified	Overall Total
England total-Undiscounted	2,300	6,500	1,300	5,900	400	16,400
England total-Discounted	*1,700*	*4,800*	*1,000*	*4,400*	*300*	12,100
Expenditure by sector as a % of total for England	14%	40%	8%	36%	2%	100%

Notes:

- Assumes the same costs distribution across sectors and the ratio of PV to non-PV costs as for the totals
- Appraisal period is 37 years (2015-2052). This is the appraisal period Defra has asked the Environment Agency to use for WFD analysis. This was 43 years in 2009 (the start of cycle 1), made up of the three 6 year cycles of the planning process, plus 25 years.
- Severn, Dee and Solway Tweed River Basin Districts in England only include costs.
- Water industry costs are mid-point estimates. They have at least +/- 30% range reflecting the uncertainty of the estimates which should be considered when reading this information.
- Numbers may not sum to totals due to rounding. RBD totals (>10m) are rounded to the nearest £10m, England totals (>100m) are rounded to the nearest £100m.

[1] The data that underpins the draft economic analysis were collated at a catchment level by local Environment Agency environmental planning experts.

Sectoral analysis

Table 3 presents the discounted costs of Scenario 4 for England and the ratios of these against the different affordability indicators applicable to each sector as detailed in Table 1 and Figure 1.

Table 3: Sectoral analysis England – Costs of WFD measures under Scenario 4				
Sectors	**Agriculture and rural land management**	**Industry, services and other***	**Water Industry**	**Government**
Total PV costs (£m)	4,800	1,000	4,400	1,700
Average Annual costs (as reported in EA, 2014)	180	40	160	60
Sectoral analysis				
Annual costs as a % of GVA (2013 GVA)	2.5%	0.5% to 1.5%	Total national costs of WFD measures equate to 0.037% of average median household disposable income after housing costs for England.	n/a
Annual costs as a % of TIFF (2013 TIFF)	4.4%	n/a		n/a
Annual costs as a % of Gross operating surplus	n/a	1.5% to 3.1%		n/a
Annual costs as a % of Gross investment	n/a	7% to 16%		n/a
Defra budget as % 2013-14	n/a	n/a		3.2%
Annual costs as a % of Defra funding to EA 2012-13	n/a	n/a		8.3%
Annual costs as a % WFD related funding	n/a	n/a		74%
* Based on statistics for manufacturing and industry, including the thermal energy sector.				

As can be seen from Table 3, the costs of Scenario 4 equate to around 4.4% of Total Income from Farming (TIFF) for England, and around 2.5% of agriculture's contribution to the national economy in terms of gross value added. Although not all stakeholders were persuaded of the value of considering costs in relation to gross added value, it has been included in the analysis due to its relevance for understanding impacts on national economic output.

The figures for "industry, services and other" are based on statistics for the UK as a whole, although the great majority of the sector is in England so the derived indicator is approximately the same. The total annual equivalent costs associated with Scenario 4 would equate to around 1.5% of gross operating surplus across the industry and manufacturing sector and 3.1% for those sub-sectors most likely to implement measures. Turning to gross investment, the equivalent annual costs equate to 7% for the sector as a whole and 16% for those sub-sectors most likely to be affected. At both the sectoral and sub-sectoral level, costs are a relatively small proportion of total gross added value for the manufacturing activities of concern.

In terms of the costs of measures to the privatised water sector, these are assessed in terms of the burden that they would place on households as the key customer group. The assessment indicates that the costs of the measures would equate to around 0.037% of the average median household disposable income after housing costs, with there being some regional variation around this but rising as a maximum to 0.072%.

The proposed level of government expenditure would equate to around 3.2% of Defra's 2013/14 budget, and around 8.3% of Defra funding to the EA in 2012/13 (latest data readily available).

Further considerations

The affordability indicators identified for each sector stem from a similar accounting perspective but vary in detail. Nevertheless, the assessment is considered to be even handed in its treatment of actors in the different sectors. To ensure even handedness, it is important to consider additional factors, such as industry structure and market structure, and the impacts that these have on the potential for cost pass-through and competitiveness impacts. Industry structure covers aspects such as the size and number of operators in the sectors, barriers to entry, technical characteristics of the installations and level of capital investment, etc. Market structure relates to the price elasticities of demand and competition between products. The greater the ability to pass costs through the more affordable the measure/policy is likely to be.

These additional factors are summarised in Table 4 (with further discussion of the industry and market structure provided in the relevant sections of the full report).

Table 4: Additional factors affecting affordability

Group	Industry structure	Market structure	Other considerations
Agriculture and rural land management	Large numbers of small firms undertaking a range of different productive activities having different economic values. Levels of economic performance can vary widely	Traditionally farmers are considered to be price takers with cost pass through limited	
Industry, services and other	Industry (manufacturing) is characterised by a large number of smaller companies. However, significant differences in size exist and these have a significant effect on statistical averages values. In addition, sub-sectors may vary considerably from the averages	Competition within the manufacturing sector will vary by sector but for many players there may be some but limited cost pass-through. The sector includes the thermal power sub-sector which has more inelastic demand but faces structural problems and heavy regulatory burden. Other operators may also currently face a heavy regulatory burden	Certain sub-sectors are likely to bear most of the costs, making it important to also consider how these vary from manufacturing as a whole Due to regulatory burden currently faced by some of the "heavy industry" sectors, timing of measures, particularly large capital investments, may be important to affordability
Water industry	Regulated structure comprising small number of large water and waste water companies, together with smaller water only companies	Possibility of cost pass through with increases in water bills to both household and other customers regulated by Ofwat.	Company level analysis recommended by ministerial guidance.
Government	Central allocation of budgets across Departments, with Departmental allocation of funding across competing activities/services	Funding of measures will be based on raising additional taxes, by allocating expenditure towards WFD rather than on alternative services/activities, or through continued borrowing.	Non-governmental organisations that are important in helping to deliver WFD measures rely on public sector funding to support their activities.

1 Introduction

1.1 The Water Framework Directive and Affordability

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the Water Framework Directive (the WFD) was adopted.

The WFD promotes the application of economic principles, methods and instruments to management of the water environment. In particular, economic assessments, such as cost-effectiveness analysis (referred to in Annex III) and/or cost-benefit analysis, play a major role when selecting measures for achieving good ecological status, or justifying less ambitious objectives (Article 4) to be included in River Basin Management Plans (RBMPs). RBMPs are the main tool for meeting the WFD objectives and are to be implemented in a number of phases. In England, the first round of RBMPs was published in 2009 and the Environment Agency (EA) is currently consulting on the second round of plans which are due to be submitted to the Secretary of State in autumn 2015.

The proper implementation of the WFD raises concerns similar to any other policy measure aimed at improving the quality of the environment. When assessing the impacts of proposed measures, policy makers not only consider the balance between costs and benefits, but also the distributional implications and affordability of those costs and benefits. These considerations relate to the WFD term disproportionate cost or expense. Given that policy makers are naturally concerned with the socio-economic consequences for those who will have to bear the costs of such measures, the question arises as to whether environmental measures are affordable and what is an appropriate methodology to assess their affordability.

The WFD does not include a definition of disproportionate cost, or of affordability. However, a technical document published in 2003 by the Common Implementation Strategy (CIS)[2] Working group (European Commission, 2003) provides some methodological tools that Member States should follow to assess if costs are disproportionate or not. The word “affordability” is used only in the context of analysing the levels of cost-recovery of water services, where it is referred to as “complementary information”. In this context, a very narrow definition is adopted, focused only on the water sector and its customers/users. Affordability is defined as “*the relative importance of water service costs in users’ disposable income, either on average or for low-income users only*” (European Commission 2003, p 68). However, without using the word “affordability”, the guidance on evaluating whether costs are disproportionate does refer to comparing costs to available financial resources (European Commission 2003, pp. 24-25). The guidance notes that “disproportionality is a political judgement informed by economic information” and that the information may include “the ability to pay of those affected by the measures” (European Commission 2003, p.193).

Under the WFD CIS process, a "Common Implementation Strategy for the Water Framework Directive - Guidance Document on Exemptions to the Environmental Objectives" (European Commission, 2009) was produced. This makes reference to both affordability and the ability to pay for those affected by the measures. In this respect, the CIS Guidance states:

[2] In order to address the challenges in a co-operative and coordinated way, the Member States, Norway and the Commission agreed on a Common Implementation Strategy (CIS) for the WFD only five months after the entry into force of the Directive, which has resulted in different working groups, including one on economics.

"Affordability (or ability to pay for a certain measure) can be one element for justifying the decision on a time extension (i.e. application of Article 4.4), if based on a clear explanation:

- *Of the non-availability of relevant alternative financing mechanisms which would not result in affordability issues,*
- *Of the consequences of non-action in deciding on an extension of the deadline,*
- *Of steps to resolve the affordability issues in the future."*

In addition:

"When affordability arguments are used to extend the deadline, the possibility to use relevant alternative financing mechanisms should be fully considered. The alternative financing mechanisms could include distribution of costs among polluters and users, use of the public budget (at different levels), private investment, EU and international funds, etc. These relevant alternative financing mechanisms should be considered at the appropriate scale."

Both the 2003 and 2009 guidance also emphasise that "disproportionality is a political judgement informed by economic information".

The issue of how to address affordability concerns continues to be discussed by CIS working groups. It is clear that it remains an important issue, particularly given the economic pressures being faced by both the private and public sectors across the EU. Indeed, research conducted for the EC under the title of a "*Comparative study of pressures and measures in the major river basin management plans in the EU*" (Stanley, Depaoli, Strosser, 2012) assesses the main challenges faced by water management systems due to the financial crisis. The study notes that the generalised reduction of financial resources for either public or private operators in charge of managing water resources may lead to affordability problems.

In general, the guidance and methodologies for assessing disproportionate costs cover the comparison of costs against benefits in some detail, but affordability is not systematically considered nor assessed in the same manner. Some research was undertaken at the Member State level into how best to assess affordability in the first round of river basin management plans, with different countries adopting varying approaches. For example, France adopted an approach that assessed programmes of measures in relation to disproportionate costs as a first stage, and then included an affordability assessment as a second step of analysis (Boeuf, 2014)[3]. Other countries considered affordability first in terms of the budget constraints facing public sector bodies.

Affordability was not assessed in detail for the first round of RBMPs for England. Given the differences in approaches that have been adopted by other Member States, and the fact that there are significant differences in water management arrangements in England compared to those that exist in other Member States[4], it is appropriate that a methodology tailored to England is developed to act as the basis for assessing affordability as part of this second round of planning.

1.2 Progress with development of RBMPs

As noted above, Member States are currently involved in the preparation of the second round of RBMPs, which are to be adopted in 2015. The EA recently completed the development of draft

[3] An overview on the approaches followed in other MS will be described in the next sections.

[4] For example, the privatised nature of water services in the UK compared to mainly public sector delivery in other Member States.

updates to RBMPs for the second planning cycle, which has included identifying the measures required to meet WFD objectives, as well as the associated costs and the sectors where they would arise. Table 1-1 sets out the sector groupings that have been used by the EA.

Table 1-1: Component sectors within the aggregated groups used for this project

EA's Sector group	Types of economic agents
Public sector	Central government and agencies (Defra, EA, NE, Coal authority) Local councils (including Lead Local Flood authorities)
Rural land management	Agriculture, horticulture and forestry
Industry, services and infrastructure	Angling and conservation Industry, manufacturing and other business (power generation, pulp and paper, food and drink) Mining and quarrying Navigation NGO Recreation Urban and transport Waste treatment, transfer, storage and disposal
Water industry	Water industry

The EA is currently consulting on different aspects of its proposed draft updates to the RBMPs. This includes publication of the economic analysis of different scenarios for the level of action to be undertaken over the period 2016 to 2021. Four scenarios have been developed and are used illustrate the costs to society of addressing environmental status issues along with the benefits of preventing deterioration, achieving protected areas objectives and improving water bodies towards good status. A fifth scenario is also provided, which illustrates a possible initial 6 year funding profile for scenario 4[5].

The EA has proposed five different scenarios for the programmes of measures to be implemented under the second cycle of RBMPs, as follows:

- Scenario 1 looks at what would happen if no further measures are taken
- Scenario 2 considers the effect of measures to prevent deterioration and to meet protected area objectives
- Scenario 3 considers improvements in water body status using all measures which are technically feasible
- Scenario 4 considers improvements in water body status using all measures which are technically feasible where benefits justify costs.
- Scenario 5 is based on an illustrated level of national funding for the most relevant water management action programmes in the 6 year period to 2021, along with an assumption that voluntary action and targeting, mediated by catchment partnerships, will help optimise outcomes through additional local efforts.

Under Scenarios 1 to 4, costs and benefits are considered over the long term, to 2052. Scenario 5 is different and illustrates the progress that could be made by 2021 towards the objectives proposed in the consultation (under Scenario 4). The illustrative funding under Scenario 5 is not a prediction of all funding and measures that will be available in the second cycle, but is linked to levels of action in programmes currently being finalised. Final decisions, including the extent of measures to be taken forward over the period 2016 to 2021, will be made by the Secretary of State when considering the approval of the updated plans in 2015.

Figure 1-1: The Environment Agency's Scenarios for Programmes of Measures

[5] The consultation documents are available at https://consult.environment-agency.gov.uk/portal/ho/wfd/draft_plans/consult?pointId=3034101#document-3034101

1.3 Purpose of the study

The overall objective of this project is to guide Defra and their Ministers in decisions on updating river basin management plans, in particular assessing whether measures to improve the quality of the water environment are affordable. Affordability is to be considered for each sector or group which may have to bear the costs, and at the national level and potentially the river basin district level.

The project is to suggest approaches applicable to the different sectors in relation to affordability as one aspect relevant to disproportionate cost decisions. These approaches must meet the following requirements:

- be applicable at an appropriate level of disaggregation;
- maintain even handedness across the sectors, and across actors within a sector;
- observe the principles of the WFD (e.g. the polluter pays principle); and
- be grounded in sound economic theory.

The indicators will be used alongside information on the costs and benefits of the draft programmes of measures as presented for consultation by the EA. As part of the work, the indicators are being applied to Scenario 4 to provide information on the degree to which the measures included in this Scenario may be considered affordable, as well as providing a balance between costs and benefits.

1.4 Approach to the study

To meet the objectives of the project, the approach was divided into a number of tasks as follows:

1. Review of the literature on measuring affordability to develop an evidence base concerning households, industry, agriculture and land management, non-governmental organisations, and government and tax payers
2. Review of approaches to affordability and ability to pay that have been taken elsewhere in UK government policy-making, and elsewhere in the EU and in other OECD countries; this includes consideration of how affordability is taken into account in other policy contexts, (such as energy), and in other regulatory contexts (such as under the Industrial Emissions Directive and REACH)
3. Definition of objective indicators that are relevant to informing Ministers' judgements about affordability for each sector and affected group, including to government and taxpayers, and
4. Analysis of available statistics and datasets to calculate values for each proposed indicator at the same levels of disaggregation as the EA are using to report estimated costs, and at any other level of disaggregation identified as relevant.

The above tasks were accompanied by engagement with stakeholders, including two workshops, one of which was with interested government departments and the other with external stakeholders. The workshops were designed to gain feedback on the usefulness of proposed indicators, as well as to highlight caveats with their interpretation. Discussions with stakeholders focused on Scenario 4 of the EA's consultation document. It should be recognised that stakeholders were keen to participate in the external workshop; with 25 stakeholders attending, with this including representatives across all of the different sectors affected by implementation, namely, NGOs, government bodies, industry and agriculture.

To facilitate stakeholder engagement and the workshop discussions, a number of case studies were developed; these subsequently have provided the basis for reporting on the assessment of affordability at the aggregate sectoral level in this report.

1.5 Structure of this report

The remainder of this report has been organised as follows:

- Section 2 provides an overview of the literature on affordability and the framework developed here to act as the basis for the assessing the affordability of the RBMP Scenarios proposed by the EA

- Section 3 provides more detail on the indicators for assessing affordability to the agriculture and rural land management sector, the views of stakeholders on these, as well as the outcomes of the assessment itself

- Section 4 presents the detailed indicators, views of stakeholders and assessment findings for the "Industry, services and other" sector

- Section 5 sets out the indicators used to assess affordability for the water utility sector and more particularly for its customers, together with the assessment results

- Section 6 provides the assessment for the public sector, which also discusses implications for non-governmental organisations, and

- Section 7 summarises the conclusions from the assessment of affordability and comments on how this assessment could be improved in the future.

2 A Framework for Assessing Affordability

2.1 Overview

As noted in Section 1.3, the overall framework that is put forward as the basis for assessing affordability has to have four key characteristics, where these include being applicable at the appropriate level of disaggregation, being even handed across sectors and actors, respecting the principles underlying the WFD and being grounded in economic theory.

Furthermore, as noted by the latest Ministerial Guidance to the EA on River Basin Planning, issued in July 2014[6] and enforceable from the 31st July:

- *"*Affordability needs to be seen in the context of the characteristics of a firm and the sector in which it operates. Considerations of affordability are not intended to protect companies that are performing poorly against the industry standard […].

- Affordability analysis is normally carried out at the level of the industry or group of firms, not for individual firms. However, in the case of water and sewerage companies, the Agencies should, where possible, present information on the costs and benefits of PoMs at individual company level.

- Affordability issues may be resolvable over time if costs can be spread or alternative ways of paying for the benefits can be found. This might require further work by government or by the affected sectors/groups to adapt during the time extension, so that the alternative objectives are not needed in the long term."

The additional requirements for even handedness essentially mean that the approaches that are proposed for different sectors should be based on the same types of indicators to the degree possible, in order to ensure coherence and consistency. Where the indicators proposed for different sectors vary, there should be a justification for this. The need for the indicators to be based on economic principles should contribute to this even handedness, as well as to meeting the requirements set out in the July 2014 Ministerial Guidance.

The question of how best to assess affordability for England has been examined before in the context of the WFD. The approaches developed for the first round of RBMPs (e.g. RPA, 2004; Jacobs et al, 2007) assessed affordability in terms of whether or not an operator could pay for a measure without significant negative effects on its business over the long term. In this respect, affordability was defined in terms of various financial ratios, also taking into account ability to pass costs downstream, previous expenditure and impacts on competitiveness. However, these studies also proposed that affordability should be assessed at the level of the individual enterprise, rather than at a higher sectoral or national level. In retrospect, it is clear that it would never have been feasible for the EA to undertake the implied level of analysis to address affordability concerns on an enterprise by enterprise basis.

The remainder of this Section sets out the findings from a review of the literature on assessing affordability in relation to other legislation or other contexts, and then under the WFD for the

[6] Available at https://www.gov.uk/government/publications/river-basin-planning-guidance

sectors covered by this report. The approaches and issues summarised here provide useful background information for Defra and provide a context to the indicators developed by this study (together with the data analysis and discussions with stakeholders). It is important to note that not all of the approaches reviewed here have been used in practice, nor are they critically assessed here. As a result, they do not form part of the recommendations of this study.

2.2 Affordability under other legislation

Affordability considerations are not unique to the WFD, and arise under other EU legislation. This includes the Marine Strategy Directive, the Industrial Emissions Directive, and the REACH Regulation. Under this legislation, affordability tends to be assessed using more company specific approaches, based on consideration of the ability of operators to pass costs downstream, levels of previous expenditure on related measures, and impacts on competitiveness, particularly for SMEs. Table 2-1 sets out the different approaches to affordability that are suggested in the guidance for each of these legislative contexts.

These approaches are relevant to this study as there should be coherence in the application of regulatory requirements applicable to a single sector, particularly where there are clear relationships between the legislation (e.g. priority hazardous substances under the WFD and their regulation under REACH). The fact that such approaches have been applied under other legislation also indicates that they are workable and have been found acceptable in similar contexts.

The key common considerations when assessing affordability in relation to these three pieces of legislation are as follows:

1. The ability to pass costs through which, in turn, depends on the structures of the industry and of the market. The industry structure covers aspects such as the size and number of operators in the sectors, barriers to entry, technical characteristics of the installations and level of capital investment, etc. Market structure relates to the price elasticities of demand and competition between products. The greater the ability to pass costs through the more affordable the measure/policy is likely to be. On the other hand, this may imply that a distributional analysis of impacts is needed to see who supports the costs in the end, and

2. The magnitude of the costs and the ability of the sector to absorb those costs which are not passed through without impacting performance, also known as resilience. The resilience of a sector or operator will depend on different factors, such as level of profits, level of assets and liabilities, return on investment, etc.

It is important to note that under these other legislative frameworks affordability may be assessed at the sector and/or or enterprise level; indeed, some of the guidance relates more to assessment at the enterprise level than at the sector level, with certain types of indicators being more relevant at the enterprise level. Only indicators used at the sector level are relevant to this study.

Table 2-1 also describes how affordability is taken into account in the Directive on the assessment and management of flood risk, which is clearly also relevant to the WFD context. This Directive does not make any reference to affordability per se, but does refer to “best available technologies not entailing excessive costs” which implicitly incorporates affordability concepts.

Table 2-1: Affordability in different regulatory contexts	
Legislation	**Affordability considerations**
Marine Strategy Directive	The equivalent of the WFD in the marine environment does not define affordability but a report to the Commission on scoping the requirements for economic assessment (COWI, 2010) concluded that an affordability analysis of the measures required information about: 1 The costs of measures 2 The financing instruments of measures (for example a measure is financed 90% by the fisheries sector and 10 % by Member States because of a subsidy) 3 The existing yearly expenditures in relevant sectors (fisheries, offshore, regional authorities, state level). For example, existing average expenditures per year in the fisheries sector (investments and operating costs). It is necessary to estimate how the costs of measures will increase the yearly expenditures of each actor. 4 A comparator to relate the expenditure increase to, for example, the existing profit margin in the fisheries sector. This makes it possible to relate the expenditure increase and its effects on the yearly profit to this margin. 5 The possibilities of passing on expenditures/costs to other payers - such as consumers. The ability to do this depends on several issues (e.g. market structure, regulatory environment, competitiveness etc.)
Industrial Emissions Directive	Directive 2010/75/EU on Industrial Emissions proposes the use of the Best Available Technology (BAT) without entailing disproportionate costs, which in reality, is interpreted as due consideration of both the costs and benefits (Frost, 2009). The preceding IPPC Directive also required that industrial installations applied BAT where this include consideration of the use of a technique under economically and technically viable conditions. The Directive did not mention affordability although some of the Reference Document on the Best Available Techniques (BREF) make explicit mention of it (and an affordability test). The Reference Document on Economics and Cross-Media Effects (CEC, 2006) notes: *the cost per unit of product may be useful for assessing the affordability of the technique in comparison with the market price for the goods produced. The cost per unit can be calculated from the annual cost divided by the best estimate of the yearly average production rate during the period being considered* The report sets out a framework which allows the economic viability assessment of BAT for a specific industry, covering aspects such as costs pass through (based on market and industry structure); resilience (or the capacity to assimilate the costs); and the speed of implementation (to assess whether there is a need to determine a more reasonable implementation period).

Table 2-1: Affordability in different regulatory contexts	
Legislation	**Affordability considerations**
REACH	REACH is a European Union regulation concerning the Registration, Evaluation, Authorisation and restriction of Chemicals. It came into force on 1st June 2007 and replaced a number of European Directives and Regulations with a single system. Socio-economic analysis is used to examine whether the benefits of continued use of the substance of very high concern outweigh the risks to human health or the environment from on-going exposures. A key component of such analyses can be arguments concerning the "affordability" or any loss in the use of the substance to industry (manufacturers and/or downstream users). The European Chemicals Agency together with the European Commission has therefore developed guidance for use by Competent Authorities and the chemicals producing and using sectors on how to assess such issues. These assessments consider: • Competition and competitiveness; • Profitability; and • Resilience. In terms of the assessment of resilience, the guidance recommends the use of a number of financial ratios and, indeed, it is suggested that these are calculated for a representative firm within a sector or as an industry average (with the uncertainties associated with the use of such an average indicated), or for the specific firm. • Current assets and current liabilities; • Equity capital and total liabilities; • Operating profit and financial costs; • Gross profit and sales; • Net profit after tax; and • Share capital, reserves and long term loans. If this information is not available, the REACH guidance suggests that industry averages are used for profitability, liquidity and solvency but using data trends over periods of 5 to 10 years.
Directive on the assessment and management of flood risk	Directive 2007/60/EC came into force on the 26 November 2007 and requires all MS to assess water courses and coast lines for flood risk, to map the extent of the risk and the assets and people at risk. The aim of the Directive is to ensure adequate and coordinated measures to reduce flood risk are in place. This Directive is to be implemented in coordination with the WFD through flood risk management plans and river basin management plans being coordinated. The Directive does not consider affordability but does state that: *Member States should base their assessments, maps and plans on appropriate 'best practice' and 'best available technologies' not entailing excessive costs in the field of flood risk management* When assessing the financial impacts of changes in flood risk management indicators such as gross margins, fixed costs and net margins are used (Penning-Rowsell et al, 2005). For agriculture these are expressed either per hectare (ha) or for a farm as a whole (Penning-Rowsell et al, 2005).

2.3 Indicators for the rural land management sector

Although there are several studies which examine the impacts of the WFD on farming (e.g. Bateman et al, 2006; Fezzi et al, 2008), in general there is a lack of peer reviewed literature setting out approaches specifically aimed at investigating the affordability of the costs of measures to farms, and according to the type and size of farm. The types of indicators identified from the literature include (see Annex 1 for a fuller discussion):

- Net farm income measures which can be combined at the sector level with cost data to assess impacts on levels of net income
- Indicators reflecting technical efficiency and levels of debt (e.g. Wilson et al, 2012), which are more useful at the farm enterprise level
- Total factor productivity data which do not easily combine with the EA cost data to provide an indicator of affordability, and
- Sustainability indicators (Zahm et al, 2008) which go beyond providing a straightforward indicator of financial affordability to also take into account agro-ecological and social sustainability and thus go beyond the scope of this study.

A report by Broekx and De Nocker (2011) is specific to the WFD and uses an indicator approach for determining the affordability of measures. Three different indicators are proposed:

- An added value criterion that compares the annual cost of the measures to be financed against total family labour income and total net farm income.
- To check the reference income criterion, the authors compare the average family labour income per annual work unit of the agricultural sector with the average gross income of people in the Walloon Region.
- In addition, they take into account the negotiating position, or potential for cost pass through, between the farmer and suppliers and/or customers.

The approach is based on the concept that a farmer has to invest in additional environmental measures at the expense of income and added value. A key problem with this approach is the wide ranging thresholds used to assess affordability: <2% is deemed affordable while >50% is deemed unaffordable; decisions on affordability in between this level are left to a policy maker's subjective judgement.

At the EU level, the WADI project studied the sustainability of irrigated agriculture in Europe in the context of post-Agenda 2000 CAP Reform and the WFD (Berbel Vecino and Gutierrez Martin, 2004). The study used indicators of the economic viability of farming to assess the possible effects of different water policies on farm income, where this was used as the indicator of the "sustainability" of water price changes due to policy implementation (and different levels of costs recovery). The indicators included: farm income; farm contribution to GDP; and farm support as defined in Table 2-2.

Table 2-2: Economic viability of farms under reform to the CAP and WFD	
Indicator	**Definition**
Farm income	The difference between the value of gross output and all expenses, including depreciation at the farm level from agricultural activities. It is designed to measure the financial viability of farming. If financial returns are consistently negative, then any farming system will be unsustainable. In order to understand the sustainability of agriculture in the medium/long-term, net profit has been adopted, by subtracting rent, depreciation and farm household labour.
Farm contribution to GDP	It has been estimated as the value added produced at farm level i.e. the difference between total revenue and intermediate consumption. Thus it is a measure of the contribution of the farm to economic wealth, and it also takes account of items that are subtracted as costs when we consider farm income only.
Farm support	Farm support is a measure taken into account as a contextual indicator provided it is related to agricultural-environmental policies. It measures the net support accorded to agriculture, and is important from two points of view. Firstly, the public decision-maker needs to know the amount of funding to farming and how this funding is going to change over time. Secondly, there is the question of equity, in the degree of support to farming.
Source: Berbel Vecino J and Gutierrez Martin C (2004): Sustainability of European Irrigated Agriculture under Water Framework Directive and Agenda 2000, available at http://www.lu.lv/materiali/biblioteka/es/pilnieteksti/vide/Sustainability%20of%20European%20Irrigated%20Agriculture%20under%20Water%20Framework%20Directive%20and%20Agenda%202000.pdf	

2.4 Indicators for industry and manufacturing sector

2.4.1 Manufacturing industry

A number of approaches to affordability in the context of industry and manufacturing have been developed. These include reference or threshold value approaches which consider affordability in terms of a series of financial indicators, such as turnover, gross profit, added value and investment costs (e.g. Vercaemst, 2002). In some cases, the approaches go beyond these more simple indicators to try and reflect more complex financial concepts such as resilience and market factors (Van der Woerd et al, 1998), however, these tools tend to have been developed for application at the company level; indeed, one of the identified drawbacks of some of the methods is that they are only applicable to larger companies and not to small and medium sized enterprises, nor at the sector level.

The reference or threshold approaches suggested for industry are similar to that proposed for agriculture by Broekx and De Nocker (2011) in that they set thresholds for determining affordability. Vercaemst (2002) for example sets a lower bound threshold of 10% of gross profit, with anything above this "to be discussed". Meynaerts et al (2010) note that the arbitrariness of any such thresholds is a key drawback of this type of approach.

Although the types of indicators proposed in such studies are relevant and appropriate, it is not for this study to specify thresholds for use by Ministers in assessing the affordability of the EA's proposed programmes of measures. However, identification of the types of thresholds that have been proposed or used elsewhere is considered of relevance to set the wider EU context.

As an alternative, Vanassche et al. (2008) propose a methodology based on indicators of liquidity and solvency, i.e. an investment is economically feasible if the actor can maintain or strengthen its competitiveness and earn a return from activities that exceeds the cost of capital in the long run.

When applied at a sector level, annual accounts are calculated for an average company on the basis of the account s of all companies in the industry over four years. In large heterogeneous sectors, it may be necessary to break the sector into different subdivisions, e.g. to reflect age and/or size.
Affordability is assessed by comparing financial ratios for actual and projected annual accounts after an environmental investment. The comparison between the relative position of the ratios before and after the environmental investment then acts as an objective starting point for the discussion of the viability of the investment, i.e. its affordability. One of the main weaknesses of this model is that it fails to take into account the competitive position of a company or sector. In addition, in the context of this study, a significant additional drawback to using such an approach is the data requirements it would create in terms of accounting for all of the different financial costs and indicators.

Based on a review of the above models and other similar approaches, Meynaerts et al. (2010) developed a broader methodology for assessing the affordability of technical abatement measures for the industrial sector. The elements of their proposed approach are as follows.

1. Reference Values: A comparison of key financial figures e.g. turnover, gross profit and added value with the additional costs of environmental measures for a representative company. Where the sector is heterogeneous, the assessment can be balanced by making a distinction between subsectors or size classes. Investment costs of abatement measures are compared to the average total investments over the past 5 years.
2. Competition: An extended affordability analysis into the competitiveness of a sector using Porter's five forces framework: (i) the entry of new competitors, (ii) the threat of substitutes, (iii) the bargaining power of buyers, (iv) the bargaining power of suppliers, and (v) the rivalry among the existing competitors. Based on qualitative information the appraisal gives an indication of an industry's ability to shift additional costs to suppliers or customers.
3. Financial Ratio Analysis: A more detailed analysis using financial ratios is carried out to determine the affordability of additional costs of environmental measures in those sectors which although highly competitive cannot pass the additional costs onto suppliers and customers.
4. Impact on Financial Ratios: A further analysis is then undertaken using more detailed financial data to establish the impact of the environmental investment on the key financial ratios.

This is the most comprehensive assessment approach identified from the literature, although issues remain as to how to define "unacceptable worsening of the financial performance". Meynaerts et al. (2009) provide an example using this approach to assess the affordability of WFD measures under the first generation of RBMPs for the Flanders industrial sector. One key issue that arose were the ability to conduct an analysis specific to only those companies that would have to bear the costs of the proposed programme of measures, and to collect some of the financial data needed at the sector level to carry out the analysis. Another issue was the fact that the ratio analysis indicated that measures were likely to be affordable at the sector level, while at the enterprise level the results could be quite different depending on the financial ratio being considered (costs relative to turnover, to gross profit, to gross added value, and to total investments). This problem arose in part because the sector level analysis was based on assumptions concerning the "average" enterprise, which in many cases may not be easily defined. They also noted issues concerning the use of an average when large variations in economic performance may exist between firms within a sector. However, no suggestions are provided as to how such issues could be overcome, other than to collect more specific data.

It should also be noted that their analysis was undertaken at a more disaggregated level than is required for this study. They applied the approach to the textile sector, and then to operators within this sector. At this level of disaggregation, the type of competition assessment suggested by Meynaerts et al. (2010) is feasible; at a higher level of aggregation, i.e. manufacturing as a whole, it is not. Although the issues surrounding the use of average values is clearly relevant to a highly aggregated level of assessment.

Further discussion on the above approaches is provided in Annex 1.

2.4.2 Ports and harbours

In relation to specific sub-sectors, work was carried out in relation to the first set of RBMPs to try and define affordability for the ports sector. RPA (2009) sets out an *Economic Methodology for Assessing Port-Related Measures for Chemical Quality under the WFD*, with the key elements of this summarised in Box 2-1. The approach drew on some of the indicators that had also be developed by earlier projects, but did not include any guiding criteria as to when the financial ratios would essentially trigger a decision that a proposed measure was disproportionately costly.

It needs to be added, however, that with regard to the latter point, potential for cost pass through, charges should reflect the costs of providing services. The Harbours Act 1964 includes provisions to allow harbour users to object to charges if they are considered to be unreasonable[7]. Harbour dues are potentially a mechanism for cost pass through but there are concerns that this might distort competition locally or internationally, e.g. if UK port dues are significantly higher than those in mainland Europe this might affect patterns of trade.

[7] Section 26 gives harbour authorities a wide power to charge ship, passenger and goods dues as they think fit. Section 27 makes certain charges levied by harbour authorities subject to a limitation that the charges must be reasonable. However ship, passenger and goods dues are excluded from the requirement of reasonableness under section 27. Instead ship, passenger and goods dues are subject to a separate objection procedure set out in section 31 by which objections on specified grounds can be lodged with the Secretary of State. Information available at http://webarchive.nationalarchives.gov.uk/20120607125851/http://assets.dft.gov.uk/publications/section-31-harbours-act/note-on-s31.pdf

Assessing the affordability of a measure requires information on the following:

- Typical annual revenues for the port authority (and any other operators who would face direct costs in implementing the measure);
- Typical pre-tax profit levels: where profits are significant, affordability may not be an issue;
- Leverage: leverage refers to a company's position in terms of its division of costs between those that are fixed and those that are variable over different levels of production. If changes are expected to affect the main core of activities, profits can be boosted or depressed more than proportionally by changes in fixed or variable costs. Maintenance dredging is assumed to be treated as a variable cost and hence significant changes in these costs may have a more than proportionate impact on profits (as fees will be based on calculations of fixed costs plus some mark up for typical variable costs);
- Potential for 'cost pass through' (i.e. for the operator to increase charge/fees to his customers): the potential for cost pass through will depend on the relative competitive position of a given port compared to the other ports which are either located nearby or which offer the same 'services' (e.g. can accept ships of the same draught or deadweight tonnage, etc.).

Figure 2-1: Affordability of Port related measures for Chemical Quality under the WFD
Source: RPA (2009): Economic Methodology for Assessing Port-Related Measures for Chemical Quality under the WFD, prepared for Defra and The Environment Agency, unpublished.

The EA has more recently developed a guide for marine dredging activities within the context of the WFD (EA, 2012a). This Guide sets out a stepped approach to the selection of measures and their evaluation. In terms of the costs of the measures and wider impacts, the Guide provides a table where the following information can be recorded, along with who will bear the costs (or benefits) as well as the geographical scope of the impacts.

- Potential for the closure of operation;
- Unemployment impacts;
- Loss of trade;
- Significant % change in operating costs;
- Limited ability to pay;
- Other indirect costs; and
- Other implications.

2.5 Indicators for the water sector

Although intuitively there is considerable agreement about what affordability means – "*ability to purchase a necessary quantity of a product or level of a service without suffering undue financial hardship*" – a simple official definition of affordability in relation to water industry services and their customers has not been found helpful. It is clear though that this sector differs considerably from the "agriculture and rural land management" and "industry, services and others" sectors. This can readily be appreciated by considering the two aspects of industry and market structure.

- The sector is comprised of a small number of companies that are regulated due to their monopolistic positions with regard to the supply of services (potable water and sewerage). Demand for these services is dominated by demand from households, with commercial, industrial and other customers accounting for much smaller levels of the services supplied.

- The companies operate within the private sector and regulated in terms of cost pass through under the principles of full cost-recovery, including in relation to any requirements to carry out environmental protection measures under the WFD and other legislation.

As a result of the regulated nature of the industry, the fact that there is very high level of cost pass through, and that households account for the majority of the services provided, the assessment of affordability for this sector is most appropriate considered for households.

From the literature, a number of potential indicators of affordability to households can be identified:

- An indicator based on the concept of a "burden ratio", e.g. water bills as a proportion of household income or expenditure;
- Self-reported problems with water affordability (e.g. based on household surveys); and
- An indicator based on levels and age of water debt.

Table 2-3 provides a summary of the advantages and drawbacks of these different indicators based on the literature and discussions with water company representatives, Ofwat and the Consumer Council for Water (CCWater). Annex 1 provides a more detailed review of the key literature in relation to assessing the affordability of water bills, including the most recent work by Ofwat and CCWater.

Table 2-3: Water affordability indicators – advantages and disadvantages			
Indicator	**Description**	**Advantages**	**Disadvantages**
Burden ratio	The burden ratio is the most commonly used indicator of the affordability of utility services. Different variants exist with most common being expenditure on WWS relative to household income or expenditure	Advantages largely depend on the exact burden ratio that is used Could be developed to support a cross-utility indicator of affordability	Disadvantages largely depend on the exact burden ratio that is used Relies on setting subjective thresholds of affordability Includes discretionary as well as essential use Does not take account of other factors that could impact on final consumption
Self-reported problems with water affordability	Existing research uses a number of questioning approaches, including: • Satisfaction with value for money; • Perceived bill fairness, and • Ability to pay.	Enables the consumers' perspective to be captured Linked to bill payment behaviour	Possible distortions from self-reporting Influenced by bill increases other than water Cannot be used to predict and assess the impact of social tariffs
Levels and age of water debt	Indicator based on levels of household revenue outstanding.	Could be developed to support a cross-utility indicator of affordability Enables the impact of some limited social tariffs to be evaluated	Disconnection ban masks those who can pay but who choose not to pay Some people will pay even if they struggle to Influenced by bill increases other than water
Source: adapted from Ofwat (2011a)[8], Ofwat (2011b)[9]			

2.1 Indicators for the public sector

Affordability for the public sector is increasingly being raised as an issue at the EU level due to the financial crisis and its impacts on national economies more generally. Traditionally, government affordability in the water sector has been linked to cost recovery issues, in particular whether the implementation costs of a programme of environmental measures can be recovered through fiscal transfers financed by tax payers or through user charges financed by consumers (Cardone and Fonseca, 2003; OECD, 2009). Following the CIS, affordability is linked to the cost recovery principle through both the contribution that every single water user (i.e. industry, agriculture, households) has towards the recovery of cost, and to the pricing structure of the water service (i.e. the costs

[8] Ofwat (2011a): Affordability and debt 2009-10 - Supporting information. Available at http://www.ofwat.gov.uk

[9] Ofwat (2011b): Affordability and debt 2009-10: Current evidence. Available at: http://www.ofwat.gov.uk

faced by the water companies). Affordability is further linked to the public sector as long as the government is involved in the "water market", whether water providers are public or private[10].

In the Netherlands, for example, affordability is considered at the level of the program of measures (PoM) during negotiations of regional water boards. Although there is no explicit consideration of the "public sector" as a potential sector impacted by the directive, it is noted that supplementary regional measures become disproportionately costly when levies and other income of water managers is insufficient to cover the costs of measures. In other words, costs are affordable as long as they are below or equal to public revenues/available financial resources.

In Belgium - Walloon region, affordability criteria are not applied to the public sector as water management is viewed as a political choice. Broekx and De Nocker (2011, p 16) point out that:

> "*To check the affordability for government is however disputable as the costs in the end will be borne by the other sectors through means of water pricing or general taxation. However, government investments are made which cannot directly be related to other sectors (e.g. investment in hydromorphological measures). This means the government is not always able to directly recover costs from other sectors.*" (Broekx & De Nocker 2011, p 16).

In contrast, in France, some considerations for public sector affordability were included in the evaluation of the Rhone-Mediterranean and Corse River Basin, where RBMPs are developed and managed by Water Agencies, which are autonomous bodies that are largely financed from revenues coming from charges or fees on water users. In this case, public sector affordability is directly linked to the water users' ability to pay for the programme of measures, in other words, the financial capability of RBD stakeholders (Boeuf, 2014).

The above approaches highlight the need to consider affordability for central government from a budgetary perspective, taking into account the fact that expenditure in one area of public policy reduces what is available to spend in other areas. There are therefore trade-offs involved in spending money on measures to meet WFD objectives rather than to meet other social or environmental objectives. Thus, one has to consider budgetary restrictions at the national level and how these then affect Defra and other departments that may have an element of WFD related expenditure, e.g. DECC and grants given to the Coal Authority for funding abandoned coal mine remediation schemes.

Relevant indicators for assessing affordability for the public sector therefore include consideration of:

- Projected changes in central government revenue streams, given the Government's aim to reduce public sector borrowing, and the implications of this for public sector spending (also taking into account tax policy)
- Changes in the share of (central government) funding to relevant public bodies involved with the WFD implementation and earmarked for WFD related measures, and
- The likely magnitude of WFD related funding compared to the costs of the measures allocated to the various NPDBs.

[10] For the importance of the economic factors included in the WFD and their implementation in Member States with a different water market, see the case of Spain (Gomez-Limon and Martin-Ortega 2013).

2.2 Practice in other Member States

As part of the literature review, approaches to affordability adopted in other countries have been examined. A key finding is that a few member states have relied in the past on the use of pre-defined thresholds to determine whether or not measures are affordable, see for instance examples of France and Romania in Table 2-4 overleaf which indicate that a threshold for costs/water bills of 3% to 4% of household income is being used to assess affordability.

Other countries have studied the use of thresholds, such as the studies carried out for Belgium as reported above and summarised below in Table 2-4. Work has also been carried out in Germany which suggested the use of thresholds, but these have not been applied in practice. The Regional Working Group on Water of Germany funded a project to investigate ways of measuring the ability to pay for environmental measures (Klauer et al., 2007). The outcome was a selection of criteria that could be used to designate and justify WFD exemptions without the need for extensive economic modelling or valuations. A number of criteria were developing, including screening criteria, proportionality for non-state actors (including households and industry) and proportionality at state level. The assessment and application of the criteria follow a three-step process. The first step assesses whether the costs are proportional at a water body level (screening and non-state actors criteria). Some of the criteria relating to disproportionality applicable to non-state actors included:

- Costs in relation to average firm profits in an economic sector; and
- Average share of expenses for water resources management/environmental protection in the turnover of an economic sector.

This approach is similar to many of the other approaches that have been proposed and are summarised in the preceding sub-sections of this report (see also Annex 1). A key difference is that the budgetary question regarding the affordability of measures seems to precede consideration of disproportionate costs in terms of the balance between the costs and benefits of proposed measures.

In other countries, say the Netherlands and Spain, affordability has been taken into account where there are concerns over affordability for local authorities, either because they have a responsibility in water management or because they face budgetary constraints (thus similar to the state and as discussed in Section 2.6). It is clear though that the way programs of measures are developed and financed can clearly influence how affordability concerns might be taken into account and at when within the overall planning process, as follows.

- The programs of measures developed (for the first RBMPs and now the second) were/are not aimed at achieving good water status: they were/are developed taking into account more or less explicitly technical feasibility, cost-effectiveness and the financing capacity of sectors and of public administrations. As such, in many cases, the design of the PoMs already considers “available financial resources” (potentially increased by a % considered as acceptable).

- Furthermore, member states might apply CBA to identify programmes of measures and then address affordability concerns for (1) adapting measures at the local level (e.g. for industries

of a given water body) and for (2) communicating around the PoM (stressing that affordability concerns are considered).

- In some cases, co-funding is in place – with costs shared between sectors and state (EU) subsidies, or between local authorities and state (EU) subsidies. In some cases, even if the share of costs to be supported by local authorities is low, it is this part that can act as the main constraint for implementing measures, due to affordability concerns for local authorities rather than linked to state budgets.

Table 2-4: Affordability Assessment in other EU Member States

1. France, Rhone-Mediterranean and Corse (RMC) River Basin

In France, the methodology for assessing disproportionate costs of the Programme of Measures in the first RBMP include an affordability assessment as a second step of the analysis, with cost-benefit analysis undertaken as the first step of the assessment.

However, this method proved to be difficult to apply in practice, as the use of CBA for each water body was difficult. Ability to pay by each sector was thus often used as a first screening. To address the challenges encountered in the first RBD cycle, in the second RBMP cycle ability to pay has then become the basic parameter for assessing disproportionate costs. This type of assessment is better suited for spreading implementation costs over time or, in other words, to phase RBMP implementation.

PoM costs are considered disproportionate for households if the average household expenditure for water services exceeds **3% of the average household income**. In addition, some PoM costs cannot be attributed to a specific sector (e.g. hydromorphological measures), so these costs are covered by taxpayers as a whole. The analysis will then calculate these costs and compare them to average household income. In the Artois Picardie river basin, a **4% threshold** is being applied.

2. Romania

Affordability was taken into account in the frame of the selection of measures related to water services and wastewater infrastructure. Costs of measures were translated into increases in water bills expressed as percentage of the mean annual household income (with differences in annual income between regions being accounted for). A threshold value of **4%** was used for the relative importance of water bills in household annual income. This assessment was carried out in parallel of CBA. It is unclear whether it effectively led to adapting the PoM and removing some measures for reducing overall costs and making the PoM more affordable.

Romania currently is interested in developing an assessment framework for addressing affordability issues for other sectors like: industry, agriculture and hydromorphology (mainly financed from the public budget).

3. Netherlands

Although the NL did not look at thresholds, they decided what was affordable and then only looked at measures that would fit within their budget.

Table 2-4: Affordability Assessment in other EU Member States

4. Belgium, the Walloon Region[11]

For the first PoM, affordability was assessed for three different sectors:

- For agriculture (comparing the costs of measures proposed for the agriculture sector with farmers revenues)
- For the industrial sector (comparing the costs of measures proposed for the industrial sector with the gross value added (GVA) of the industrial sector (sub-sectors)
- The costs of measures that needs to be financed by public funds with the usual level of public expenditures in the water sector.

The same assessment has been proposed for the second programme of measures. The question of thresholds (and appropriate thresholds for justifying disproportionate cost levels) has also been discussed. The conclusion from the discussion are:

- Even if thresholds are defined, the final decision will remain based on political judgment – making the selection of thresholds (that remain always very difficult to justify on objective terms) a rather "useless" exercise;
- One might fix a given threshold (e.g. 3%) for the total costs of measures proposed in the PoM for the industrial sector. Thus, if the costs of the measures proposed for the industrial sector were around 2%, you would then conclude that costs are proportionate. However, cost disproportionality for the industrial sector (and agriculture?) might need to be assessed at the sector level accounting for the obligations and costs from different directives and programmes – and not isolating costs of water-related measures.

There were some discussions also on « affordability for the State », knowing that public budgets are clearly limited. It was unclear for the Walloon region whether the "State" could be considered as a stakeholder to whom "disproportionality cost" issues could apply. As the final choice is seen as a political one, it might not be required to put effort in focusing on the public sector.

The experience stressed the challenges in addressing "affordability issues" for the agriculture sector. Comparing the costs of the measures for the agriculture sector with the total CAP subsidies allocated to a given region was identified as a potentially useful comparison.

2.3 Summary of key findings from stakeholders engagement

As noted above, stakeholder engagement was undertaken through telephone interviews and face-to-face meetings, followed by a workshop where the main findings of the report and indicators were presented and discussed in further detail. The stakeholders included members from the agricultural sector, water industry, manufacturing and chemicals sectors, ports and harbours and NGOs, as well as representatives of customers of the water industry. There was a high degree of interest in the issue of affordability and the feedback from stakeholders has been important to the development of the affordability framework presented below. This does not mean that stakeholders will agree with all aspects of the framework presented here. Some would have preferred a much more

[11] Broekx S & De Nocker L (2011): Disproportionate cost analysis of the program of measures to reach the environmental objectives of the Water Framework Directive in the Walloon Region. Accomplished under the authority of Société Publique de la Gestion de l'Eau (SPGE). Available at https://www.vito.be/Lists/ScientificOutput/Attachments/856/56756100.PDF on 19 August 2014. The study discusses different thresholds but the range for acceptability of costs is too large to be meaningful.

disaggregated and detailed operator specific approach, while others would have preferred the clear definition of thresholds constituting what is and is not affordable. Both of these approaches were outside the terms of reference for this study.

Other main points from the discussion with stakeholders are that:

- differences in cost pass-through should be considered as they may have implications for the indicators to be used at sectoral level
- sequencing and financial planning timeframes are very important for measures that entail capital investment
- differences between operators within the same sector group can be so large that a sectoral average may not represent the "typical company". Although median values may be more appropriate than sector averages, the data are generally not available to enable median values to be derived, and
- generally, affordability is not an independent issue for non-government organisations, as some of these organisations will only undertake works if they are funded to do so by Defra or the EA, while others will only do so if the works are consistent with meeting their own objectives.

Some stakeholders also noted that although a sectoral analysis based on national average or sector aggregates can be a useful starting point for assessing affordability, but that it also should be recognised that there are significant variations within the sector groups. They would therefore hope that this issue was considered when implementing the programmes of measures.

This has fed into the development of the framework presented below. More detailed discussion on stakeholder views in relation to the indicators proposed specifically for their sector is provided in Sections 3 to 6.

2.4 The affordability framework and relevant indicators

A common theme coming out of the literature review across all sectors is the use of the financial accounting information or balance sheets to ensure even handedness when assessing the ability to pay for measures. A balance sheet summarises the assets, liabilities and equity at a specific point in time, and gives investors an idea as to what is owned and what is owed, thus reflecting the ability to pay for additional investment.

After identifying potential financial and other indicators based on the literature review, checks were carried out to determine what statistics may be available at the national and sectoral level to support the assessment. This further informed the choice and form of the indicators. For example, at the sectoral level, totals are used to assess the performance of the sector and as the basis for calculating the key ratios; at the enterprise level, averages are used, with the logical caveat that when a sector is varied in its character (related to industry structure) then the average may misrepresent overall performance. The alternative would be to use median values (and as suggested by some stakeholders). However, median values are seldom reported in the types of statistics that are relevant to the aggregate level analysis being undertaken here (they are not reported for instance in the FBS although the standard error of the mean is and shows significant variation, nor are they available for manufacturing).

Table 2-5 sets out a summary of the indicators that are being proposed by this study for the different sectors. As can be seen from this table, all measures stem from accounting balance sheet concepts.

Table 2-5: Proposed indicators of Affordability by aggregate sectors			
Sector	**Basis**	**Indicators**	**Other**
Agriculture	Industry level accounts and profitability, resilience and liquidity	• Total Income from Farming (TIFF) • Gross Value Added • Farm Business Income • Liabilities / Debt • Investment levels	• Cost-pass through • Past investment • Burden of other regulation • Subsidies
Industry, services and other (i.e. manufacturing and infrastructure)	Industry level accounts and profitability, resilience and liquidity	• Gross operating surplus • Gross investment / capital employed • Liabilities / Debt • Long term payments • Gross Value Added	• SME adjusted average versus average across all firms – with and without thermal energy generation • Past investment levels • Burden of other regulation
Water sector	Household accounts indicators of affordability	• Water bill as a % of household income (by income decile) • Self-reported problems -> as acceptability of future water bills	• Implications for businesses
Central government (and NGOs)	Total project public expenditure (budgets) and Departmental expenditure limits	• Changes in government revenues • Changes in DEL to Defra & DECC • WFD related funding compared to costs of measures allocated to NPDBs	• Information on different NGO types • Fund raising abilities and constraints on different types of NGOs

3 Affordability in the rural land management sector

3.1 Introduction

3.1.1 The sector

For the purpose of the RBMPs, the rural land management sector covers agriculture and other land management activities, such as forestry. Agriculture in particular will be the dominant economic activity represented by this sector and will be associated with the majority of the measures included in the programmes of measures being put forward in the different river basins.

Forestry is expected to be responsible for a small number of measures and is generally considered as beneficial to the achievement of WFD objectives[12]; therefore it has been excluded from the analysis carried out here[13]. As such this may result in an overestimate of impacts on the agricultural sector, but it is expected this will be minor.

3.1.2 The indicators

There is a series of statistics on the economics of agricultural and other land management activities across England. One of the key sources of agricultural statistics is the Farm Business Survey (FBS). The FBS provides information on the physical and economic performance of farm businesses in England, to inform policy decisions on matters affecting the farming sector. It is intended to serve the needs of government, government partners, farming and land management interest groups, and researchers. The FBS is an annual survey and uses a sample of farms that is representative of the national population in terms of farm type, size and regional location. In addition, the farm business benchmarking site provides a resource for farmers to assess their performance against estimates generated by farm accounts data.

Aggregate agricultural accounts are also available and provide a tool for analysing the economic situation of agriculture, to support policy making in the UK and at the EU level.

These data sets provide the indicators used here to assess the affordability of the proposed programmes of measures under Scenario 4 for England. Affordability is assessed first against sectoral level indicators linked to the aggregate agricultural accounts and then against indicators based on the FBS at an enterprise level. It is therefore important to stress that the first stage of the analysis, which examines sector level affordability, provides the main focus for this study. The second stage has been carried out to highlight where intra-sectoral variation may be an important consideration in determining what policies are used to implement the proposed measures.

[12] Based on discussions with the Forestry Commission.

[13] Forestry covers around 10% of land in England compared to 69% for agriculture. As a result, the GVA associated with forestry is significantly smaller than that for agricultural. Information from EA (2014).

The main indicators are as follows:

- Sectoral level:
  - Contextual information on the number of enterprises and the size of the sector
  - Contextual information on the potential for cost pass-through
  - Annualised costs as a percentage of Total Income From Farming (TIFF)
  - Annualised costs as a percentage of Gross Value Added (GVA)
  - Consideration of current levels of investment, including liabilities, and the degree to which there is scope for additional investment
- Enterprise level:
  - Costs of a measure/bundle of measures as a % of FBI and implications in terms of loss of income
  - Consideration of current levels of investment
  - Consideration of access to finance and/or alternative sources of funding.

TIFF is the income generated by production within the agriculture industry and represents business profits plus remuneration for work done by owners and other unpaid workers (or GVA after deduction of consumption of fixed capital, taxes, labour costs, interest and rent but including all subsidies)[14]. Gross Value Added does not reflect the distribution of income across individual farms. However, it does reflect the contribution that farming makes to the national economy and is therefore often used as an indicator of the impacts that policy measures may have on a country's overall economic performance. For this reason, GVA will be used as an indicator of affordability for the agricultural sector, although it is not considered as strong an indicator as TIFF.

Figure 3-1 overleaf, sets out the overarching framework for this assessment. At the measure level, one considers the most costly measures first. If these appear to be affordable, further assessment may not be needed.

3.1.3 Stakeholders' views

The indicators provided above together with preliminary suggestions on the approach for assessing affordability for the sector were discussed with stakeholders through face-to-face meetings, as well as the stakeholder Workshop. This included discussions with the National Farmers Union, Country Landowners Association and a representative from the UK Irrigation Association.

The main comments from the stakeholders are as follows (in some cases these may reflect personal views rather than the official views of the organisation they represent):

- GVA is not an appropriate indicator of affordability as it masks the distribution of income across individual farms. The Total Income from Farming (TIFF) is a better indicator at the sectoral level.

- The affordability analysis should also take into account the distribution of the measures across the sectors. Figures reported in the EA's economic analysis (summary) demonstrate that rural land management and the water sector are responsible for the vast majority of measures.

[14] See also: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/208436/auk-2012-25jun13.pdf

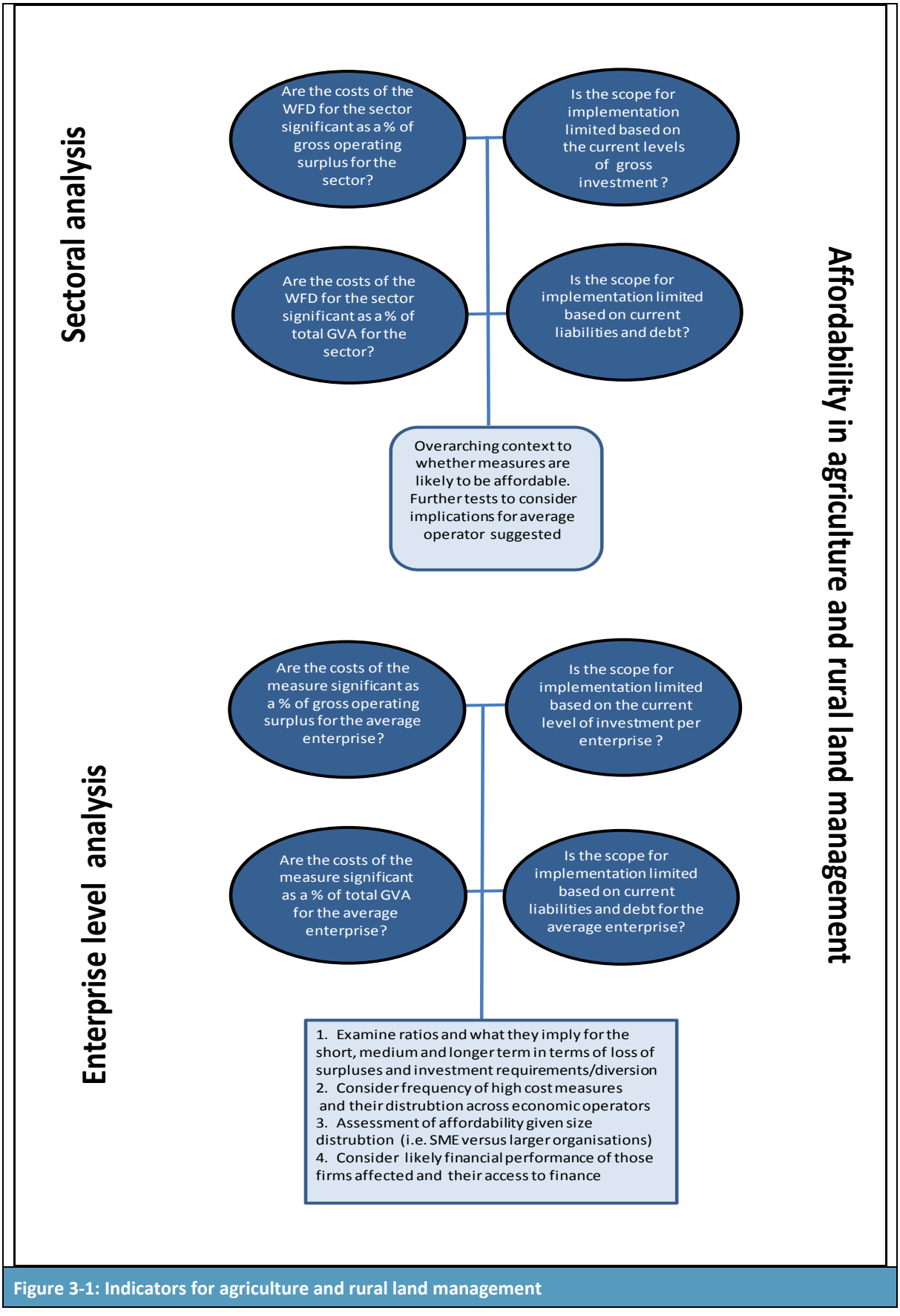

Figure 3-1: Indicators for agriculture and rural land management

- Measures that are cost neutral and those which represent best practice or the legal minimum should be implemented by farms. However, those farms which exceed this minimum should not be penalised; the actions that they have already taken should be recognised.

- The analysis should be risk based and targeted. Larger farms will have economies of scale and will probably need less upfront funding to implement measures.

- A top-down, sectoral approach risks losing important information and overlooks the difficulties faced by farmers, including access to finance.

- There needs to be a series of farm types considered within the analysis, including arable, dairy, grazing livestock, poultry (meat), poultry (eggs), pigs and horticulture. There are a number of different pressures depending on the time of year, sector and farm size which should be taken into account. These are also important considerations for access to finance.

- The 2016 to 2052 year time period over which costs are annualised costs is too long and not meaningful within the context of farm management decision making. Return on Investment for most farms, especially tenant farms, is much shorter and no longer than 10 years.

- Other funding mechanisms should also be examined, including "payments for ecosystem services" (e.g. looking at the supply chain and the potential for such payments from primary processors and supermarkets to support the measures required at the farm level).

3.2 Costs of measures under Scenario 4

As noted in Section 2, this assessment is concerned with Scenario 4 for England, which includes the costs and benefits of achieving Protected Area objectives, no deterioration, and good status in all water bodies where measures are technically feasible and where benefits justify the costs. Under this scenario, no measures are ruled out on the basis of affordability or the availability of funding. The total costs of Scenario 4 are estimated at around £4,800 million from 2015 to 2052.

3.3 Relevant sector information

3.3.1 Financial performance within the sector

The agriculture sector is characterised by a large numbers of firms and high levels of competition. Generally, the UK farming sector is characterised by small firms as illustrated by Table 3-1, which shows the Standard Labour Requirement (SLR) for farms in England. SLR is used to determine the size of a farm, with an SLR < 0.5 representing the smallest farm size.

Table 3-1: Standard Labour Requirement (SLR) for farms in England (June 2014)			
Stratum	**Description**	**Sampling rate (%)**	**Number of farms**
1	SLR < 0.5	13	45,383
2	SLR>= 0.5 and < 1	18	14,945
3	SLR>= 1 and < 2	30	15,903
4	SLR>= 2 and < 3	45	8,853
5	SLR>= 3 and < 4	65	7,972
6	SLR>= 5	78	7,724
10	SLR unknown	35	4,232
All		28	105,012
Source: Defra (2014d)			

In line with the figures presented above on SLR, Figure 3-2 indicates that the majority of farms have an annual income of less than £30,000.

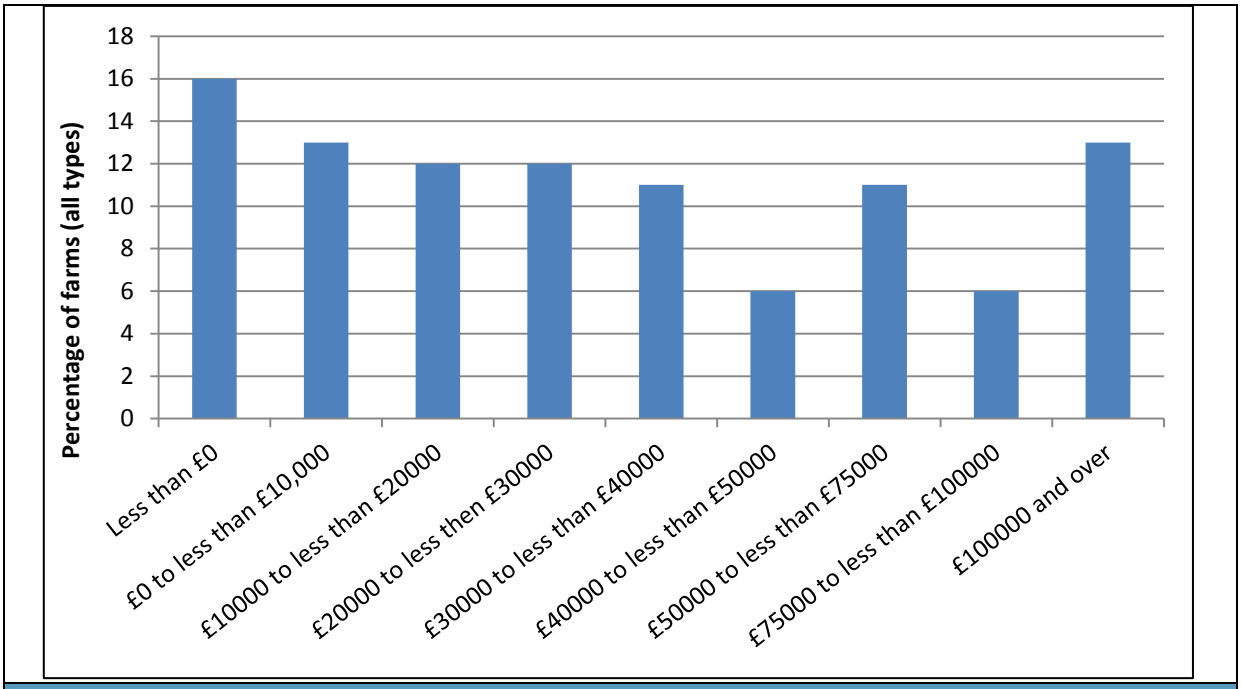

Figure 3-2: Distribution of farm incomes (all farm types)
Source: Farm Business Survey (FBS) (2014)

In addition to the average farm having an annual income below £30,000, farmers are traditionally considered to be price takers. They have a limited ability to exercise any influence on the price of goods sold, as they are commodities whose prices are normally established on the global market. Furthermore, given that their goods are traded in a global market, farm income is strongly affected by changes in exchange rates.

3.3.2 Performance across farm type

One of the main characteristics of the agricultural sector is the large variation in performance across farms, and across enterprises within the same farm type. The FBS provides statistics for low,

medium and high levels of economic performance, as presented in Table 3-2 below. As can be seen, there is a significant variation in income across the farm types.

Table 3-2: Farm Business Income (£/farm) Time Series by Farm Type, England In real terms 2012/13 prices (red colour indicates below average whereas green colour indicates above average figure)					
Type	**2009/10**	**2010/11**	**2011/12**	**2011/12**	**2012/13**
Arable	**66,700**	**88,700**	**86,700**	**85,300**	**63,200**
Cereals	48,000	92,500	98,000	97,000	68,000
General cropping	76,000	121,500	104,500	104,000	91,500
Horticulture	76,000	52,000	57,500	55,000	30,000
Livestock	**59,700**	**48,300**	**46,900**	**48,000**	**44,500**
Dairy	67,500	72,000	89,500	89,500	51,500
Grazing livestock (Lowland)	33,000	23,500	33,000	33,000	16,500
Grazing livestock (LFA)	29,500	23,500	30,000	30,000	19,500
Specialist pigs	86,000	48,500	39,500	39,500	41,000
Specialist poultry	82,500	74,000	42,500	48,000	94,000
Mixed	**37,500**	**55,500**	**68,500**	**76,500**	**38,000**
All types	**50,000**	**62,500**	**68,500**	**68,500**	**46,500**
Notes: From 2009, farm type classification changed from 'standard gross margins' (SGM) typology to standard outputs (SO) typology. From 2011, there is a revised framework separating specialist poultry meat from specialist poultry layers.					
Source: Defra (2014): FB, available at: https://www.gov.uk/government/collections/farm-business-survey#documents					

Farming representatives would argue that it is important that a "like for like", comparison is undertaken; in other words, farms should be compared by size, type and location as these can be important determinants of affordability and the potential for implementation of measures.

However, it must be remembered that the purpose of the study is to develop indicators which are suitable for application at a national level. At this stage, Ministers are considering the overall scale of ambition that is proportionate to the available total resources and as such this large variation in financial performance is not relevant. However, this variation would need to be considered when designing policy measures at a more local level. Any variations in financial performance and considerations of affordability are not intended to protect enterprises which are performing poorly against the industry standard.

3.3.3 Environmental expenditure

Another argument frequently used when considering affordability is the need to account for past investment in environmental measures. As highlighted by stakeholders, it is important that costs do not fall inequitably on those that have already implemented pollution reduction measures. On the other hand, one would also expect that the level of pollution from farms that have already invested in pollution reduction will be lower, so that they would not bear as great a burden as those who have taken little action prior to this second round of RBMPs.

The Farm Practices Survey (FPS)[15] asks questions about how farming practices in England are affected by current agricultural and environmental issues. The 2014 publication gives the results of the FPS run that focused on practices relating to greenhouse gas mitigation. The topics and findings in this publication relevant for WFD purposes and diffuse pollution are:

- Nutrient management: The proportion of holdings with a nutrient management plan has increased steadily from 46% in 2006 to 60% in 2014, accounting for 74% of the farmed area

- Anaerobic digestion: Less than 2% of holdings currently process slurries, crops or other feedstocks by anaerobic digestion either on their farm or elsewhere

- Fertiliser, manure and slurry spreaders: In 2014, 71% of farmers spread manure or slurry on their grassland or arable crops either themselves or hiring a contractor to do so and 84% spread fertiliser. Of those farmers spreading some or all of the manure or slurry themselves, 64% never calibrate their spreader

- Manure and slurry storage: In 2014 just over two thirds of holdings (67%) with livestock stored solid manure in temporary heaps in fields while over half (55%) also stored manures and slurry on a solid base. These figures have remained similar since 2011. The proportions of holdings with the facilities to store slurry in a tank or a lagoon are 20% and 18% respectively. The majority of manure and slurry stores are uncovered

- Grassland[16]: In 2014, 78% of livestock holdings had sown some or all of their temporary grassland with a clover mix and 58% have sown their temporary grassland with high sugar grasses, and

- Soil drainage: Almost 2.8 million hectares of crops and grassland has artificial under-drainage in 2014. Approximately 22% of the current drained area requires some repair or replacement of the field drains.

Larger farms are more likely to have a nutrient management plan in place. By region, the East of England has the greatest number of nutrient management plans in place, with cereal-based farms topping the list in terms of type of farm (see results in Table 3-3 below). Over the past four years more holdings reported a financial benefit (49% in 2014) from having such a plan than an environmental one (34% in 2014); this may indicate that in the future there will be a more limited ability to further reduce nutrients so that more costly measures may need to apply instead.

[15] The results are based on responses from approximately 2 500 holdings. Holdings were targeted by farm type and size to ensure a representative sample. To be included in the sample, holdings had to have at least 50 cattle, 100 sheep, 100 pigs, 1,000 poultry or 20 hectares of arable crops or orchards. Available at https://www.gov.uk/government/statistics/farm-practices-survey-february-2014-greenhouse-gas-mitigation-practices

[16] In some situations sowing grassland with a clover mix or high sugar grasses can be a cost-effective method of increasing production and improving environmental protection.

Table 3-3: 2014 Results on uptake of nutrient management plans (proportion of holdings)				
Farm type	**Proportion of holdings**			**No. of responses used**
Farm size	**Holdings with a NM plan**	**Holdings without a NM plan**	**Not applicable**	
Small	51%	39%	9%	969
Medium	66%	27%	6%	444
Large	76%	19%	5%	1,068
All farms	**60%**	**32%**	**8%**	**2,481**
Region				
North East	39%	48%	13%	154
North West & Merseyside	46%	47%	7%	287
Yorkshire & The Humber	61%	32%	7%	343
East Midlands	67%	26%	7%	337
West Midlands	56%	35%	8%	286
East of England	80%	15%	4%	340
South East	64%	27%	9%	240
South West	54%	37%	9%	494
All farms	**60%**	**32%**	**8%**	**2,481**
Farm type				
Cereals	84%	11%	4%	567
Other crops	79%	16%	5%	350
Pigs & poultry	45%	31%	24%	157
Dairy	71%	25%	3%	430
Grazing livestock (LFA)	24%	64%	12%	286
Grazing livestock (Lowland)	37%	52%	12%	436
Mixed	73%	25%	2%	255
All farms	**60%**	**32%**	**8%**	**2,481**

Information such as this can be used to consider whether the additional measures required under the Scenarios are aimed at addressing such gaps in the implementation of pollution reduction measures or go well beyond what this would imply. This is important for two reasons:

- Assessment of affordability should be based on an even handed approach, and should therefore take into account the degree to which measures are being required of "poor performers" within a sector who have avoided the need to invest in measures others have been required to undertake, and

- Affordability arguments should not be used as a means of rewarding such "poor performers" who may also be poor performers more generally. In other words, if a measure has been widely adopted within a sector, then the fact that it may be unaffordable for a farm that is performing poorly financially should not be an acceptable argument on affordability grounds.

At the sectoral level, as only 60% of farms currently have a nutrient management plan in place, there is clearly scope for additional take-up. Care is needed in interpreting these data though as uptake may be limited by other conditions, e.g. geomorphological conditions (moorlands) and other extensive systems where inputs are generally at a low level and farmers are unlikely to see a positive benefit from producing a nutrient management plan.

3.4 Sectoral level analysis

3.4.1 Total Income from Farming and Gross Value Added

As noted above, the total costs for the agricultural sector are £4.8 billion for England. The latest figures for TIFF and GVA for 2013 (Defra, 2014e) are given in Table 3-4.

Table 3-4: 2013 outcome for TIFF and GVA for England (Defra, 2014f)	
Indicator	**England**
TIFF	£4,293 m
GVA	£7,506 m
Sources: Defra (2014e) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387749/agriaccounts-regstatsnotice-17dec14.pdf	

Table 3-5 reports the estimated costs of Scenario 4 relative to the performance of farms in England against GVA and TIFF. Under Scenario 4, the WFD measure costs account for 4.4% of TIFF which may raise concerns for affordability (and is above the thresholds proposed in some other EU countries for assessing affordability).

Table 3-5: Sectoral analysis for England– Costs of WFD measures				
Scenarios	**Total PV costs (£m)**	**Equivalent Annual Costs**	**Equivalent annual costs as a % of GVA (2013 GVA)**	**Equivalent annual costs as a % of TIFF (2013 TIFF)**
Scenario 4	4,800	180*	2.5%**	4.4%
Notes: * As reported in EA, 2014 ** Annualised from total PV over 40 years				

The above analysis is static, as it considers equivalent annual costs in relation to 2013 performance data. A more dynamic approach would be to consider trends over time. Figure 3-3 shows how TIFF has varied over the last 20 years for the UK as a whole, and a similar trend would be expected for England. As can be seen from the figure, TIFF has fluctuated significantly over the last five to ten years in real terms (thus excluding the effect of changes in the exchange rates). Over a longer time period, TIFF remains at a level higher than in the late 1990s/early 2000s although it is below the peak seen in the mid-1990s. Over the longer term, Total Income from Farming per Annual Work Unit (AWU) of entrepreneurial labour has performed better than TIFF owing to a decline in the number of farmers and other unpaid workers.

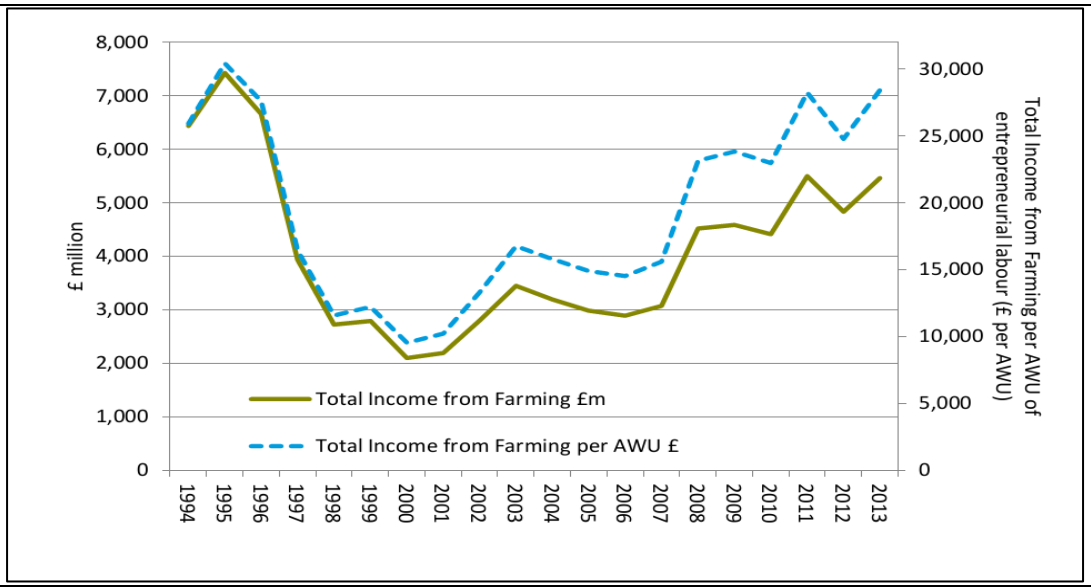

Figure 3-3: Agricultural industry income trends in the UK (in real terms)
Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/379757/agriaccounts-tiffstatsnotice-27nov14.pdf

Table 3-7 provides a parallel analysis, for England, indicating the ratio of the estimated equivalent annual costs of Scenario 4 as a % of TIFF in different years for the English regions. As can be seen from these data, the equivalent annual costs associated with Scenario 4 would equate to over 5% of TIFF for some of the previous years. This analysis highlights the importance of global economic factors to the sector, including not only the overall performance of national economies but also the impact that foreign exchange rates can have on TIFF.

Table 3-6: Historic comparison of TIFF to costs of WFD measures

Scenarios	Annualised costs as a % of 2009 TIFF	Annualised costs as a % of 2010 TIFF	Annualised costs as a % of 2011 TIFF	Annualised costs as a % of 2012 TIFF
Scenario 4 costs	5.23%	5.80%	5.30%	4.73%
TIFF (£m)	3,443	3,101	3,396	3802

Source: TIFF provided in: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/320614/agriaccounts-regstatsnotice-17jun14.pdf, where 2012 is provisional

3.4.2 Capital expenditure and debt

The total capital expenditure for farms across England for 2012/13 is estimated at £2,533 million. The above annualised costs would comprise 12% of this level of annual investment. This is not an insignificant percentage, but it is not clear whether this suggests that significant levels of normal investment would be delayed by the need to undertake capital expenditure specific to the WFD. For example, some of the annual investment captured in the 2012/13 figures may well have been related to the WFD; if this is the case, then the impacts will be less significant.

As for levels of debt, the latest Aggregate balance sheet for the UK agricultural sector shows total liabilities of £15,618 million for 2013[17]. This represents an increase of 50% over the last ten years. However, total assets were estimated at £270,749 million, which is an increase of 156% over the last ten years, indicating that net worth has steadily increased in real terms.

3.5 Enterprise level analysis

3.5.1 Range of costs across measures

The measures required in relation to the agriculture sector will vary depending on the farm type and the activity leading to environmental degradation. It would be expected that different measures would be required for dealing with diffuse phosphate pollution from fields of grazing livestock, an arable field or fields where manure is spread. This variation will result in a range of measure costs.

The analysis provided below for England considers the potential implications that the costs of individual measures may have on an individual farming enterprise's financial performance, to establish the importance of affordability considerations as part of government policy towards the implementation of programme of measures. Table 3-7 draws on information provided by the EA to illustrate the distribution of the magnitude of capex and opex associated with measures proposed in relation to the agriculture and rural land management sector under Scenario 4. It should be noted that the distributional data presented in this table can only be developed for a sub-set of the measures relevant to this sector due to the way in which the cost estimates were developed. For example, the costs of a measure that would be implemented across a series of waterbodies may have been bundled together, resulting in no separate cost being entered against a given water body. This indicates that some of the "measures" and their associated costs reported in Table 3-7 as having higher levels of capex and opex may actually correspond to a "measure" that will be applied in multiple locations and across multiple enterprises.

Table 3-7: Proportion of WFD measures (Scenario 4) by cost range for Agriculture and rural land management (undiscounted)

Band	Capex	Opex
Not known	66%	73%
less than £10k	9%	5%
£10k-50k	11%	8%
£50k-200k	7%	13%
£200k-500k	4%	
more than £500k	4%	

Source: Source: Environment Agency, National Appraisal Summary Sheet (v1.3.2)
Note: The percentages have been calculated across all measures for which specific cost data are available; analysis only carried out for England.

In addition, it is not known whether more than one measure may fall on an individual enterprise, such that the sum of the costs falling on an enterprise could become unaffordable. This uncertainty,

[17] Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/379763/agriaccounts-balancesheetdataset-27nov14.xls

together with the fact that the costs of a single measure may fall across more than one operator, means that the figures presented in Table 3-7 should be interpreted with caution.

3.5.2 Costs of individual measures

The various affordability indicators are considered below with respect to low, mid and high cost scenarios involved in implementing a measure. The assumptions for these scenarios are set out in Table 3-8 , based on hypothetical total cost assumptions.

Table 3-8: Illustrative scenarios for individual measure costs (capex and opex)		
Scenario	**Costs**	**Mid-point (used in analysis)**
Low costs	Less than £10,000	£5,000
Mid costs	£10,000 to £50,000	£25,000
High costs	More than £50,000	£50,000

The most relevant indicators at the enterprise level stem from the Farm Business Survey, with Farm Business Income (FBI) being the key indicator:

- It is most closely aligned to 'profit' as a measure, and one which is also relevant to other economic sectors
- It is the most widely quoted and used measure within the farming sector and in the available literature, so will be readily understood and accepted by stakeholders, and
- It is the main measure used in agricultural analyses, so the data are readily available and there is more information on how to interpret changes in values, etc.

Caution is needed, however, in its use due to variability between sectors, farms and on a year to year basis. For example, the financial performance of livestock farming in general appears to be poorer than other farm types, with significant variations also apparent across enterprises within the livestock sector.

The variability in FBI across farm types may mean that a given level of expenditure (capital and/or operating) may be affordable for some farms but not others. The average FBI by farm type is expressed as a proportion of the measure costs for the three cost scenarios, as given in Table 3-9. It is important to note that median FBI was not identified in the data builder of the FBS; as a result, we have reported the standard error of mean to indicate the variability in FBI across farm types.

Table 3-9: Measure costs as a proportion of FBI (2012/2013) for each scenario by farm type					
Farm types	**Average FBI per farm 2012/2013**	**Standard error of mean**	**Scenario**		
			Low costs	**Mid costs**	**High costs**
All farm types	***48,091***	***2,323***	***10%***	***52%***	***104%***
Cropping	72,342	5,112	7%	35%	69%
Cereals	72,838	6,229	7%	34%	69%
General cropping	98,174	14,764	5%	25%	51%
Horticulture	30,308	6,961	16%	82%	165%
Grazing Livestock	***27,177***	***1,611***	***18%***	***92%***	***184%***
Dairy	51,194	3,760	10%	49%	98%
Grazing livestock (lowland)	16,515	1,914	30%	151%	303%
Grazing livestock (LFA)	20,346	1,861	25%	123%	246%

Table 3-9: Measure costs as a proportion of FBI (2012/2013) for each scenario by farm type					
Farm types	Average FBI per farm 2012/2013	Standard error of mean	Scenario		
			Low costs	Mid costs	High costs
Other types & mixed	***49,954***	***5,759***	***10%***	***50%***	***100%***
Pigs	43,294	15,696	12%	58%	115%
Poultry	99,406	20,229	5%	25%	50%
Mixed	40,065	4,753	12%	62%	125%

As might be expected, the analysis presented in the table highlights the fact that high cost measures may raise affordability issues for some farm types (e.g. grazing livestock, horticulture) if care is not taken in the design of the policy instruments used to implement the measures.

It must also be recognised that this analysis compares total costs (capex and opex) to one year's FBI; as a result, costs equating to over 100% of annual average FBI may not give rise to affordability concerns if they are spread over an extended time period (i.e. the 37 years adopted as the analysis time horizon by the EA).

3.5.3 Current liabilities and debt

High capital cost measures may raise affordability issues if they fall on smaller farming enterprises, however this is considered unlikely as one would expect the higher cost measures to be associated with larger operations). However, as the Ministerial guidance notes, such issues may be resolvable over time if costs can be spread or alternative means of funding measures can be identified. Discussions with stakeholders have indicated that access to funding can vary according to the type of farm tenancy, with tenanted farms being less able to access finance.

Table 3-10 presents some illustrative results for the levels of capital expenditure compared to the average liabilities across different farm types.

Table 3-10: Increase in liabilities from capital expenditure for each scenario				
Farm Type	Average Liabilities per farm 2012/13 (£)	Scenario		
		Low costs	Med costs	High costs
Dairy	259,700	2%	15%	39%
LFA Grazing Livestock	54,100	9%	74%	185%
Lowland Grazing Livestock	67,000	7%	60%	149%
Cereals	155,200	3%	26%	64%
General cropping	242,600	2%	16%	41%
Pigs & Poultry	282,000	2%	14%	35%
Mixed	132,000	4%	30%	76%
Horticulture	144,800	3%	28%	69%
All farms	**150,000**	3%	27%	67%

3.6 Summary of findings on affordability

Tables 3-11 and 3-12 provides a summary of the assessment of affordability against the indicators identified as being most relevant for the agriculture and rural land management sector. When interpreting the figures presented in Table 3-11, it should be noted that although Scenario 4 cost estimates account for agri-environment payments, these are also included in TIFF. As a result, the percentage calculations are a good reflection of the impacts of the Scenario on the sectoral income.

Table 3-11: Sector level analysis - Equivalent annual costs (EAC) as a % of sectoral performance indicators	
	England
EAC as % TIFF	4.4%
EAC as % Gross Value Added	2.5%

Table 3-12: Measure costs as a proportion of FBI (2012/2013) by farm type – England only				
Farm types	Average FBI per farm 2012/2013	Scenario		
		Low costs	Mid costs	High costs
All farms	48,091	10%	52%	104%
Grazing Livestock	27,177	18%	92%	184%
Other types & mixed	49,954	10%	50%	100%
Farm types	**Average Liabilities per farm 2012/13 (£)**	**Low costs**	**Mid costs**	**High costs**
All farms	150,000	3%	27%	67%

The enterprise level analysis given in Table 3-12 is considered a useful addition as it highlights that some of the higher cost measures could lead to affordability issues for specific farm types and for smaller farm enterprises. The analysis has revealed significant differences in income and in performance across farm types, and indeed within the same farm type. In particular, high cost measures (whether capex or opex) may raise affordability issues for grazing livestock, horticulture, some pig farms and mixed farms. As the costs of implementation will vary according to location and farming type, this suggests that such differences may need to be recognised when designing the actual policy and other mechanisms that will drive implementation of the programmes of measures (e.g. the grant schemes or new regulations). The more detailed economic analyses that accompany the design of changes in policy are better suited to considering such issues than the broader analysis that is carried out to support development of the overall programme of measures for the second round of RBMPs.

However, it must also be recognised that this analysis compares total costs (capex and opex) to one year's FBI; as a result, costs equating to over 100% of annual average FBI may not give rise to affordability concerns if they are spread over an extended time period (i.e. the 37 years adopted as the analysis time horizon by the EA).

Other issues that may merit consideration at a more regional or local level are as follows:

- Distributional issues: What percentage of farms would be required to implement the WFD measures? It is not yet clear whether some of the measures apply equally across all regions or only in some regions.

- Incidence: Are the same farms being expected to undertake multiple measures? This may be important as the incidence of multiple measures may make the proposed programme less affordable for those affected. However, it may also be the case that those being tasked with implementing multiple measures may be the poorer environmental performers who have not taken any action to date above the legal minimum. As noted above, affordability assessment is not intended to provide a basis for poor environmental performers to avoid meeting their environmental responsibilities.

- Funding mechanisms: What proportion of agri-environment payments could support WFD objectives at the farm level under the new regime? What are the opportunity costs to the farmer of these agri-environment payments? It has been suggested by stakeholders that the new scheme for agri-environment payments may reduce the level of support to farmers. Agri-environment payments are considered to be a good funding mechanism to assist farmers in implementing environmentally friendly measures, but they need to be greater or equal to the opportunity costs of implementing the measures.

4 Industry, Services and Other

4.1 Introduction

4.1.1 The Sector

The broadest grouping of activities adopted by the EA in developing the different RBMP Scenarios for England is that of "Industry, Services and Other". The economic activities that fall under this heading include:

- Industrial and manufacturing activities, including for example thermal power generation
- Other commercial activities
- Infrastructure related activities, including for example inland waterways/canals, ports, marinas and harbours, and highways related activities
- Activities undertaken by non-governmental organisations.

The diverse range of activities and actors comprising this group poses challenges for the development of robust indicators and thus for assessing the affordability of the overall programme of measures proposed under Scenario 4, as well as that of individual measures.

As a result, it has been necessary to sub-divide this sector grouping to some extent. In part, this is in response to discussions with stakeholders, but sub-division has also been based on consideration of financial data at the sectoral level as well as the types of measures that might be required of different sets of actors and the magnitude of the costs associated with these. The two key sub-sectors that have been separated out are the thermal power generating sector and the inland waterways/canals, ports and harbour sectors.

- The thermal power generating sector has been separated out from other industrial and manufacturing activities due to the fact that its financial characteristics vary significantly from those of other industrial and manufacturing activities. Furthermore, the types of measures that may be required by this sector are significantly different, for example, relating to the need to change water intake systems and may involve large one-off expenditures which would be agreed at the site level.

- The waterways, ports and harbours sector has also been separated out due to the complex nature of the businesses comprising this sector, which includes fully commercial operators as well as trust ports and the non-governmental organisations (NGOs) such as the Inland Waterways, Canals and Rivers Trust (this is discussed further below).

There may be costs included under this sector grouping that would fall on other NGOs, such as The Rivers Trust or the River Restoration Trust. However, it became clear after discussions with a range of different NGOs that affordability was not a concept relevant to their role under the WFD. These organisations would undertake those measures that benefited them in terms of fulfilling their own charitable objectives or relied on funding from Defra or the EA to undertake works. It was further suggested that NGOs would not undertake any measures which do not fit with their "objects".

In this regard, it was suggested that NGOs fall into three main groups: those that don't have any specific budgets earmarked towards WFD related measures but which will contribute (financially or in-kind) to works being undertaken by others; those that are funded almost solely by grants in terms of their delivery of WFD measures; and those that are funded through a range of different revenue streams, which may include government grants as a major component. Given that affordability is not a concept that is readily applied to this sector, they are not considered in detail in this Section, although the importance of government funding to their activities is highlighted in Section 6.

Measures related to road transport will be largely delivered by public bodies, namely the Highways Agency and local authorities; these are therefore considered under the section on affordability for the "public sector" in Section 6.

4.1.2 The indicators

A number of indicators of affordability were considered for this sector grouping, starting from consideration of an enterprise level balance sheet and the standard financial indicators of profitability, resilience and liquidity. As for agriculture and rural land management, this includes indicators at the sectoral level as well as at the enterprise level, with the same stepped approach being applied as for agriculture; see Figure 4-1.

The data and indicators upon which the analysis is based are also comparable to those used for the agriculture and land management sector. The main indicators and their interpretation are set out in Table 4-1.

Table 4-1: Indicators for assessing affordability for the industry, services and other sector grouping

Indicator	What indicator demonstrates
Capacity for additional investment and maintenance	
Gross operating surplus	The funds available for new investments and subsequent maintenance. A high gross operating surplus suggests that the sector has the capacity to make new investments. However, caution is needed as it does not inform on whether the available funds are already committed.
Gross investment in machinery and equipment	A proportion of WFD measures will involve investment in physical machinery and equipment. Comparing the funds already invested with the expected costs of measures demonstrates the degree of additional burden. If the measures represent a significant proportion of current investment, spending on other investments would likely be reduced.
Gross value added	Gross Value Added (GVA) is the difference between the value of goods and services produced and the cost of raw materials and other inputs used up in production. Where the cost of measures is a significant proportion of GVA, further analysis would be necessary.
Current liabilities and debt	
Liabilities	The difference between gross capital employed and net capital employed provides an approximation for current liabilities of the sector. High liabilities in relation to the costs of measures would limit the amount of additional debt the sector could take on.
Payments for long term rentals and operational and financial leasing of goods	This indicates the level of funds already committed by the sector. High long term payments could mean that taking on additional investment and maintenance is not possible.

Table 4-1: Indicators for assessing affordability for the industry, services and other sector grouping	
Indicator	**What indicator demonstrates**
Current investment in environmental protection	
Total expenditure on environmental protection	Where total expenditure on environmental protection measures is already high, industry may be unable to afford additional measures. Considering the magnitude of the increase will be crucial to determine affordability.
Expenditure on waste water management and protecting biodiversity and the landscape	Focusing on expenditure on waste water management and protecting biodiversity and the landscape demonstrates whether WFD measures will significantly increase expenditure in this area.

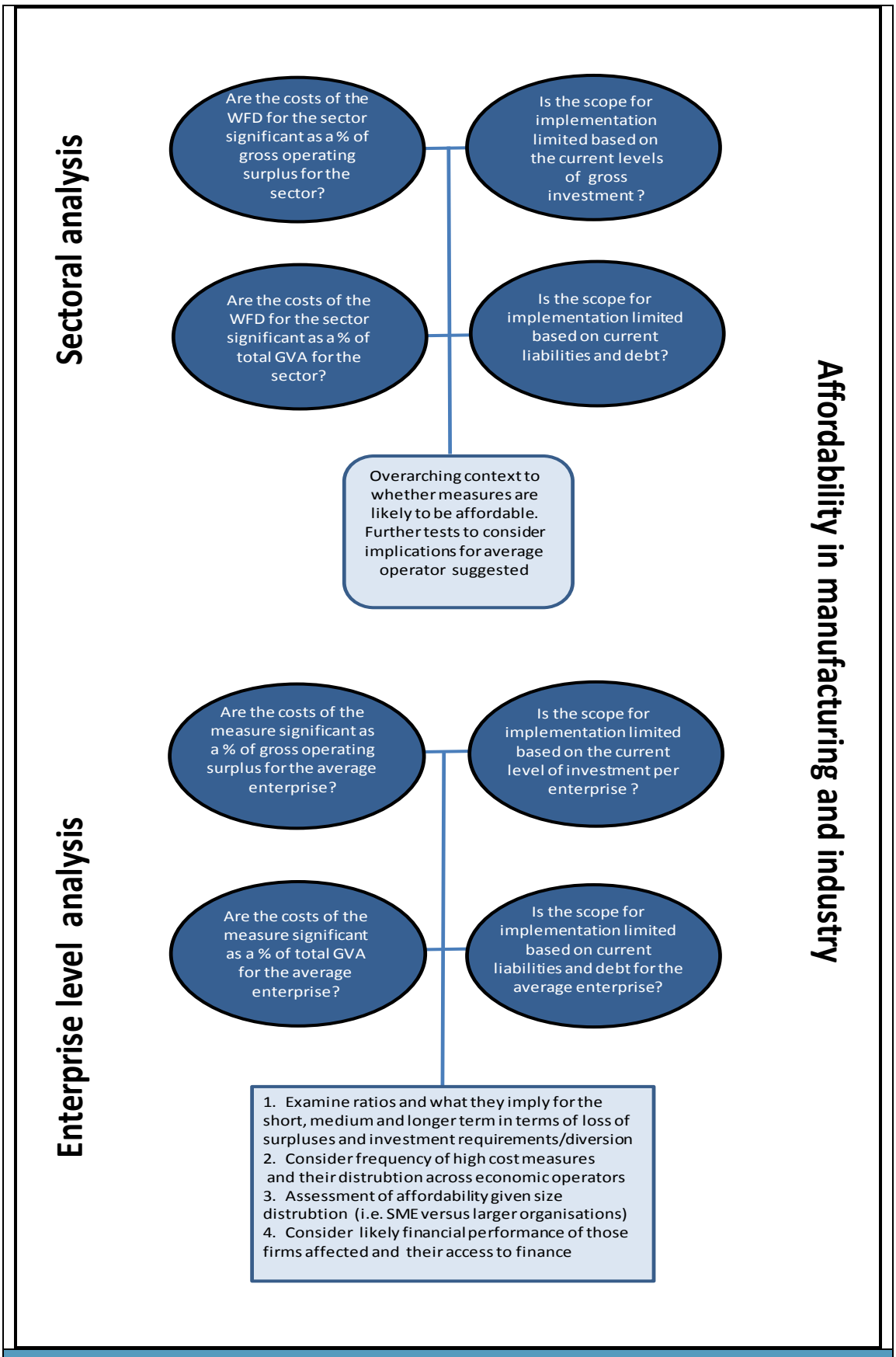

Figure 4-1: Framework for assessing affordability to industry, services and other

In addition to the financial indicators set out in Table 4-1, it is important that the broader regulatory and market contexts within which these sectors operate is taken into account. In particular, the following additional factors are considered to be important:

- The extent to which some of the sub-sectors within this grouping will be subject to other environmental regulation which also impacts on their financial performance and viability; this includes consideration of historic investments on WFD related measures
- The potential for cost pass-through, as the degree to which costs can be transferred to customers may be dependent on industry and market structure
- The speed at which measures are to be implemented as certain types of measures may be more affordable if they are timed to coincide with normal maintenance or capital replacement cycles, and
- The degree to which final decisions on measures and their exact requirements occurs at the site level (which may also be implicit in the above considerations).

As noted in Section 1 of this report, it is important to ensure that poor performers are not exempt from environmental responsibilities. In the European Commission's communication 'On the Road to Sustainability' (2003) the issue of affordability to industry of adopting "best available techniques" depends on the net costs of implementing a technique in relation to the associated environmental benefits or whether the technique can be introduced under economically viable conditions. The communication also stresses that such an approach should be applied at the sectoral level to avoid installations in a difficult financial situation being permitted to continue polluting due to their inability to afford measures.

It is therefore important to stress that the first stage of the analysis, which examines national, sectoral level affordability, provides the main focus for this study. The second stage has been carried out to highlight where intra-sectoral variation may be an important consideration in determining how to implement the proposed programme of measures.

4.1.3 Stakeholders' views

We held discussions with the manufacturing industry including the energy producers, representatives of the ports and harbours sector, the Federation for Small Businesses and the Chemical Industries Association.

The energy sector, i.e. thermal power producers, raised the following points:

- Affordability should take account of cumulative costs from other legislation. There are already several pieces of legislation/initiatives which require plants to take measures to protect the environment, including water. These include the Large Combustion Plant Directive, Industrial Emissions Directive, Eel Regulation (EU and England & Wales) and water abstraction reform.

- The LCPD and the IED have their own affordability issue in the Best Available Technology (BAT) element. When the IED comes into force in Jan 2016, all plants will require a revised permit. The four environmental regulators of the UK have all taken a slightly different approach to BAT, with the EA producing an interim BAT assessment. They expect many plants to close at this point.

- Each plant should be considered on a site by site basis in addition to any sector level analysis. At present very few generation plants are making a profit, indeed some are making a loss and surprisingly are still running.

- Argued that under the IED it will be harder to produce site specific BAT references. There is also the issue of applying BAT to existing plants. Financial viability will be a key concern for existing plants but it is not clear how this will be taken into account given the change in how BAT will be applied.

- Capital investments are currently difficult to finance. It is not just the costs of the equipment/machinery to consider, there is also the costs of designing, making and also subsequent regular testing. Plant closures required as part of the installation of new plant should also be considered in the costs, because they can have significant financial implications.

The ports and harbours sector noted concerns over the potential inclusion of high cost measures within the second set of RBMPs. It was noted that there is a wide variety of ports and harbours with different financing structures and performance. From the sector's perspective affordability will always be an issue for UK ports, whether they are trust ports or privately owned.

Sector representatives noted that the potential for costs pass-through by operators was constrained. The Harbours Act 1964 includes provisions to allow harbour users to object to charges if they are considered to be unreasonable[18]. Furthermore, there are concerns that significant increases in harbour dues or fees might distort competition locally or internationally e.g. if UK port dues are significantly higher than in Europe this might affect patterns of trade. Some of the commercial harbours face competition at European level (container ports) where any additional costs applying in the UK alone may make them less competitive than their European counterparts.

The Federation for Small Businesses noted that the margins that most small and medium sized enterprises (SMEs) are working to are quite small, limiting their ability to afford significant regulatory burdens. They are also concerned that the WFD should not add to already significant environmental regulation burdens for some of the sectors; the combined impacts of other regulations are already significant. The issue is not solely the cost burden placed by regulation but also the human resource requirements in terms of both time and expertise. Many SMEs do not have the ability to deal with the information and other requirements stemming from changes in regulation. In this respect, it was suggested that many SMEs should essentially be viewed as equivalent to a "household".

[18] Section 26 gives harbour authorities a wide power to charge ship, passenger and goods dues as they think fit. Section 27 makes certain charges levied by harbour authorities subject to a limitation that the charges must be reasonable. However ship, passenger and goods dues are excluded from the requirement of reasonableness under section 27. Instead ship, passenger and goods dues are subject to a separate objection procedure set out in section 31 by which objections on specified grounds can be lodged with the Secretary of State. Information available at: http://webarchive.nationalarchives.gov.uk/20120607125851/http://assets.dft.gov.uk/publications/section-31-harbours-act/note-on-s31.pdf

4.2 Costs of measures under Scenario 4

The estimated costs of Scenario 4 for the "Industry services and other" sector across England are roughly £1,300 million undiscounted, and £1000 million in present value terms (EA, 2014); this equates to around £37.5 million in equivalent annual costs (spread over 37 years). Based on the currently available data, it is not possible to separate out the costs relating specifically to the thermal power generating sector or to the waterways, ports and harbours sector. This is important as it means that the implications of Scenario 4, as presented here, may be over-estimated for the other sub-sectors. This issue is discussed further below as part of interpreting the results of the analysis in relation to the individual indicators.

4.3 Relevant sector information

4.3.1 Financial performance data

General manufacturing and industry

A range of financial statistics are available for the UK industry and manufacturing sectors from publicly available sources, such as Eurostat and the Office for National Statistics (ONS), which provide data on their financial state. The ONS's financial data are available for the "manufacturing" sector as a whole which will include industrial activities. Eurostat provides a further level of detail, breaking the sectors into a number of sub-sectors, some of which are not relevant for this analysis. It is worth noting that figures from these sources will cover companies in England and will also incorporate other UK operators (i.e. in Scotland, Wales, and Northern Ireland).

Besides separately considering thermal power generation and the ports and harbours sectors, it is important to consider only those sub-sectors that are generally more polluting or use water for processing/manufacturing. This is because such sub-sectors are those most likely to be required to implement measures under Scenario 4, and thus are those that should act as the focus for considering affordability. Based on discussions with the EA, this includes the following sub-sectors:

- Food, drink and tobacco
- Textiles
- Wood, paper and printing
- Chemicals and pharmaceuticals
- Plastics and non-metallic
- Metals; and
- Other manufacturing and equipment.

General statistics on the financial performance of these sub-sectors as well as the manufacturing sector as a whole are available from the ONS and Eurostat's Structural Business Statistics database, and include information on turnover/gross value of activities, capital expenditure, capital employed, liabilities and rates of return. 2012 is the most recent year for which the data are available.

Turnover for the manufacturing sector as a whole was £506 billion and gross value added was £149 billion. Whilst these statistics illustrate the general financial health of the sector, a number of other statistics are more useful when considering affordability. Gross operating surplus, which is an indication of the funds that are available for investments or increased operating expenditure, was

£69 billion in 2012. Net capital expenditure for the sector was over £13 billion, of which gross investment in machinery and equipment accounted for £11 billion.

As well as identifying the funds available for additional capital and operational expenditure, the level of current debt and liabilities will influence access to finance which can be secured for new investments. Eurostat reports that 'payments for long term rental and operational and financial leasing of goods' amounted to £2.5 billion in 2012 for the sector. Using the gross and net capital employed, the current liabilities exceed £18 billion.

Thermal power sector

Financial statistics from Eurostat and ONS are also available for the power generation sector. Both sources provide information for the Electricity, gas, steam and air conditioning supply sector, (hereafter power sector) which includes the production, transmission, distribution and trade of electricity, as well as other sub-sectors. For the purpose of analysing WFD measure affordability, it is assumed that the production of electricity would be responsible for the majority of measures. Where possible the statistics for this sub-sector are used.

Turnover for the sector was £106 billion and gross value added was £23 billion. Gross operating surplus, which is an indication of the funds that are available for investments or increased operating expenditure, was £17 billion in 2012. Net capital expenditure for the sector was over £12 billion, of which £8 billion was invested in machinery and equipment.

Waterways, ports and harbours

In 2011, the UK ports industry employed an estimated 117,200 people and contributed nearly £7.9 billion to UK GDP (equivalent to 0.5% of UK GDP) (NB: This excludes shipping and business services) (Oxford Economics, 2013).

More detailed financial statistics are available in Annex 2, for the water freight transport sector. This will include a wide range of activities beyond those of just the port or the harbour. As a result, they are a poor indicator of the potential impacts on the sector. For this reason, no further use of ONS or Eurostat statistics for this sub-sector is made here.

4.3.2 Financial performance at the enterprise level

General manufacturing and industry

In 2012, there were close to 125,000 enterprises in the UK manufacturing sector, employing almost 2.5 million people. The vast majority of enterprises have a small workforce, with 94% employing less than 50 people (see Table 4-2). This highlights the importance of also considering costs at the enterprise level.

Table 4-2: Size of enterprises by number of employees in the UK manufacturing sector and specific sub-sectors in 2012 (data compiled from Eurostat)						
Sector	0 to 9	10 to 19	20 to 49	50 to 249	250+	Total
Manufacturing sector	**94,218**	**13,191**	**9,591**	**6,252**	**1,347**	**124,599**
Food, drink and tobacco	4,138	899	817	674	302	7,820
Textiles	6,055	829	529	278	34	7,725
Wood, paper and printing	17,764	2,058	1,318	720	89	21,949
Chemicals and pharmaceuticals	1,798	332	363	363	126	2,982
Plastics and non-metallic	5,930	1,388	1,064	795	145	9,322
Metals	18,782	3,195	2,274	1,085	117	25,453
Other manufacturing & equipment	5,423	977	856	586	112	7,954

The only financial data provided by Eurostat linked to enterprise size is gross operating surplus by, as reported in Table 4-3. The average Gross Operating Surplus for those enterprises with 0-9 employees is around £55,000.

Table 4-3: Gross operating surplus of UK manufacturing sector by enterprise size in 2012 (data compiled from Eurostat)						
	0-9	10-19	20-49	50-249	250+	Total
Number of enterprises	94,218	13,191	9,591	6,252	1,347	124,599
Gross operating surplus (£million)	5,146	3,481	6,407	15,852	37,999	68,886
Average GOS by enterprise size (£)	54,623	263,908	668,063	2,535,450	28,210,057	552,860

The broader set of financial data reported in Eurostat at the sub-sector level (see Annex 1) has been combined with information on the number of enterprises in the sector and in the different sub-sectors to calculate the values for the "average enterprise" (i.e. the mean). These are also provided in Annex 1. Unfortunately, the combined sets of data are not available in formats that would enable calculation of the median value (i.e. the middle value across all enterprises). However, it is clear that the median values would relate to an enterprise employing up to and including 9 people.

Thermal power sector

The power sector had approximately 1,800 enterprises with 120,000 employees, 97% were classed as a SME. Care is required in using these figures, however, as they will include enterprises that are not relevant to the WFD such as windfarms and some solar operations. It is expected though that some of these smaller enterprises will include hydropower schemes (e.g. run of river) that may be linked to measures under Scenario 4, as well as enterprises employing greater than 250 employees which will include larger combustion plants.

Table 4-4: Size of enterprises in the UK power sector and production of electricity sub-sector in 2012 (data compiled from Eurostat)						
Sector	0 to 9	10 to 19	20 to 49	50 to 249	250+	Total
Power sector	**1,658**	**77**	**30**	**35**	**29**	**1,829**
Production of electricity	1,571	70	25	23	21	1,710

Eurostat provides the gross operating surplus by enterprise size for the power sector, as reported in Table 4-5. It was not possible to identify this information for the production of electricity sub-sector; therefore caution is needed with the outcomes of this analysis as the power sector includes a

number of enterprises which are not relevant to this analysis. The average gross operating surplus for those enterprises with 0-9 employees is around £582,000, which increases with enterprise size. Comparison of these figures with those given in Table 4-3 indicates the significant disparity between operators in this sub-sector compared to the other industry and manufacturing sub-sectors separated out for this analysis.

Table 4-5: Gross operating surplus of UK power sector by size in 2012 (data compiled from Eurostat)						
	0-9	10-19	20-49	50-249	250+	Total
Number of enterprises	1,658	77	30	35	29	1,829
Gross operating surplus (£million)	966	102	104	914	15,147	17,232
Average GOS by enterprise size (£)	582,618	1,328,701	3,456,308	26,104,285	522,295,928	9,421,658

Waterways, ports and harbours

As indicated above, as the available ONS and Eurostat data are too broad to reflect the potential impacts on actual port and harbour operators, the corresponding data on enterprise size and financial performance per employee is not relevant.

4.3.3 Environmental expenditure

Stakeholders have argued that it is important that historic investment in environmental protection measures should be taken into account, given that this has been significant for some businesses. Figure 4-2 below sets out the data that are available on total environmental protection expenditure, which includes operational expenditure, capital expenditure and research and development activities. Such expenditure has been highest for *Other Industries*[19] which includes a wide range of actors including some of the sub-sectors highlighted for this analysis as being relevant.

Excluding this group, the sector with the highest total expenditure in environmental protection over the three year period (2010-2012) is *Food, Beverages and Tobacco Products* with a total of £1.2 billion, followed by *Basic and Fabricated Metals* and *Other Machinery and Equipment* with £870 million and £861 million respectively.

Annex 1 provides an additional break-down of these environmental protection expenditure data, highlighting in particular the level of expenditure classified as operational costs, averaging 78% (£4,883 million), with around 13% (£797 million) being spent on capital investments, and the remainder linked to R&D. Annex 1 also provides data on expenditure on waste water management and protection of bio-diversity and landscape.

[19] Textiles, Clothing and Leather Products, Wood and Wood Products, Printing and Publishing, Rubber and Plastics, Non-Metallic Minerals, Computer, Electronic and Optical Products, Paper and Pulp, Transport Equipment, Furniture Manufacture, Repair and Installation & Other Manufacturing

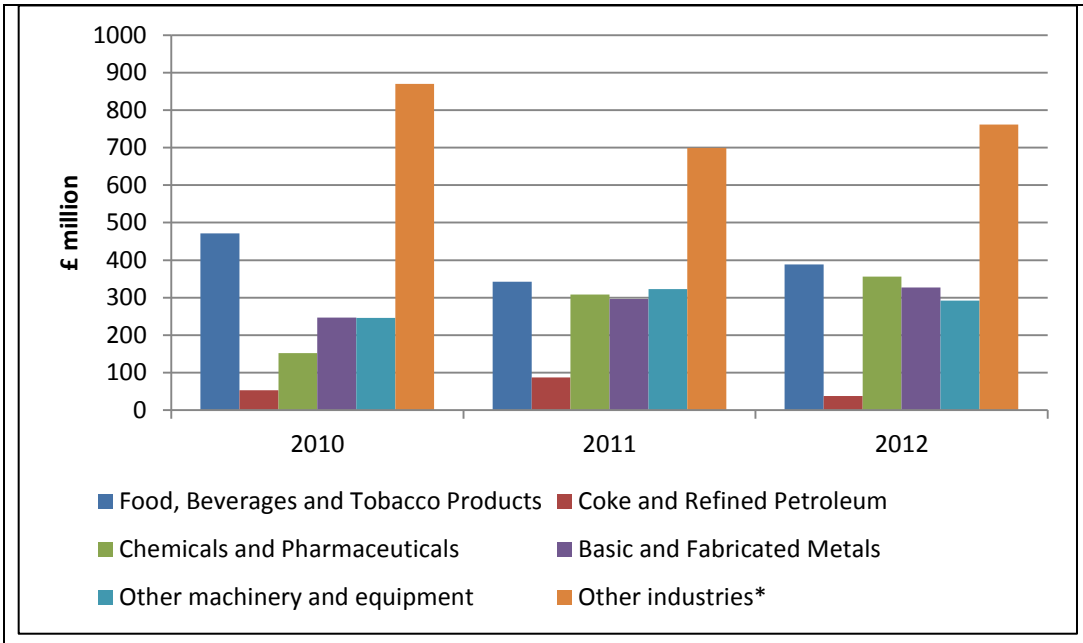

Figure 4-2: Total expenditure on environmental protection (2010-2012)
*Textiles, Clothing and Leather Products, Wood and Wood Products, Printing and Publishing, Rubber and Plastics, Non-Metallic Minerals, Computer, Electronic and Optical Products, Paper and Pulp, Transport Equipment, Furniture Manufacture, Repair and Installation & Other Manufacturing
Source: ONS website, Expenditure in Environmental Protection. Available at http://www.ons.gov.uk/ons/rel/environmental/uk-environmental-accounts/2014/rft-epe-ind.xls

In our view it is difficult to know how to interpret these data given the lack of detail as to what this expenditure actually constituted, what the drivers for it were and on what sectors the majority of this expenditure fell. For example, the average expenditure by industry on waste water management and protection of bio-diversity and landscape varies significantly across the sectors and indeed from year to year.

Taking the average total expenditure for each category across the sectors over the three year period, expenditure on waste water management and protection of biodiversity and landscape is 31% and 34% (respectively) of total environmental expenditure[20]. Although this expenditure could be WFD specific, it may also be driven by other regulatory requirements (e.g. Integrated Pollution Prevention and Control) or out of a desire to demonstrate corporate sustainability or corporate social responsibility.

Those enterprises which have already undertaken significant levels of environmental expenditure in waste water management are less likely to currently be causing environmental degradation. As a result, they are less likely to be required to implement a large number of or costly WFD measures over the 2016 to 2052 period under Scenarios 4 and A, for England and Wales respectively.

For these combined reasons, these data are not used further in this analysis.

[20] Note that data are only available on total spend at this level of disaggregation.

Thermal power sector and ports and harbours

Although environmental expenditure data are available in a grouping that would cover the thermal power sector, the same grouping covers other utilities including the water industry. It is therefore not possible to use these data in a meaningful manner.

No equivalent Eurostat data on environmental expenditure for the ports and harbours sector are available.

4.3.4 Cost burden of other regulation

It is outside the scope of this study to undertake a detailed investigation of the costs stemming from other environmental legislation affecting the various sub-sectors and that may be relevant to affordability considerations. It is possible to provide some illustrative data, however.

- The thermal power sector raised the issue of the costs falling on the sector under the Industrial Emissions Directive and requirements that will be falling on large combustion plant from 2016. Under the "upper" scenario presented in the impact assessment prepared for Defra[21], the one-off costs to the thermal power sector (covering 13 plants) are estimated at around £750 million, with increases in annual operating costs of around £41 million. In addition to these, will be the costs of other new legislation such as the Eels Regulation, which estimates costs to owners/operators of obstructions/abstractions of £4.6 million per annum of installing eel passes and screens[22]. A significant portion of these costs is likely to fall on this sector.

- The Federation for Small Businesses raised the increasing cost burden that the REACH Regulation is placing on many of the sub-sectors highlighted above (chemicals, textiles, metal working, etc.), as well as the burden associated with the climate levy. It is not possible to put a value on these costs, although it is clear that sectors such as the chemicals industry will continue to bear significant costs in complying with REACH up to the 2018 final substance registration deadline.

The above discussion highlights the potential importance of the timing of when measures are required to be implemented. Delaying when the chemical sector is required to undertake investments under the WFD until after 2018 may help make measures more affordable. Similarly, the thermal power sector noted that delaying the requirement to install new intake valves, etc. in relation to the WFD (and the Eels Regulation) until planned maintenance works are undertaken would make such measures much more affordable for the industry.

4.3.5 Industry and market structure

Data on the industry structure in terms of the number and size of enterprises is given above. It is significantly more difficult to provide data on the market structure across such a diverse set of sub-

[21] AMEC/Defra 2011: Updated Impact Assessment of the Industrial Emissions Directive (IED): Large Combustion Plants – Final Supporting Report. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82615/industrial-emissions-amec-ia-lcp-120312.pdf

[22] Defra (2009): Impact Assessment of Measures for the Recovery of the European Eel. Available at http://www.legislation.gov.uk/ukia/2009/335/pdfs/ukia_20090335_en.pdf

sectors. Indeed, it is not possible to do so for the highlighted industrial and manufacturing sub-sectors. All of these sectors will be operating within an increasingly global economy, with most of them regulated at the EU level for single market and consumer and worker health and safety purposes, as well as having to adhere to additional national requirements.

The degree to which individual actors will be able to pass costs onto their customers will depend on the nature of their actual product offering, the number of competitors also making these offerings, their costs of production and hence pricing policies, etc. There are too many variables to be able to comment at the sectoral level on cost pass-through. However, this standard consideration within affordability assessments could be undertaken at the site level.

Within the power sector, there is at present a mixture of large companies which are involved in generation and retail, smaller companies which are retail only and also a series of non-water related sources e.g. wind. Many companies are moving away from vertical integration (generation and retail), so that there is no real link between generation and retail. In terms of distribution and transmission, there are regional monopolies (regulated by Ofgem), whose rate of return and revenues are negotiated with the regulator. The generation of energy is not regulated and there is a competitive market (after subsidies).

The ports and harbours sector is very diverse in terms of size and function and also the ownership structure, which includes trust ports, private company ports and municipal ports. A port's physical attributes are important, in particular its size, marine access and location, as ships continue to increase in length and draught, particularly on the long distance routes limiting their manoeuvrability and requiring greater navigable depths in port access channels.

Most of the largest ports are in private-sector ownership. There are about 120 commercial ports in the UK. These range from major all-purpose ports (London and Liverpool); ferry ports (Dover); specialised container ports (Southampton and Felixstowe) and ports catering for specialised bulk traffic. There are also smaller ports, essentially catering for local traffic or for particular sectors, such as fishing (Peterhead and Fraserburgh) or leisure use (Cowes which focuses on sailing and tourism) (Oxford Economics, 2009).

Associated British Ports (ABP) owns and operates 21 ports in the UK and accounts for around 25% of all UK seaborne trade. Many of the smaller ports (and a few of the larger) are trust ports. Trust ports are independent statutory bodies; each being governed by its own unique statutes and having no shareholders or owners. Any surplus is reinvested into the port for the benefit of the stakeholders.

A few ports belong to local authorities, who act as a landlord with private terminal operators acting as tenants. They are usually small and commercially insignificant, though there are exceptions such as Sullom Voe and Portsmouth. This type of port is excluded from the affordability discussion in this section as it will fall under public authority related measures.

As noted earlier, the sector is concerned over retaining its competitiveness against other European ports, should it be required to undertake significant levels of additional investment or incur significant increases in recurrent costs.

4.4 Sectoral level analysis

As detailed in Table 4-6 overleaf, the total costs for the Industry, Services and Other sector are £1.3 billion for England, with approximately 50% being capital expenditure and 50% being operating expenditure.

As indicated earlier, the financial statistics which are being used as part of this analysis are for the financial year 2012 and represent the UK as a whole. Therefore the outcomes from the analyses may underestimate the relative weight of the costs to the financial performance of companies in England. It should be noted that the analysis was also carried out based on a five year average (2008 to 2012 inclusive); this had little impact on the conclusions (see Annex 2). Given that the 5 years cover a period of poor economic performance, use of these averages may under-predict what could be affordable for industry and manufacturing. As a result, the main analysis is undertaken using the 2012 data.

The outcomes for the affordability indicators against the total WFD costs under Scenario 4 for England for the Industry, Services and Other sector are provided in Table 4-9. The WFD measure costs account for 1.5% of gross operating surplus for the sector, this increases to 3.1% if allocated only across the specific sub-sectors most likely to implement WFD measures.

The measure's costs account for a larger proportion of gross investment in machinery and equipment, however, at 7.0% for the sector and 15.8% for the sub-sectors. Particularly for the sub-sectors, a consequence of this level of extra expenditure may be reduced investment in other parts of the business.

It must be noted though that it has not been possible to separate out the expenditure that would be required in the thermal power and ports and harbours sub-sectors. Measures entailing significant capital costs may be required in the thermal power sector, in particular. As a result, the analysis presented in Table 4-6 will be overly pessimistic in terms of the impact that Scenarios 4 would have on industry and manufacturing.

That said, it is also of note an outcome of more than 3% of gross operating surplus for the most likely sub-sectors, the total costs of the two scenarios may not be considered affordable in other EU Member States where the 3% threshold has been adopted (e.g. some regions in France). It would be considered affordable in the other Member States which have adopted higher thresholds (e.g. 4% some regions in Belgium).

Table 4-6: Outcomes of affordability indicators under Scenario 4 for England for the Industry, Services and Other sectors and sub-sectors (2012 financial performance)

Sector	Gross operating surplus	Gross investment in machinery and equipment	Gross value added
Industry, Services and Other	***£87,320 m***	***£18,953 m***	***£241,645 m***
Manufacturing sector*	£68,886 m	£11,018 m	£148,486 m
Thermal power sector	£17,232 m	£7,935 m	£23,210 m
Waterways, ports and harbours	£1,202 m	Not available	£69,949 m
Total sub-sectors	***£42,915 m***	***£8,356 m***	***£89,618 m***
Manufacturing sub-sectors	£39,010m	£6,843 m	£84,190 m
Thermal power sub-sectors	£3,325 m	£1,513 m	£4,279 m

Table 4-6: Outcomes of affordability indicators under Scenario 4 for England for the Industry, Services and Other sectors and sub-sectors (2012 financial performance)			
Sector	**Gross operating surplus**	**Gross investment in machinery and equipment**	**Gross value added**
Waterways, ports and harbours sub-sectors	£669 m	Not available	£1,149 m
Scenarios 4 and A for England and Wales as Equivalent Annual Costs as a % of sectoral performance			
Manufacturing sector	1.5%	7.0%	0.5%
Sub-sectors	3.1%	15.8%	1.5%
* Manufacturing as defined by Eurostat includes industrial activities			

4.5 Enterprise level analysis

4.5.1 Range of costs across measure

This section considers the potential implications that the costs of individual measures may have on an individual enterprise's financial performance, to establish the importance of affordability considerations as part of the roll-out of the programmes of measures (e.g. in licensing decisions, grant awards, etc.). Table 4-7 draws on information provided by the EA to illustrate the distribution of the magnitude of capex and opex associated with the measures proposed under Scenario 4. It should be noted that the distributional data presented in this table can only be developed for a sub-set of the measures that would arise in the "industry, services and other grouping" due to the way in which the cost estimates were developed. This is why the analysis is not available for a significant proportion of measures. For example, the costs of a measure that would be implemented across a series of waterbodies may have been bundled together, resulting in no separate cost being entered against a given water body. This indicates that some of the "measures" and their associated costs reported in Table 4-7 as having higher levels of capex and opex may actually correspond to a "measure" that will be applied in multiple locations and across multiple enterprises.

Table 4-7: Proportion of WFD measures (Scenario 4) by cost range for Industry, services and other sector (undiscounted)		
Cost range	**Capex**	**Opex**
Not available	42%	78%
Less than £10,000	7%	1%
£10,000 - £50,000	12%	5%
£50,000 - £200,000	17%	16%
£200,000 - £500,000	10%	
More than £500,000	12%	
Source: Environment Agency, National Appraisal Summary Sheet (v1.3.2) Note: The percentages have been calculated across all measures for which specific cost data are available		

As can be seen from Table 4-7, most of the "measures" fall into the lower cost ranges. However, there are measures which will cost over £1 million, possibly raising issues over affordability, if these fall on a single or smaller operator. In addition, it is not known whether more than one measure may fall on an individual enterprise, such that the sum of the costs of the set of measures falling on an enterprise becomes unaffordable. No data are available at present on this aspect. This

uncertainty, together with the fact that the costs of a single measure may fall across more than one operator, means that the figures presented in Table 4-7 should be interpreted with caution.

4.5.2 Costs of individual measures

The various affordability indicators are considered below with respect to low and high cost scenarios on the levels of capex and opex that might be involved in implementing a measure. The assumptions for these two scenarios are set out in Table 4-8. As noted above, the aim is to test whether affordability concerns may need to be addressed as part of implementation activities.

Table 4-8: Illustrative scenarios for measure costs (capex and opex)		
Scenario	**Capex**	**Opex**
Low costs	£30,000	£5,000
High costs	£1,000,000	£30,000

General manufacturing and industry

The outcomes of this enterprise level analysis for the manufacturing sector are presented in Table 4-9.

Table 4-9: Financial ratios for the average enterprise within the UK manufacturing sector and specific sub-sectors					
Scenario	**Type of expenditure**	**Analysis level**	**Gross operating surplus**	**Gross investment in machinery and equipment**	**Gross value added**
Manufacturing sector			*£552,860*	*£88,431*	*£1,191,711*
Sub-sectors (weighted average)			*£468,847*	*£82,243*	*£1,011,838*
Low costs	Capex	Sector	-	34%	3%
		Sub-sector	-	36%	3%
	Opex	Sector	0.9%	-	0.4%
		Sub-sector	1%	-	0.5%
High costs	Capex	Sector	-	1,131%	84%
		Sub-sector	-	1,216%	99%
	Opex	Sector	5%	-	3%
		Sub-sector	6%	-	3%

Under the low and high costs scenarios, the operating expenditure for a single measure accounts for between 1% and 6% (respectively) of gross operating surplus. It is assumed likely that the measures would generally involve enterprises with over 10 employees and that the higher cost measures will fall on larger enterprises which will have gross operating surpluses well above the average. Table 4-3 presented data on average gross operating surplus by enterprise size, and comparison of the figures given in that table with those presented in Table 4-9 highlights the significant increase in gross operating surplus above the average earned by companies with over 50 employees. If a significant proportion of the measures were to fall on enterprises employing less than 10 people, then affordability becomes more questionable. In this case, opex under the low cost scenario would represent around 10% of gross operating surplus, while the high cost scenario would represent over 50%.

Considering the capital expenditure scenarios in relation to gross investment in machinery and equipment, the implementation of an individual measure for the average enterprise could strain company finances under the low scenario at circa 35% of total gross investment; the implication is that investment in other capital would need to be postponed unless implementation of measures was phased at the site level to take such issues into account. This is particularly true for smaller companies, with lower than average levels of gross investment. Under the high costs scenario, the outcomes for the sector as a whole and the specific sub-sectors are over 1,000%. If these costs were to occur in a single year, they would clearly represent an exceptional capital cost for the average enterprise but not necessarily for larger enterprises. Unfortunately, data are not available by enterprise size on gross investment to analyse this issue further. It must be recognised though that the percentage figures given in Table 4-9 relate to average annual levels of gross investment; at the enterprise level one would expect investment to "spike" in certain years and approach zero in others.

The indicator outcomes in relation to gross value added also highlight potential issues in relation to measures with high capex requirements. Under the low costs scenario, the capex and opex account for a maximum of 3% of GVA. Turning to the high costs scenario; capital expenditure accounts for 84% of GVA for the average enterprise in the manufacturing sector and almost 100% of GVA for the specific sub-sectors. Whilst the indicator outcomes for the sector as a whole and the specific sub-sectors are similar, there are differences which highlight the importance of considering the most relevant sub-sectors.

As noted earlier, the above figures will include measures that may actually be required of the power sector or the ports and harbour sub-sectors. Indeed, the measures required of the thermal power sub-sectors may be some of those associated with higher levels of capex and opex. It is therefore important to examine the extent to which the affordability for these sub-sectors would vary from the analysis presented above for industry and manufacturing.

Thermal power sector

The enterprise level analysis for the power sector is provided in Table 4-10. The majority (75%) of the indicator ratios for the power sector indicate that capex and opex would account for fairly low percentages. This is particularly true for percentage of gross operating surplus, where even the high capex costs scenario would constitute only 1.3% of gross operating surplus.

Compared to gross investment, the high costs scenario reflects a significant level of gross annual investment in machinery and equipment, particularly for the electricity generation sub-sector. Thus, the same conclusion as applied to the more general industrial and manufacturing sectors is also relevant here: investment in other capital would need to be postponed unless implementation of measures was phased at the site level to enable the cost-effective planning of capital investment. This may be particularly important for this sector given that it is currently undergoing structural reorganisation.

In addition, if these enterprises were to be responsible for more than one measure (which is possible), then affordability may be a greater concern, particularly in relation to capex. As part of the stakeholder discussions, industry representatives drew attention to the full costs of measures associated with changes in abstraction intakes and other actions which would require temporary plant shut-downs. The costs are not just those associated with the installation of new capital equipment, but also include the loss of revenues while the plant is closed. This suggests that steps

can be taken to make measures more affordable, for example by linking measure implementation to scheduled plant maintenance activities.

Table 4-10: Financial ratios for the average enterprise within the UK power sector and production of electricity sub-sector					
Scenario	**Type of expenditure**	**Analysis level**	**Gross operating surplus**	**Gross investment in machinery and equipment**	**Gross value added**
Power sector			*£9,421,658*	*£4,338,473*	*£12,689,995*
Sub-sectors (average)			*£2,392,853*	*£1,118,713*	*£3,164,941*
Low costs	Capex	Sector	-	1%	0.2%
		Sub-sector	-	3%	1.0%
	Opex	Sector	0.1%	-	0.04%
		Sub-sector	0.2%	-	0.2%
High costs	Capex	Sector	-	23%	8%
		Sub-sector	-	89%	32%
	Opex	Sector	0.3%	-	0.2%
		Sub-sector	1.3%	-	1%

Waterways, ports and harbours

Although it is not clear that many measures are to be required of the ports and harbours sub-sector, financial statistics have been considered in relation to the affordability indicators, with the results provided in Table 4-11. Where the financial statistics are available, the indicator ratios are below the 5% level in all but one instance. The capital expenditure required for an individual measure under the high costs scenario accounts for 58% of gross value added of the sea and coastal freight water transport sub-sector, raising a possible concern for ports and harbours whose activities fall into this sub-sector.

Table 4-11: Financial ratios for the average enterprise within the UK ports and harbour sector and sea and coastal freight water transport sub-sector					
Scenario	**Type of expenditure**	**Analysis level**	**Gross operating surplus**	**Gross investment in machinery and equipment**	**Gross value added**
Ports and harbour sector			*£798,941*	*Not available*	*£46,477,741*
Sea and coastal freight sub-sector (average)			*£995,703*	*Not available*	*£1,709,821*
Low costs	Capex	Sector	-	-	0.1%
		Sub-sector	-	-	2%
	Opex	Sector	0.6%	-	0.01%
		Sub-sector	0.5%	-	0.3%
High costs	Capex	Sector	-	-	2%
		Sub-sector	-	-	58%
	Opex	Sector	4%	-	0.1%
		Sub-sector	3%	-	2%

Overarching remarks

Across the sectors, the instances where the indicator ratios are above 50% and more likely to raise affordability concerns are isolated to the capital costs of an individual measure under the high costs scenario. Data provided by the Environment Agency indicates that some measures would have costs of the magnitude presented in the high costs scenario (similar data has not been provided for Wales). These measures are more likely to be affordable where a large company or multiple companies are responsible. It is also important to bear in mind that this is a one-off cost compared to one year's financial data; the implications of spreading capital costs over a number of years is considered below.

4.5.3 Current liabilities and debt

The capital expenditure required to implement WFD measures may comprise a significant investment for many enterprises. In some instances, enterprises may finance such measures through a loan. The current liabilities and debt of enterprises will not only be important when securing a loan, but if they are already high this could influence whether a measure is affordable.

The following analysis considers how the per annum repayments of a loan to finance an individual WFD measure (5 year repayment period and 5.5% interest rate[23]) could impact the liabilities and debt of the industry and manufacturing sector. Under the low costs scenario, securing a loan for £30,000 would require a per annum repayment of about £7,025. Under the high costs scenario, the repayment for a loan of £1,000,000 is around £234,176 per annum. The impact on the liabilities and long-term payments (rental and operational and financial leasing of goods) for the average enterprise within the industrial and manufacturing and power sectors (not available for ports and harbours) are detailed in Table 4-12. Note that the indicator related to liabilities is expected to better relate to the types of expenditures that enterprises would face under the WFD than increases in payments for long term rentals or the leasing of goods.

[23] Interest rates of this scale are reported by the Bank of England for 2008 but since then, they have been slightly lower (although access to finance has been more limited). In addition, it is expected that rates will increase in autumn next year so this figure has been retained for analysis.

Table 4-12: Financial ratios for the average enterprise within the UK manufacturing and power sectors and specific sub-sectors			
Scenario	**Analysis level**	**Liabilities (*gross capital employed minus net capital employed*)**	**Payments for long term rental and operational and financial leasing of goods**
Manufacturing sector		*£144,945*	*£19,835*
Sub-sectors (average)		*Not available*	*£22,040*
Low costs	Sector	4.8%	35%
	Sub-sector	-	32%
High costs	Sector	162%	1,181%
	Sub-sector	-	1,062%
Power sector		*Not available*	*£82,820*
Sub-sectors (average)		*Not available*	*£25,444*
Low costs	Sector	-	8.5%
	Sub-sector	-	28%
High costs	Sector	-	283%
	Sub-sector	-	920%

This analysis highlights the potential increase in liabilities and long-term payments associated with individual measures, however, it does not in itself inform on the affordability of the measures. A high outcome for these indicators does not necessarily mean the measures are unaffordable; this could simply be an indication of relatively low levels of debt at present (which has been noted as a current trend with businesses taking out loans at a low[24]). For instance the average enterprise within the power sector has £82,000 of long term payments, compared to £20,000 in the manufacturing sector, giving a larger increase for the manufacturing sector.

Although long term payments may not be as robust an indicator, the implied increases in loans compared to long-term payments for both sectors under the high costs scenario are sizeable. Considering that over 90% of enterprises within these sectors have less than 50 employees, have an annual turnover of £4,000,000 and GVA of £1,100,000, it may be difficult to secure additional loans to finance higher cost measures (particularly at present due to lower than average rates of lending by banks[25]). Likewise it could be problematic for SMEs to take on an additional £234,000 of debt per annum for 5 years. Again though, it should be stressed, that it is considered unlikely that SMEs are the type of enterprise that is associated with such high cost measures. Furthermore, if such costs were to fall on smaller companies, then these are likely to be those that are performing poorly in terms of meeting their environmental responsibilities.

This finding does, however, highlight a potential case for such high cost measures being subjected to a follow-up assessment of affordability as part of the day-to-day implementation of the proposed Scenario 4 RBMP.

[24] NFIB website: January 2015 Report: Small Business Economic Trends - Small Business Optimism Falls, but Still in Normal Zone. Available at http://www.nfib.com/surveys/small-business-economic-trends/

[25] Bank of England (2014): Trends in Lending. Available at http://www.bankofengland.co.uk/publications/Documents/other/monetary/trendsjuly14.pdf

4.6 Summary of findings on affordability

Tables 4-13 and 4-14 provide a summary of the assessment of affordability against the indicators identified as relevant for the "industry, services and other" sector grouping. . Note that these are based on comparing the Scenario 4 costs with UK level statistics as figures are not available at the England level.

As can be seen from Table 4-13, the total annual equivalent costs associated with Scenarios 4 and A combined would equate to around 1.9% of gross operating surplus across the industry and manufacturing sectors as a whole, and 3.4% for those sub-sectors most likely to implement measures. Turning to gross investment, the equivalent annual costs equate to 12% and 19.3% for the sector as a whole and then those sub-sectors most likely to be affected.

Table 4-13: Sector level analysis - Equivalent annual costs (EAC) as a % of sectoral performance		
	Industry and manufacturing all*	Sub-Sectors most likely to be affected by WFD*
EAC as % gross operating surplus	1.9%	3.4%
EAC as % gross investment in machinery and equipment	12.0%	19.3%
EAC as % gross value added	0.9%	1.6%
* Excludes power sector and ports and harbours sector, leading to an overestimate of impacts at sectoral level. It was not possible to separate out impacts at the sub-sector levels		

Although stakeholders were not all persuaded of the value of considering costs in relation to gross added value, it has been included in the analysis due to its relevance for understanding impacts at the economy level, in terms of national economic output. At both the sectoral and sub-sectoral level, costs are a relatively small proportion of total gross added value for the manufacturing activities of concern.

Table 4-14 summarises the findings of the enterprise level analysis, with the most robust indicators highlighted in bold. Key conclusions from the analysis are as follows:

- For the **average industry and manufacturing enterprise**, the low cost scenario implies costs that are only around 1% of gross operating surplus, although the implications are higher with regard to the implied percentage of gross investment and liabilities that £30k in capex represents. It must be remembered though, that in the case of gross investment, this ratio reflects the value of the capex costs to the average level of gross investment in one year; so a ratio of 36% does not mean that the investment is unaffordable, only that it reflects a diversion of this percentage of investments away from other machinery and equipment. For the average enterprise, the high measure costs scenario would appear more likely to be unaffordable; however, it is not expected that measures having such high costs would be required of the "average" enterprise. Instead, it is much more likely that such costs would fall on larger enterprises and, hence, be more affordable.

- For the **average enterprise in the UK electricity sub-sector**, the cost scenarios clearly raise fewer issues of affordability. In both cases, and as stressed by sector representatives, expenditure that appears affordable on the basis of the types of ratios presented here may not be affordable in practice if it is not timed to coincide with planned maintenance activities.

- For the **average enterprise in the UK ports and harbours sub-sector**, the high scenario would be borderline in terms of the ratio of opex to gross operating surplus using the types of thresholds reported in the literature. For this sector, the key concern is that any measures expected of it should not result in cost increases that would make it less competitive than its European rivals; in this respect, they would argue that they should not be expected to undertake works that would not also be required by ports in other Member States.

Overall, the findings of the enterprise level analysis highlight that this high level assessment does not address the more site specific issues which may need to be considered as part of the day-to-day implementation of the proposed RBMPs for higher cost measures.

Table 4-14: Enterprise level analysis

Indicator	Figures for average enterprise	Low cost (£30k capex, £5k opex)	High cost (£1m capex, £30k opex)
Manufacturing and industry sub-sectors			
Opex as a % of gross operating surplus	**£468,850**	**1%**	**6%**
Opex as a % of gross value added	£1,011,840	0.5%	3%
Capex as a % of gross value added		3%	99%
Capex as a % of gross investment in machinery and equipment	**£82,240**	**36%**	**1200%**
Loan repayments as a % of current liabilities	**£144,950**	**5%**	**170%**
Electricity sub-sector			
Opex as a % of gross operating surplus	**£2,392,850**	**0.2%**	**1.3%**
Opex as a % of gross value added	£2,392,850	0.2%	1%
Capex as a % of gross value added	£3,164,940	1%	32%
Capex as a % of gross investment in machinery and equipment	**£1,118,710**	**3%**	**89%**
Loan repayments as a % of current liabilities	**n/a**	**n/a**	**n/a**
Ports and harbours and sea and coastal water transport			
Opex as a % of gross operating surplus	**£995,700**	**0.5%**	**3%**
Opex as a % of gross value added	£1,709,820	0.3%	2%
Capex as a % of gross value added		2%	58%
Capex as a % of gross investment in machinery and equipment	**n/a**	**n/a**	**n/a**
Loan repayments as a % of current liabilities	**n/a**	**n/a**	**n/a**

5 Affordability in the Water industry

5.1 Introduction

5.1.1 The Sector

There are 10 regional water and sewerage companies (WaSCs) that are responsible for the treatment and disposal of sewage in England and Wales, 9 of which operate primarily within England. There are an additional 9 more local companies that only supply clean water. These services are paid for by the water companies' customers through their water bills.

Because water supply and wastewater disposal are generally regarded as critical services (and are therefore extremely price and income inelastic), affordability in relation to water provision normally has been linked to affordability of water bills for households. This is particularly applicable to the UK due to the fact that water companies in the UK rely on cost-recovery through water and sewerage bills to finance investment. Over the last 20 years, the water industry has invested about £20 billion into protecting rivers and other water courses, equating to roughly £1,300 for every household.

Investment by the water industry in water management is reviewed at regular intervals. Every 5 years Ofwat, the economic regulator for water and sewerage, sets limits on the prices water companies can charge their customers in a process referred to as the Periodic Review. In December 2014 Ofwat published its final determinations on the limits for 2015 to 2020 based on its scrutiny of water company business plans. The Periodic Review is the principal mechanism for agreeing and funding the actions that the water industry must take to carry out its responsibilities, including protection of the environment. The cost of any improvements required of companies will be reflected in customers' bills.

As noted In Section 2.1, the latest Ministerial guidance stated that estimated costs of measures for the water industry should be provided at company level. Given the regulated nature of the water utilities within England (and Wales), the starting point for affordability for the water industry is Ofwat's set of price determinations for the individual companies, taking into account the financeability of their business plans, where this includes environmental expenditure agreed with the EA specific to the WFD[26]. Thus, when measures are incorporated into the business plans approved by Ofwat, they should be affordable for the companies themselves through cost-recovery. The high level of cost pass through that exists for this sector compared to the other sectors (which may face difficulties in passing costs down the value chain due to market structures) means that the issue becomes one of affordability for water company customers – households, as well as manufacturing, commercial and other customers. As also discussed in Section 2, as households account for the bulk of water supply and sewerage services, it is also appropriate to consider affordability in terms of the implications for them.

[26] The water companies being considered here are only those with combined sewerage and water: Anglian Water; Northumbrian Water; Severn Trent Water; South West Water; Southern Water; Thames Water; United Utilities; Wessex Water; and Yorkshire Water. Focus on this set was agreed with Defra and Ofwat.

5.1.2 The indicators

As discussed in Section 2, a number of potential indicators of household affordability are identified in the academic and grey literature. Those that are most relevant to the type of accounts based framework being applied here include:

- Indicators based on the concept of a "burden ratio", e.g. water bills as a proportion of household income or expenditure
- Self-reported problems with water affordability, and
- Indicators based on levels and age of water debt.

Most commonly, the affordability of utility services has been measured using a "**burden ratio**", which in this context could be based on the ratio of expenditures for water and wastewater services (WWS) relative to different indicators of burden. The figure below provides an indication of different types of water affordability metrics based on the burden ratio concept.

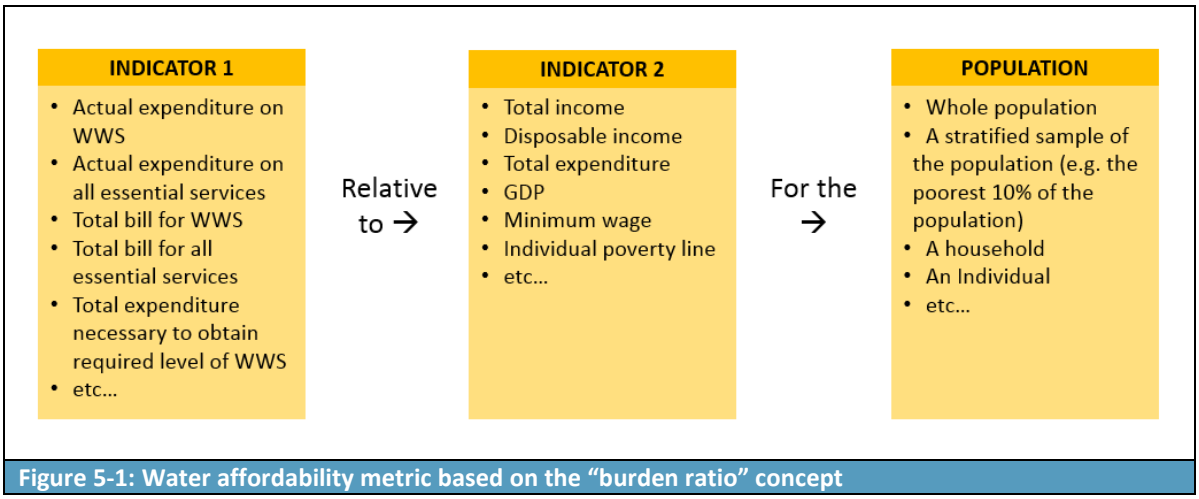

Figure 5-1: Water affordability metric based on the "burden ratio" concept

Examination of the implications of WFD expenditures in terms of a burden ratio is consistent with assessment of impacts on household balance sheets. As indicated in Figure 5-1, however, there is a range of possible variations in the ratio that can be applied, although their application in practices depends on the availability of the relevant data. We have therefore considered two different burden ratios for the purposes of this study:

- A WFD expenditure based ratio: this compares the costs of each of the larger WaSCs expenditure on WFD related measures to household disposable income either before or after housing costs (based on data produced by the Office of National Statistics), and

- A total water bill based ratio: this compares projected water bills (as provided by Ofwat) to household disposable income either before or after housing costs.

With respect to self-reported problems, as part of developing their business plans for PR14, the WaSCs carried out customer surveys to establish whether or not the proposed plans were acceptable (overall) to their customers. The responses to these surveys are used here to act as a proxy for self-reported problems in paying bills and to act as an indicator of affordability. This is despite the fact that the responses indicate customer acceptability of the overall water bill, rather

than just the WFD component. In this regard, it should be remembered that part of the future water bill will relate to past expenditure specific to the first round of RBMPs (and to previous environmental quality drive expenditure before that).

Research by CCWater (2009) has identified a range of factors that have an impact on consumers' perceptions of affordability. For example, those 'making ends meet' are more likely to consider bills affordable if it is important that they are paid, even if they are expensive (for example, housing costs). Those households 'in arrears' are more likely to base their decision on cost – with cheaper bills (e.g. TV licence) perceived as more affordable. Households deemed as 'struggling' fall somewhere in between. A number of other factors have also been identified as influencing consumers' perceptions of affordability. These include the level of perceived control over the amount they needed to pay (e.g. whether they can pay in regular fixed instalments, price increases and the degree to which these could be planned for), and whether they felt the cost was justified (CCWater, 2009). The timing of the survey may even have an influence, for example, if it is conducted in the lead-up to Christmas when household resources are stretched. Hence, any measure of affordability based on consumer surveys should take into account the potential for distortions caused by self-reporting (Ofwat, 2011b).

Although levels and age of water debt has been proposed in previous work by Ofwat, for example, it is not carried forward here to act as an indicator of affordability. This is due to differences in how companies treat "debt" from an accountancy perspective, differences in who is responsible for collecting debts (e.g. local authorities may be responsible for collecting water bill payments under certain agreements with some companies), and problems in terms of interpreting debt as an income related problem rather than a refusal to pay water bills (due to the inability of companies to cut peoples' supplies off).

It should be noted that there are two studies which are relevant to future assessments of affordability:

- A **Water bills projection model** study to design, build and test an annually updatable water bills projection model to be used in-house by Defra, Ofwat and the EA (currently underway). The model will be used to advise policy makers and stakeholders on the potential scale and likely distribution of impacts of policy and other factors. The model will be a valuable analytical tool for informing policy development and assessing second round impacts (such as cost pass through) of measures for economic impact assessments, and

- **Understanding affordability pressures across sectors**, commissioned by Ofgem, this study will look at affordability across a range of sectors. In particular the patterns of household spending in relation to all regulated sectors; characteristics of an essential service and how this influence spending decisions; characteristics of those customers with affordability problems. Phase one of the study was published in January 2015[27].

[27] UKRN (2015): Understanding affordability pressures in essential services. Available at http://www.ukrn.org.uk/wp-content/uploads/2015/01/UKRN-Affordability-Report.pdf

5.1.3 Stakeholders' views

The key points made by stakeholders in discussions with them over indicators of affordability for the water industry are as follows:

- A burden ratio indicator based on the percentage of households that are paying more than some indicative percentage of their disposable household income on water bills could be an indicator of affordability, although it should be recognised that any threshold set for judging whether or not a bill is unaffordable is arbitrary.

- As part of the application of burden ratio indicators, consideration should be given to the most vulnerable groups in terms of disposable income. (But see below in relation to the role of other policies or approaches to address this.)

- As disconnections have been banned, the non-payment of bills is a reflection on both affordability and acceptability; so it may not be such a good indicator of affordability alone.

- The Consumer Council for Water (CCWater) noted that 1 in 5 households are reporting that bills are not affordable, with this up from 1 in 7 or 1 in 8 a few years ago. As a result, they consider that there is merit in looking at impacts of changes in bills on specific "vulnerable" populations (see also CCWater, 2014).

- On the other hand, CCWater also noted that the social tariffs available or being introduced by companies should also be taken into consideration. Not all companies currently have a social tariff in place, although they will do by April 2015. (It is of note though that some companies have been surprised that up-take of the social tariffs they offer is not as great as expected based on modelling exercises.)

- Customer acceptability of proposed future water bills is a static indicator and it is not clear how it may change in the future and what factors could lead to this changing (e.g. perceptions regarding large shareholder payouts, etc.).

- The phasing of actions, and of the transmission of their cost to customers, is clearly relevant to whether or not it is affordable, and this should be a consideration.

- WaSCs noted that the surveys that they undertook were not specifically aimed at testing their proposed WFD programmes of expenditure, but rather their overall programmes of work which will have included other investments aimed at improving levels of services, etc. of which the WFD was just one aspect.

The water company representatives with whom the indicators were discussed did not foresee that there should be affordability concerns over the 2015 to 2020 period, based on the environmental programmes incorporated in the draft business plans. It was also noted that different companies had adopted different approaches to managing future risks, in terms of the costs of delivering schemes. Some of the companies also expressed the view that the WaSCs are doing their fair share in terms of undertaking investment and other expenditure to improve the water environment.

Some companies also noted the work that they did in assisting other organisations to undertake WFD related actions, including providing technical and other support, as well as assisting financially in some cases.

5.2 Costs of measures under Scenario 4

The total undiscounted costs of Scenario 4 for England are £5,900 million undiscounted, or £4,400 in present value terms (EA, 2014). This equates to around £165 million per annum in equivalent annual costs (spread over the 37 year period). The distribution of costs however varies significantly by region, as shown in Table 5-1; with the main costs falling in North West, Thames and Anglian regions.

Table 5-1: Scenarios 4 and A (costs in £million to prevent deterioration, achieve protected area objectives and improvements in status where benefits exceed cost)

River basin district	Water industry (undiscounted)
Anglian	1,070
Dee	<1
Humber	570
North West	1,650
Northumbria	220
Severn	360
Solway Tweed	90
South East	380
South West	560
Thames	1,020
England total	**5,900**

Notes:
Severn, Dee and Solway Tweed River Basin Districts are England only costs. Cost of chemicals' measures that affect good ecological status are included. Numbers may not sum to totals due to rounding. RBD totals (>10m) are rounded to the nearest £10m, England totals (>100m) are rounded to the nearest £100m. All sector costs are subject to uncertainty. Water industry costs are mid-point estimates. They have at least +/- 30% range reflecting the uncertainty of the estimates which should be considered when reading this information.

5.3 Assessment based on the burden ratio

5.3.1 WFD costs relative to household income

Data available from the Department for Communities and Local Government indicates that in 2011 there were 22,102,000 households in England. This figure is projected to increase to 23,215,000 in 2016 and 24,307,000 in 2021, with an average increase of 221,000 per year[28]. The average disposable household income before and after housing costs is available from the Department for

[28] Department for Communities and Local Government (2013): Household Interim Projections, 2011 to 2021, England. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190229/Stats_Release_2011FINALDRAFTv3.pdf

Work and Pensions[29]. These are reported as both means and medians covering the UK population as a whole. The relevant figures for 2012-13 are:

- Median disposable household income before housing costs: £22,880
- Mean disposable household income before housing costs: £27,820
- Median disposable household income after housing costs: £19,448
- Mean disposable household income after housing costs: £24,024

These two sets of data can be used in combination with the estimated costs of WFD measures for the water industry to develop a burden ratio. The resulting calculations are presented in Table 5-2.

Table 5-2: National level burden ratios based on disposable household income before housing costs

	Households - 2016	Equivalent annual average costs of measures (£)	Annual average cost per household (£)	Annual average measure costs as a % of median disposable income after housing costs
England	23,215,000	165,000,000	6.89	0.035%
Wales	1,349,000	5,161,000	3.83	0.020%

As can be seen from the results presented in Table 5-2, the costs associated with the measures currently being planned for the water industry represent 0.035% of median disposable income after housing costs for England.

This analysis has been repeated for England at a regional level, based on the costs presented in Table 5-1 and a rough allocation of these to the main WaSCs. The results are therefore indicative only. They are also not directly comparable with those given in Table 5-2, as it was only possible to source household estimates at the regional level for either 2013 or 2018[30]; 2018 projections are used here as they are more appropriate to the time period covered by the current frame being considered here.

As can be seen from Table 5-3, the annual average cost of measures being planned represent between 0.07% at the highest (North West Region and RBD) and 0.007% at the lowest (East and West Midlands - Severn RBD) of median disposable household income after housing costs.

Table 5-3: National level burden ratios based on disposable household income before housing costs

	Households – 2018	Equivalent annual average costs of measures (£)	Annual average cost per household (£)	Annual average measure costs as a % of median disposable income after housing costs
Anglian (East of England)	2,736,000	29,931,000	10.94	0.056%
Humber (Yorks and Humber)	2,485,000	15,945,000	6.42	0.033%

[29] Department for Work and Pensions (2014): Households Below Average Income: An analysis of the income Distribution 1994/95 – 2012/13. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325416/households-below-average-income-1994-1995-2012-2013.pdf

[30] House of Commons Library (2011): Household Projections in England and the Regions: 2008 - 2033. Available at www.parliament.uk/briefing-papers/SN03949.pdf

Table 5-3: National level burden ratios based on disposable household income before housing costs				
	Households – 2018	Equivalent annual average costs of measures (£)	Annual average cost per household (£)	Annual average measure costs as a % of median disposable income after housing costs
North West (North West)	3,279,000	46,156,000	14.08	0.072%
Northumbria (North East)	1,287,000	6,154,000	4.78	0.025%
Severn (West and East Midlands)	7136000	10,070,000	1.41	0.007%
Thames and South East	7481000	39,162,000	5.23	0.027%
South West (South West)	2,518,000	15,665,000	6.22	0.032%
Total	26,922,000	163,083,000	n/a	n/a
Notes: Costs of measures for the Dee and Solway Tweed have not been allocated to the above regions. Projected numbers of households for 2018 and not 2016 as for analysis presented in Table 5-3.				

Overall, this analysis indicates that the newly proposed measures under the WFD are unlikely to contribute to any water bill affordability issues on their own. The analysis, however, fails to reflect the fact that an element of current and future water bills will also include costs associated with previous investments under the first round RBMPs and that these may require on-going funding in order to ensure no deterioration. For this reason, consideration is also given to total water company bills below

5.3.2 Water industry costs relative to household income

The second variant of the burden ratio is the amount of the water bill relative to household income. Between 2002 and 2011 the trends in household income and water bills diverged, probably as a result of the economic downturn which depressed wages and inflated other costs. The divergence can be seen in Figure 5-2 below and may indicate that affordability issues for households have increased over recent years.

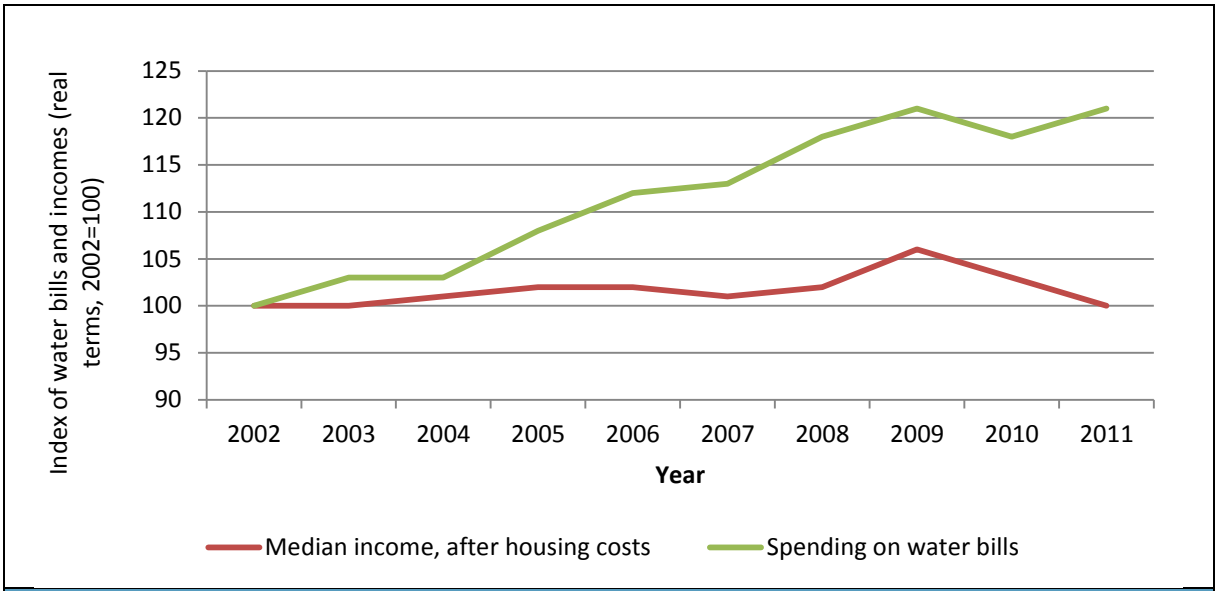

Figure 5-2: Spending on water bills compared to median incomes, 2002-2011 (adapted from National Audit Office (2013): Infrastructure investment: the impact on consumer bills)

Table 5-4 below presents a trend analysis by company showing the combined bill starting in 2010 and as forecast by the Ofwat price determinations up to 2019-20 (based on 2012/13 prices).

Table 5-4: Average annual combined bill for water and sewerage companies

Water company	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Anglian	408	380	375	370	368	363
Northumbrian	368	362	362	362	362	362
Severn Trent	315	298	294	294	293	297
South West	516	492	488	485	482	479
Southern Water	413	381	381	379	378	378
Thames	350	339	343	338	337	337
United Utilities	388	363	361	359	357	355
Welsh	416	409	407	403	398	396
Wessex	459	417	417	417	416	416
Yorkshire	353	338	338	338	337	336

Source: Ofwat (2014): Setting price controls for 2015-20 – draft price control determination notice

The data given in Table 5-4 can be combined with the data on median and mean average disposable household income before and after housing costs to provide an indication of the extent to which affordability concerns are likely to arise. These results are given in Table 5-5 for 2015/16 as the start of the period relevant to the second round RBMPs. Examination of the figures presented in Table 5-6 indicates that the average combined water bill equates to 2.5% or less than average household disposable income after housing costs, regardless of whether median or mean disposable income is considered. It should be noted that this analysis was carried out using UK figures for median and mean household disposal income.

Table 5-5: Combined water bill as a % of household disposable income (2015/16 bills compared to 2012/13 household disposable income)				
Water company	**Median before housing costs**	**Median after housing costs**	**Mean before housing costs**	**Mean after housing costs**
England				
Anglian	1.7%	2.0%	1.4%	1.6%
Northumbrian	1.6%	1.9%	1.3%	1.5%
Severn Trent	1.3%	1.5%	1.1%	1.2%
South West	2.2%	2.5%	1.8%	2.0%
Southern	1.7%	2.0%	1.4%	1.6%
Thames	1.5%	1.7%	1.2%	1.4%
United Utilities	1.6%	1.9%	1.3%	1.5%
Wessex	1.8%	2.1%	1.5%	1.7%
Yorkshire	1.5%	1.7%	1.2%	1.4%
Average England combined water bill	1.7%	1.7%	1.7%	1.7%
Sources: Ofwat (2014): Setting price controls for 2015-20 – draft price control determination notice. Department for Work and Pensions (2014): Households Below Average Income: An analysis of the income Distribution 1994/95 – 2012/13, July				

The literature review found that benchmarks are commonly used together with burden ratios to act as the basis for determining whether or not an increase in household bills would be affordable. The benchmark values typically quoted as being relevant (e.g. by the World Bank, OECD) for developed countries are in the range of 3% to 4% for water and sanitation services. For comparison purposes, a recent study across 14 western European countries found that expenditure on water and sanitation services typically accounts for around 1.1% of disposable income, rising to 2.6% for poor households (in Ofwat, 2011).

5.3.3 Burden ratios for population sub-groups

Although previous assessments, such as Ofwat's 2009-10 analysis (see Annex 1), also considers affordability by household type, we do not present such an analysis here as part of the main assessment. This is because the aim of this assessment is to consider whether or not the overall costs that will be incurred by water companies and their customer base as a whole are affordable. How the costs are allocated across sub-populations within the customer base, and whether that distribution is affordable for all sub-populations, is a different policy question and outside the scope of this study.

5.4 Self-reported problems with water affordability

5.4.1 Water company surveys

In 2009, Ofwat ran a quantitative survey asking households about the affordability of their water and sewerage bills. Reporting the findings of this survey, Ofwat (2011) states that:

- 85% of household customers surveyed did not find it difficult to pay their water bills on time
- 11% of customers said that they usually paid on time, but sometimes found this difficult

- 2% of customers said that they sometimes paid late, depending on the other bills they had to pay
- Fewer than 1% often found it a challenge and had to delay paying their water bills, and
- Fewer than 1% rarely paid their bills on time.

As part of PR14 process, Ofwat has had the water companies undertake customer engagement to assess the extent to which their proposed business plans are acceptable to their customer base. Information on "acceptability" can therefore be found in the draft business plans on customers' satisfaction with services and on the value for money of the proposed plans for 2015 to 2020. In most of the plans, statistics are given on the percentage of customers surveyed that would agree that the changes in water bills implied by the plans are "acceptable".

Table 5-6 presents the data quoted in the various water companies' Business Plans on the percentage of customers surveyed (in some cases also separately reporting on households and business customers) that indicated that the proposed plans were acceptable in terms of their impact on water bills. As can be seen, all of the companies report customer acceptability levels at greater than 70% based on bills expressed in real terms, with Thames Water having the lowest levels and reporting a figure of "over 70%". Anglian and Welsh Water would appear to have the highest levels of customer acceptability.

Table 5-6: Customer acceptability of water company business plans

Water company	% customers surveyed that said business plan impact on bills was "acceptable" or "affordable"
Anglian Water	90% of customers surveyed
Northumbrian Water	88% by survey; 75% by additional quantitative research
Severn Trent Water	88% of customers surveyed
South West Water	84% of customers based on real term prices; 70% of customers after accounting for inflation in indicative bills
Southern Water	75% household customers and 81% business customers surveyed
Thames Water	Over 70% of customers surveyed (including both household and non-household)
United Utilities	75% of household customers surveyed; an econometric model predicted that the plan would be affordable for 86% of customers (basis for determining not given)
Welsh Water	94% of customers surveyed; 84% households and 88% non-households indicated improved value for money
Wessex Water	81% of customers surveyed (80% bills affordable, 6% struggling to pay and 14% starting to worry)
Yorkshire Water	Not given in published Business Plan. Reference is made to CCWater 2012 tracker which found that 87% of customers agree the company's charges are fair and affordable. 77% of customers surveyed

Notes: Based on data presented in company Business Plans or in Ofwat's draft determinations

In addition, the water industry has carried out research into whether or not customers would support measures to improve water quality and to determine what their willingness to pay for this would be (although it must be noted that willingness to pay is not the same as affordability). The general finding is that customers are willing to pay for environmental improvements as long as others stakeholders, including the water companies, are also contributing and doing their part e.g. reducing leakage from pipes.

5.4.2 Research by CCWater

Research by CCWater (2014) has found lower levels of acceptability than the water companies, with one in five customers feeling their charges are unaffordable (an increase from one in eight customers last year). Figure 5-3 shows the results to a similar question on affordability posed to consumers in CCWater's 2012 Annual Tracker Survey (CCWater, 2013). These findings suggest potentially lower levels of affordability of water bills than identified by the water company surveys in terms of the acceptability of bills if only those that "agree" are considered; if those that are neutral are also taken into account, then the percentages for whom bills are affordable in 2012 were similar to those found by the companies surveys.

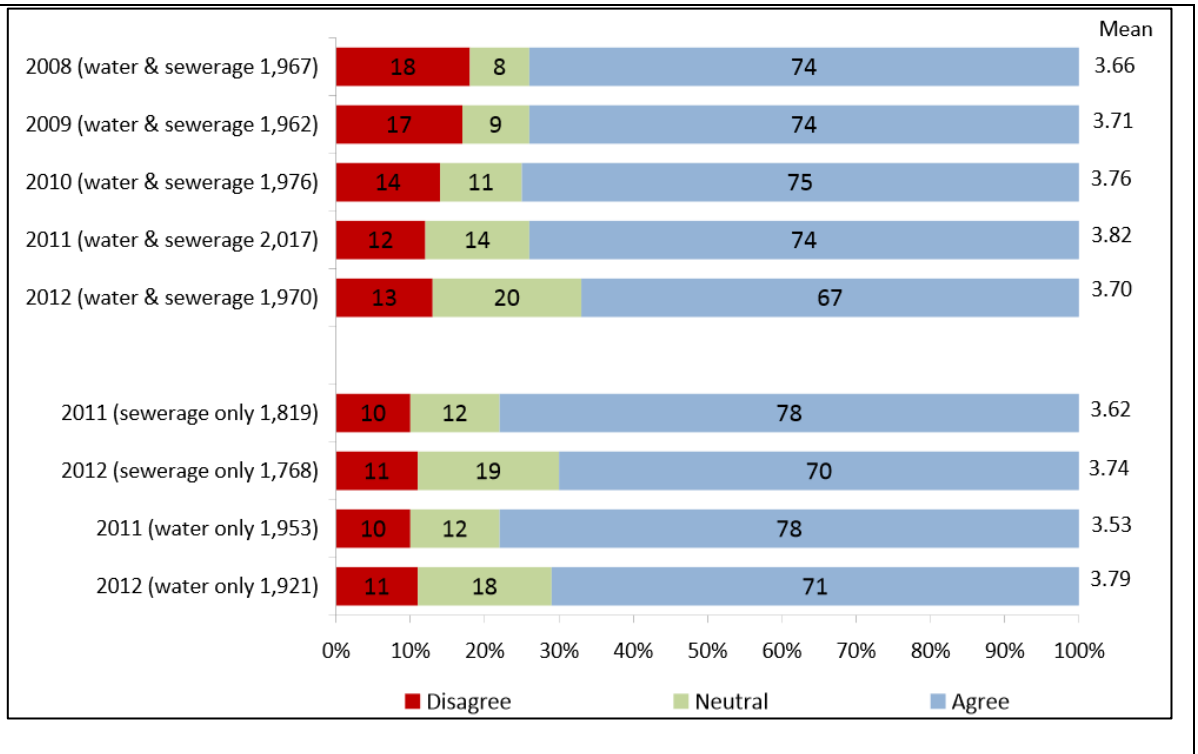

Figure 5-3: How much do you agree or disagree that the water and/or sewerage charges that you pay are affordable to you? (CCWater, 2013)

Note: Excluding 'don't know' responses; the first five bars show figures for WaSC respondents over the last five years and the lower four bars show figures for WoC respondents over the last two years.

5.5 Summary of findings on affordability

It is generally agreed that because the privatised water companies in the UK can pass on the costs of the services they provide to the consumers, affordability for this sector should be based on affordability for their customers, with the focus of this being on households as the customers accounting for the majority of the services provided by the companies. The key indicators of affordability are burden ratios reflecting the impact of increases in costs on customers disposable income and then on customers more generally in terms of the "acceptability" of water bills.

The key findings of this assessment are as follows.

1) When assessing the burden associated solely with the costs of the measures being proposed for the second round RBMPs, the ratios indicate that the total national costs of the WFD measures equate to 0.037% of average median household disposable income after housing costs (the lowest measure of average household disposable income) for households in England.

2) There is regional variation around these figures for England, with the ratios for the average equivalent costs predicted by the EA for each RBD to median household disposable income after housing costs ranging from 0.025% to 0.072%. These calculations have required making some assumptions on the overlap between RBDs and Regions, but are considered reasonable indicators; note they are also based on 2018 projected population levels, as these appeared to be the most relevant set of statistics readily available.

3) The above sets of indicators relate solely to the costs of new measures proposed for the second round of RBMPs and do not reflect the continued expenditure required of the water industry to ensure no deterioration in the water environment. Work has been undertaken to develop a model that enables separation of WFD costs from other regulatory costs as part of WaSC's combined water bills. Unfortunately, the end outputs for this work have not been available in time for inclusion in this study. As a result, calculations have been provided which indicate that for England the average combined water bill equates to 2.5% or less than average household disposable income after housing costs, regardless of whether median or mean disposable income is considered.

4) The rate of self-reported problems is also a reasonable indicator and relates to the concept of acceptability, with information on this available from the water company business plans. This is a static indicator and it is not clear how it may change in the future, but acceptability ratings for the 10 larger water companies' 2015 to 2020 Business Plans are all above 70% with many being above 80%. The percentage figures suggest that the business plans proposed by the companies, which include WFD expenditure programmes roughly in line with the EA's Scenario 4, are acceptable.

6 Affordability in the Public Sector

6.1 Introduction

6.1.1 The sector

Traditionally, government affordability in the water sector has been linked to cost recovery issues, in particular whether the implementation costs of a programme of environmental measures can be recovered through fiscal transfers financed by tax payers or through user charges financed by consumers (Cardone and Fonseca, 2003; OECD, 2009). As noted in Section 1, affordability for the public sector is increasingly being raised as an issue at the EU level due to the financial crisis and its impacts on national economies more generally (Stanley, Depaoli and Strosser, 2012).

Focusing on England, for the current round of river basin planning, the EA has developed cost estimates for action falling to the public sector and, for the purposes of this assessment, this is assumed to include:

- Central government expenditure (e.g. Defra and DECC)
- Expenditure by responsible government agencies, where this includes the Environment Agency, Natural England, the Coal Authority, the Highways Agency and the Forestry Commission England, and
- Local government expenditure.

6.1.2 The indicators

As for the other sectors, the indicators proposed for assessing public sector affordability are based on a budgetary or balance sheet perspective, which takes into account the fact that expenditure on one area of public policy reduces what is available to spend on other areas. In other words, there are trade-offs involved in spending money on measures to meet WFD objectives rather than to meet other social or environmental objectives. Thus, one has to consider budgetary restrictions at the national level and how these then affect Defra and other departments that may have an element of WFD related expenditure, e.g. DECC and grants given to the Coal Authority for funding abandoned coal mine remediation schemes.

Although the public sector varies from all of the other sectors with regard to "cost pass-through", given that public sector funding is financed through taxes, rates, fees and borrowing (which is itself paid off through taxes), there are constraints on budget levels. These constraints stem from political pressures for fiscal consolidation and the need to reduce the current public deficit. In particular, the UK Government's fiscal consolidation policies are aimed at reversing the rise in borrowing experienced between 2007-08 and 2009-10 (OBR, 2014)[31], and long-term economic plans still include a reduction in the public deficit to achieve full economic recovery from the financial crisis. Indeed, the reduction in public net-borrowing has been achieved in part by a reduction in public spending (i.e. reduction in Department Expenditure Limits - DEL, reductions in Annually Managed Expenditure - AME, and debt interest saving).

[31] The Office of Budgetary Responsibility estimates that the public sector net borrowing fell from 11% of GDP in 2009-10 to 7.3% in 2012-13 and is forecast to fall to 5.5% in 2014-15 (OBR, 2014)

Given the above, the potential indicators for assessing affordability for the public sector are:

- Projected changes in central government revenue streams, given the Government's aim to reduce public sector borrowing, and the implications of this for public sector spending (also taking into account tax policy)

- Changes in the share of (central government) funding to relevant public bodies involved with the WFD implementation and earmarked for WFD related measures, and

- The likely magnitude of WFD related funding compared to the costs of the measures allocated to the various public bodies.

6.1.3 Stakeholders' views

Discussions were held with a sub-set of the key public sector agencies as well as with NGOs, who are reliant on public sector funding. The Forestry Commission England indicated that funding of measures under the WFD is not an issue for them. They have a budget allocated for relevant activities and believe that they are able to meet any requirements out of this budget. Instead, they wished to emphasize the positive role that woodlands can have as a delivery measure in its own right. In contrast, the Coal Authority confirmed that it relies on funding from Defra and DECC to deliver the minewater remediation schemes that it undertakes. Any reductions in the funding made available to the Authority will translate directly into a reduction in the number of schemes that can be delivered.

6.2 Costs of measures under Scenario 4

The economic analyses conducted by the EA estimates that the costs for the public sector in England are £2,300 million undiscounted and £1,700 million in present value terms (roughly £63.7 million in equivalent annual costs) (EA, 2014).

6.3 Relevant sector information

6.3.1 The national context

Affordability for the public sector has to be considered within the broader context of the UK economy. Although the recovery of the UK economy from the economic crisis is well established, the financial crisis severely affected public finances and as a consequence, the current government adopted a policy of fiscal consolidation that will be continued over the next few years IFS (2014). As reported in the UK Budget 2014 (HM Treasury 2014), in order to achieve full economic recovery, the current government's long-term economic plan includes the reduction of the fiscal deficit to reduce the UK's debt. The Autumn Statement 2014 (HM Treasury, 2014a) confirms this long-term trend, although it points out that since the publication of the Budget 2014, the external risks to the UK economy have increased, mainly due to the deteriorating conditions of the Euro Area.

The Office of Budgetary Responsibility (OBR) estimates that the public sector's net borrowing fell from 11% of GDP in 2009-10 to 7.3% in 2012-13 (OBR, 2014). The OBR's December 2014 "Economic

and Fiscal Outlook" forecasts a further decline of the Public sector's net borrowing to 4% of GDP in 2015-16, until it reaches a small surplus of 0.2% of GDP in 2018-19 (OBR, 2014a).

The fiscal consolidation and the consequent reduction in public net-borrowing have been achieved by a rise in taxes and a reduction of public spending. The policy decisions undertaken under the Autumn Statement 2014 assumes a further fiscal consolidation. As a consequence, in the following budgetary years 2018-19 and 2019-20, the Total Managed Expenditure (TME)[32] will be held flat in real terms, implying a reduction in "Departmental expenditure limits – DEL", the financial resources allocated to the different government departments.

The following figure shows the main government spending sectors opposed to the main government revenue sources, as set up in the current Government Budget 2014-2015. Social protection (30.3%), Health (19.1%) and Education (13.4%) are the main areas where public expenditure is planned to be allocated. On the other side, income taxes, with a share of 25.8% of the total government revenue, are confirmed to be the main revenue source.

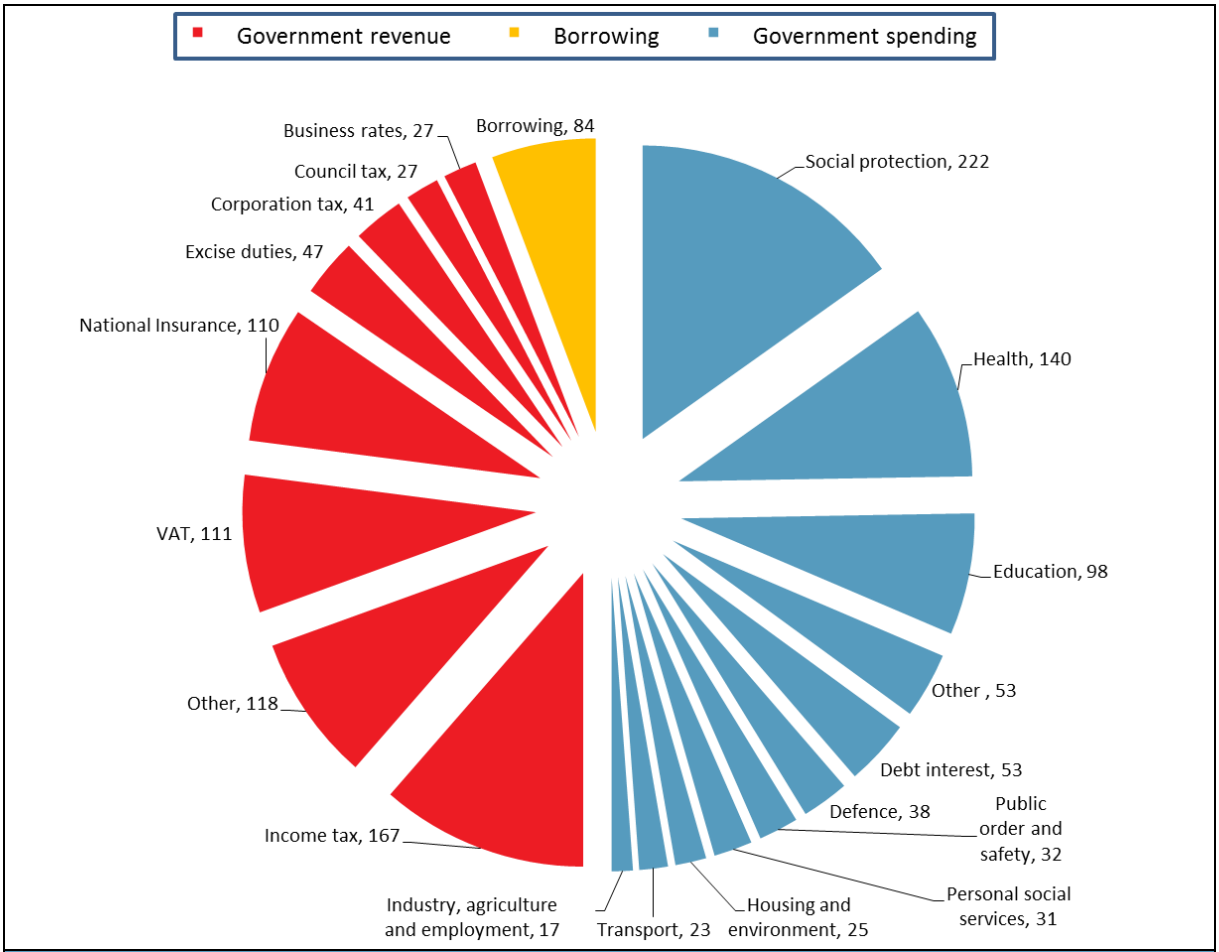

Figure 6-1: Government spending and revenue, UK Budget 2014-15 (£ billion)
Source: HM Treasury (2014)

[32] The Total Managed Expenditure (TME) is the total amount spent by the Government, and it includes both the Departmental budgets allocated by the Government itself, and money spent outside the budgetary control such as welfare and pensions.

6.3.2 Defra expenditure limits and resource budgets

The Impact Assessment of 1st Cycle of River Basin Plans (Defra, 2009) remarks that the scope for government intervention in the context of the WFD relies on the fact that the water environment is subject to market failures that the existing legislation in not able to correct. In addition, the IA notes that the majority of the costs of the WFD implementation are supported by the Water companies and the Central government, including a transfer of funding to the Environment Agency (meeting 16.3% of the costs). On the other hand, Local government is responsible for a share of 0.2% of the total cost. In this respect, the public expenditure statistical analysis (HM Treasury 2013) shows an on-going decline of financial resources allocated to Defra, the government department responsible for policy and regulations on environmental issues, and for the public sector funding of WFD related measures in England, including those carried out by the Environment Agency.

In terms of the share of total public expenditure, the budget allocated to Defra would appear to show a steady decline, 0.73% in the 2008-09 budgetary years to an expected 0.52% in the 2015-16 year. Figure 6-2 shows how resource DEL to Defra compares to other departments in the budgetary year 2013-14. The NHS is the department to which the largest share of resources are allocated (29.9%), followed by education (14.8%) and Defence (10.4%). For 2014-15, Defra's share was 0.6% of DEL.

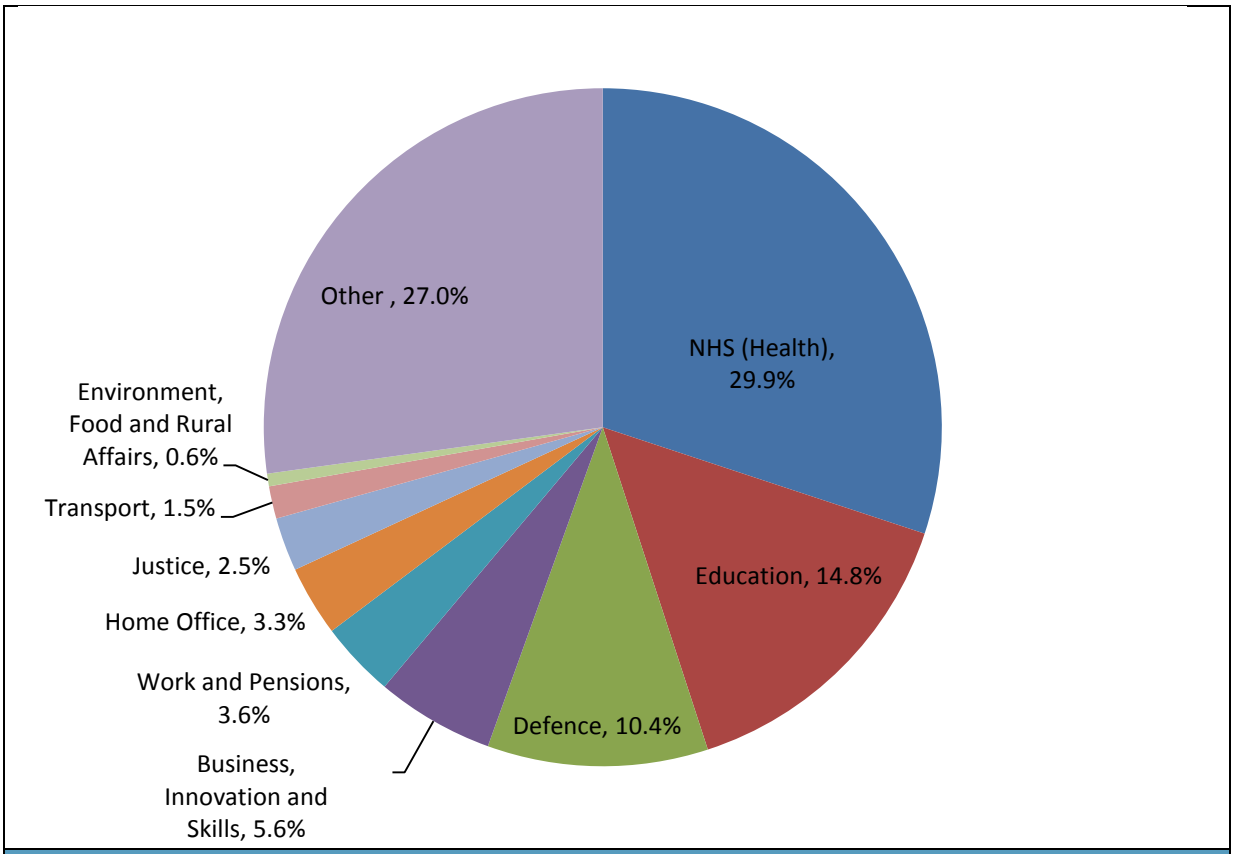

Figure 6-2: Resource budget, resource DEL by department group – 2012-13
Source: HM Treasury (2013, Table 1-3)

Although the next UK Budget will be published in March 2015, the Autumn Statement 2014 forecasts a further decline in financial resources allocated to government departments which will likely affect Defra funding too. In the 2015-2016 budget plans, the department expenditure limits (DEL) resource

budget for Defra is expected to decline by up to 28.4% from the 2008-2009 levels, as illustrated in Figure 6-3.

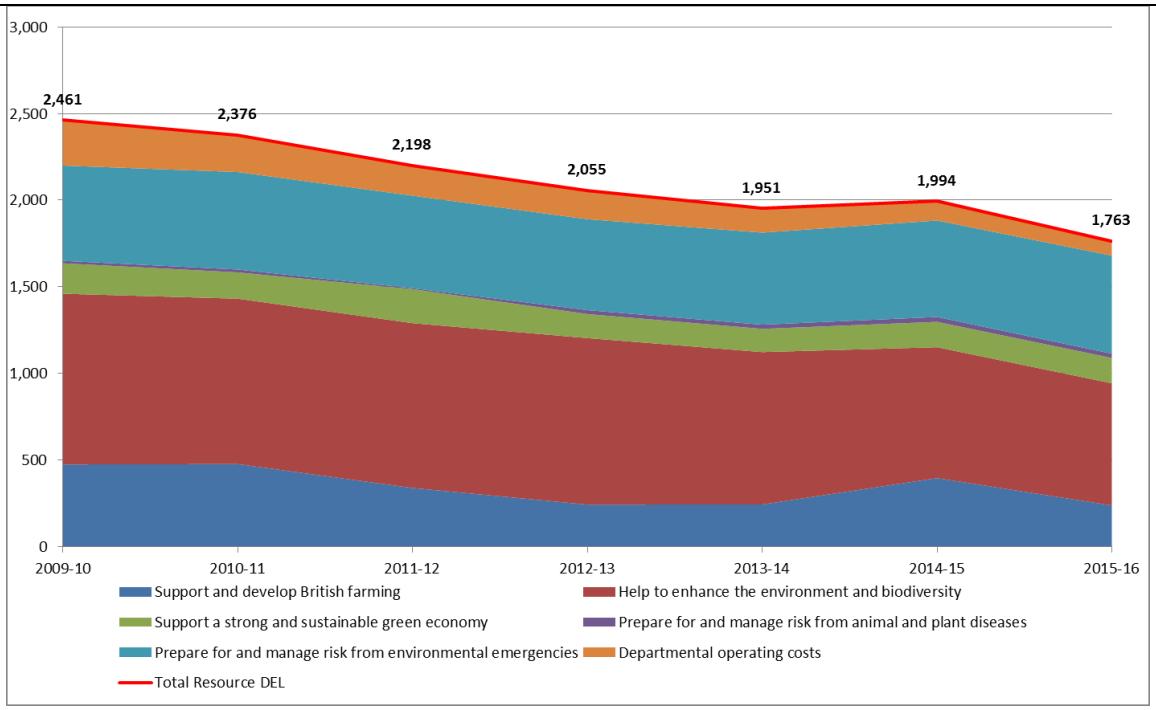

Figure 6-3: Defra's resource DEL, by policy area – 2009-10 to 2015-16 (£ millions)
Source: Defra (2013a)

An analysis of the departmental accounts shows how resources are allocated across the different Defra's policy areas. The following figure refers to the budgetary year 2014-15; the planned £1.99 billion is divided across Defra's five strategic areas (plus "departmental operating costs). Even including the financial resources provided to other Non–Departmental Public Bodies, such as the EA, which are not managed directly by the department, "enhancing the environment and biodiversity" covers 38% of the total amount, followed by "support to farming" (20%), "prepare for and manage risk form environmental emergencies" (17%), "prepare for and manage risk from animal and plant diseases" (12%), and "support a sustainable and green economy" (7%). This breakdown is illustrated in Table 6-1, overleaf.

Table 6-1: Defra's and NDPBs resource DEL – 2012-13 to 2015-16 (£ millions, and %)								
Defra	**2012-13**		**2013-14**		**2014-15**		**2015-16**	
Support and develop British farming	242	19.5%	243	20.9%	395	31.8%	237	22.7%
Help to enhance the environment and biodiversity	468	37.7%	400	34.3%	324	26.1%	327	31.2%
Support a strong and sustainable green economy	139	11.2%	134	11.5%	147	11.8%	146	14.0%
Prepare for and manage risk from animal and plant diseases	206	16.6%	226	19.4%	238	19.2%	228	21.8%
Prepare for and manage risk from environmental emergencies	23	1.8%	24	2.0%	28	2.3%	25	2.4%
Departmental operating costs	164	13.2%	139	11.9%	111	8.9%	83	7.9%
Total Defra	**1,243**	**100%**	**1,165**	**100%**	**1,243**	**100%**	**1,047**	**100%**
Total Defra - Departmental operating costs	***1,078***		***1,027***		***1,132***		***964***	
NDPBs								
Support and develop British farming (Net)	0.6	0.1%	0.7	0.1%	1.1	0.2%	1.0	0.1%
Help to enhance the environment and biodiversity (Net)	493	60.7%	480	61.0%	431	57.5%	378	52.8%
Support a strong and sustainable green economy (Net)	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Prepare for and manage risk from environmental emergencies (Net)	318	39.2%	306	38.9%	318	42.4%	337	47.1%
Total NDPBs	**812**	**100%**	**786**	**100%**	**750**	**100%**	**716**	**100%**
Total Defra + NDPBs	**2,055**		**1,951**		**1,994**		**1,763**	
Note: NDPBs include: Agriculture and Horticulture Development Board; Consumer Council for Water; Environment Agency; Gangmasters Licensing Authority; Joint Nature Conservation Committee; National Forest Company; Natural England; Royal Botanic Gardens, Kew; Sea Fish Industry Authority **Source:** Defra (2013a)								

Environmental protection expenditure

An analysis of Environmental Protection Expenditure (EPE) can demonstrate how financial resources are allocated amongst different environmental policy goals. Figure 2-4 shows total EPE by central government between 2000 and 2012. Total EPE has increased since 2000[33], with more significant increases between 2005 and 2007. After 2008, the increase has been less marked.

Government expenditure for "waste water management" followed a broadly similar pattern, increasing from zero in 2000 to £14 million in 2012, peaking in 2009 at £29 million.

The environment protection expenditure across the different environmental sectors is shown in Figure 6-4. Waste management accounts for the largest proportion, followed by environmental protection. The low level of public sector expenditure on waste water management is due to the privatised nature of the water sector in the UK (see also Section 5). In 2012, water management had a share of 0.1% of the total expenditure, while during the peak of 2009 its share was 0.2%.

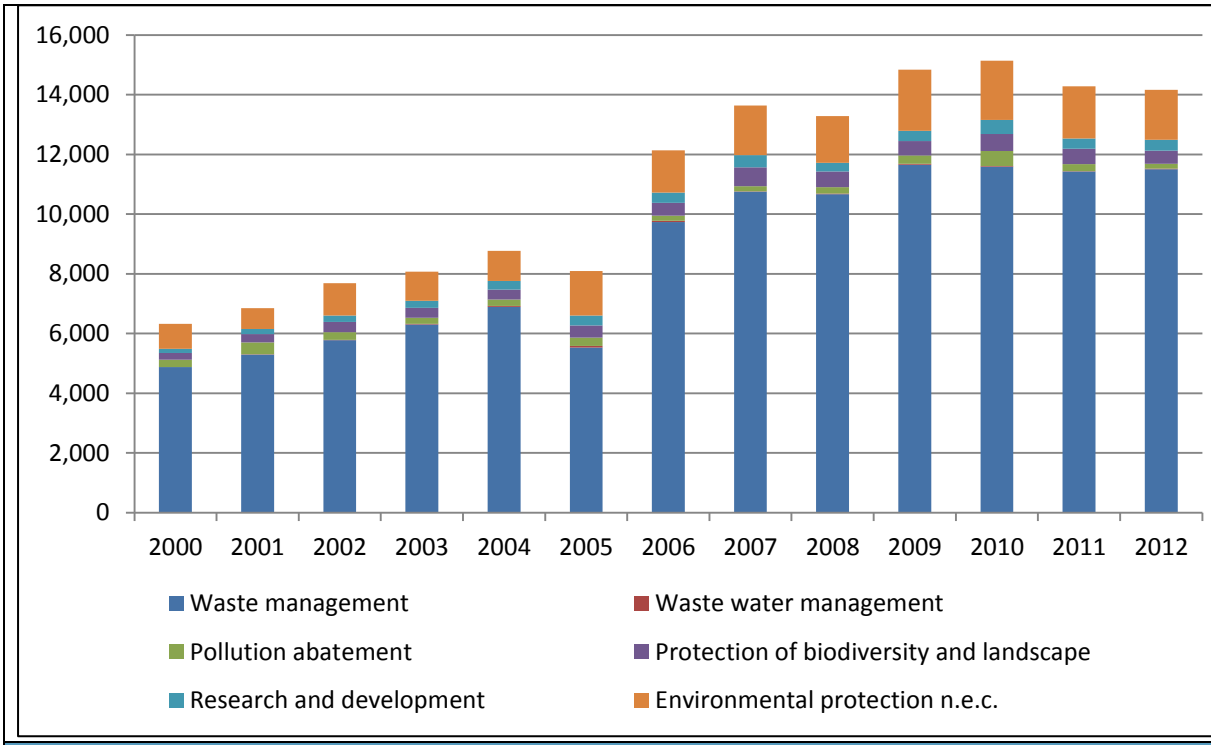

Figure 6-4: General Government Environment Protection Expenditure, 2000-2012 (£ million)
Source: ONS (2014)

6.3.3 EA, Natural England and Coal Authority WFD-related budgets

The Environment Agency is a non-departmental public body of Defra, established under the provisions of the Environment Act 1995 (which also defines the establishment of the Scottish Environment Protection Agency). Although its financial results are consolidated into the Defra annual report and accounts, the EA also publishes its own annual report, and on the basis of this it is possible to describe the main trends in its funding.

[33] One average, the EPE to GDP ratio was 0.8% between 2000 and 2012.

The stream of funding to the EA derives mainly from two sources:

1) Charging scheme and other flood defence levies; and
2) Defra (and previously Welsh Government) grant-in-aid.

The EA faces a limited capacity to adapt the funding derived from its charging schemes so as to generate additional funds to finance WFD related measures for example. As a result, the EA must rely on funding from Defra for these purposes.

Table 6-2 below describes the main trends in the EA's funding over the financial years 2008-09 to 2012-13. As can be seen, grant-in-aid from Defra accounted for an average 62.6% of total EA funding between the budgetary years 2008-09 and 2013-14.

Table 6-2: Environment Agency total funding, 2008-09 to 2012-13 (£ million)

	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Total	**1,180**	**1,252**	**1,216**	**1,200**	**1,200**	**1,093**	**1,095**	**1,078**
Grant-in-aid	770	834	800	750	723	648	675	677
Charging scheme and other flood defence levies	374	383	379	n/a	n/a	346	343	340
Miscellaneous sources	36	35	37	n/a	n/a	99	77	61

Note: values in shaded cells are planned
Source: EA report and accounts (several years)

Natural England also receives substantial funding from Defra with a portion of this relevant to the WFD. By analysing its report and accounts, it is possible to observe that Defra grant-in-aid funding is on average above 90% of Natural England's budget, as shown in Table 6-3 below.

Table 6-3: Natural England funding (£000)

	2011-12	2012-13	2013-14
Defra Grant-In-Aid	201,699	189,159	191,965
of which to WFD	*2,997*	*3,270*	*3,170*
Other Income	17,539	14,238	9,598
Total	**219,238**	**203,397**	**202,068**

Source: Natural England report and accounts (several years)

Discussions with the Coal Authority also highlight the importance of Defra and DECC funding to the implementation of minewater schemes, which are critical to achieving good status in a large number of water bodies. The Coal Authority has receives funding of around £10 million to cover the 5 year period ending in March 2015 for non-coal mine water remediation works. DECC provides further funding for coal related minewater schemes.

Table 6-3 also shows the share of WFD-targeted funding, which accounts for an average 1.6% of the total Defra grant-in-aid over the 3 year period. In this respect, beginning in April 2011, the total Defra funding to the EA for management of environmental quality of surface water bodies is also available; based on the most recent Defra annual report and accounts, the total amount of funding

to the EA for water quality related purposes (indeed, not limited to the WFD) was £86.4 million in 2011-12 and £78 million in 2012-13.

6.3.4 Local government

Local authorities fund their activities from three main sources or revenues:

- Grants from central government;
- Council Tax revenues; and
- Other locally generated fees and charges for services.

However, since the beginning of the financial crisis, the total financial resources available to local governments have decreased. In this respect, a report by the Local Government Association (LGA, 2014) points out that core funding for local government will have been reduced by 40% in real term over the course of this Parliament.

Within this context of increasingly scarce financial resources, it is therefore important to understand how financial resources are allocated across different policy goals. Figure 6-5 shows the net-current expenditure of local government in England for the budgetary year 2010-11. Education accounts for the largest proportion of total expenditure (44.1%), followed by social care (20.5%) and police services (11.6%). Expenditure allocated to environmental and regulatory services represents 5.1% of total expenditure, while highway and transport services and planning and development (which may include an element of WFD related expenditure e.g. SUDs) represents 5.5% and 2.1% respectively.

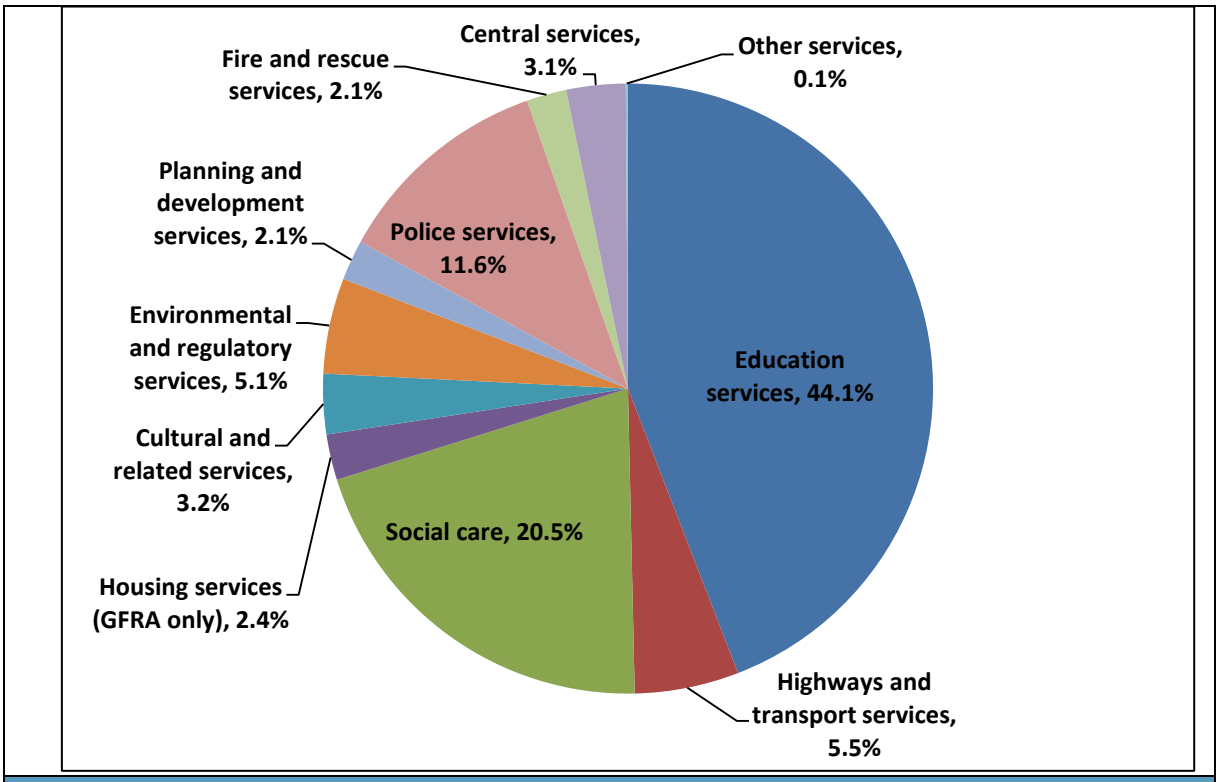

Figure 6-5: Local Government net current expenditure, 2010-2011
Source: DCLG (2012, Revenue Outturn Summary)

Environmental and regulatory services, includes the following sub-categories: regulatory services (including water safety), community safety, flood defence, land drainage and coast protection, and waste management. For the budgetary year 2010-11, the main share of the total expenditure on environmental and regulatory services is waste management services (60.7%). In the same budgetary year, the net-expenditure for flood defence, land drainage and coast protection with the inclusion of water safety represents a share of 15.5% of the total.

An EA publication (2012) highlights the responsibilities of Local Authorities relating to the WFD. The key local authority functions can be summarised as follows:

- Strategic planning and local planning policies: incorporation of WFD priorities into Local Plans and Infrastructure Delivery Plans
- Development management and building regulations functions: avoiding deterioration of water bodies, secure greenspace and sustainable drainage
- Integrating water environment and WFD issues into drainage and flood risk management functions: promoting the use of Sustainable Drainage Systems (SuDS)
- Environmental health and pollution control functions: engaging business to avoid water pollution, reducing risk of pollution
- Managing a local authority 's own buildings and assets, and greenspace functions: council owned housing; industrial estates; and green space
- Local authority highways functions: highways design and maintenance, managing flood risk and level of pollution in highways runoff, and
- Local authority community leadership, advocacy and partnership role.

Local authorities fund their activities from three main sources or revenues:

- Grants from central government
- Council Tax revenues, and
- Other locally generated fees and charges for services.

Since the beginning of the financial crisis, the total financial resources available to the local governments have decreased. A report by the Local Government Association (LGA, 2014) points out that core funding for local government will have been reduced by 40% in real terms over the course of this Parliament. In addition, the report notes that other reductions in the availability of financial resources are expected up to the year 2019/2020.

As noted in Section 2, the bulk of local government expenditure is devoted to education (44.1%), social care (20.5%) and police services (11.6%)[34]. Expenditure allocated to environmental and regulatory services is around £5.2 billion or 5.1% of total expenditure, while highway and transport services and planning and development (which may include an element of WFD related expenditure for SUDs, etc.) represents 5.5% and 2.1% of total expenditure respectively.

Under the heading of environmental and regulatory services, for the budgetary year 2010-11, the main share of local government net-expenditure is on for waste management services (60.7% of the total environmental and regulatory services expenditure). In the same budgetary year, the net-expenditure for flood defence, land drainage and coast protection with the inclusion of water safety represented a share of 15.5% of the total.

[34] Figures quoted are for the 2010-11 budgetary year.

6.4 Sectoral level analysis

The budgetary data presented above can be used as the basis for assessing the affordability of Scenario 4 for the public sector. As noted in Section 6.2, the average annual cost to the public sector of delivering Scenario 4 for England is estimated at £60 million. This cost is most appropriately compared to Defra's total budget, and then to the budgets of the EA and Natural England specific to the WFD. This analysis is presented in Table 6-4. As can be seen from the table, the Scenario 4 costs equate to around 3.2% of Defra's total budget for the 2013-14 financial year. The annual costs equate to around 8.3% of the funding granted to the EA on an annual basis (based on 2013-14 figures), are equate to around 74% of the total funding from Defra to the EA and Natural England relevant to the WFD (in the case of the EA to meeting water quality goals). It is not clear what proportion of the Scenario 4 costs would be incurred by local authorities and so it has not be possible to carry out an indicator analysis for local authority spending.

Table 6-4: Government sector analysis for England and Scenario 4

Budget	£ Million	Ratio of Scenario 4 annual expenditure to budget
Defra total budget 2014-15 (DEL)	1,950	3.1%
Defra funding to EA 2012-13	723	8.3%
Defra funding to Natural England 2013-2014	192	31.3%
Defra funding to WFD 2012-2013[(a)]	81.2	73.9%

Note: (a) it includes all the funding to water quality
Source: EA (2014, Economic Analysis) and Defra, EA, Natural England report and accounts (several years)

As Defra has calls on its funding besides the WFD, one indicator of affordability may relate to the value for money delivered by other Defra funded projects compared to measures under the WFD. Some examples of Defra funded projects which may compete for funds with the WFD and their associated BCRs are shown in the table below. The relatively high BCRs for some of these projects, such as the LEADER programme for business growth with BCR from 6.05 to 6.71, may indicate that they are more attractive for public spending over the WFD which may have lower benefits in relation to costs but may be cheaper. However there are risks associated with simple comparison of BCRs as these are linked to disproportionality rather than affordability alone and therefore will not provide a clear representation of the affordability of a programme.

Table 6-5: Benefit Cost Ratios for RDPE activities

Area of activity	Sub-area	Low BCR	High BCR
Environmental Land Management: Agri-Environment	Mid-tier	2.2	5.3
	Higher-tier	2.2	5.5
Environmental Land Management: Forestry	Creation	1.6	4.7
	Management	5	6.1
Farm and Forestry Productivity		0.86	1.73
Growth Programme		1.73	6.79
LEADER	Direct Growth: Business	6.05	6.71
	Indirect Growth: Community	3.55	3.87

Source: Defra (2014c), available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319445/rdpe-ia-201406.pdf on 14 January 2015.

6.5 Summary of findings on affordability

Affordability issues for the government will be intrinsically linked to the opportunity costs associated with spending public resources on one specific policy area rather than on another one. In other words, the trade-offs of investing in protection of the water environment should be compared with the benefits of expenditure in other areas, including education, health, social care, transportation, etc.[35].

In terms of affordability, the above analysis suggests the annual level of public expenditure associated with Scenario 4 is equivalent to 3.2% of Defra's 2012-2013 DEL, and around 10% of the allocation for "enhancing the environment and biodiversity".

It is also important to emphasise the role that Defra's grant funding, as well as the EA's, to NGOs plays in the delivery of the WFD. Table 6-6 shows the sources of funding for some of the more important NGOs in terms of implementing WFD measures.

Table 6-6: Sources of funding for different NGOs

NGO	Member-ship	Donations & legacies	National / European	Grant	Invest-ments	Activities for generating funds and commercial trading	Public mtngs and other actions
Angling Trust (2012)	83%,	13%					
Rivers Trust (2012)		3%	95%				
Inland Waterways Association (2012)	29%	14%		2%	2%	50%	1%
RSPB (2012)	32% (membership and donations) 23% (only legacies)			22%		17%	
Royal Society of Wildlife Trusts (2012)	58% - Contributions 15% - Legacies 3% - Donations 10% - Royalties				12%	2%	

Although a high share of the funding comes from membership, donations and legacies for some of these organisations, significant funding stems from government grants or other national awards for organisations such as the Rivers Trust. The Rivers Trust has indicated that it relies on funding from Defra and the EA in order to leverage funding from other donor organisations (whether private or public, including European Commission sources). RSPB also noted that it uses government grants

[35] As it was pointed out at the beginning of the section, the point of fiscal consolidation is to reduce public debt. However, it cannot ignore that other policy goals have to be maintained to ensure productivity gains and long-run growth. In this respect, Cournède et al (2013, p 14) point out that "spending reductions can entail potentially large long-term losses in output when they cut into areas where governments provide particularly valuable public goods or growth-enhancing services that are insufficiently produced by market forces".

and the starting point for gaining contributions from other donors. Without some funding from Defra or the EA, it would not be possible to generate some of the other grant funding.

Table 6-7 below illustrates an example of the use of such funding by a NGO. As can be seen from this summary of the Rivers Trust's operations, a significant amount of its project spend is actually co-financed by other parties, with in-kind services and other contributions accounting for a relatively small share of the total costs (although these contributions would also be lost without the starter funding provided by Defra or the EA.

Table 6-7: The Rivers Trust's River Improvement Fund Programme

The River Improvement Fund Programme was a strategic national initiative between DEFRA and The Rivers Trust, in collaboration with the Environment Agency, to raise ecological status of identified water bodies to satisfy the requirements of WFD, to maintain and improve Special Areas of Conservation and to satisfy and complement requirements of Salmon Action Plans and Eel Management Plans.

Rivers trusts are active in every WFD RBD with more than 40 rivers trusts and river groups in England & Wales fielding over 150 technical specialists in fisheries and catchment management and having access to more than 20,000 active volunteers.

The Rivers Trust circulated initial requests for qualifying project proposals to the rivers trust movement during summer / autumn 2009. Individual trusts then prepared and submitted formal project application schedules. These applications were assessed by The Rivers Trust for **viability**, effectiveness and value. The subsequent short list was technically assessed by the Environment Agency at national level for Water Framework Directive, Eel Management Plan and Salmon Action Plan compliance. Budgets were then allocated and contracts issued. This process was replicated for the additional phases.

The Rivers Trust developed a series of guidance fact sheets which were incorporated into project contracts to assist project management, delivery, finance, reporting and completion.

Up to 31 March 2014, the total river improvement project value has been over £8m. Financing of the fund is set out in the next table, with the co-financing totalling nearly 40% of the total project costs. The total number of projects totals just over 200 (204 including 140 salmon action plans, 34 eel management plans and 30 SPA/EMP/SAP habitats) and over 2,800 km of river with improved ecological potential.

Phase	Project spend	Co-finance achieved	Contribution in kind (technical specialists and other volunteers)	Contribution in kind (assets/time from riparian owners or farmers)	Total co-funding achieved
Phase 1	£1,816,307	£741,340	£228,591	£64,235	£1,034,166
Phase 2	£1,331,949	£403,737	£139,772	£21,475	£564,984
Phase 3	£2,850,744	£496,196	£169,327	£98,991	£764,514
Totals	**£5,999,000**	**£1,641,273**	**£537,690**	**£184,701**	**£2,363,664**

Source: http://www.theriverstrust.org/rifp/pics/outputs.png

7 Study findings

7.1 Purpose of the study

The objective of this project was to guide Defra and their Ministers in decisions on updating river basin management plans, in particular assessing whether measures to improve the quality of the water environment are affordable. Affordability was to be considered for each sector or group which may have to bear the costs.

As the decision to implement environmental measures can affect a large variety of economic agents, there is the issue of considering the affordability of measures across the sectors in a consistent and equitable manner.

7.2 Factors affecting affordability

A range of different factors may affect what is affordable to a sector and hence what indicators are used as part of an assessment of affordability. Examination of how affordability is assessed under other legislation, through the wider literature review and based on discussions with stakeholders, indicates that these factors include:

1. The ability to pass costs through which, in turn, depends on the structures of the industry and of the market. Industry structure relates to aspects such as the size and number of operators in the sectors, barriers to entry, technical characteristics of the installations and level of capital investment, etc. Market structure relates to the price elasticities of demand and competition between products. The greater the ability to pass costs through the more affordable the measure/policy is likely to be, and

2. The ability of the sector to absorb those costs which are not passed through without impacting performance, also known as resilience. The resilience of a sector or operator will depend on different factors, such as level of profits, level of assets and liabilities, return on investment, etc.

In addition to these, the ability to sequence investments in line with plant closures or over time as part of longer financial planning may be important for measures that entail significant capital investments. It should also be born in mind that differences between operators within a sector can be great and that there may need to be some consideration of these differences when making decisions on how measures are implemented in practice (e.g. as part of licencing decisions, grant funding and other policy mechanisms). This does not mean that poor performers should be able to use affordability as an excuse for not meeting their environmental responsibilities, however.

Table 7-1 summarises the key factors identified for the different sectors considered in this study.

Table 7-1: Factors affecting affordability			
Group	**Industry structure**	**Market structure**	**Other considerations**
Agriculture and rural land management	Large numbers of small firms undertaking a range of different productive activities having different economic values. Levels of economic performance can vary widely	Traditionally farmers are considered to be price takers with cost pass through limited	Measures may be linked to certain types of agricultural activity and some enterprises may be asked to undertake more than one measure. TIFF and FBI can vary significantly over time due to global commodity nature of agriculture and fluctuations in foreign exchange rates
Industry, services and other	Industry (manufacturing) is characterised by a large number of smaller companies. However, significant differences in size exist and these have a significant effect on statistical averages values. In addition, sub-sectors may vary considerably from the averages	Competition within the manufacturing sector will vary by sector but for many players there may be some but limited cost pass-through. The sector includes the thermal power sub-sector which has more inelastic demand but faces structural problems and heavy regulatory burden. Other operators may also currently face a heavy regulatory burden	Certain sub-sectors are likely to bear most of the costs, making it important to also consider how these vary from manufacturing as a whole Due to regulatory burden currently faced by some of the "heavy industry" sectors, timing of measures, particularly large capital investments, may be important to affordability
Water industry	Regulated structure comprising small number of large water and waste water companies, together with smaller water only companies	Possibility of cost pass through with increases in water bills to both household and other customers regulated by Ofwat.	Company level analysis recommended by ministerial guidance.
Government	Central allocation of budgets across Departments, with Departmental allocation of funding across competing activities/services	Funding of measures will be based on raising additional taxes, by allocating expenditure towards WFD rather than on alternative services/activities, or through continued borrowing.	Non-governmental organisations that are important in helping to deliver WFD measures rely on public sector funding to support their activities.

7.3 Proposed affordability indicators

The above factors were taken into account when establishing the indicators to act as the basis for the assessment of affordability for each sector. The end choice of indicators was informed by both the literature review and the types of indicators used in other contexts and proposed in relation to the WFD, and the availability of the supporting statistical data needed to undertake the analysis. Table 7-2 provides a summary of the affordability indicators that are adopted here for each of the different sectors. To ensure a consistent and even-handed approach, most of the affordability

indicators stem from accounting based concepts (see Annex 3 for a summary of the views of stakeholders on the indicators based on discussions from a Workshop held in November 2014).

Table 7-2: Proposed indicators of Affordability by aggregate sectors

Sector	Basis	Indicators	Other
Agriculture and rural land management	Industry level accounts and profitability, resilience and liquidity	• Total Income from Farming (TIFF) • Gross Value Added • Farm Business Income • Liabilities / Debt • Investment levels	• Cost-pass through • Past investment • Burden of other regulation • Subsidies
Industry, services and other (i.e. manufacturing and infrastructure)	Industry level accounts and profitability, resilience and liquidity	• Gross operating surplus • Gross investment / capital employed • Gross Value Added • Liabilities / Debt • Long term payments	• SME adjusted average versus average across all firms – with and without thermal energy generation • Past investment levels • Burden of other regulation
Water industry	Household accounts indicators of affordability	• Cost of measures as a % of household income • Water bill as a % of household income • Self-reported problems -> as acceptability of future water bills	• Non-affordability indicators related to water debt and water poverty – but outside scope of this study
Central government (and NGOs)	Total project public expenditure (budget) and Departmental expenditure limits	• Changes in government revenues • Changes in DEL to Defra & DECC • WFD related funding compared to costs of measures allocated to NPDBs	• Importance of funding to NGOs ability to assist in delivery of WFD objectives

The most important of these indicators are those that can be applied at the sectoral level, i.e. they provide an indication of affordability at an aggregate, national level of assessment. These are the most important indicators for decision-makers to take into account when considering the proposed updates of the River Basin Management Plans and any use of exemptions based on disproportionate expense. The indicators that operate at this level are highlighted in bold in Table 7-2.

A sectoral analysis does not capture the variation between the enterprises within a sector and the potential impacts on them. For this reason, a second stage of enterprise level analysis has been undertaken and decision makers may wish to take this into account. We suggest that policy decisions and implementation at an enterprise/measure level may require further analysis or procedures to take account of particular cases where affordability issues may arise.

This is most relevant for "agriculture and rural land management" and "industry, services and other manufacturing" (and in particular the thermal power sector). An enterprise level analysis carried out using the indicators highlighted in bold, plus the other indicators listed in Table 7-2, highlights that there may be cases where the proposed measures would give rise to affordability concerns. It is not

clear though how often such concerns may arise, based on the analysis carried out here. For example, one would expect that measures having high capital and/or operating costs would be required of larger operators rather than for the "average" enterprise; if this is the case, then affordability appears to be less of a concern. If multiple measures are required of an individual enterprise though, the cumulative costs of measures may give rise to concern. In such cases, the ability to pass costs on to customers may be important. Among those sectors investigated, affordability issues for industries such as the agriculture and the thermal power sectors are strongly affected by the limited ability to pass costs through to customers due to higher levels of competition.

In contrast the water industry has a greater ability to pass costs onto their consumers (subject to regulatory controls by Ofwat). Affordability, therefore, becomes a question for their customers, with the main customer group being households in England. It is for this reason that burden ratios linked to household disposable income are adopted here, as well as details of the acceptability of water bills to water company customers. Identifying an appropriate indicator for the public sector has been more difficult. The analysis has been constrained to consideration of Departmental expenditure limits as set by previous budgets and consideration of the level of funding provided by Defra to the EA and other bodies.

7.4 Outcomes of affordability analysis

The outputs of this study, the affordability indicators, are intended to complement the information on the draft programmes of measures presented for consultation by EA and NRW in the process of updating River Basin Management Plans. It was agreed, that the affordability indicators should be applied to the costs estimated for Scenario 4 of the EA's consultation documents. Table 7-3 shows the discounted costs of Scenario 4 as a percentage of the affordability indicators for each sector.

Table 7-3: Sectoral analysis – Costs of WFD measures under Scenario 4

Sectors	Agriculture and rural land management	Industry, services and other*	Water Industry	Government
Total PV costs (£m)	4,800	1,000	4,400	1,700
Equivalent annual value	180	40	165	63
Sectoral analysis				
Annual costs as a % of GVA (2013 GVA)	2.5%	0.5% to 1.5% (E&W)	Total national costs of WFD measures equate to 0.037% of average median household disposable income after housing costs for England.	n/a
Annual costs as a % of TIFF (2013 TIFF)	4.4%	n/a		n/a
Annual costs as a % of Gross operating surplus	n/a	1.5% to 3.1% (E&W)		n/a
Annual costs as a % of Gross investment	n/a	7% to 16% (E&W)		n/a
Defra budget as % 2013-14	n/a	n/a		3.2%
Annual costs as a % of Defra funding to EA 2012-13	n/a	n/a		8.3%
Annual costs as a % WFD related funding	n/a	n/a		74%

Source: PV costs based on EA, 2014
Notes: Based on statistics for manufacturing and industry, including the thermal energy sector.

As can be seen from Table 7-3, the costs of Scenario 4 equate to around 4.4% of Total Income from Farming (TIFF) for England, and around 2.5% of agriculture's contribution to the national economy in terms of gross value added. Although not all stakeholders were persuaded of the value of considering costs in relation to gross added value, it has been included in the analysis due to its relevance for understanding impacts on national economic output.

The figures for "industry, services and other" are based on statistics for the UK as a whole, although the great majority of the sector is in England so the derived indicator is approximately the same. The total annual equivalent costs associated with Scenario 4 would equate to around 1.5% of gross operating surplus across the industry and manufacturing sector and 3.1% for those sub-sectors most likely to implement measures. Turning to gross investment, the equivalent annual costs equate to 7% for the sector as a whole and 16% for those sub-sectors most likely to be affected. At both the sectoral and sub-sectoral level, costs are a relatively small proportion of total gross added value for the manufacturing activities of concern.

In terms of the costs of measures to the privatised water sector, these are assessed in terms of the burden that they would place on households as the key customer group. The assessment indicates that the costs of the measures would equate to around 0.037% of the average median household disposable income after housing costs, with there being some regional variation around this but rising as a maximum to 0.072%.

The proposed level of government expenditure would equate to around 3.2% of Defra's 2013/14 budget, and around 8.3% of Defra funding to the EA in 2012/13 (latest data readily available).

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Annex 1 Literature Review

A1.1 Affordability under Other EU Legislation

A1.1.1 Overview

Affordability as a concept is an element of other legislation that operates at the EU level. This includes for instance the Marine Strategy Framework Directive (MSFD), the Industrial Emissions Directive (and the IPPC Directive before that), and the REACH Regulation. It also includes other legislation such as the Biocidal Products Directive, but how such assessments are to be carried out in the future has not yet been determined.

Although the specific terminology is slightly different in these other legislative contexts, the issues are similar. For this reason, the approaches that apply under the IPPC Directive and the REACH Regulation are reviewed here as they are the best defined. In addition, this legislation may apply to some of the same sectors as required to take action under the WFD.

A1.1.2 Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control)

The Industrial Emissions Directive proposes the use of the Best Available Technology (BAT) without entailing disproportionate costs, which in reality, is interpreted as due consideration of both the costs and benefits (Frost, 2009). In order to determine the most appropriate BAT, both the financial strength of a particular industry and BAT candidates should be assessed. Quantitative and qualitative information to determine financial stability includes general and economic information such as the number and size of companies, yearly turnover values and the applicable regulations and legislation (Daddi et al., 2013). Competitiveness of companies within the sector is assessed, e.g. using Porter's Five Forces (see discussion below on the REACH Regulation). A comprehensive assessment of candidate BAT follows a stepwise methodology including the technical viability of the BAT, qualitative or quantitative assessment of environmental performance and then economic viability in terms of cost-effectiveness and cost feasibility (Daddi et al., 2013). Daddi et al. (2013) report that data availability, particularly quantitative data which includes financial, environmental performance, investments and operating costs, is often lacking making it difficult or impossible to verify the economic viability of techniques at the sectoral level.

The preceding IPPC Directive also required that industrial installations applied BAT where this included consideration of the use of a technique under economically and technically viable conditions. Disproportionately also played a role in setting the emission levels associated with BAT. Indeed, the Directive noted, *where the application of emission levels associated with the best available techniques would lead to disproportionately high costs compared to the environmental benefits, competent authorities should be able to set emission limit values deviating from those levels.*

The Directive did not mention affordability although some of the Reference Document on the Best Available Techniques (BREF) made explicit mention of it (and an affordability test). The Reference Document on Economics and Cross-Media Effects (CEC, 2006[36]) notes:

> *the cost per unit of product may be useful for assessing the affordability of the technique in comparison with the market price for the goods produced. The cost per unit can be calculated from the annual cost divided by the best estimate of the yearly average production rate during the period being considered*

The report sets out a framework which allows the economic viability assessment of BAT for a specific industry, depicted in the following figure. This process is described in more detail in **Error! Reference source not found.**.

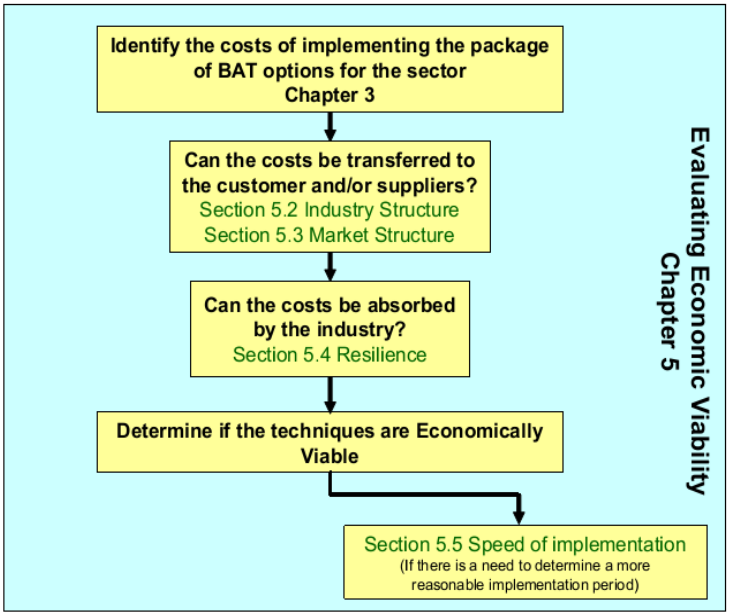

Figure A8-1: Evaluating economic viability of BAT

A1.1.3 Registration, Evaluation, Authorisation and restriction of Chemicals – the REACH Regulation

REACH is a European Union regulation concerning the Registration, Evaluation, Authorisation and restriction of Chemicals. It came into force on 1 June 2007 and replaced a number of European Directives and Regulations with a single system.

REACH has several aims, which include the following:

[36] European Commission (2006): Integrated Pollution Prevention and Control. Reference Document on Economics and Cross-Media Effects. Available on http://eippcb.jrc.ec.europa.eu/reference/BREF/ecm_bref_0706.pdf

- To provide a high level of protection of human health and the environment from the use of chemicals;
- To make the people who place chemicals on the market responsible for understanding and managing the risks associated with their use; and
- To enhance innovation in and the competitiveness of the EU chemicals industry.

Some substances have hazards that could pose significant risks to health and the environment depending on the extent of exposures to them (e.g. they cause cancer (carcinogenic), or they have other harmful properties and remain in the environment for a long time (persistent) and gradually build up in animals (bioaccumulative)). These are referred to in REACH as substances of very high concern[37]. Under the Regulation, there are two procedures for managing the risks associated with such chemicals: Authorisation and Restrictions.

[37] HSE (nd) REACH – Substances of Very High Concern. Available at http://www.hse.gov.uk/reach/resources/svhc.pdf

Table A1-1: Components for assessing economic viability of BAT	
Component	**Sub-component**
Industry structure	**Size and number of plants in the sector** - Different sized plants can react differently to the implementation of BAT - larger plants can deliver economies of scale, but capital costs for equipment will generally be high and there are usually long lead times for the replacement of equipment. Replacements for smaller sized plants and equipment may be less capital intensive, but payback times for equipment may be just as long as those of larger plants. **Technical characteristics of installations** - The infrastructure that already exists at installations will have some influence on the type of BAT that can be installed and may also influence the cost of installing that BAT. **Equipment lifetime** - Some industries have long plant and equipment lifetimes, while in other industries, routine wear and tear and process innovations require items of equipment to be replaced more frequently. For some industry sectors, the economic lifetime is the determining factor for investment cycles. **Barriers to entry or exit of the sector –** If there are barriers that prevent the entry of new players to the market (such as high equipment or licensing costs), or there are barriers that prevent players leaving the market (exit barriers such as low liquidation returns on specialist assets etc.), then these might be an issue that needs to be considered in the assessment.
Market structure	**Extent of the market** - It may determine the power that the customer has over the price of the commodity. In a local market, the customer might rely on the producer and may have limited control over the price. This will be less so in a 'global market', where prices are determined on the open market and European operators need to remain competitive against producers from outside Europe. **Elasticity in price** - There may be an option of passing the costs on to the customer. Price elasticity is the term used by economists to describe how sensitive customers are to changes in price. **Competition between products** - In a sector where there is little or no differentiation between the commodity that is supplied by a large number of producers then competition is fierce. This might be the situation in industries such as metals, bulk chemicals, cement and power supply, where individual operators have little flexibility for setting or increasing prices.
Resilience	Describes the sector's ability to absorb the increased costs of implementing BAT, while ensuring that it remains viable in the short-, medium- and long-term. When describing the resilience of a sector, the consideration of longer-term trends (5-10 years) is more useful. There are different financial ratios that can be used to assess resilience describing the **liquidity, the solvency and the profitability.** The **liquidity** describes the ability of an operator to pay off its immediate liabilities and can be measured using the current ratios and/or the quick ratio. The 'current ratio' and 'quick ratio' are similar, but because stock can sometimes be difficult to liquidate (cash, reserves, accounts receivable and bonds are easier to liquidate), the quick ratio excludes the stock. $\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$ $\text{Quick ratio} = \frac{\text{Current assets (excluding stock)}}{\text{Current liabilities}}$ where: Current assets: those assets that are easily converted into cash (e.g. bonds, funds, accounts receivable, etc.); items such as equipment are not sold off so easily and are classified as long-term or noncurrent assets. Current liabilities: those that have to be paid within 12 months, (e.g. accounts payable to suppliers, wages, taxes, etc.).

Table A1-1: Components for assessing economic viability of BAT	
Component	**Sub-component**
	Solvency - The ability of an operator to fulfil its obligations in the long term. The higher the solvency, the less risk will be perceived by investors and the healthier the company will appear. Interest coverage is another useful measure of solvency. The higher the interest coverage, then the healthier the company looks. Healthier companies are more able to fund environmental investments. $\text{Solvency} = \frac{\text{Equity capital}}{\text{Total liabilities}}$ $\text{Interest coverage} = \frac{\text{Operating profit}}{\text{Financial costs}}$ where: Equity capital: the total value of the assets of the company (i.e. the capital that could be raised by selling everything off). Total liabilities: debts and outstanding financial obligations that the company has. Operating profit: a measure of the company's earning power from on-going operations. It is the company's earnings before deduction of interest payments and taxes. Financial costs: outgoing funds to cover loans and interest payments, or the cost of borrowing. **Profitability** - If profit margins are high, the sector can be considered to be resilient and operators are in a better position to absorb the costs of implementing BAT. $\text{Gross profit margin} = \frac{\text{Gross profit x 100}}{\text{Sales}}$ $\text{Net profit margin} = \frac{\text{Net profit before interest and taxation x 100}}{\text{Sales}}$ $\text{Return on capital employed (ROCE)} = \frac{\text{Net profit before interest and taxation x 100}}{\text{Share price + reserves + long term loans}}$ $\text{Return on assets (ROA)} = \frac{\text{Net profit before interest and taxation x 100}}{\text{Total assets}}$ where: Gross profit: sometimes called 'gross income' is the value of the pre-tax net sales minus the cost of the goods and services sold. Sales: revenue from sales. Net profit before interest and taxation: made up from income (gross sales) minus depreciation and other expenses incurred in running the business (e.g. operating costs, heating, lighting, telephones, insurance, etc.). ROCE measure of the effectiveness with which the funds have been deployed and if this ratio is greater than the cost of capital for this company, then it is a good indicator that the business is viable in the long term.
Speed of implementation	Immediate upgrades can be difficult to plan for and may cause difficulties for industry if there is no opportunity to harmonise the upgrade with existing business planning and investment cycles. Techniques that require a significant capital investment or significant plant and infrastructure changes will, of course, need more time. The marginal costs of implementation will have to be considered as well as whether it is an old or a new industry.

Under both of these procedures, socio-economic analysis is used to examine whether the benefits of continued use of the substance of very high concern outweigh the risks to human health or the environment from on-going exposures. A key component of such analyses can be arguments concerning the "affordability" or any loss in the use of the substance to industry (manufacturers and/or downstream users). The European Chemicals Agency together with the European Commission has therefore developed guidance for use by Competent Authorities and the chemicals producing and using sectors on how to assess such issues.

These assessments consider:

- Competition and competitiveness;
- Profitability; and
- Resilience.

This approach is clearly similar to that applied when assessing the viability of BAT, as described in Table A1-1. However, the REACH guidelines provide a greater discussion on the context surrounding the use of the different indicators, and is summarised below for this reason.

Competition and competitiveness

In general, competition and competitiveness impacts are considered to be most important for those products which are traded globally. However, within the context of the WFD and England, it may also be important for products that are traded within the EU, if the loss of competitiveness for English firms is a concern. Considerations include impacts on investment flows, the number of competing firms within a market and their geographic spread, and the sensitivity of price to demand for the product (price elasticity of demand).

In a sector where there is little or no differentiation between the products that are supplied by a large number of actors, then there will be little opportunity for one actor to pass on any additional costs to downstream customers. Alternatively, if a sector is characterised by more specialist products, and where there is an opportunity to differentiate one manufacturer's product from that of the competition's, then there may be more flexibility on the price. Information that may be relevant to assessing the level of competition includes:

- Number of competitors in the market;
- Market share of competitors;
- Rate of growth in the industry;
- Exit barriers – i.e. costs to leave the industry;
- Diversity of competitors – is this the only substance they make/sell?
- Product differentiation; and
- Cost of manufacturing per unit (alternatively the cost of value added).

Strong rivalry in a sector (i.e. between competing manufacturers, or competition within each downstream user market) is likely to result in strong competition on price and may possibly constrain profit margins and, therefore, the sector's ability to absorb or to pass on any costs of the proposed restriction. The concentration, or number of players in the market, can indicate the level of rivalry in the sector. Similarly, if there are high exit barriers (i.e. high shutdown costs) then these factors are likely to lead to strong rivalry within a sector.

Profitability

The guidance also indicates that where changes in the profitability of companies in the market can be described, this should be considered. This assessment is to be based on the use of data gathered on the level of competition and possible price sensitivity of demand to make an informed judgement on whether additional costs at any part of the supply chain will be passed on further down the chain.

There may be an option to pass any additional costs (e.g. additional cost of the alternative) on to downstream users and the end product customer. Price elasticity is the term used to describe how sensitive downstream users and the end product customers are to changes in the manufacturer's price. If inelastic prices are a characteristic of that industry sector, then it can be relatively easy to pass on the costs to downstream users and the end product customer. When the price is elastic, it is difficult to pass on the costs to downstream users and the end product customer so the manufacturer/importer may have to bear the brunt of any increase in costs. It will be important to consider the elasticity of the product along the whole supply chain and what impact this could have on the long term viability of the industry.

Resilience

'Resilience' describes a company or sector's ability to absorb any increase in costs, while ensuring that it remains viable in the short-, medium- and long-term. In order to ensure this viability, economic operators will need to be able to generate sufficient financial returns on an on-going basis to be able to invest in, for example, process development, product development, new equipment, etc. Any increased costs associated with environmental compliance will either need to be absorbed by the company/sector or passed on to the customer.

In terms of the assessment of resilience, the guidance recommends the use of a number of financial indicators and ratios, and it is suggested that these are calculated for a representative firm within a sector or as an industry average (with the uncertainties associated with the use of such an average indicated). Key indicators include:

- Current assets and current liabilities;
- Equity capital and total liabilities;
- Operating profit and financial costs;
- Gross profit and sales;
- Net profit after tax; and
- Share capital, reserves and long term loans.

If this information is not available, the REACH guidance suggests that industry averages are used for profitability, liquidity and solvency.

However, caution is also noted with respect to the use of such data ratios. The key issues relevant to this study are that:

1. Although it may be possible to gain an understanding of the overall profitability of the firm, data may not necessarily reflect the performance of an individual product that they produce;

2. It will be necessary to obtain a series of profitability data (i.e. data over at least a 5 year period) as some industries profitability can vary significantly in different market conditions. One year's profitability in most cases cannot be used as a representative year for future

years. Similarly, trends in profitability based on past years performance may not necessarily give a true representative of future conditions faced by these industries in the future, especially under the new conditions of the proposed restriction; and

3. When describing the resilience of a sector, the consideration of longer-term trends (5-10 years) is useful to ensure that short-term fluctuations are not allowed to distort the understanding of the long term resilience of the sector.

As for the IED, liquidity and solvency are key measures. Liquidity is a short-term measure of the health of a company and describes the company's ability to pay off its immediate liabilities (see also **Error! Reference source not found.** regarding the approaches used under the IED). Solvency of a company describes the company's ability to fulfil its obligations in the longer term. Solvency is when a firm's assets exceed its external debt (liabilities). Therefore the firm has a good financial basis or stability and, as such, solvency is a good measure for the overall well-being of the company. If external debts are greater than the asset values, a state of insolvency exists.

However, the guidance also notes that companies with higher profit margins and overall profits will find it easier to absorb any increase in production costs, but a business that is both solvent and liquid will not necessarily be profitable. A simple definition of profit is revenue after costs have been deducted.

More importantly profit can also indicate the return on capital invested i.e. it compensates the owner of the capital for the loss of the capital for any other potential use. This is usually a good basis for investors to determine whether the return on their investment will yield an adequate return relative to the solvency risk of the company as well as alternative investments elsewhere including risk-free investments. There are various measures of profitability.

The ROCE is the percentage of return the firm is able to generate on its long-term capital employed in the business. It is also sometimes used as a measure of efficiency. A firm's ROCE allows investors to judge the financial effectiveness of the company action and possibly be used for growth forecasts. A high ROCE indicates that a significant proportion of profits can be invested back into the company for the benefit of shareholders. The reinvested capital is employed again at a higher rate of return, which helps to produce higher earnings-per-share growth. A high ROCE is, therefore, a sign of a successful growth company. If the ROCE is lower than the rate of a risk-free investment such as a fixed savings account, then the firm may be better off closing down.

Consistency is a key factor of performance. Sudden changes in the ROCE could indicate a loss of competitiveness in the market or that more assets are held as cash. There are no firm benchmarks because ROCE can be low during periods of recession, but as a very general rule of thumb, ROCE should be at least double the current interest rate. An ROCE any lower than this suggests that a company is making poor use of its capital resources.

A1.2 Approaches to affordability for agriculture

A1.2.1 Overview

Although there are studies which focus specifically on the impacts of WFD on farming, in general there is a lack of peer reviewed literature investigating the affordability of the costs of measures to

farms in the context of water management. Studies related to the WFD generally examine impacts at the farm level, according to the type and size of farm.

Most of the relevant research to assessing affordability, including the grey literature, has focused on measuring resource productivity for the agricultural sector, including Defra special studies in agricultural economics, in a more general context. There are also statistics produced at the national and regional level on farms' performance, as well as various accounting indicators, that could be used for assessing affordability.

A1.2.2 Farm business statistics

There is a series of statistics on the economics of agriculture across the UK. One of the key sources of agricultural statistics is the Farm Business Survey (FBS). The FBS provides information on the physical and economic performance of farm businesses in England, to inform policy decisions on matters affecting farm businesses. It is intended to serve the needs of government, government partners, farming and land management interest groups, and researchers. The FBS is an annual survey and uses a sample of farms that is representative of the national population of farms in terms of farm type, farm size and regional location. In addition, the farm business benchmarking site provides a resource for farmers to estimate their performance against estimates generated by farm account data.

There are three main measures of farm income that come from the FBS:

- Farm business income (FBI): (sometimes referred to as Farm Business Profit) is total farm gross margin less the sum of the fixed costs incurred, before any charges for unpaid labour or notional rent on owner occupied land;
- Net farm income: it is the FBI after adding back interest (net of any interest received) and ownership charges, minus unpaid manual labour costs and the emoluments of the principal director(s), rental value and income from separable diversified activities; and
- Cash income: is revenue less expenditure. The costs exclude any imputed costs and depreciation charges. Cash income also excludes valuation changes. These can be very significant, particularly on livestock farms. It is equivalent to FBI, gross of valuation changes and depreciation, and net of any profit/loss on sale of assets. As cash income excludes depreciation, it is the widest measure of income and, compared to the other income measures provides a better indication of the short term income position.

As can be seen from Tables A1-2 and A1-3 below, FBI varies significantly across the different farm types. In the 2012/2013 financial year, it varied from a low of £16.5k for lowland livestock grazing to a high of £94k for specialist cropping, closely followed by £91.5k for general cropping.

Table A1-2: Farm Business Income (£/farm) Time Series by Farm Type, England In real terms 2012/13 prices (red colour indicates below average whereas green colour indicates above average figure)

Type	2009/10	2010/11	2011/12	2011/12	2012/13
Cereals	48,000	92,500	98,000	97,000	68,000
General cropping	76,000	121,500	104,500	104,000	91,500
Dairy	67,500	72,000	89,500	89,500	51,500
Grazing livestock (Lowland)	33,000	23,500	33,000	33,000	16,500
Grazing livestock	29,500	23,500	30,000	30,000	19,500

Table A1-2: Farm Business Income (£/farm) Time Series by Farm Type, England In real terms 2012/13 prices (red colour indicates below average whereas green colour indicates above average figure)					
Type	**2009/10**	**2010/11**	**2011/12**	**2011/12**	**2012/13**
(LFA)					
Specialist pigs	86,000	48,500	39,500	39,500	41,000
Specialist poultry	82,500	74,000	42,500	48,000	94,000
Mixed	37,500	55,500	68,500	76,500	38,000
Horticulture	76,000	52,000	57,500	55,000	30,000
All types	**50,000**	**62,500**	**68,500**	**68,500**	**46,500**
Notes: From 2009, farm type classification changed from 'standard gross margins' (SGM) typology to standard outputs (SO) typology. From 2011, there is a revised weighting framework separating specialist poultry meat from specialist poultry layers. Source: Defra (2014): FB, available at: https://www.gov.uk/government/collections/farm-business-survey#documents					

Table A1-3: Net Farm income (£/farm) by Farm Type, England (in real terms 2012/13 prices)					
Type	**2009/10**	**2010/11**	**2011/12**	**2011/12**	**2012/13**
Cereals	31,000	75,000	81,000	80,500	49,500
General cropping	56,500	100,000	83,500	83,000	73,000
Dairy	49,000	54,000	72,500	72,500	34,500
Grazing livestock (Lowland)	22,000	12,500	23,000	23,000	6,500
Grazing livestock (LFA)	20,500	14,500	22,500	22,500	11,000
Specialist pigs	84,500	44,500	36,500	36,500	41,000
Specialist poultry	82,500	73,500	46,500	56,000	109,000
Mixed	22,000	41,000	52,500	61,000	21,500
Horticulture	74,000	50,500	57,000	54,000	30,500
All types	**37,000**	**49,000**	**55,000**	**55,500**	**34,000**
Notes: From 2009, farm type classification changed from 'standard gross margins' (SGM) typology to standard outputs (SO) typology. From 2011, there is a revised weighting framework separating specialist poultry meat from specialist poultry layers. Source: Defra (2014): FB, available at: https://www.gov.uk/government/collections/farm-business-survey#documents					

In addition, one of the recent balance sheets released by Defra (Defra, 2014) reports on the profitability and resilience of farms in England based on the result of the latest FBS and uses the indicators[38] given in Table A1-4. The balance sheet is based on a sample of around 1,900 farm businesses covering all regions of England and all types of farming with the data being collected by face to face interview with the farmer. Results are weighted to represent the whole population of farm businesses that have at least €25k of standard output as recorded in the annual June Survey of Agriculture and Horticulture. In 2012, there were just over 56,000 farm businesses meeting this criterion.

[38] Note that in the release they are called indicative measures but the word measure is avoided here to avoid confusion with RPMP measures.

Table A1-4: Indicators of profitability and resilience of farms	
Indicator[1]	**Description**
Liabilities	A measure of indebtedness. Liabilities are the total debt (short and long term) of the farm business including mortgages, long term loans and monies owed for hire purchase, leasing and overdrafts. High levels of liabilities will require consistent income flows to ensure that interest on borrowing can be paid.
Net worth	A measure of wealth. Net worth subtracts the value of total liabilities from total assets, including tenant type capital and land. This represents the wealth of a farm if all of their liabilities were called in. Businesses with a high net worth are likely to be resilient, at least in the short term to fluctuations in their income. This is because they can draw on these reserves to support the business if the financial position of the farm deteriorates.
Gearing ratio	A general term describing a financial ratio that compares some form of owner's equity (or capital) to borrowed funds (Gearing Ratio = [Liabilities / Net Worth]*100). Gearing is a measure of financial leverage, demonstrating the degree to which a firm's activities are funded by owner's funds versus creditor's funds. It is used to explore investment habits and the potential risk associated with farming enterprises. The gearing ratio provides a measure of the long term financial viability of a farm. A lower ratio (less than 50%) is generally seen as more acceptable because this suggests that the farm business is more likely to be able to meet its investment needs from earnings.
Liquidity	'Liquidity' is a measure of the short term financial viability of farms. A large proportion of the assets on a farm, such as land or machinery, will typically have a monetary value that is difficult or costly to realise in the short term. The liquidity ratio provides an indication of the ability of a farm to finance its immediate financial demands from its current assets, such as cash, savings or stock. If the liquidity ratio is equal to or above 100%, then a farm is able to meet its current liabilities using current assets. If the ratio is less than 100%, then a farm is unable to meet its immediate financial demands using current assets
Net interest payments as a proportion of Farm Business Income	This measure provides an indication as to whether farms can afford to pay the interest on their debts
Return on Capital Employed (ROCE)	Provides an indication of productivity and efficiency. ROCE provides a more holistic view than profit margins, focusing on efficient use of capital and low costs and allowing an equal comparison across farms of differing sizes. It is calculated as economic profit divided by capital employed.
Source: Defra (2014) Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/328852/-fbs-balancesheetanalysis-10jul14.pdf. The data used is from farms present in the Farm Business Survey (FBS) for 2010/11 to 2012/13	

A1.2.3 Farming based indicators

The report by Rural Business Research (Wilson et al, 2012) indicated that high, improving and top farm businesses are typically characterised by a series of physical factors, (e.g. larger farm size), financial factors (e.g. high net worth and low borrowings) and managerial attitudes and drivers (e.g. attention to detail, focusing upon margins and cost control). The report reviews a number of documents focusing on technical efficiency and levels of debt as good indicators of farms' profitability. Technical efficiency is defined as the efficiency with which inputs are utilised to produce outputs. The report also uses a number of indicators of high performance such as:

- Farm Business Income per ha (FBI/ha) as an indication of high performing businesses;

- Farm Business Performance Ratio = Farm Business Outputs / (Farm Business Costs +unpaid labour); and
- Agricultural Output: Agricultural Input Ratio = Output from agriculture / (agriculture input costs + agriculture unpaid labour).

Other indicators described in the literature include Total Factor Productivity (defined as Gross output per £100 input), Net Farm Income, output per farm and output per unit area. Zahm et al (2008) reports on sustainability indicators for French farming, using the IDEA method (Indicateurs de Durabilité des Exploitations Agricolesor Farm Sustainability Indicators). The method is based on research work conducted since 1998 and is based on 41 sustainability indicators covering the three dimensions of sustainability; agro-ecological sustainability, socio-territorial sustainability scale and economic sustainability.

With regard to the economic sustainability of farms, six indicators are proposed, as set out in Table A1-5.

Table A1-5: Indicators of economic sustainability

Components	Indicators	Maximum values for each	
		Indicator	Component
Economic viability	Available income per worker compared with the national legal minimum wage	20	30 units
	Economic specialization rate	10	
Independence	Financial autonomy	15	25 units
	Reliance on direct subsidies from CAP and indirect economic impact of milk and sugar quotas	10	
Transferability	Total assets minus lands value by non-salaried worker unit	20	20 units
Efficiency	Operating expenses as a proportion of total production value	25	25 units
Total		**100**	**100**

The study notes that the indicator giving the best overall picture of economic sustainability is the efficiency indicator, which shows the capacity of the farm to develop its own production autonomy. The ratio between the value of total inputs and the gross production value (excluding subsidies) shows the ability of the production system to generate production value from its own resources without excessive reliance on agrochemical or fodder inputs. Each indicator is given a score and to get the overall sustainability score the lowest value of the three scales is taken as the final numerical sustainability value.

The method is designed as a self-assessment tool not only for farmers but also for policy makers to support sustainable agriculture where the farm is scored on the different indicator. The IDEA method revealed highly variable sustainability scores; in a sample of more than 1,500 farms, the sustainability scores varied from 25 to 67. The study thus concluded that the IDEA method could be used for comparisons between farms which share the type of production and similar local contexts but is less useful for comparisons across farm types and in different locations and geo conditions.

UK farmers are also advised on how to make better use of their annual accounts and assess different plans in a series of booklets published by Defra and SEERAD. The first, 'Using the Farm Accounts to

Point the Way' explains how to make use of the farm's profit and loss account and the balance sheet to assess business performance and viability. The document provides farmers and others with a better understanding of how financial accounts can be converted into management accounts. The booklet sets out net profit as the main financial indicator.

The second booklet, 'Mapping Out a Farming Future' (Defra, 2004) explains how possible changes to the farm business are assessed so that plans are made on as sound a basis as possible. It sets out a process of objective setting through to setting out the options to assessing the potential for extra revenues and potential reduction in costs from the different options, as well as impacts on cash flows. Although the booklet includes aspects of viability and risk (e.g. lower prices or poor harvest yield), it does not include thresholds to assess whether the plan is viable.

A1.2.4 WFD specific studies

The report by Broekx and De Nocker (2011) is specific to the WFD and uses an indicator approach for determining the affordability of measures, where this is based on three sets of thresholds, as set out in Table A1-6.

Table A1-6: Indicators for affordability in agriculture

Indicator	Affordable	Intermediate	Not affordable
% added value net farm income (REF)	< 2%	2% - 50%	> 50%
% added value family labour income (RTT)	< 2%	2% - 50%	> 50%
income > reference-income	yes	no	no

Net farm income (REF – Revenu du travail et du capital de l'exploitant) equals the difference between the total revenues and costs. A compensation for family labour and capital is not included as a cost.
The family labour income (RTT – Revenu du travail) equals net farm income, reduced with a compensation for the manager's entrepreneurship (capital investment).
It is assumed for the family labour income that the entire capital for land, machinery, infrastructure is borrowed and interest payments are made. The family labour income per annual working unit can be contrasted with the gross wage of a full time employed worker in another sector, the so called comparable reference income.

The approach is based on the use of an added value criterion and compares the annual cost of the measures to be financed against total family labour income and total net farm income. To check the reference income criterion, the authors compare the average family labour income per annual work unit of the agricultural sector with the average gross income of people in the Walloon Region. In addition, they take into account the negotiating position, or potential for cost pass through, between the farmer and suppliers and/or customers. In general, the report notes that farmers in Belgium are price takers and additional costs cannot be shifted to suppliers or customers. Consequently, the farmer has to invest in additional environmental measures at the expense of income and added value. A key problem with this approach is the wide range for the intermediate criterion, when the decision will have to be subjective. In addition, it is unclear whether all three indicators have to be met to pass the affordability criteria.

At the EU level, the WADI project studied the sustainability of irrigated agriculture in Europe in the context of post-Agenda 2000 CAP Reform and the WFD (Berbel Vecino and Gutierrez Martin, 2004).

The study used indicators of the economic viability of farming to assess the possible effects of different water policies on farm income, where this was used as the indicator of the "sustainability" of water price changes due to policy implementation (and different levels of costs recovery), as well as changes in cropped area and cropping patterns. The indicators included: farm income; farm contribution to GDP; and public support as defined in Table A1-7.

Table A1-7: Economic viability of farms under reform to the CAP and WFD

Indicator	Definition
Farm income	The difference between the value of gross output and all expenses, including depreciation at the farm level from agricultural activities. It is designed to measure the financial viability of farming. If financial returns are consistently negative, then any farming system will be unsustainable. In order to understand the sustainability of agriculture in the medium/long-term, net profit has been adopted, by subtracting rent, depreciation and farm household labour.
Farm contribution to GDP	It has been estimated as the value added produced at farm level i.e. the difference between total revenue and intermediate consumption. Thus it is a measure of the contribution of the farm to economic wealth, and it also takes account of items that are subtracted as costs when we consider farm income only.
Farm support	Farm support is a measure taken into account as a contextual indicator provided it is related to agricultural-environmental policies. It measures the net support accorded to agriculture, and is important from two points of view. Firstly, the public decision-maker needs to know the amount of funding to farming and how this funding is going to change over time. Secondly, there is the question of equity, in the degree of support to farming.
Source: Berbel Vecino J and Gutierrez Martin C (2004): Sustainability of European Irrigated Agriculture under Water Framework Directive and Agenda 2000, available at http://www.lu.lv/materiali/biblioteka/es/pilnieteksti/vide/Sustainability%20of%20European%20Irrigated%20Agriculture%20under%20Water%20Framework%20Directive%20and%20Agenda%202000.pdf	

The study highlights the fact that the marginal value of water varies amongst the farming systems, according to crop response to irrigation (in terms of the value of increased yield and quality), crop mix, and the underlying profitability of crops as determined by financial net margins. Net margins are especially sensitive to the fixed costs of labour and machinery at farm level.

Within previous work completed by RPA for the Environment Agency on Poole Harbour (unpublished) the question of affordability was considered in relation to farming and nutrient management. In this study affordability included consideration of:

- Contribution to the problem (through source apportionment) compared with contribution to the solution
- Cost compared with profitability: this indicator considered net farm business income for cereal farms, dairy farms, grazing livestock, and an average for all farms for each region. In previous work done by RPA the cost was considered to be divided equally over the number of farms in the region. If the net farm income is taken as profit then the percentage of profits accounted for by the increase in costs would provide an indication of affordability
- Cost compared with ability to pass costs on: farmers have limited ability to pass costs on to their customers and as such it is likely that they will have to absorb much of the costs within their business, affecting their profitability, and
- Scale of improvement and measures that have already been taken: Farmers have been encouraged to reduce nitrogen use and reduce nitrate leaching for many years through programmes such as agri-environment schemes. This may mean that some farmers are

already undertaking actions which will be covered by the WFD measures therefore it would seem fair that these farmers need to do less than those who have not changed their management to include these measures.

A1.2.5 WFD impact studies

Bateman et al (2006) investigated the impacts of the WFD on agricultural practices (as well as the distribution of benefits) as part of the Catchment Hydrology, Resources, Economics and Management (ChREAM) project[39], funded under the RELU programme. The study used the Humber basin as the study area on the basis of the high level of diffuse pollution from farming and the mix of farm types. In addition to economic and hydrological modelling, it used a survey method to convey farmers' attitudes towards measures to reduce pollution. In the Derwent catchment, the model predicted that a 40% rise in fertiliser tax would encourage only a small shift from fertiliser-intensive crops, such as wheat and oilseed rape, to less intensive crops such as barley and other cereals. This would be accompanied by a general expansion of lowland grassland areas, with attendant increase in livestock, primarily dairy and beef cattle. Such changes in fertiliser use would lead to only modest water quality improvements in this particular catchment. The SLIMMER model was used to examine the impact upon agricultural land use of four scenarios applied over the full extent of the Humber catchment:

i. Imposing a £50 per tonne fertiliser tax;
ii. Convert 20% of farm land to set aside;
iii. Implementation of an Environmentally Sensitive Area (ESA) scheme; and
iv. An increase of 1^{o}C in mean annual air temperature.

All scenarios except (i), which gave negligible benefits throughout, showed considerable spatial variability in their effectiveness at reducing nitrate concentrations. Scenario (ii) offered improvement in some smaller catchments, but resulted in an increase in nitrate concentration at some of the northern sites where concentrations are currently low. Scenario (iii) offered more substantial benefits, especially in the western and northern headwaters of the Humber, but was least effective in the most urbanised catchments. The effects of Scenario (iv) differed dramatically across the Humber region, in terms of the impact on land use and consequences for nitrate concentrations. Although a general reduction in nitrate concentrations was suggested, some areas, particularly in the uplands, were likely to see a marked increase.

The study notes that variation in the physical environment and agri-economic context implies that WFD implementation will involve spatially differentiated responses from farmers and land managers. For example, contrasting soil types, topography, rainfall, etc. could mean that the impacts of a given land use upon water quality will differ radically by location.

Fezzi et al (2008) also highlights the importance of the variability of farm type together with the environmental context to assessing the costs of WFD implementation in the UK, since this might

[39] CSERGE (2012): Catchment Hydrology, Resources, Economic and Management (chREAM): Integrated Modelling of WFD Impacts upon Rural Land Use and Farm Incomes, accessed at http://www.cserge.ac.uk/sites/default/files/110616%20-%20ChREAM%20Project%20Report%20-%20Revised.pdf

involve differentiated responses from farmers and land managers. This diversity is addressed in the study, which is based on a large dataset of more than 2,000 individual farms derived from the FBS to derive farm-specific estimates of the impact upon farm incomes of possible WFD measures. The study adopts a farm accounts approach with the emphasis on the variability of the economic impacts across the range of farm types and locations. The study however does not assess the impact of certain micro-level policies (e.g. fencing exposed waterways) nor does it include long-run considerations, and possible switches between different land uses but only changes in land use intensity. The report focuses on the economic impacts of four potential measures:

a. reducing inorganic fertilizer application;
b. converting arable land to ungrazed grassland;
c. reducing livestock stocking rates; and
d. reducing livestock dietary N and P intakes.

The analysis focuses on farm gross margin (FGM), defined as the difference between revenues arising from the different activities undertaken within the farm and variable costs. The results of the study are shown in Table A1-8 by type of measure. A reduction in fertilizer input of 20% generates an average decrease in FGM of £4,000 per farm, reducing mean FGM to £58,900. However, the variability of the impacts, shown by the percentiles in the last three columns, is substantial. For example, still considering a 20% cut in fertilizer application, about one-tenth of farms are estimated to face FGM losses in excess of £10,500 per annum. These are typically large dairy and livestock farms (see figure below), since their output is strongly associated with grass production and associated fertilizer inputs.

Table A1-8: Change in FGM (1000 £) and post-policy expected FGM (in parentheses) associated with each measure, in all farms

Measure	Mean	Median	10 percentile	90 percentile
20% Fertilizer reduction	-4 (58.9)	-1.8 (28.3)	-10.5	0.2
Change in the diet	-3.1 (59.8)	0 (29.4)	-6.7	0
20% Livestock reduction	-4.1 (58.7)	-1.1 (28.3)	-12.7	0
20% Switch to grass	-4.0 (58.8)	0 (28.5)	-10.9	0

The study reports that dairy farms produce, on average, FGM/ha values which are roughly twice that of cropping farms. Grazing livestock farms are typically characterised by the lowest FGM/ha and profits. However, there is large variation between farms within the same group. The impacts per ha of the different measures vary significantly across type of farms, as shown in the next figure, with a reduction in livestock having the greatest impact on dairy farms in terms of FGM/ha followed by fertilizer reduction. For cropping farms, switching to grass will have the greatest impact per ha in FGM.

A1.2.6 Conclusions on potential indicators of affordability

The literature highlights the differences in income and in performance across other indicators among farm types and within the same farm type. This suggests that although a general framework may apply across farms, it may also be important to consider such differences later in implementation policy development. It is also clear though that many of the thresholds suggested in the literature are only of value at the individual farm level and could not be readily applied at the sectoral level.

Based on the above discussion, it would appear that the most relevant indicators are TIFF and Farm Business Income. This is for three main reasons:

- It most closely aligned to 'profit' as measure that will also be relevant to other economic sectors;
- It is the most widely quoted and used measure within the farming sector and in the available literature so will be readily understood and accepted by stakeholders; and
- It is the main measure used in agricultural analyses, so the data are readily available and there is more information on how to interpret changes in values, etc.

Caution is needed, however, due to variability between sectors, between farms and on a year to year basis. Moreover, as the literature has also revealed, different WFD related measures will have varying impacts, linked to the level of uptake.

A1.3 Approaches to affordability for industry and manufacturing sector

A1.3.1 Introduction

There have been few attempts in the UK to develop methodologies to assess the disproportionate costs of measures proposed under the WFD in the UK. One of the earliest of these is *CEA and Developing a Methodology for Assessing Disproportionate Costs* (RPA et al, 2004). This report sets out a procedure for assessing disproportionality which includes aspects of affordability, referred to as economic viability within the report, as follows:

1) net present value for the programme of measures (accompanied by benefit-cost ratios properly caveated)
2) simplified form of economic viability assessment based on financial data for the company/sector to examine implications for the sector
3) details by sector of estimated present value costs (or equivalent annual values) and predicted contribution to total benefits based on their contribution to reducing the risk of failure (providing an indication of adherence to the PPP), and
4) a distributional assessment indicating the end incidence of costs and benefits.

With regard to the second point, the report suggests for this to be carried out at a high level to begin with, increasing in detail depending on the ability of assessors to reach a conclusion on the impacts on viability. At a minimum, the assessment would be based on a comparison of financial costs to typical profit levels for the sector (for example, based on a five year average). However, a more detailed analysis may be important where there is likely to be significant variability in firms and in their ability to absorb environmental control costs (as taking the average may significantly over- or under-estimate impacts). It was highlighted that: *This may be particularly important for sectors such as farming, where there are significant numbers of small operators who are below average. It will also be important for the many industrial sectors characterised by SME companies but dominated by a few larger operators* (RPA et al, 2004).

Following from the above, a more detailed analysis based on a series of 'case study operators' that reflected the range of firms within a sector would enable a more reliable calculation of the percentage of profits that would be accounted for through the increased expenditure (taking into account factors such as the level of product and technology innovation within the sector and hence the potential for cost structures to change over time). It was suggested that this would help identify not only whether a measure would give rise to significant affordability issues for a sector as a whole, but also whether there would be implications for relative competitiveness within a sector and hence important intra-sector distributional effects.

The report also highlights the importance of "costs pass through", as follows: "*Added to the share of profit accounted for by an investment would be an assessment of the degree of cost-pass through that was possible for the sector".* It was noted that this may require discussion with trade associations and an examination of the degree of competitiveness within the sector (nationally and internationally). In addition, consideration of the ability of consumers and/or the wider economy to afford increased prices as a result of cost-pass through would be essential for some measures.

In 2006, Defra commissioned more detailed research on disproportionate costs (Project 3 of the Collaborative Research Programme) (Jacobs, 2007). The guidance produced under this contract

provided a stepwise approach which included the assessment of impacts on vulnerable and/or disadvantaged groups as well as the scale of investments made on environmental improvements. It also suggested that affordability combined the information into two indicators:

- The ratio of the equivalent annual costs of measures after cost pass through to pre-tax profit levels; and
- The ratio of equivalent annual costs of the measures after pass through to annual revenues.

This guidance was more focused at the individual operator than at a sector-wide consideration of affordability.

For industry and manufacturing, affordability is related to the costs which an economic sector (or a single firm) may incur when implementing technical and other measures, and how these may impact on financial performance, such as turnover and gross profits. It is important to ensure that poor performers are not exempt from environmental responsibilities. In the European Commission communication 'On the Road to Sustainability' (2003) the issue of affordability of BAT is considered. Affordability here is based on estimated net costs of implementing a technique in relation to environmental benefits achieved through its implementation or whether the technique can be introduced under economically viable conditions. It is highlighted in this communication that this approach can only be applied at the European sectoral level to avoid installations in a difficult financial situation being permitted to continue polluting due to their inability to afford measures. Generally, there is a paucity of literature addressing the issue of affordability at the general industry or manufacturing level; the literature that has been identified is very sector specific.

As discussed above, for private sector operators, the approaches developed for the first round (e.g. RPA's work in 2004, Jacobs et al in 2007) assessed affordability in terms of whether or not an operator could pay for a measure without significant negative effects on its business over the long term. In this respect, affordability has been defined in terms of various financial ratios, taking into account ability to pass costs downstream, previous expenditure and impacts on competitiveness. These approaches were more geared towards industry and manufacturing than, say, agriculture or environmental NGOs in terms of proposed measures and criteria.

A1.3.2 Relevant business information

Annual Business Survey

The main national statistical source of information on the performance of industry and manufacturing is the Annual Business Survey, which reports on a number of indicators for different industry sectors and at different level of detail. This includes (Annex 1 provides a fuller description of the types of statistical data available from the ONS):

- Total net capital expenditure;
- Gross value added at basic prices;
- Number of enterprises;
- Total turnover; and
- Enterprise survival rate.

ONS also provides data on rates of return and net operating surplus. The rate of return measures the gain or loss on an investment over a specified period, usually a year, expressed as a proportion of the initial investment cost. Net operating surplus is a profit-like measure that shows business

income after deducting costs of compensation of employees, taxes on production and imports less subsidies and consumption of fixed capital from value added, but before subtracting financing costs and business transfer payments. This provides an approximate measure of a company's operating cash flow which is available to pay debts and make investments.

The European Commission's Structural Business Statistics database – Eurostat - contains a range of financial indicators for businesses in each of the Member States. Those which are useful in terms of assessing the financial health and affordability for the UK manufacturing sector are presented in **Error! Reference source not found.**.

Table A1-9: Annual detailed enterprise statistics for industry (£million)					
Year	Turnover or gross premiums written	Turnover or gross premiums written (per enterprise)	Gross operating surplus	Gross operating surplus (per enterprise)	Gross operating surplus/turnover (gross operating rate) (%)
2008	£502,586.6	£3.8	£66,104.1	£0.5	13.2
2009	£448,768.6	£3.5	£51,588.3	£0.4	11.5
2010	£484,324.3	£3.9	£69,389.5	£0.6	14.3
2011	£512,813.7	£4.2	£75,484.2	£0.6	14.7
2012	£513,351.6	£4.1	£68,885.8	£0.6	13.4

Eurostat's turnover figures for the manufacturing sector in the UK are largely identical to the ONS figures as these are used as part of the requirements under the Structural Business Statistics Regulation, with any variation being a result of the exchange rate. The total turnover per enterprise (on average) was £4.1 million in 2012.

Financial data for publicly quoted companies

An alternative source would be the use of financial data provided by various websites for publicly listed companies. Such data could be used to provide an indicator of the general health of companies within UK industry and manufacturing, albeit with the caveat that they apply to companies listed on the FTSE (Financial Times Stock Exchange) or on the AIM (Alternative Investment Market).

Environmental expenditure

In addition, data are available on total environmental protection expenditure, which includes operational expenditure, capital expenditure and research and development activities. As demonstrates, this is highest in the *Other Industries*[40] which includes a wide range of actors.

[40] Textiles, Clothing and Leather Products, Wood and Wood Products, Printing and Publishing, Rubber and Plastics, Non-Metallic Minerals, Computer, Electronic and Optical Products, Paper and Pulp, Transport Equipment, Furniture Manufacture, Repair and Installation & Other Manufacturing

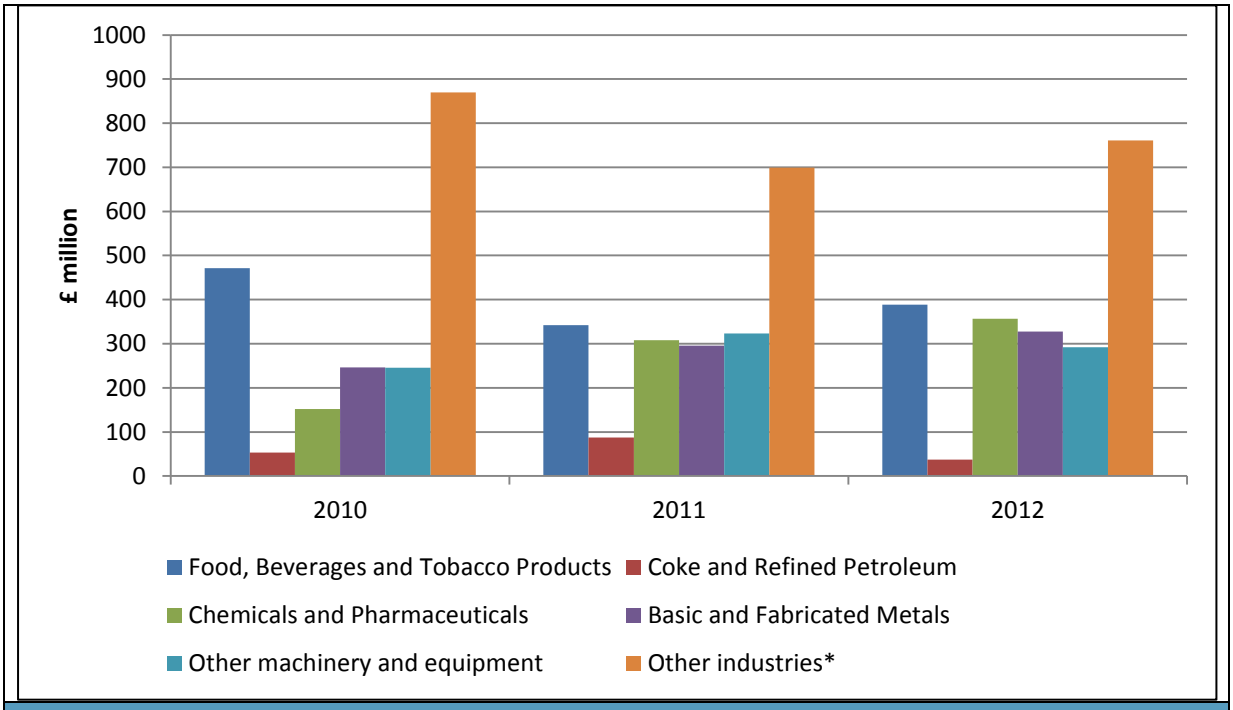

Figure A1-2: Total expenditure on environmental protection (2010-2012)[41]

Excluding this group the sector with the highest total expenditure in environmental protection over the three year period is *Food, Beverages and Tobacco Products* with a total of £1.2 billion, followed by *Basic and Fabricated Metals* and *Other Machinery and Equipment* with £870 million and £861 million respectively. Environmental protection expenditure can also be further dissected by type of expenditure – opex, capex and research and development.

A1.3.3 WFD related approaches

The **Regional Working Group on Water of Germany** funded a project to investigate ways of measuring the ability to pay for environmental measures (Klauer et al., 2007). The outcome was a selection of criteria that could be used to designate and justify WFD exemptions without the need for extensive economic modelling or valuations, as depicted in **Error! Reference source not found.**. As it can be seen, the criteria were divided by group (non-state actors and the state) and the assessment of the ability to pay completed at different stages. Non-state actors included households and industry. The assessment itself follows a three-step process, as set out in Figures A1-3 and A1-4 below.

[41] Statistics available at http://www.ons.gov.uk/ons/rel/environmental/uk-environmental-accounts/2014/rft-epe-ind.xls

Table A1-10: Criteria for assessing actors' ability-to-pay, adapted from Gorlach et al. 2007			
Category	**Criterion**	**Definition**	**Recommendation**
Screening criteria	Comparison of costs for single measures within different water bodies of similar water quality	Should a single measure within one water body be more expensive than in other water bodies, a closer investigation of the proportionality of the costs is justified	**Suitable** criterion for the pre-assessment of disproportionality
	Cost-effectiveness relationship of single measures in different water bodies	Should a single measure in terms of its environmental effects be more expensive in one water body than on average in other water bodies, a closer investigation of the proportionality of costs is advised	**Suitable** criterion for the pre-assessment of disproportionality
	Comparison of the costs of programmes of measures in different water bodies of similar water quality	If the programme of measures is x-times more expensive in one water body than on average in other water bodies of similar water quality, an in-depth analysis of proportionality is justified	**Suitable** criterion for the pre-assessment of disproportionality
	Costs of programmes of measures in comparison to current expenses for water resources management	Should the costs of programmes of measures exceed current expenses for water resources management by x%, further investigation should be undertaken	**Suitable** criterion for the pre-assessment of disproportionality
Proportionality for Non-State Actors	Cost allocation in relation to pollution caused	Costs of measures are considered as disproportional, if the share of the costs to be borne by an actor exceed this his contribution to the problem by x%	**Not a suitable** criterion
	Costs in relation to average firm profits in an economic sector	Should the costs of measures to be borne by a firm exceed x% of the average firm's profits within this sector, the measure is considered disproportionate	**Partially suitable** criterion
	Average share of expenses for water resources management/environmental protection in the turnover of an economic sector	If the shares of expenses for water resources management/environmental protection in the turnover of the firm exceed the sectors' average by x%, the costs of measures can be considered disproportionate for the firm.	**Suitable** criterion
	Costs in relation to average disposable household income	Costs of measures can be considered disproportional for households, if the expenses incurred by households (e.g. for water services) exceed x% of the average disposable income.	**Suitable** criterion
	Costs in relation to the average current expenses of the agencies responsible for maintenance of water courses	Costs of measures can be considered disproportionate for the responsible agencies if they exceed current expenses by x%	**Not a suitable** criterion
Proportionality at State level	Costs in relation to the state budget	Of the budget relevant costs for all programmes of measures within one *Land* exceed x% of the available public budget, they can be considered as disproportionate	**Partially suitable** criterion
	Costs in relation to GDP	If the overall costs of programmes of measures exceed x% of the GDP of the *Land* they can be considered as disproportionate	**Suitable** criterion

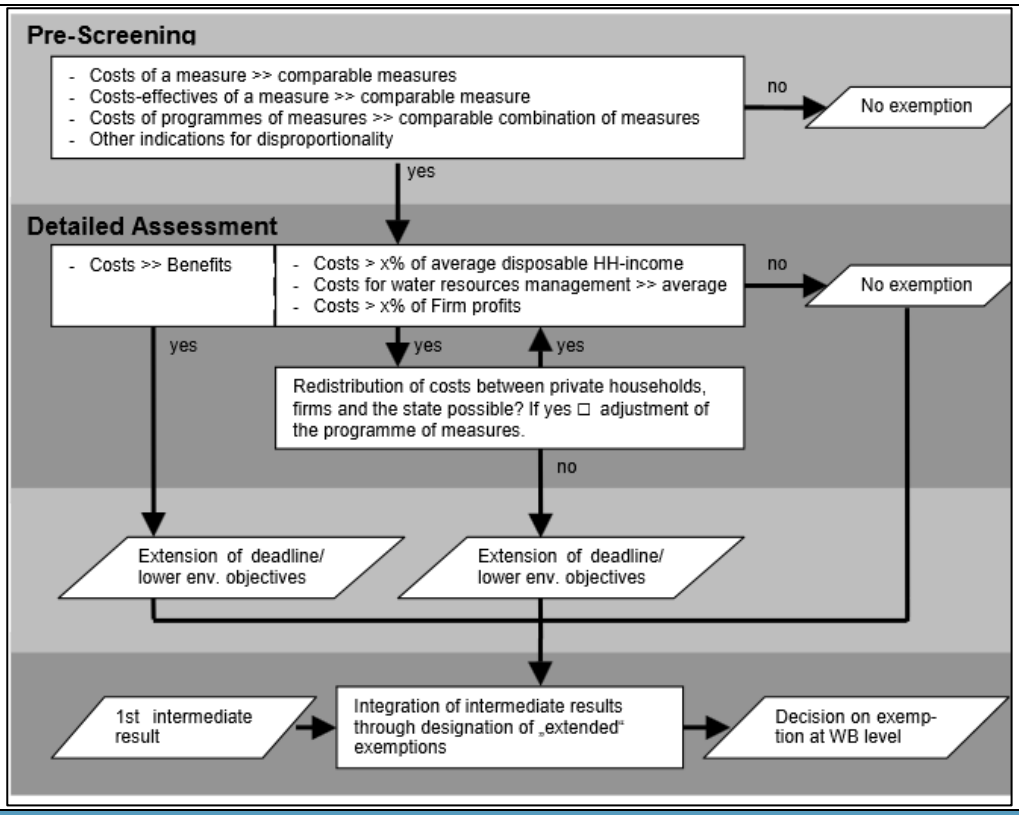

Figure A1-3: Step 1 of the assessment of affordability

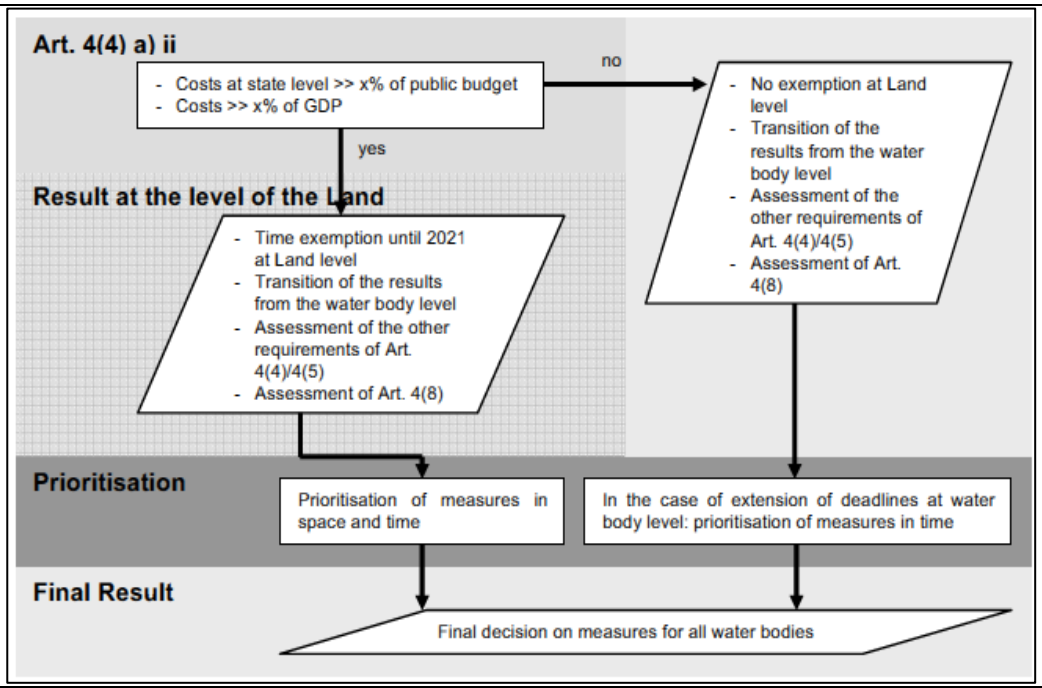

Figure A1-4: Step 2 and 3 of the assessment

As can be seen from Figures A1-3 and A1-4, some of these criteria relate to disproportionality, while others relate to affordability concerns. These include:

- Costs in relation to average firm profits in an economic sector; and
- Average share of expenses for water resources management/environmental protection in the turnover of an economic sector.

Both of the above indicators were found to be partially suitable and suitable when used in case studies; although their refinement was recommended to facilitate application on a larger scale.

Should one wish to use the second criterion in the UK, environmental expenditure as a percentage of total spending has been found to be highest in the energy production and distribution sector and the food, beverages and tobacco products sector in 2010/11 (URS, 2011). Sectors with particularly low environmental expenditure as a percentage of total spend were mining and quarrying and coke and refined petroleum (URS, 2011). It has been noted that the energy sector traditionally dominates environmental expenditure spending in previous years (URS, 2011).

Threshold or Reference value approaches

An alternative approach - *the reference value or threshold approach* - has been put forward by a number of authors. Under these approaches, indicative reference values are calculated e.g. turnover, gross profit, added value and total average investment costs of the past 5 years.

Vercaemst's reference value approach uses indicative boundaries to reflect the affordability for annual costs or investments, where the upper boundary is definitely affordable and the lower boundary is definitely not affordable . Should the indicator value fall between the upper and lower bounds, further discussion or information is necessary to determine affordability (Vercaemst, 2002). This large 'grey zone' is highlighted as a potential drawback of this approach (Meynaerts et al., 2010).

Table A1-11: Indicative reference values (Vercaemst, 2002)

Annual costs relative to	Acceptable	To be discussed	Unacceptable
Turnover	<0.5%	0.5-5%	>5%
Gross profit	<10%	10-100%	>100%
Added value	<2%	2-50%	>50%
Investment costs relative to	**Acceptable**	**To be discussed**	**Unacceptable**
Average total investments of the past 5 years	<10%	10-100%	>100%

Other studies have applied variations upon the reference approach which rely on two key summary indicators, resilience and market situation to determine whether a company can absorb the additional environmental costs internally or pass them onto their customers (Van der Woerd et al., 1998). This approach is intended to analyse the effects of future environmental measures on an individual industrial company's (medium-large and large size companies) finances by comparing the current and expected financial situation with and without additional environmental measures. Meynaerts el al. (2010) considers this a drawback as the method cannot be used to calculate the affordability for small and medium sized companies or an entire sector. The approach uses a series of internal indicators to determine an overall internal Resilience score in the past, present and future which is then compared to a series of fixed thresholds. The indicators demonstrate the liquidity, solvency, rentability and activity of the company. A series of external indicators determine the score

for Market Situation, which can then be used to determine the possibility of transferring the additional environmental costs to clients. The competition score is based on five indicators; power of suppliers, power of clients, potential competition, threats of new entries and market concentration (drawing from Porter's Five Forces of competition) which are based on a series of basic figures.

'Carrying capacity' based on liquidity and solvency

Vanassche et al. (2008) propose that classical investment analyses such as the payback time, the net present value or the internal rate of return are not sufficient to determine the affordability of environmental measures which are usually unprofitable. The DAFFIE (Decision Aid Framework for Investments in Environment) model provides a methodology for estimating affordability by ascertaining whether an industry or company has adequate carrying capacity for the additional costs of environmental measures. The carry capacity is considered adequate and thus the investment economically feasible if the actor can maintain or strengthen its competitiveness i.e. the ability to maintain sufficient liquidity and solvency and to earn a return from activities that exceeds the cost of capital in the long run (Vanassche et al., 2008). When applied at a sector level, annual accounts are calculated for an average company on the basis of the account statements of all companies in the industry over four years. In large heterogeneous sectors, it may be necessary to break the sector into different subdivisions, e.g. to reflect age and/or size.

The first step is to gather the necessary financial data from a company's annual accounts of the four latest years available to calculate the average annual accounts. The projected annual account is simulated on the basis of the average annual account which takes into account the net costs of the environmental investment options. The financial ratios can then be calculated for the actual and projected annual accounts. Finally, calculated ratios are compared to the ratios from a reference group. The comparison between the relative position of the ratios before and after the environmental investment can act as an objective starting point for the discussion of the viability of the investment.

One of the main reported weaknesses of this model is that it fails to take into account the competitive position of a company or sector. Instead, when necessary this must be considered in a qualitative manner (Meynaerts et al., 2010). In the context of this study, there is a significant additional drawback to using such an approach; this is the data requirements it would create in terms of reporting and accounting for all of the different financial costs and indicators.

Other Models

Meynaerts et al. (2010) have reviewed the models described (and additional models not reviewed here due to their similarity) and have developed an affordability assessment of technical abatement measures for the industrial sector which incorporates various aspects of the evaluation models. The consecutive steps of an affordability assessment of technical abatement measures for an industrial sector are described below:

1. Reference Values: A comparison of key financial figures e.g. turnover, gross profit and added value with the additional costs of environmental measures for a representative company. Where the sector is heterogeneous, the assessment can be balanced by making a distinction between subsectors or size classes. Investment costs of abatement measures are compared to the average total investments over the past 5 years.

2. Competition: An extended affordability analysis into the competitiveness of a sector using Porter's five forces framework: (i) the entry of new competitors, (ii) the threat of substitutes, (iii) the bargaining power of buyers, (iv) the bargaining power of suppliers, and (v) the rivalry among the existing competitors. Based on qualitative information the appraisal gives an indication of an industry's ability to shift additional costs to suppliers or customers.

3. Financial Ratio Analysis: A more detailed analysis using financial ratios can help to determine the affordability of additional costs of environmental measures in those sectors which although highly competitive cannot pass the additional costs onto suppliers and customers.

4. Impact on Financial Ratios: The DAFFIE (Decision Aid Framework for Investments in Environment) method is then applied to determine the impact on the financial performance on a sector. This requires the financial data for the four latest years available, which is averaged to reduce the impact of yearly fluctuations. The impact on the annual account of certain environmental investments is simulated based on the costs.

To date this is perhaps the most comprehensive assessment of affordability, although issues remain as to how to define "unacceptable worsening of the financial performance". Meynaerts et al. (2009) provide an example using this approach to assess the affordability of WFD measures under the first generation of RBMPs for the Flanders industrial sector. Two programmes of measures were proposed, the first to reach Good Ecological Status (GES) by 2015 and the second to defer achievement of GES to 2021 or 2027. Most of the measures related to sustainable water use and improvement of surface and groundwater quality.

In 2005-2007, the gross value added of total industry in Flanders was on average €33.28 million. The total annual costs of the 'all to good' programme were estimated at €239 to €398 million, compared with €198 to €340 million for the 'alternative' programme. Using the reference value approach, these costs equate to less than 2% of gross value added and are considered affordable. However, further analysis was conducted as the gross added value was not solely based on the activities of those companies which would bear the costs and some costs had a high degree of uncertainty.

A more detailed assessment was completed for the textiles industry based solely on financial information of the firms that would bear the costs of the proposed measures. In practice, just two measures could be assigned to specific companies, whereby total annual costs amounted to €1.1 million and investments would be €4.3 million. Measure costs were compared to the turnover, gross value added, gross profits and investment costs for the responsible companies, see Table A1-12.

Table A1-12: Ratio analysis textiles industry (Meynaerts et al., 2010)

	Ratio	Affordable at sector level?	Affordable at firm level (% of firms)		
			Yes	To be discussed	No
Annual costs relative to					
Turnover	0.09%	Yes (<0.5%)	65%	24%	12%
Gross profit	2.53%	Yes (<10%)	33%	13%	54%
Gross added value	0.33%	Yes (<2%)	71%	17%	13%
Investment costs relative to					
Total investments	4.17%	Yes (<10%)	50%	22%	28%

The ratio analysis demonstrates that the abatement measures are likely to affordable at a sector level. However at an enterprise level the results are quite different and depending on the ratio, only 33 to 71% of firms can afford the cost of the measures.

In conclusion, the authors identified a number of potential issues with the approach. The analysis is based on the average enterprise which in many cases is not easily defined. Expert judgement or consultation with the sector under consideration would be necessary in some instances. It is also noted that the results of the affordability assessment for an average firm should not be generalised as large variations in economic performance may exist between firms within a sector. The approach is limited in time and space and depends strongly on the availability of financial data.

A1.3.4 Conclusions on potential indicators for industry and manufacturing

The type of analysis undertaken by Meynaerts et al would seem to be the most appropriate in terms of providing a sound indication of the affordability of WFD measures, although it is not suggested that thresholds be set. The analysis is fairly information intensive, however, and would require consideration of individual sectors on their own, rather than as a group. This makes it less appropriate for the type of national level assessment to be undertaken for the purposes of this study.

However, when the industry sector is characterised by a small amount of players, the capacity to pass costs through will be greater than when there are significant numbers of players in the market. It is less clear how such factors can be taken into account in an assessment, other than by using the types of general industry data available from Eurostat on the number of operators, and then the number of SMEs within a sector.

A1.4 Approaches to affordability for the water sector

A1.4.1 Introduction

Affordability in the water sector has been traditionally linked to affordability of the water bills. This is because, in the UK, water companies can use costs-recovery to finance investment, subject to approval by the regulatory authority Ofwat; it is also because water supply and wastewater disposal are generally regarded as being critical services thus being extremely price and income inelastic, with households acting as the main consumer group.

Although intuitively there is considerable agreement about what affordability means – "*ability to purchase a necessary quantity of a product or level of a service without suffering undue financial hardship*" – it is a difficult concept to define precisely (Kessides et al. 2009). There are several related notions (as identified by Fankhauser & Tepic, 2005):

- Firstly, a distinction should be made between "affordable" and "low cost". Even if WWS are provided at low-cost, some consumers may not have enough income to pay for them;

- "Ability to pay" is also distinct from "willingness to pay", which is defined as the amount of income a person is willing to forego in order to obtain a certain service;

- Finally, the notion of affordability is closely related to "poverty". The affordability of utility services is one of many indicators used to measure poverty.

Importantly, there is no official definition of affordability in relation to WWS and their customers. In 2011, Ofwat published a detailed analysis of affordability, using 2009-10 data, which included assessing affordability issues by different consumer groups and demographics (Ofwat, 2011c).

To date, the best efforts to assess the financial impact and affordability of utility bills have been in the energy sector. A number of new studies need to be mentioned in this regard:

- A **Water bills projection model** study has recently been commissioned to design, build and test an annually updatable water bills projection model to be used in-house by Defra, Ofwat and the EA. The model will be used to advise policy makers and stakeholders on the potential scale and likely distribution of impacts due to our policies. The model will be a valuable analytical tool for informing policy development and assessing second round impacts (such as cost pass through) of measures for economic impact assessments;

- **Understanding affordability pressures across sectors:** this study, commissioned by Ofgem, will look at affordability across a range of sectors. In particular: the patterns of household spending in relation to all regulated sectors; characteristics of an essential service and how this influences spending decisions; characteristics of those customers with affordability problems. The study will identify potential solutions to address affordability problems.

The results of the above studies are not yet available but should be at the end of this year/beginning of next.

A number of potential indicators of affordability have been identified in the peer-reviewed and grey literature. These include:

- An indicator based on the concept of a "burden ratio", e.g. water bills as a proportion of household income or expenditure;
- Self-reported problems with water affordability (e.g. based on household surveys); and
- An indicator based on levels and age of water debt.

These indicators are discussed in the following sub-sections. It is important to note that indicators relating to water poverty have been excluded from the list above as these are outside the scope of this project.

A1.4.2 Burden ratio

Previous approaches to affordability for England and Wales

For water and other utility services, typical approaches to assessing affordability have similar drawbacks. Using the burden ratio approach, one indicator (e.g. expenditure on WWS) is calculated relative to another indicator (e.g. total household income or expenditure) over a certain population (e.g. the population of a nation). Thus, the burden ratio approach relies on setting specific (subjective) thresholds above which WWS becomes "unaffordable".

A 3% threshold has been used by the Consumer Council for Water (CCWater), the Walker review and others, to report on the affordability of water and sewerage services (Ofwat, 2012). However, as commented by Ofwat (2012), these organisations use gross income to determine which customer groups are likely to have affordability issues. This is important because gross income figures will result in fewer household customers with affordability issues compared to using income net of housing costs. Ofwat (2012) emphasised that such ratios are not appropriate as thresholds for policy interventions; they are merely indicators to describe patterns in the observed data. In this context, Ofwat suggested that it could be useful to report against indicative thresholds of above 3% and above 5% of household income (after housing costs) spent on water and sewerage bills.

Factors that guided Ofwat in this judgement include (Ofwat, 2012):

- The fact that the threshold for fuel poverty was originally based on double the 'median' or typical expenditure on bills - households in England and Wales typically spend 1.6% of their income on water and sewerage, rising to 3.7% of income among the poorest third of households.
- Typical expenditure patterns - for example, average home energy bills are three times higher than average bills for water and sewerage.
- Similarity to thresholds in other developed economies - the affordability benchmarks typically used by governments and international agencies in developed countries are in the range of 3% to 4% for water and sanitation services. A recent study across 14 western European countries found that expenditure on water and sanitation services typically accounts for around 1.1% of disposable income, rising to 2.6% for poor households.
- Similarity to other measures of affordability:
  - Customers reporting that they are struggling to afford their bills (self-reported affordability);
  - Customers known to owe money to their water company, how much they owe and the length of time payment has been due (debt);

- Customers' overall ability to afford all their household bills – not just water and sewerage (material deprivation); and
- How affordable customers find the costs of water and sewerage to meet their 'essential needs' (affordability of essential consumption).

Other approaches to affordability

The World Health Organisation considers that a water bill is unaffordable when it represents more than 5% of monthly household income or expenditure (Estupiñán et al., 2007). Benchmarks used by various international organisations in measuring the affordability of utility services are summarised in the Table below (after Fankhauser & Tepic, 2005).

Table A1-13: Benchmarks used in measuring affordability (in % total household income/expenditure)

Source	Electricity	Heating	Water
World Bank (2002)	10-15		3-5
WHO (2004)	10		
IPA Energy (2003)	10	20	
UN/ECE		15	
UK Government		10	
US Government		6	2.5
Asian Development Bank			5

Source: Fankhauser & Tepic (2005)

In addition to the above, there are numerous other factors that could be taken into account in developing an affordability metric based on a burden ratio.

Population

At a macro-level, affordability could be estimated for a national (e.g. UK) or international population (e.g. EU). It could also be calculated for a stratified sample of the population, for example, a particular income group (e.g. the poorest 10% of the population), the population of a specific geographic region (e.g. the population of a utility operating area), or a specific family type (e.g. lone parents or pensioners). Although aggregate (macro-level) indicators are useful for providing an overview of affordability, several studies have indicated the importance of analysing affordability at a micro-level. National average figures, for example, would not reveal variations by region or by water utility, which are important given that tariff structures are set at this level. Average figures also hide variations by family type, which may have a role in social policy formulation (OECD, 2003). At the micro-level, affordability could be calculated for a household, or even for an individual.

Smets (2008, in OECD [2010]) assesses affordability at the national level and for the poorest decile of the population (using average net disposable income). A similar approach has been taken by Ofwat in assessing affordability risks in England and Wales. As shown in the table below, Ofwat (2011c) estimate water affordability risks for each decile of the population, using unequivalised income.

Table A1-14: Water affordability risks by income decile for 2009-10		
Income decile	**Spending more than 3% of income**	**Spending more than 5% of income**
1	87%	74%
2	62%	23%
3	42%	8%
4	23%	3%
5	11%	1%
6	6%	-
7	2%	-
8	1%	-
9	1%	-
10	-	-
All households	23%	11%
Note: To calculate income deciles, Ofwat divides the population into ten segments – i.e. the 10% of households with the lowest incomes are in the first income decile. These are calculated using unequivalised income. Source: Ofwat (2011c): Affordability and debt 2009-10: Current evidence, available at: http://www.ofwat.gov.uk/future/customers/metering/affordability/pap_tec201105affevid.pdf		

As commented by Gawel & Bretschneider (2010), one of the limitations of the burden ratio approach is that it does not account for the fact that household sizes and compositions vary. The table below shows the affordability risks for different household types based on Ofwat's analysis of the Family Resources Survey (FRS) 2009-10 data. As indicated in the table, lone parents are the most likely group to spend more than 3% and 5% of their income on water bills, followed by working-age adults living alone and single pensioners.

Table A1-15: Water affordability risks by household type for 2009-10			
Household Type	**Spending >3% of Income**	**Spending >5% of Income**	**Total Number of Households (millions)**
Lone parents	42%	18%	1.4
Working-age adults living alone	36%	22%	4.5
Single pensioners	36%	14%	3.6
Pensioner couples	16%	5%	2.6
Couples with children	14%	7%	4.4
Couples without children	13%	6%	4.7
Multi-unit and other (for example, two working-age adults sharing a property)	10%	5%	2.1
Total	**23%**	**11%**	**23.3**
Source: Ofwat (2011c): Affordability and debt 2009-10: Current evidence, available at: http://www.ofwat.gov.uk/future/customers/metering/affordability/pap_tec201105affevid.pdf			

While Ofwat bases its analysis on household-level data, Venter and Behrens (2005) note that what is affordable at a household level may not necessarily be affordable from an individual's perspective. Furthermore, using personal expenditure and income data to calculate the affordability index does not solve this problem because family resources are shared to some extent within each household unit (Estupiñán et al., 2007). Furthermore, within the context of this study, analysis at the individual

household level does not inform on affordability at the national level. For this reason, an income decile based approach is not suggested.

Single-dimensional indicators versus multi-dimensional indicators

Another issue is related to the overall spend on utility services versus one service only.In order to overcome this problem, Ofwat (2011a) proposes that a multi-dimensional indicator of affordability should be developed, based on expenditure on energy and water[42]. A similar approach has already been operationalised by Foster (2004), who uses 15% of household monthly income or expenditure as a way to define affordability of three public services – water, electricity and gas. Fankhauser and Tepic (2005) review government and international institutions' rules on what constitutes an acceptable level of utility expenditures. They find that affordability becomes a problem if bills for water, electricity and heating exceed 25% of total outgoings on average over a year (expenditure may fluctuate seasonally).

Gross income versus net income

Linked to the concept of a multi-dimensional measure of affordability, is the idea of measuring affordability relative to a population's (e.g. a household's) "disposable income". The European Commission in its Green Paper on **s**ervices of general interest, for example, has expressed the possibility of defining affordability based on the price of "*a basket of basic services related to the disposable income of specific categories of customers*" (European Commission, 2004)**.**

Over the last few years, various factors have contributed to a reduction in disposable incomes in the UK including high inflation, lower wage growth, benefit reductions, increased burden of unsecured debt and higher unemployment (North, 2012). Escalating energy prices have also given rise to real and growing affordability problems for many utility customers. Ofwat data suggests that, in England and Wales, well over half of lower income households are spending more than 3% of their disposable income (after housing costs) on water charges; with the situation being worse in higher bill areas (CCWater, 2014).

Smets (2008, in OECD [2010]) proposes an affordability index linking WWS bills to disposable income and provides indications on how to handle this data (e.g. how to translate per capita into household water consumption, depending on the number of household members). This index can be calculated at a national or local level and can vary depending on the definition given for "poor" households. Affordability is assessed at the national level (using average net disposable income) and for the poorest decile of the population.

Disposable income was also the indicator favoured by Pires (2007) in his study on the affordability of consumer tariffs in Portugal. Pires (2007) identified geographically concentrated clusters of the population that would fall below an affordability threshold set at 3% of household disposable income. Pires found that there was not an affordability problem for Portuguese society as a whole because WWS represents a very small proportion of overall expenditure by households on utility services.

OECD (2003) proposes a method to take into account the fact that in general people living in larger households need less income per person to achieve the same standard of living as those living in

[42] The rationale for selecting energy and water being that both are essential services.

smaller households, based on ordering household incomes on a per equivalent adult basis. 'Equivalising' household income to take into account the number of people in the household is also an approach suggested by Ofwat (2011a)[43]. However, Ofwat's methodology group was divided on the issue of whether or not equivalised income should be used (the majority felt that unequivalised income would be more appropriate).

Ofwat (2011a) also identifies the following factors as potentially being relevant in defining income-based indicators of affordability:

- Treatment of very low income households. The Family Resources Survey contains a number of records with a very low income. Some are even negative when housing costs are deducted. DWP's (2014) publication on 'Households Below Average Income' deals with this issue by setting low-incomes to a minimum of zero. The fuel poverty indicator currently deals with low income households by adjusting incomes (from the English Housing Survey) to reflect the minimum benefits available for different households. A question therefore arises as to whether or not low-incomes should be similarly imputed for an indicator of WWS affordability.

- Whether or not disability benefits should be counted as a source of income. Ofwat's methodology group suggest that disability allowances should be removed from income, as these benefits are designed specifically to deal with disability (and are not, therefore, available to pay the water bill). However, Ofwat (2011a) did not make this adjustment in their study due to the additional complexities involved (e.g. because disability benefits do not necessarily match the cost arising from the disability).

- Whether or not second homes should be included. Ofwat's methodology group was of the view that second homes should be removed from any indicator.

- Whether or not the indicator should be restricted to the lowest income groups, to avoid households with high bills and high incomes from being included. This could help to eliminate the element of choice in housing costs and help to target those with affordability problems.

Income versus expenditure

Affordability can be defined as the share of monthly household income that is spent on WWS, or as the share of utility payments in total household expenditures. According to Fankhauser and Tepic (2005), using household expenditures rather than income tends to provide more accurate information, as household income data may not capture all sources of revenue. Furthermore, two households with identical incomes could have very different outgoings (Ofwat, 2011a).

[43] Effectively, equivalised income standardises all differences in expenditure between households to the equivalent expenditure faced, for example, by a couple. While equivalising is a recommended approach for measuring income poverty, its applicability to measuring the affordability of water and sewerage bills relative to income is not as clear cut (Ofwat, 2011a).

Nevertheless, the majority of studies assessing affordability to date appear to rely on income (rather than expenditure) data (Ofwat, 2012). The Family Resources Survey[44] includes information on water bills paid by households which could be used to calculate an income-based indicator based on "actual" bills.

Social tariffs and cross-subsidies

Ofwat (2011a) notes that if an "average" tariff is used to calculate water affordability, there is a risk that the effects of any social tariff could be lost within the indicator. The following example is provided by Ofwat (2011a):

- Imagine that the average price per unit of water is £1 per m3 and that, for our indicator, all bills are calculated using this value

- Now imagine that the company introduces a social tariff that results in some customers only paying 75p per m3. The company still needs to receive enough money to carry out its functions, so other customers are charged extra to make up the deficit. However, the average price for water remains at £1 per unit

- Although many customers receive a large discount, the indicator is calculated using the same average price for water – so is unchanged. Hence, some households could be identified as facing affordability problems, even though they receive a subsidy through the social tariff scheme.

Other considerations

A series of broader considerations are often raised in the literature in relation to whether affordability is defined in terms of either actual payments or billed amounts, and the fact that tariffs in England and Wales will include a degree of social tariff and cross-subsidy. Consideration of these issues is more related to arguments regarding water poverty rather than affordability. Policies to deal with water poverty and income distribution exist but are independent of the general question over whether or not measures aimed at delivering environmental improvements are affordable at the national level.

A1.4.3 Self-reported problems with water affordability

One potential indicator of affordability identified by Ofwat (2011a) is self-reported problems with water affordability based on opinion surveys and complaints. Existing research uses a number of questioning approaches, including (Ofwat, 2011c):

- Satisfaction with value for money;
- Perceived bill fairness, and
- Ability to pay.

Research by CCWater (2014) has found than one in five customers feel their charges are unaffordable, an increase from one in eight customers in the previous year. CCWater (2009)

[44] See Department for Work and Pensions: https://www.gov.uk/government/collections/family-resources-survey--2

identified that many factors have an impact on consumers' perceptions of affordability. For example, those 'making ends meet' are more likely to consider bills affordable if it is important that they are paid, even if they are expensive (for example, housing costs). Those 'in arrears' are more likely to base their decision on cost, with cheaper bills (e.g. TV licence) being perceived as more affordable. People who are 'struggling' will fall somewhere in between.

A number of other factors have also been identified as influencing consumers' perceptions of affordability. These include the level of perceived control over the amount they needed to pay (e.g. whether they can pay in regular fixed instalments, price increases and the degree to which these could be planned for), and whether they felt the cost was justified (CCWater, 2009). The timing of the survey may even have an influence, for example, if it is conducted in the lead-up to Christmas when household resources are stretched. Hence, any measure of affordability based on consumer surveys should take into account the potential for distortions caused by self-reporting (Ofwat, 2011b).

A1.4.4 Levels and age of water debt

Levels of debt across the WWS sector have increased significantly since 1999, when the ban on disconnections was introduced. In 2009-10, WWS companies in England and Wales wrote off £161 million worth of household debt (Ofwat, 2011c). This is equivalent to 2% of total revenue billed (Ofwat, 2011c).

Levels of outstanding household revenue by debt age bands from 2003-04 to 2009-10 are shown in the Figure A1-5 below. The total amount of revenue outstanding has risen from £939 million in 2003-04 to £1.58 billion in 2009-10, representing an increase of 70% in six years. This is higher than the increase in water bills over the same period (20%). While water debt has increased in all age bands, the greatest increases have been in the older debt age bands. At the same time, the number of households with revenue outstanding has been increasing at a slower rate. This suggests that there is a group of customers who are persistently not paying their bills and who are, therefore, accumulating water debt (Ofwat, 2011c).

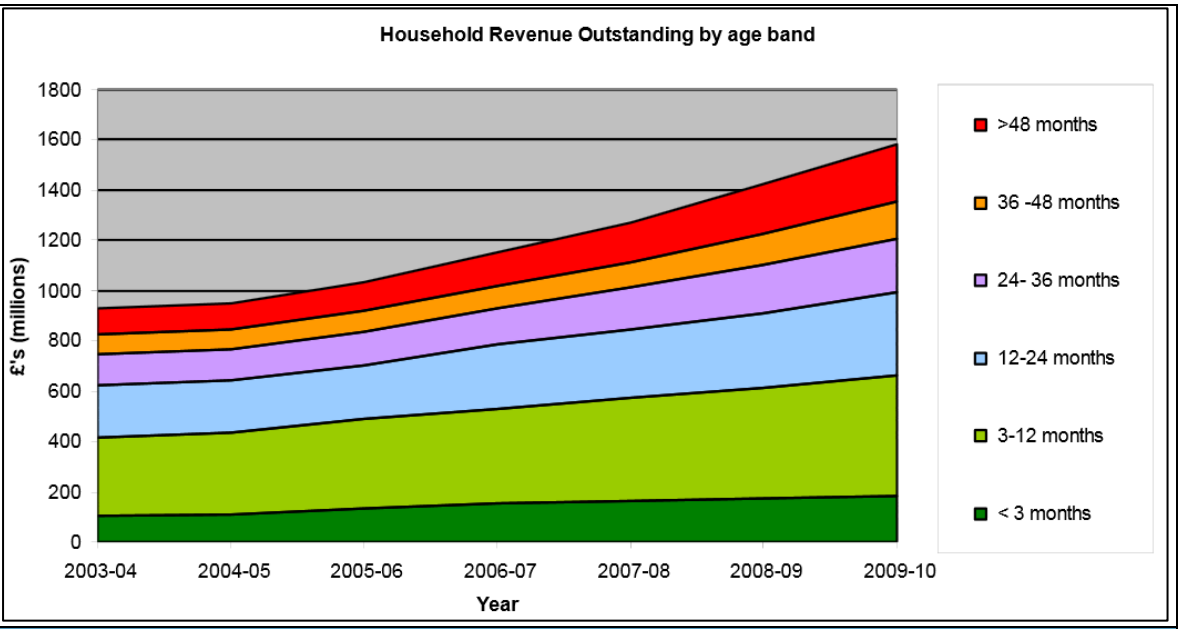

Figure A1-5: Levels of household revenue outstanding 2003-04 to 2009-10 by debt age band (Ofwat, 2011c)

Ofwat (2011a, 2011b) identifies 'levels and age of water debt' as a potential indicator of affordability, with this indicator having two key advantages:

- Firstly, that it could be developed to support a cross-utility indicator of affordability (e.g. water, energy etc.); and
- Secondly, that it enables the impact of some limited social tariffs to be evaluated.

CCWater (2009) suggests that customers do not pay their water bills for a variety of different reasons. For example, customers may:

- Not be able to afford to pay because of competing demands on their income;
- Place a low priority on the payment of water bills, knowing that the consequences of not paying are limited (due to disconnection ban);
- Find that the billing and payment options do not suit their circumstances; or
- Withhold payment because they are in dispute with the WWS company.

Care therefore would need to be taken to ensure that the use of any such indicator did not mask those who have the ability to pay but who are choosing not to (e.g. due to a dispute) (Ofwat, 2011b). This suggests that the use of such an indicator could be unreliable.

Another factor to consider is the fact that some people will continue to pay their bills even if they struggle to do so. As noted previously, research by CCWater (2012) has shown that some households restrict their food intake and heating in order to be able to pay their water bill. Furthermore, not all households with debt will necessarily have outstanding water bills (Ofwat, 2011b). Clearly, these households find their bills unaffordable, even if they are not yet in water debt.

Finally, it also should be recognised that the levels and age of household water debt are influenced by bill increases other than water (Ofwat, 2011b).

A1.4.5 Conclusions on potential indicators of affordability for water utilities

Most commonly, the affordability of utility services is measured using a "burden ratio" based on the ratio of expenditures for WWS to the total income of the household. However, as remarked by Gawel & Bretschneider (2010), the burden ratio suffers from several limits, such as the fact that it does not take into account differences in numbers of members in each household, as well as in technological endowments that could impact on the household's final consumption. Ofwat's Report on affordability and debt identifies that the burden ratio does not capture true affordability, as higher-income households may be able to afford higher bills. Furthermore, the ratio is influenced by bill increases other than water and sewerage. Finally, even in this case, when defining the threshold above which the ratio is indicative of unaffordability for a particular population (i.e. 3% or 5%), the choice is subjective and discretionary.

Ofwat's advisory group has suggested that, rather than concentrating on a single indicator of water affordability, a more prudent approach would be to look at a wider basket of indicators (Ofwat, 2011a). Ofwat (2011a) proposes to consider:

- An indicator based on water bills as a proportion of household expenditure and income;
- Self-reported problems with water affordability – through opinion surveys and complaints; and
- An indicator based on levels and age of water debt.

Table A1-16 outlines the key advantages and disadvantages of the indicators considered within this report. Further discussion with water industry stakeholders has indicated that levels and age of water debt are calculated in different manners across companies. As a result, it cannot readily be used as an indicator for the purposes of this study, as interpretation would be inconsistent across companies.

Table A1-16: Water affordability indicators – advantages and disadvantages		
Indicator	**Advantages**	**Disadvantages**
Burden ratio	Advantages largely depend on the exact burden ratio that is used Could be developed to support a cross-utility indicator of affordability	Disadvantages largely depend on the exact burden ratio that is used Relies on setting subjective thresholds of affordability Includes discretionary as well as essential use Does not take account of households' technological endowments that could impact on their final consumption
Self-reported problems with water affordability	Enables the consumers' perspective to be captured Linked to bill payment behaviour	Possible distortions from self-reporting Influenced by bill increases other than water Cannot be used to predict and assess the impact of social tariffs
Levels and age of water debt	Could be developed to support a cross-utility indicator of affordability Enables the impact of some limited social tariffs to be evaluated	Disconnection ban masks those who can pay but who choose not to pay Some people will pay even if they struggle to Influenced by bill increases other than water Variations in accountancy practices mean that any indicator will not be consistent across companies
Source: Adapted from Ofwat (2011b)		

A1.5 Non-Governmental Organisations (Conservation and Recreation)

A1.5.1 Overview

Within the context of this study, we have assumed that NGOs can be defined as:

> *Any non-profit organisation not established by a government entity or intergovernmental agreement.*

This definition therefore includes within its scope many charities and the voluntary sector, where the latter is based on a broad definition and therefore includes sport and social clubs, etc.

None of the previous assessment methodologies have addressed the question of whether the proposed programmes of measures being put forward are affordable in practice to this group of actors. The implicit assumption has been that NGOs will fund those measures which they gain from and up to the degree to which their budgets allow. Clearly, if NGOs are currently bearing on-going costs associated with already implemented measures, then it may be more difficult for them to take on the burden of costs associated with additional measures to be implemented under the second round.

There are many NGOs within the UK who are stakeholders in the water environment and therefore who have an interest in implementation of the WFD. However, it is only those NGOs with a management responsibility for waterbodies (or assets within or along these) or who take responsibility for implementing measures at the local or regional level for whom affordability may be an issue.

For the purposes of this report, we have assumed that they include:

- National organisations, such as the RSPB, the Wildfowl and Wetlands Trust, the Rivers Trust, the WWF, the Angling Trust, the Royal Yachting Association, etc.
- Regional or area-focused organisations such as the Wetland Trusts, the Wildlife Trusts, and
- Local organisations, such as angling clubs, recreation clubs and other more locally focused environmental or nature conservation groups.

In addition, NGOs within the UK relevant to the WFD fall into two main categories: those involved in conservation related activities and those concerned with the provision of or quality of recreation related services. There will also be significant overlap between conservation and recreation related NGOs, for example in terms of their members, people who enjoy angling may also enjoy local wildlife and therefore they may donate to both the RSPB and Angling Trust. Estimates suggest that there may be around 15 NGOs which might be affected by or have an interest in the WFD.

A1.5.2 Approaches for assessing affordability

In contrast to the other sectors, we have not identified any literature that is specific to assessing the affordability of investments or on-going costs for the third sector. This may in part be due to the fact that one would consider the financial balance sheet of a charity in a similar manner that one would examine the balance sheet of company in order to determine its financial viability. However, given the differences in revenue raising mechanisms, there may be important differences.

Based on the literature, it would appear that there may be a range of approaches:

- Comparison against a series of key performance indicators
- Assessment of the sustainability and risks of funding sources, and
- Consideration of other non-financial factors.

Key performance indicators

Key Performance Indicators (KPIs) are quantifiable measurements of an organisation's health or success. KPIs are usually benchmarked against peer organisations (Bierman, nd), and some of the benchmarks that are used by non-profit organisations when assessing performance include (Bierman, nd):

- Program efficiency ratio (program service expenses divided by total expenses – shows how much the organisation is spending on its primary mission)
- Operating reliance ratio (unrestricted program revenue divided by total expenses – shows whether the organisation could pay all its expenses from program revenues)
- Fundraising efficiency ratio (unrestricted contributions divided by unrestricted fundraising expenses – how efficient is the organisation at raising money)

Examples of the types of performance measures that fall under these headings are given by Epstein & McFarlan (2011), with these presented in **Error! Reference source not found.**7 below.

Table A1-17: Examples of financial performance measures of non-profit organisations

Category	Performance measures
Administrative efficiency	Administrative expenses divided by total expenses of the organisation Percentage of revenues the organisation spends on administrative expenses
Program efficiency	Program support or charitable commitment (% of total expenses spent directly for the charitable purpose) Program expenses divided by total expenses Program expenses growth Current spending factor (total expenses divided by total revenues) Program output index (number of units of actual physical output divided by total program expenses) Productivity rate (outputs divided by inputs)
Fundraising efficiency	Percentage of donations left after subtracting the cost of getting them Percentage of revenue the organisation spends on fundraising expenses Fundraising expenses divided by total expenses Donor dependency (operational surplus subtracted from donations, divided by donations)
Other financial performance measures	Revenue growth Working capital ratio (working capital divided by total expenses) Days' cash in hand
Source: Epstein & McFarlan, 2011	

A1.5.3 Sources of funding

Financial risks related to funding

Given the fact that the above list of NGOs operate at different geographic levels, and will hold completely different statuses in terms of their ability to generate revenue streams, they are also likely to have very different capacities in terms of making capital investments or funding long-term maintenance and operating costs. These differences together with those regarding the revenue raising mechanism that are open to different NGOs may be important.

This aspect is recognised by the Charity Commission (2010), whose guidance on risk management states: *The risks that a charity faces depend very much on the size, nature and complexity of the activities it undertakes, and also on its finances.* This guidance notes that the major financial risks for charities are likely to relate to (Charity Commission, 2010):

- Termination of funding from other bodies
- The future of contracts
- Fundraising from the general public
- Fluctuations in investments and
- An unforeseen rise in demand for their services.

The guidance expands upon these by defining financial risks as stemming from: inaccurate or insufficient financial information; inadequate reserves and cash flow; dependency on limited income sources; inadequate investment management policies; and insufficient insurance cover. The first three of these are clearly relevant to assessing affordability within the context of this study.

Essentially, taken together these translate to the need for a business model that can respond to long-term as well as short term requirements.

Availability of funding

The recent recession has put pressure on this sector and over 75% of charity leaders believe that the recession will reduce funding and investment from the public and private sector, as well as increase the demand from service users and decrease reserves (Hopkins, 2010). Between 2008 and 2009, 42% of charities saw a fall in their income, and over half of the 389 charities surveyed considered mergers to cope with the recession (Hopkins, 2010). Despite this, evidence suggests that charitable giving does not necessarily decrease in a recession and in 1991-1993 only one third of charities reported a fall in their total income (Hopkins, 2010).

Government funding for NGOs constitutes a significant portion of their income, for example 33% of the third sector's total income is from statutory sources, while charities received £7.8 billion in income from government contracts in 2006/07, compared to £4.3 billion from grant funding (Hopkins, 2010). Although this represents a significant income for NGOs, it is only 2% of government spending (Hopkins, 2010). Charities rely largely on donors, government grants and contracts, and investments for their income (NAO, 2012). Other sources of funding include subscriptions (e.g.

membership of an angling club), commercial activities and land rents[45], royalties and dividends. In addition, there are some funding sources which are specific to recreational NGOs, including: competition entry fees; coaching; sponsorships; and advertising.

The NAO (2012) found that in 2009/10 more than 61% of all registered charities received more than 75% of their income from one source. Of smaller charities (those with an income of less than £10,000), 53% received at least 75% of their income from just one source, compared with 80% of the largest charities. The proportion of income coming from each source also varies with the sector, as shown in **Error! Reference source not found.** below.

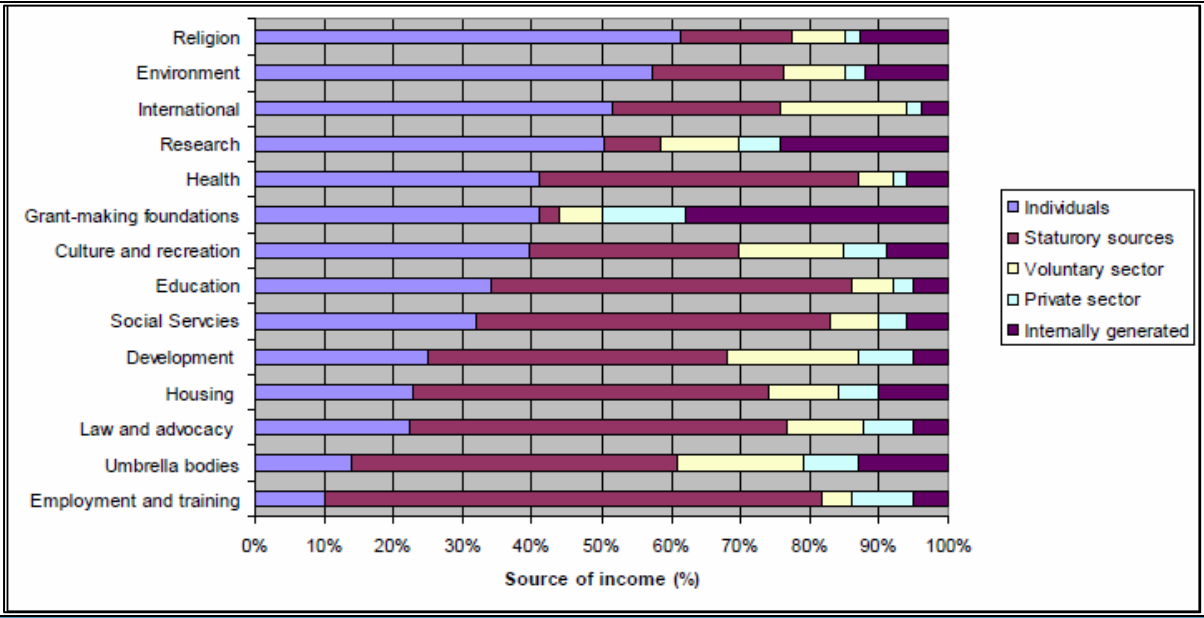

Figure A1-6: Income sources of UK charities by sub-sector 2006/07 (% of income) (Hopkins, 2010)

As can be seen from this table, charities operating in the environmental arena have a relatively high proportion of their income which comes from individual donations at over 50%, compared to other charities. In addition, statutory sources would appear to account for around 20% of total funding, with the voluntary sector account for around 10%.

The following table show sources of funding for specific NGOs. Similarly, it shows how a high share of the funding comes from membership, donations and legacies. Note that the data should be interpreted with caution due to the lack of specific data on what is included under each specific source.

[45] For instance, sixty of RSPB's reserves are farmed, covering more than 20,000 hectares, with around 170 tenant farmers, and 200 employees. More information available at: http://www.rspb.org.uk/Images/catchmentsensitivefarming_tcm9-132857.pdf

Table A1-18: Sources of funding for different NGOs							
NGO	Member -ship	Donations & legacies	National / European	Grant	Invest-ments	Activities for generating funds and commercial trading	Public mtngs and other actions
Angling Trust (2012)	83%,	13%					
Rivers Trust (2012)		3%	95%				
Inland Waterways Association (2012)	29%	14%		2%	2%	50%	1%
RSPB (2012)	32% (membership and donations) 23% (only legacies)			22%		17%	
Royal Society of Wildlife Trusts (2012)	58% - Contributions 15% - Legacies 3% - Donations 10% - Royalties				12%	2%	

A1.5.4 Non-financial factors

US Department of State guidance on Starting and Sustaining an NGO identifies a range of non-financial factors that include:

- On-going evaluation of activities
- Strong leadership
- Strong relationships with stakeholders, and
- Diversity (number and nature) of funding sources.

Implicit in some of this guidance is the length over which a charity has been operating, with this indicating that the above criteria are being met.

The need for a diversified funding base is highlighted by other authors (Atkinson et al, 2002) as being an essential indicator of long-term sustainability. Another issue that has been highlighted include donors setting inappropriate project periods, which are too short to facilitate long-term planning and development by the NGOs (e.g. to commit to funding for longer than 3 years). Constraints on the use of funding to cover organisation overheads, administration and development may also affect the ability of a NGO to continue to operate.

The Sustainable NGO[46] website provides advice to NGO managers on strategic and operational problems. The website highlights six categories of indicators focusing on different aspects of financial sustainability. These are similar to the criteria identified above, but also include:

- The ability to cover overhead costs;
- The profit and loss aspects of individual projects and services; and

[46] Sustainable NGO website: Indicators of financial sustainability. Available at http://www.thesustainablengo.org/improving-financial-viability/financial-sustainability-indicators

- Trends and structure of fixed costs and the degree to which there are reserve funds or other sources of emergency funding.

The website also highlights the importance of the existence of a monitoring process to help ensure organisational sustainability.

A1.5.5 Potential indicators of affordability

Some of the above measures of affordability would not work well at the sectoral level for NGOs, for example the different key performance indicators, as it would be very difficult to generate such data for all of the relevant organisations.

The most appropriate indicators then are likely to be ones surrounding the sustainability and diversity of funding sources, combined with the fact that the environmental sector as a whole is funded more than 50% by individual donations/subscriptions. Based on the types of funding above, it would appear that the main indicators of affordability for NGOs relate to the longevity and constancy of membership, as well as the stability of funding from central government. Thus their affordability is closely linked with the affordability aspects of households and the public sector.

Indeed, as noted in the main report, discussions with representatives of key NGOs as part of this study highlighted the importance of public sector funding to organisations expected to deliver WFD objectives.

Annex 2 Stakeholder Workshop on proposed indicators

On the 7th November, 2014 a stakeholder workshop was held to discuss the proposed indicators with representatives of the key stakeholder organisations with whom discussion on indicators had been held during the research phase of the study. The aim of the workshop was to provide feedback to the stakeholders on those indicators that the study team had selected to act as the basis for the affordability assessment. It was also considered to provide an opportunity for stakeholders representing one sector to comment on those indicators being proposed for other sectors.

The organisations invited to attend the Workshop included the following:

- Defra
- Welsh Government
- Natural Resources Wales
- Wildlife Trusts
- River Restoration Centre
- Inland Waterways, Canals and Rivers Trust
- Rivers Trust
- RSPB
- Angling Trust
- UK Major Ports
- Federation of Small Businesses
- RwEN
- Energy UK
- Ofwat
- Water UK
- Yorkshire Water
- Coal Authority
- Severn Trent Water
- Thames Water
- Portsmouth Water
- UK Irrigators Assoc.
- National Farmers Union
- Country Landowners Association
- National Farmers Union
- Consumer Council for Water

Presentations were given by the Defra project manager as to the aims of the study and how its outputs would be used. The study team then described the overall approach to the study and set out the proposed indicators for each sector. Participants were then divided into a series of discussion groups, and asked to provide group responses to four key questions. The questions and a summary of the responses are given below.

1. **Do differences in cost pass-through across the sectors have implications for the indicators?**

- Yes, cost pass through varies between and within sectors which means caution is needed when interpreting the indicators.
- The cost pass through for government is very different compared to the private sector and this must be borne in mind.
- Sequencing and financing timeframes vary between and within sectors, for instance, water companies have longer financing timeframes.
- More detailed sector information is needed in the future (related to current caveats of indicators).

2. **Does the combined set of indicators provide an even-handed and coherent approach across all of the sectors?**

- Overall the approach is even-handed and coherent but the following caveats should be applied:
  - As it stands, the Industry, Services and Other sector is too broad. As a result, the sectoral average may not represent the "typical company";
  - There needs to be a two level analysis, involving a national and local level analysis
  - There is a need to ensure that the role of Defra funding as a mechanism for generating matched funding is recognised, as this provides a mechanism for leveraging other funding making delivery more affordable overall.
- One may wish to use willingness to pay studies across a wider range of sectors but this may not be possible across all sectors.

3. **Will the combined set of indicators provide Ministers with the information that they need to assess affordability? Are there too many indicators? Which are the most important?**

- Although most indicators appear to work, the uncertainty over the costs makes any affordability analysis more complicated and uncertain
- We/Ministers should also look at what other Member States are doing – we need some benchmarking across sectors/countries
- The consequences of delaying action should also be investigated in order to keep the end goal in mind.

4. **What caveats need to be made when interpreting the indicators? Have we addressed the most important of these?**

- A sectoral analysis may underestimate the impacts on businesses of different sizes. There is a problem with using averages (see earlier comments on question 2). Moreover, affordability can vary according to demographics (e.g. water companies).
- One aspect concerning the acceptability of business plans by WatCos is that they did not specifically ask about the acceptability of measures from WFD alone. This may need addressing in the future.
- The level of analysis should reflect the importance of the issue and the magnitude of expected impacts (positive and negative).

Risk & Policy Analysts Limited

Farthing Green House, 1 Beccles Road
Loddon, Norfolk, NR14 6LT, United Kingdom

Tel: +44 1508 528465
Fax: +44 1508 520758
E-mail: post@rpaltd.co.uk
Website: www.rpaltd.co.uk