

**DEPARTMENT FOR THE ENVIRONMENT, FOOD AND  
RURAL AFFAIRS**

**WATER FRAMEWORK DIRECTIVE (WFD) ECONOMIC  
ANALYSIS: INFORMATION ON TRENDS TO IMPROVE  
THE BASELINE SCENARIOS**

**FINAL**

**WRc Ref: DEFRA7242  
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# **WATER FRAMEWORK DIRECTIVE (WFD) ECONOMIC ANALYSIS: INFORMATION ON TRENDS TO IMPROVE THE BASELINE SCENARIOS**

## **FINAL**

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August 2006

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## **ACKNOWLEDGEMENT**

In total more than 400 stakeholders were approached, inviting input via workshops, email or telephone interview. As a result, 3 workshops were held, 50+ telephone interviews conducted and numerous email inputs incorporated. The contributions made by stakeholders to this work via these channels are greatly appreciated. We would like to particularly thank those able to attend workshops, and to review draft outputs, to provide valuable inputs and refinements to the views presented.



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## LIST OF ABBREVIATIONS

AMP	Asset Management Plans
BAU	Business as Usual
CAMS	Catchment Abstraction Management Strategy
CAP	Common Agricultural Policy
CEA	Cost-effective analysis
CfD	Charges for Discharges
CIS	Common Implementation Strategy
CSO	Combined Sewer Overflows
Defra	Department for Environment, Food and Rural Affairs
EA	Environmental Agency
EU	European Union
FAWG	Forests and Water Guidelines
FDMS	Flood Defence Management System
GDP	Gross Domestic Product
GQA	General Quality Assessment
HA	Highways Agency
HOST	Hydrology of Soil Type
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention Control
NALD	National Abstraction Licensing Database
PAH	Poly Aromatic Hydrocarbons
RBC	River Basin Characterisation
RBD	River Basin District
RHS	River Habitat Survey

SUDS	Sustainable Urban Drainage Systems
SWS	Surface Water Sewers
TBT	Tributyltin
TPI	Targeted Programme of Improvements
UKTAG	UK Technical Advisory Group
UWWT	Urban Waste Water Treatment
WFD	Water Framework Directive

## **SUMMARY**

### **I BENEFITS**

This report presents stakeholder views of how pressures impacting on water bodies might change between now and 2015 as a result of policies/activities already in place or planned (i.e. a baseline scenario). It identifies evidence to support these views; and assesses the value that this information will give in enhancing current risk assessments for the Water Framework Directive (WFD).

The report will contribute to the implementation of the WFD in England by:

- Supporting the development of assumptions for the preliminary cost-effectiveness analysis to be undertaken in late 2006;
- Aiding the process of considering new measures and policy instruments for the WFD, for example, in terms of control of hydromorphological and non-agricultural diffuse pollution pressures;
- Aiding the Environment Agency's evaluation of the policy baseline as part of their Strategic Assessments undertaken in Spring 2006;
- Informing the work to be undertaken by the liaison panels at the river basin district level as led by the Environment Agency.

### **II OBJECTIVES AND SCOPE**

The overall objective was to identify, characterise and assess trend information so as to improve the second river basin characterisation process. Specific objectives were to:

- Gather information on the pressures impacting on water bodies from different activities and sectors in England;
- Identify how these might change between now and 2015 as a result of policies/changes already in place or planned;
- Assess the certainty in views on the direction and scale of changes/trends;
- Identify evidence (e.g. datasets, information, research, expert judgement) that there is to support these views;
- Determine the value that this information will give to existing risk assessments.

The report addresses all activities that impose, or potentially impose, pressures on the water environment with the exception of agricultural pressures resulting from CAP reform and the Nitrates Directive, which is covered by a separate study. The focus of the study was engaging stakeholders to present a picture of trends for England.

### III REASONS

Current risk assessments contain little information on how activities and the associated pressures impacting upon water-bodies might change between now and 2015. This reflects a scarcity of quantitative information on trends. However, guidance from the EU on preparing a baseline scenario (a “projection” of business as usual policies (i.e. those in place irrespective of the WFD) and trends) recognises the role and usefulness of experts when deriving business as usual forecasts on pressures, without relying on quantitative information, which may not exist, or might not be known of, or may not be available within suitable timeframes. This work was, therefore, undertaken to capture expert views to enhance the quantitative information already encompassed within the risk assessments.

### IV CONCLUSIONS AND RECOMMENDATIONS

In total more than 400 stakeholders were approached, inviting input via workshops, email or telephone interview. As a result 3 workshops were held, 50+ telephone interviews conducted and numerous email inputs incorporated. The contributions made by stakeholders to this work are greatly appreciated.

#### General Comments

1. The study revealed **relatively little quantitative trend information**. However, it was considered that much of the qualitative information and expert judgment was of value and could improve the baseline scenario for many of the activity-pressure relationships. The Common Implementation Strategy (CIS) document indicates<sup>1</sup> that the use of this type of **qualitative information is acceptable** in the absence of quantitative data. What is then required is a method for using and translating such qualitative trends when the risk of failing environmental objectives in 2015 in specific water bodies is assessed, taking into account the effectiveness of policies in place, or those planned for the near future. These aspects should be investigated further particularly for some of the least well quantified activity-pressure relationships. A possible approach would be to undertake a **sensitivity analysis where different levels of effectiveness for the specific measures** described by the consulted experts are applied to examine the implications (in terms of trends in status) in particular water bodies. This might be particularly appropriate where measures are aspirational rather than mandatory: many of the consulted stakeholders and experts believed that such aspirational measures will be more effective than sometimes thought.
2. Overall, the trend information gained from stakeholders is characterised by **significant uncertainty**. For many of the pressures, driving forces such as population change and climate change will cause an increase in gross trends. Counteracting this, for many sectors, there are policy measures already in place that will help to alleviate the increasing problems; in many cases it was difficult to determine the direction of the resulting net trend. Another source of uncertainty was the difficulty in estimating the level of uptake, and likely effectiveness, of policies and planned mitigation measures.
3. Despite this uncertainty, for **some pressure-activity relationships, stakeholders were confident** that planned policies and mitigation measures will lead to a decreasing trend in pressure by 2015, in some cases to the extent where the pressure will be of low

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<sup>1</sup> The CIS document on preparing a baseline scenario provides guidance on how to derive business-as-usual forecasts on pressures without relying on quantitative data. In such cases a qualitative approach is advocated. Where, for example, “expert groups” provide a judgement on evolution, based on partial data plus deliberation.

significance when considering the need for new measures. Those pressure-activity relationships where confidence was highest were:

- Forestry – all pressures, the Forestry Commission was confident that policies already in place should eliminate the impact of forestry on compliance risk for the WFD in most locations in England and that no further measures are anticipated;
- Ports and Marinas – all pressures with the exception of abstraction and flow;
- Navigation – all pressures with the exception of abstraction and flow, and alien species.

Stakeholders were reasonably confident about:

- Urbanisation – abstraction and flow;
- Transport – diffuse sources;
- Agriculture - diffuse sources;
- Ports and Marinas – abstraction and flow;
- Navigation – abstraction and flow, and alien species.

The views expressed in this document for these sectors are of particular value in ongoing processes. For other sectors, the confidence in the information given was low.

4. Whilst all sectors were invited to share their views on baseline trends, information was not gained for all. **Some gaps in information** have been identified. The most important of these relate to Industry (excluding the Water Industry, the Energy Industry and Mining), where future trends in point source discharges and abstraction/flow regulation pressures are unknown, but potentially of importance.
5. Whilst all **key drivers** have been identified as having an impact upon at least one activity-pressure combination, population change, economic growth and climate change are identified as having the greatest influence.

## Significance

1. Table 5.1 (reproduced as Table 1.1 below) summarises the significance given to each pressure-activity relationship.

**Table 1.1 Significance ranking of each Activity-Pressure Combination**

Activity/ Sector	Pressure	Significance Ranking
Urbanisation	Diffuse sources	High Significance, particularly with respect to discharge to surface water sewers and CSOs. In addition, the current EA risk assessment for diffuse urban pressures is limited
Urbanisation	Point sources	High Significance; include sustainability issues with enhanced wastewater treatment
Urbanisation	Abstraction/flow	Significant but spatially and temporally varied
Urbanisation	Morphological	Significant locally, particularly with respect to flood defence

<b>Activity/ Sector</b>	<b>Pressure</b>	<b>Significance Ranking</b>
Transport	Diffuse sources generally	High Significance for Local Authority roads, not significant/moderate significance for highways
Transport	Diffuse Sources - Acidification	Not Significant – Moderate
Transport	Point sources	High Significance for Local Authority roads (see diffuse)
Transport	Abstraction/flow	Moderate
Transport	Morphological	Generally Moderate but may be significant locally
Agriculture	Diffuse sources	High Significance for sediment, organic enrichment and faecal contamination (other pressures not encompassed by this study)
Industry	Diffuse Sources	Unlikely to be of high significance, information lacking
Industry	Point Sources	Potentially High Significance, information lacking
Industry	Abstraction/flow	Potentially High Significance, information lacking
Industry	Morphological	Unlikely to be of high significance, information lacking
Agriculture	Point sources	Not Significant, although small point source discharges probably considered under diffuse
Agriculture	Abstraction/flow	Significance unclear
Agriculture	Morphological	Not Significant
Forestry	Diffuse sources	Low Significance
Forestry	Point sources	Low Significance
Forestry	Abstraction/flow	Low Significance
Forestry	Morphological	Low Significance
Ports & Marinas	Morphological; dredging and infrastructure	Probably significant at national as well as local level
Ports & Marinas	Abstraction/flow	Only an issue locally
Ports & Marinas	Point source – oil	Not significant
Ports & Marinas	Point source – sanitary determinands	Not significant, slight reduced trend
Ports & Marinas	Diffuse source – pesticide (antifouling paints)	Significant TBT reduction; possible copper increase
Ports & Marinas	Alien species pressure	Possibly significant
Navigation <sup>2</sup>	Morphological	Only likely to be locally significant
Navigation	Abstraction/flow	Only likely to be locally significant
Navigation	Point source – oil	Not significant
Navigation	Point source – sanitary determinands	Not significant
Navigation	Diffuse source – pesticide (antifouling paints), enhanced turbidity	Not significant
Navigation	Alien species pressure	Only likely to be locally significant
Flood Defence	Morphological	High significance at national level but particularly in South East

<sup>2</sup> Largely inland waterways and canals

2. The pressure-activity relationships where the potential impact of trend data was highest and where confidence was at least 'reasonable' are listed below. The information on trends contained in this document **should be considered in taking forward future risk assessments**.
  - Diffuse sources- Agriculture;
  - Morphology - Flood defence;
  - Diffuse sources – Transport – acidification;
  - Navigation – Morphology;
  - Navigation – Alien species.
3. The pressure-activity relationships where the potential impact of trend data was highest, but where confidence in the information provided on trends was low are listed below. It may be appropriate to undertake **further work to improve the confidence** in the trends and risk assessments associated with these pressure-activity relationships.
  - Diffuse sources – Urbanization;
  - Point sources – Urbanization;
  - Morphology – Urbanization;
  - Abstraction and flow – Transport;
  - Point, diffuse sources, abstraction and flow – Industry.
4. The pressure-activity relationships where **high local variation** was highlighted are listed below. The consideration of these pressure-activity relationships will be particularly **relevant for the Regional Liaison Panels** in developing river basin district plans:
  - Diffuse sources – Urbanisation particularly with regards to combined sewer overflows and their programmes of improvement under the Asset Management Plans programme;
  - Morphology – Transport;
  - Agriculture – Diffuse source pollution, particularly in relation to the areas of land taking up the High Level Entry Schemes under the Common Agricultural Policy;
  - All pressures – Ports and marinas and navigation;
  - Morphological – Flood defence with particular pressure on the South East.

## V RESUMÉ OF CONTENTS

The report is divided into five sections as follows:

- Section 1 – an introduction to the work undertaken;
- Section 2 – an outline of the objectives, scope and approach;
- Section 3 – background information about the Article 5 risk assessments, the information that was used by the Environment Agency in the initial risk assessments, as well as some of the limitations of the initial approaches, and an

introduction to key definitions used in the report, for activities, pressure, drivers and gross trends, policies and net trends;

- Section 4 - captures the information collected from the review of literature and from stakeholder consultation. It reports the results according to sector/activity – pressure relationships detailing: the drivers affecting these activities and the resulting gross trends in pressures; the policies and mitigation measures in place that will impact between now and 2015; and the resulting net trends in pressures. There is also a summary of the significance of the results in terms of the value they might add to the existing risk assessments. The results are supported by detailed pressure-activity tables in Appendix E and a significance ranking matrix in Appendix F;
- Section 5 – draws conclusions about the nature of the information collected and its significance in re-assessing the risk assessments, in particular to identify pressure-activity relationships where: the potential impacts are high; they may be subject to a high degree of local variation; and the confidence in the views given is high.

## 1. INTRODUCTION

### 1.1 Baseline scenarios and expert judgement

The European Union Member States and the European Commission have jointly developed a common strategy for supporting the implementation of the Water Framework Directive (WFD), with the aim of allowing a coherent and harmonious implementation of the Directive. To that end, a number of working groups were established to develop documents that provided experts and stakeholders with guidance in the implementation of the Directive. The focus was on methodological questions related to a common understanding of the technical and scientific implications of the Directive. One of the working groups (WATECO) dealt with the implementation of the WFD's economic elements in the broader context of the development of integrated river basin management plans as required by the Directive. One of the aspects covered by the working group was on methodologies to prepare a baseline scenario, which is taken to be a "projection" of business-as-usual policies (i.e. those in place irrespective of the WFD) and trends.

The guidance recognises the role and usefulness of experts in the development of a baseline scenario, for example, when deriving business-as-usual forecasts on pressures without relying on quantitative data, which may not exist, may not be known of, or that may not be available within suitable timeframes. The use of expert groups is aimed at using partial knowledge to build a judgment on trends based on partial data plus deliberation: the stakeholder groups convened for this study were considered to be such expert groups.

Defra and the Welsh Assembly government have produced Economic Supportive Documents, in collaboration with the Economic Advisory Stakeholder Group, which provide contextual economic and cost recovery background information to the Article 5 Reports for each River Basin District (RBD). These documents contain information on the characteristics of the driving forces within each RBD and provide forecasts for some, such as population, number of households, output and employment to 2015. In addition, attempts are made to link economic information with the most important activities and pressures for the characterisation of water bodies and the associated risk assessment. These documents are considered to be important sources of information for the development of baseline scenarios for use in the refinement of the Article 5 risk assessments and the subsequent drafting of River Basin Management Plans. This is particularly so, as they are regionally based, and there are often large differences in many of the activity pressure relationships within and between RBDs which need to be taken into account in developing baseline scenarios.

### 1.2 This project

Defra has contracted WRc to gain stakeholder views of how pressures impacting on water bodies might change between now and 2015 as a result of policies/activities already in place or planned (i.e. the baseline scenario); to determine what evidence we have to support these views; and to assess the value that this information will give to the risk assessments already carried out for the WFD.

In addition, this work will contribute to the implementation of the WFD in England by:

- Aiding the development of assumptions for the preliminary cost-effectiveness analysis to be undertaken in late 2006;
- Aiding the process of considering new measures and policy instruments for the WFD, for example in terms of control of hydromorphological and non-agricultural diffuse pollution pressures;
- Aiding the Environment Agency's evaluation of the policy baseline as part of their Strategic Assessments undertaken in Spring 2006; and
- Informing the work to be undertaken by the liaison panels at the river basin district level, as led by the Environment Agency.

### **1.3 This report**

This report is the output from that contract, and is based on information gathered from stakeholders in England over the last 6 months. The report is divided into five sections as follows:

- Section 1 – an introduction to the work undertaken;
- Section 2 – an outline of the objectives, scope and approach;
- Section 3 – background information about the Article 5 risk assessments, the information that was used by the Environment Agency in the initial risk assessments and some of the limitations of the initial approaches, and an introduction to key definitions used in the report, for activities, pressure, drivers and gross trends, policies and net trends;
- Section 4 - captures the information collected from the review of literature and from stakeholder consultation. It reports the results according to sector/activity –pressure relationships, detailing the drivers affecting these activities and the resulting gross trends in pressures, the policies and mitigation measures in place that will impact between now and 2015 and the resulting net trends in pressures. There is also a summary of the significance of the results in terms of the value that they might add to the existing risk assessments. The results are supported by detailed pressure-activity tables in Appendix E and a significance ranking matrix in Appendix F;
- Section 5 – draws conclusions about the nature of the information collected and its significance in re-assessing the risk assessments in particular to identify pressure-activity relationships where: the potential impacts are high; they may be subject to a high degree of local variation; and the confidence in the views given is high.

## 2. OBJECTIVES AND APPROACH

### 2.1 Objectives

The aim of the work was to identify, characterise and assess trend information so as to improve the second river basin characterisation process. The work will inform ongoing work by the Environment Agency (EA) on the policy baseline as part of their Strategic Assessments. It will also inform the later work of the liaison panels at the river basin district level. Specific objectives were to:

- Gather information on the pressures impacting on water bodies from different activities and sectors in England;
- Identify how the above might change between now and 2015 as a result of policies/changes already in place or planned;
- Assess the certainty in views on the direction and scale of changes/trends;
- Identify what evidence (e.g. datasets, information, research, expert judgement) there is to support the above views;
- Determine the value that this information will give to existing risk assessments.

The terms of reference for the work are given in Appendix A.

### 2.2 Scope

The report addresses all activities which impose, or potentially impose, pressures on the water environment (see also Section 3.2). Exceptions to this are the pressures imposed by agriculture. For agricultural pressures, the study did not address all agricultural pressures since changes resulting from Common Agricultural Policy (CAP) reform and the Nitrates Directive will be covered by a separate study commissioned by Defra and being undertaken by Cambridge University (BAU II, 2006). The focus of the study was engaging stakeholders to present a picture of trends for England.

### 2.3 Approach

The objectives were realised in 7 stages:

**Stage 1: Review of existing information.** WRc reviewed previous information, sent to Defra and the Environment Agency by stakeholders, relevant to the risk assessments. Appendix B provides a list of the information sources reviewed;

**Stage 2: Stakeholder interviews.** Interviews were held with key stakeholders in England to prepare a draft list of pressures and associated datasets for discussion at a national workshop; and to identify preferences for issues to be discussed.

**Stage 3: Briefing on pre-workshop research.** A pre-workshop report was circulated prior to the workshop for comment;

**Stage 4: National Workshop February 21<sup>ST</sup> 2006, London:** A one-day workshop was held to allow stakeholders to identify and characterise trend information, and to identify and prioritise activity-pressure combinations;

**Stage 5: Further pressures research:** carried out through two pressure-based workshops dealing with Agriculture and Forestry, held on 16<sup>th</sup> March 2006, and Ports, Navigation and Flood Defence, held on 6<sup>th</sup> April 2006. Further research for other pressure-activity areas was undertaken through literature review and a second round of interviews with key stakeholders;

**Stage 6: Reporting:** At an interim stage to provide the Environment Agency with views in time for their Strategic Assessment exercise, to be updated by mid-April when all information has been received;

**Stage 7 Final Reporting:** A draft final report was sent to stakeholders for review; their comments were taken into account in producing the final document.

Details of the approaches made to involve stakeholders in this process are documented in Table C.1 in Appendix C. A list of stakeholders approached at each stage and a copy of the introduction letter, questionnaire and workshop agendas are available in a separate Annex to this report. In total, more than 400 stakeholders were approached, inviting input via workshops, email or telephone interview. As a result 3 workshops were held, 50+ telephone interviews conducted and numerous email inputs incorporated.

An important element in reporting the results was the **assessment of significance**; this was done in two parts using the same approach. For the first part, participants in the pressure-based workshops were asked to judge the value of the information gathered in terms of how important the data is for improving knowledge of the pressures and the river basin characterisation (i.e. do the trends and confidence in them suggest that it is important enough to re-evaluate the risk assessment, at least for some water-bodies?). The following table was used to aid this judgement.

Potential impact of new information/data	high = 2	low = 1	no =0
Confidence in new data/data	high=2	low=1	No=0
Confidence in existing risk assessment	high=0	Mod=1	Low=2

For the second part, significance was reassessed, by WRc, when the tables were complete for all activity-pressures, so that the information for these sectors could be considered in context with that from other sectors.

### **3. BACKGROUND**

#### **3.1 Article 5 Risk Assessment**

The Water Framework Directive requires water bodies to achieve a number of objectives by 2015, including: good ecological and chemical status for surface waters, good chemical status and good quantitative status for groundwaters, and for heavily modified and artificial water bodies, good ecological potential and good surface water chemical status. As part of the Article 5 risk assessment (characterisation), the Environment Agency have determined the most significant pressures and impacts on the water environment and assessed the likelihood that water bodies will achieve the relevant objectives.

The Agency's assessment framework uses: activity, source pressure, exposure pressure and impact data. Water bodies have been assessed with respect to the magnitude of the activity or pressure exerted upon them and, where the data are available, the susceptibility of the environment; resulting in a categorisation of high, moderate, low or no exposure pressure. The pressure category is then converted to a risk using impact data where available and a measure of confidence. If impact data are not available (e.g. there are no monitoring data), thresholds for risk category are determined subjectively. A measure of confidence in the output is based on the method, quality of data or understanding of the processes. The risk thresholds have been established through agreement by the UK Technical Advisory Group (UKTAG) and its subgroups, expert judgment within the Environment Agency or by using existing classification schemes as a guide.

Surface, Ground, Transitional and Coastal waters have been risk assessed. The individual risk assessments for each type of water body and their associated activities are provided in Appendix A. However, it should be noted that for some risk assessments, whilst associated activities were identified and discussed, the risk assessment was based on observed data alone. The risk assessments encompass a range of point and diffuse source pressures, alien species pressures, abstraction and flow regulation pressures, and morphological pressures.

In the first risk assessments, the Agency used a number of datasets (Table 3.1) including those holding: abstraction and point source discharge information, land cover data, agricultural census data, and surface and groundwater monitoring datasets. In addition, output from models was used to derive some information at a national scale (e.g. atmospheric deposition of nitrogen). The advantage of using these datasets is the consistent and reliable information that they provide at a national scale. Some modelling datasets relating to agricultural diffuse pollution were not used in (RBC1). In particular, the MAGPIE spatial database of agri-environmental data could have been used to determine nitrogen loss risk (Water UK, 2004). In addition, other models for assessing nitrogen and phosphorus risk characterisation were available, e.g. INCA and PSYCHIC, according to Water UK (2004). With respect to urban diffuse risk assessment, the first risk assessments did include coverage of diffuse urban sources, although information from the Highways Agency (HA) as a source of road runoff pollution information, derived from extensive research was not used (Water UK, 2004) identified. It is not clear, however, whether this information would have been sufficient to aid a nationally consistent risk assessment.

**Table 3.1 Summary of databases and information sources used in RBC1**

Pressure (waterbody)	Database
Abstraction (rivers)	National Abstraction Licensing Database (NALD) Generalised Quality Assessment (GQA) biology data LowFlows2000 software; catchment areas, flow stats, baseflow indices Water Company discharge data Catchment Abstraction Management Strategy (CAMS); unlicensed abstractions
Abstraction (groundwater)	NALD MAGPIE Model; estimated recharge Hydrology of Soil Type (HOST); baseflow index BGS Aquifer response map
Morphological Alteration (rivers)	River Habitat Survey (RHS) Flood Defence Management System (FDMS) Urban land use GIS cover
Point Sources (Rivers, Transitional & Coastal Waters)	LowFlows2000; flow statistics AMP4 database; planned stricter discharge consents Charges for Discharges database (CfD) Integrated Pollution Control (IPC) database Integrated Pollution Prevention and Control (IPPC) database
Point Sources (Groundwater)	Databases on potential point sources of pollution; authorised discharges to ground, landfill sites, petrol stations, IPPC/PPC sites, groundwater pollution database
Diffuse Phosphorus (Rivers)	Agricultural Census data GQA sampling data
Diffuse Phosphorus (Groundwater)	Agricultural Census data (HOST); baseflow index Groundwater quality monitoring data
Diffuse Nitrogen (Rivers)	Trajectory Model output; atmospheric deposition of NO <sub>x</sub> FRAME Model output; atmospheric deposition of NH <sub>x</sub> Agricultural census data GQA sampling data
Diffuse Nitrogen (Groundwaters)	Groundwater nitrate vulnerable zone map High nitrate vulnerability Groundwater vulnerability Predicted nitrate concentrations in groundwater Groundwater monitoring data Aquifer classification map
Urban Diffuse (Rivers)	LCM2000 Land cover database; identification of urban and suburban land use GQA; biology
Urban Diffuse (Groundwater)	LCM2000 Land cover database; identification of urban and suburban land use Low permeability drift database Aquifer classification database Groundwater monitoring database

Typically, the first risk assessment did not include information describing how activities and the associated pressures impacting upon water-bodies might change between now and 2015. However, three main trends were incorporated into the first risk assessment and reflected cases where trend information was readily available or where planned investment was already funded. The three were: (i) water industry investment plans (AMP4) that influenced the assessment of point source metal, nutrient, pesticide, and sanitary determinand discharges for rivers, and point source sanitary determinands for transitional and coastal waters, (ii) an assessment of nitrate concentrations in groundwater based on extrapolation of observed

trends on nitrate levels, (iii) Environment Agency Water Resource Strategies that assessed risk to the hydrological flow regime (abstraction risk to surface and groundwaters) in 2015, using business-as-usual growth factors applied to abstractions. This included abstraction for public supply, spray irrigation and various industrial uses.

The initial risk assessment provided a first indication of what and where the pressures and impacts affecting the water environment may be, rather than, a comprehensive measure of the current ecological status of water bodies. In addition, it is based on an estimate of where good status is for each water category since exact boundaries of status will not be defined at European Union (EU) level until the end of 2006. Consequently, a further risk assessment is planned. The first risk assessment process engaged the views of a range of stakeholders and these will inform the refinement of risk assessment. The refinement will include or take into account:

- a) an improved knowledge of water status and associated pressures through implementation of a formal WFD monitoring program;
- b) identification of further significant groundwater dependent wetlands;
- c) identification and characterisation of further important smaller water bodies, which could include waters of significance for biodiversity;
- d) the outcome of the EU intercalibration exercise, which will formally define where 'good status' lies;
- e) the outcome of the daughter directives on groundwater and priority substances and the revised Bathing Water Directive;
- f) better data on economic trends in River Basin Districts to determine risk of non achievement of WFD objectives by 2015;
- g) continued stakeholder involvement in characterisation work e.g. stakeholder workshops, consultations, bilateral meetings.

### **3.2 Drivers, Gross Trends, Policies and Net Trends**

In considering the trends in baseline information the project differentiated between gross trends, resulting from drivers, and net trends resulting from policies or mitigation measures. These were considered in the context of individual pressure-activity relationships. The following definitions were used:

- **Activities (e.g. mining) impose pressures** (e.g. chemical pollution) on the water environment.
- **Drivers** affect activities and lead to **gross trends** in the pressures (not environmental policies). They are the key 'high-level' issues that impact upon many or all activities and in turn, pressures on the water environment.
- **Policies or mitigation measures** aim to reduce pressures on the water environment (either as a direct aim or as a side effect); their effect on gross trends leads to **net trends**. Each activity is impacted by a number of policies or mitigation measures. For example, future changes in environmental pressures and likely pollution loads from industry will be

influenced by (a) policies that shape current and planned environmental management and expenditure plans, (b) the pressure to reduce costs including the rationalisation of energy demands, (c) planned investment in incorporating best practice management and best available technology and (d) future industrial output.

### **3.2.1 Key activities**

The key activities considered in this report are:

1. Urbanisation and the Water Industry
2. Transport
3. Industry
4. Agriculture
5. Forestry
6. Ports and Marinas
7. Navigation
8. Flood Defence

### **3.2.2 Key Drivers**

The key drivers identified in this report are:

1. Economic growth (employment and output)
2. Demographic evolution (population and households)
3. Land use change
4. Technological change
5. Consumption/ Behavioural change
6. Climate
7. Wider Government Policies

### **Economic growth (employment and output)**

Changes in economic growth and how that relates to the different economic sectors will influence the potential impacts on water bodies in 2015. For example, increases in economic sectors that have a high water demand would potentially increase abstraction pressures, and an increase in manufacturing industry may lead to increased pressures from point source discharges and emissions to the atmosphere. As has been illustrated by the DEFRA funded

“Article 5 economic analysis of water use supporting documents”, there will be regional differences in the growth of the different sectors, which should be taken into account when undertaking risk assessments for the different RBDs. Examples from the activity pressure tables presented later in this report are predicted declines in textile output, modest growth in chemicals and food manufacturing industries, and no change in the metals industry. These changes and trends may have potential impacts on the status of affected water bodies – these are the gross trends arising. The application, implementation and effects of appropriate measures and policies, to prevent or mediate any impacts arising from the gross trends, will lead to the net effects on water bodies.

### **Demographic evolution (population and households)**

The total population of England is increasing. There are significant regional differences in the estimated population projections and hence densities. Population densities are expected to show a downward trend in the North East and North West and a rise in all other regions by 2021<sup>3</sup>.

The number of households in England has risen by 73% since the early 1900s. The main reason for this increase has been population rise, but changing family structures, lifestyles, and longer life expectancy also play an important part. The number of households in England and Wales are projected to rise a further 19% between 1996 and 2021. Seventy one per cent (2.7 million households) of the total projected growth by 2021 is likely to be due to one-person residencies. An increasing proportion of people who live by themselves have supplemented the historic trend of decreasing family size. The proportion of one-person households was under one-fifth in 1971 and is projected to rise by about a third by 2021. Migration patterns contribute to different household growth across the country<sup>4</sup>.

The Government’s sustainable communities agenda<sup>5</sup> sets out a strategic approach to development and housing expansion in the South East of England. It also contains proposals to tackle weak housing demand and regeneration in the Midlands and North of England. The 200,000 extra new homes to be created by 2016 are in addition to those proposed in existing regional planning guidance. The Barker Review of Housing<sup>6</sup> Supply suggests that a further 70 – 120,000 new homes may need to be built each year.

Changes in population and household will affect water demand in particular areas of the country, and the requirements for infrastructure development, will potentially have impacts on the hydrology and morphology of water bodies. In addition, population growth increases the generation of sewage leading, potentially, to a greater level of pollution via water industry discharges. Additionally, increased wastewater treatment may not be sustainable, requiring enhanced energy consumption, increased generation of greenhouse gases and a greater requirement for sludge disposal.

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<sup>3</sup> [http://www.environment-agency.gov.uk/yourenv/432430/432434/432461/438824/?lang=\\_e](http://www.environment-agency.gov.uk/yourenv/432430/432434/432461/438824/?lang=_e)

<sup>4</sup> [http://www.environment-agency.gov.uk/yourenv/432430/432434/432461/440885/?version=1&lang=\\_e](http://www.environment-agency.gov.uk/yourenv/432430/432434/432461/440885/?version=1&lang=_e)

<sup>5</sup> <http://www.communities.gov.uk/index.asp?id=1139870>

<sup>6</sup> [http://www.hm-treasury.gov.uk/media/053/C7/barker\\_review\\_execsum\\_91.pdf](http://www.hm-treasury.gov.uk/media/053/C7/barker_review_execsum_91.pdf)

## Land use change

In England and Wales, more than 70% of the land is used for agriculture. The area used for crops has declined partly as a result of the introduction of the EU Set-Aside scheme. The total area of agricultural land is not expected to change significantly. The area of woodland increased over the 20th century and continues to increase, but England and Wales remain two of the least wooded countries in Europe. About 11% of land is currently in urban use; this has grown rapidly in the past 50 years and continues to grow as more homes are built<sup>7</sup>.

## Technological change

Higher standards of living are changing water demand patterns; this is reflected mainly in increased domestic water use, especially for personal hygiene. Most of the UK population has indoor toilets, showers and/or baths for daily use. The result is that most of the urban water consumption is for domestic use. Most of the water use in households is for toilet flushing, bathing and showering, for washing machines and dishwashing. The proportion of water for cooking and drinking, compared with the rest of the uses, is minimal. Statistics show that there is a potential to improve the water efficiency of common household appliances such as toilets, taps and washing machines. New technologies have a positive impact on the use of water by domestic appliances, and have achieved important reductions over the last 20 years. Increasing the market penetration of appliances in the domestic field is difficult and requires information campaigns to explain the reasons and advantages of the new appliances, for example in terms of reduced water bills. Different experiences show that savings can be achieved using various water saving devices in households, public places and industry (especially hotels and leisure centres). For example, water-saving devices on taps, and toilets with 6 l/flush, could achieve reductions in use of around 50%. The Government's Sustainable Buildings Code promotes the efficient use of water in new housing.

Technological changes have also been instrumental in reducing emissions from potentially polluting sources particularly through the application of best available techniques as required by the IPPC Directive.

## Consumption/ Behavioural change

Water consumption per person in households increased by 7% between 1992 and 2001 in England and Wales. In 1995, the average and peak demands for public water supply were higher than in other years because of the unusually hot dry weather that year. In 1972, only 66% of households owned a washing machine. Ownership increased to 90% by 1996 and is projected to increase further to 94% by 2010. Household water consumption has risen by 70% over the past 30 years mainly due to the introduction of water demanding appliances<sup>8</sup>.

The water companies are running campaigns to gain public support for reducing the overall amount of water that is used. These campaigns provide advice to customers on water saving devices and how to be water efficient within the home environment i.e. trying to encourage and establish behavioural changes.

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<sup>7</sup> <http://www.environment-agency.gov.uk/yourenv/432430/432434/432448/432787/?version=1&lang=e>

<sup>8</sup> <http://www.environment-agency.gov.uk/yourenv/432430/432434/432453/434390/?version=1&lang=e>

## Climate Change

Climate change is a key driver that imparts a number of potential impacts, however, the timing and magnitude of these is highly uncertain and many may only begin to occur at an appreciable level post 2015. The most important of these impacts are outlined as follows:

- Whilst predicted future changes in rainfall and temperature vary regionally across England and Wales, typically, heavier more intense rainfall is predicted during winter months. If realised, this will increase the generation of both agricultural and urban (including combined sewer overflows) pollutants whilst potentially reducing the effectiveness of mitigation measures.
- More flash rainfall may increase run-off from farmland, is less likely to feed aquifers and more reservoirs may be required. Increased flooding raises the risk of flushing of contaminants from contaminated land and abandoned mines.
- An increase in flood defences would enhance hydromorphological pressures impacting upon surface waters. Higher sea levels increase the likelihood of seawater intrusion into groundwaters and the flooding of landfills located in the coastal zone.

Predicted hotter and drier summers (primarily in the South East) will lead to reduced river flows, a concentrating of pollutants, increased likelihood of eutrophication, and a reduction in water available for abstraction. Similarly wetlands and lakes may shrink, whilst clay soils, prone to cracking during dry weather, will become less able to attenuate pollutants washed down by infiltration. Longer crop growing seasons and enhanced crop growth would increase nutrient uptake and provide soil cover for longer periods.

Climate change is also predicted to impact upon domestic, industrial and commercial, and agricultural and horticultural water demand. A small impact of climate change upon domestic demand is predicted (Downing et al. 2003) (an increase of 1.8%) by the 2020's with a 2.8% increase over the same period for the industrial/commercial sectors e.g. consumption of soft drinks. A significant rise in irrigation use (of about 20%) is predicted, although the impacts are region specific, ranging from a decrease of 4% in the North West to an increase of 24-25% in the Thames region.

More specific impacts of climate change are incorporated within the Tables of summarised information (Appendix E).

## Wider Government Policies

Participants at the national workshop in February 2006 introduced the concept of 'Government' as another driver potentially leading to gross trends in the various activities-pressure relationships on water bodies. Given that Government spending accounts for about 40% of UK GDP, Government policies on taxation and spending can have significant impacts on economic growth, and on business and consumer behaviour.

Also covered by this driver are a wide range of Government policies not aimed at mitigating impacts on the water environment directly. These include, for example, Sustainable Forest Management policies, the Sustainable Communities Agenda and implementation of the Landfill Directive. Again, such policies change behaviour in ways that lead to gross trends in the pressures from certain sectors. This contrasts with policies whose aims are focussed

directly on mitigating pressures from activities affecting water status, which are captured under the heading of 'policies in place/mitigation'.

## 4. RESULTS

Table 4.1 presents a summary of activities and related pressures from a range of sectors including, but not exclusively, those identified in the Environment Agency risk assessment method summaries (see Appendix B). Table 4.1 also references the series of Tables given in Appendix C, which capture information describing the pressure-activity trends derived from that provided by stakeholders prior to the national workshop, at the national workshop and in the subsequent pressure based workshops and consultations. This series of tables has been broken down into the following broad sector/activity categories; Mining, Urbanisation (including Water Industry issues), Transport, Industry, Agriculture (selected activities), Forestry, Navigation, Ports and Marinas, and Flood Defence. Each of these categories is further subdivided and tabulated by associated pressures. In some cases, pollutant-specific tables have been derived e.g. the use of Tributyltin (TBT) in the Ports and Marinas sector. In other cases, a table reflects a range of pollutants that can, i) be expected to behave and trend in a similar way and/or ii) insufficient information is available to warrant further subdivision to specific pollutants e.g. point source pressures under Urbanisation. In the case of Urbanisation, point and diffuse pollutants are combined within the same table since urban pollutants can originate as diffuse in nature before discharging to a waterbody from a point outlet.

The following sub-sections, summarise the information provided by stakeholders for each of the broad activity/sector categories, identifying gross trends, policies and measures, and resultant net trends.

**Table 4.1 Summary of the Pressure Activity relationships described in tables, in Appendix C, with table reference numbers**

Note: Green boxes indicate those pressure activity relationships identified (although not necessarily incorporated) by the Environment Agency in RBC1. Yellow boxes indicate other relationships that might be significant. Water Industry issues are included within Urbanisation. Port and Marina (P&M) activities include shipping, dredging, and development (infrastructure) pressures.

Source/Activity Pressures	Mining	Urban	Agric	Forestry	Industry	Aqua-culture	Transport	Amenity pesticide	Land-fill	Navig-ation	Land claim	Flood Defence	Aggreg extractn	P&M Dredging	P&M Shipping	P&M Develop
<b>1. Diffuse Source Pressures</b>																
a) Sediment Delivery			A1a	F1a			T1			N4						
b) Acidification			A1b	F1b	I1		T1a									
c) Chlorinated Solvents		U1**					T1									
d) Dangerous Substances		U1**					T1									
e) Mines and Minewaters	M1e															
f) Nutrient nitrogen		U1** *					T1									
g) Nutrient Phosphorous		U1** *					T1									
h) Organic enrichment			A1b													
i) Pesticides (Tributyl Tin)										N1i					P1	
j) Pesticides and Sheep Dip			A1c	F1c				Am3								
k) Urban Discharges		U1														
l) Faecal Contamination		U1	A1d													
<b>2. Point Source Pressures</b>																
a) Nutrient Phosphorus		U2			I2		T1									
b) 3. Metals		U2			I2		T1									
c) Dangerous Substances		U2			I2		T1									
d) Pesticides		U2			I2		T1									
e) Sanitary Determinands		U2			I2		T1			N2c					P2a	
f) Other Determinands		U2			I2		T1			N2f						
<b>3. Abstraction &amp; Flow Reg. Pressure</b>		U3	A3	F2	I3		T2			N2a						
<b>4. Morphological Pressures</b>		U4	A4	F3			T3			N1		F		P3		P3
<b>5. Alien Species Pressure</b>										N2e					P4	

\* Covered by the BAU11 study; \*\* Included within a general Urban Diffuse category within the EA risk assessment

## 4.1 Urbanisation and the Water Industry

### 4.1.1 Gross trends

Predicted population and household growth will drive urbanisation with a likely associated increase in transport infrastructure and industry. Climatic change is also likely to act as a driver of urbanisation related pressures. Point source, diffuse source, flow regulation and morphological pressures all arise from urbanisation, many of which involve or impact upon the water industry.

**Increased loss of diffuse urban pollutants** - An expansion of impervious land associated with urbanisation will increase the loss of urban pollutants, including those emitted to and deposited from the atmosphere. The list includes metals, Poly Aromatic Hydrocarbons (PAH), dangerous (priority) substances and nutrients. Whilst their loss is originally diffuse in nature, these pollutants will either discharge to surface water sewers, infiltrate into grassed or other pervious areas (potentially to ultimately reach a waterbody), or discharge directly to a watercourse. Data on the long-term trends in the quality of urban runoff is minimal. Indications are that lead (Pb) has declined by over 33% in the last decade but with platinum, copper and zinc, and PAH loads increasing<sup>9</sup>. There is a growing baseline for urban runoff pollution loads and EMCs, however there are major gaps in areas like emerging pollutants e.g. PPCPs, PAH degradation products, sewer exfiltration pollutants etc<sup>10</sup>.

**Increased discharges from Surface Water Sewers (SWS) and Combined Sewer Overflows (CSOs)** - Without mitigation, discharges from SWS and CSOs are likely to increase with urbanisation. Climate change, particularly more frequent and intense winter rainfall, will increase the likelihood of discharges from SWS and CSOs. For discharges from SWS, the frequency of runoff will increase but as the surfaces are flushed more often, the pollutant concentration will decrease meaning that overall, pollutant loads are likely to remain broadly unchanged as a result of climate change. For CSOs the increased frequency of discharge will also mean an increase in loads as the runoff is contaminated with foul water.

**More extreme hydrological regime** - An expansion of urban land will change the hydrological regime, increasing peak flows and diminishing baseflows, thereby imposing flow regulation pressures. Two other important urbanisation pressures will impact upon river flows: an increased abstracted volume for drinking water and industrial use, and an increased discharge of water from sewage treatment works and surface water sewers. These flow regulation pressures will vary both spatially and temporally. Additionally, hotter and drier summers may exacerbate abstraction/flow regulation pressures.

**Increased wastewater loads from households and industry** - Without mitigation, an increased population and expansion of industry is likely to increase pressures from point source discharges, in particular, those from wastewater treatment works. Sewage treatment, industry and households are primary sources. In addition to discharge related pressures, increased sewage treatment will generate greater sludge for disposal, greater energy consumption and greater emission of greenhouse gases. Any requirements for additional

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<sup>9</sup> Urban diffuse pollution: key data information approaches for the Water Framework Directive, Paper for CIWEM, J Bryan Ellis BSc, MSc, FGS, MIWA\* and Gordon Mitchell BSc PhD, 2005.

<sup>10</sup> Personal communication Bryan Ellis, July 2006.

treatment under the Urban Waste Water Treatment and Habitats Directives will exacerbate these pressures.

**Increased flood risk** - A greater amount of impervious land associated with urbanisation may enhance flood risk, which in turn, will increase hydromorphological pressures related to flooding. Building on flood plains will enhance this pressure.

#### 4.1.2 Policy/Mitigation and Net Trends

**Government planning policy** – This could potentially act to mitigate future enhanced pressures associated with urbanisation, particularly with respect to surface water drainage and the uptake of Sustainable Urban Drainage Systems (SUDS). The installation of SUDS would reduce the volume of surface water through encouraging infiltration and, aid pollutant attenuation within soils and retention ponds etc. Stakeholders, however, raised doubts about the uptake of SUDS, highlighting in particular the lack of clear guidance for responsibility, problems and costs associated with retrofitting and any future amendment of the Water Industry Act (1991) – ‘right of connection’, to account for SUDS.

**Water Industry Asset Management Plans** - Set future environmental priorities and can reduce impacts of abstraction, point source and CSO pressures, provided they can keep pace with population growth. However, additional sewage treatment may be unsustainable with respect to an increase in energy requirements, release of greenhouse gases, and generation of sewage sludge.

**With regards to pressures from sewage treatment works** - Existing consents will mean that water companies will have to deal with the increasing pressures as they require a position of no deterioration. However, for unconsented determinands, for example metals, pressures are likely to increase. The exception to this is where European attention has already been focused to introduce specific policies, for example, the EU Strategy on Mercury. In sensitive areas and at Natura 2000 sites, the Urban Wastewater Treatment (UWWT) and Habitats Directives already require that emissions are at levels to protect the ecosystem, so further measures are unlikely to be needed in these localities.

Overall, net trends in pressures arising from urbanisation are highly uncertain and likely to be locally variable. Generally, adverse net trends are anticipated in terms of pressures arising from point and diffuse source pollution, abstraction and morphology.

#### 4.1.3 Significance

**Local variation, generally potentially high impact but low confidence** - Stakeholders have identified probable adverse net trends in pressures arising from point and diffuse source pollution, abstraction and morphology resulting from urbanisation. However, it was concluded that impacts are likely to vary significantly locally and be strongly dependent upon the uptake of measures such as SUDS. The uncertainty associated with the uptake and effectiveness of potential measures and mechanisms associated with urbanisation imparts significant uncertainty with respect to net trends. As a result, no quantitative changes are predicted and the anticipated adverse net trends are described in qualitative terms only. Stakeholders identified all diffuse and point source pressures under urbanisation as being of high significance both within the sector and in comparison with other sectors/activities (Table 5.1).

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Urbanisation	Diffuse sources	High	Low	High
	Point sources	High	Low	Medium
	Abstraction/flow	Medium	Medium	Medium
	Morphological	High	Low	High

## 4.2 Transport

### 4.2.1 Gross Trends

**Increased road building** – Future expansion of the strategic road network managed by the Highways Agency (HA) is detailed in the Secretary of State's 'Targeted Programme of Improvements' (TPI). This is currently comprised of 41 major road improvement schemes aimed at combating some of the most pressing infrastructure problems originally announced in 'A New Deal for Trunk Roads in England'. Details of the TPI Programme can be found on the HA website. All road schemes will include high standards of environmental assessment and mitigation to mitigate potential increases in diffuse and point source pressures from a range of pollutants including nutrients, sanitary determinands, priority substances, sediment, salt, oil, pesticides (from verge management), metals, and PAH's.

Roads (as defined in PPS25) should only be located within the floodplain if there is no acceptable alternative. They should also be restricted to the shortest practical crossing, avoiding extensive construction within the floodplain. These may, therefore, lead to some hydromorphological pressures.

The emission from vehicles of acidic oxides, followed by their subsequent deposition raises diffuse acidification pressures. Other transport areas were not thought to be significant.

### 4.2.2 Policy/Mitigation and Net Trends

**Mitigation may negate gross trends for trunk roads** - The Highways Agency has a statutory duty not to pollute and a key performance measure is the identification and improvement of roads causing water quality problems. New design standards are aimed at mitigating pollution from road improvement schemes such that there is no deterioration in the existing quality of a watercourse. Mitigation of highway runoff may, therefore, negate the effect of road expansion with no strong net trend. Local authority roads, however, may well not be subject to the same mitigation given a lack of resources, hence their significance rating (Table 5.1). An increase in pollutant runoff is therefore likely, with an expansion of local authority roads driven by urban growth, however, it has not been possible to quantify this adverse trend.

**Mitigation may negate gross trends for trunk roads** - The Highways Agency has a statutory duty not to pollute. Working in partnership with the Environment Agency the HA has been undertaking a programme of research investigating the potential environmental impacts

associated with road runoff. New guidance<sup>11</sup> is now available based on this research and is aimed at assessing the potential risk and mitigating pollution from road runoff, where identified. Current road design guidance is expected to ensure that there is no deterioration in the existing quality of the watercourse. The HA is also applying this guidance in the investigation and treatment of outfalls on the existing road network that may pose a potential pollution risk. This contributes towards its environmental key performance measure. Mitigation of road runoff may, therefore, negate gross trends for trunk roads.

**Technology may offset increased road use** - An expansion in vehicle use may be offset by technological advances, such that there is no strong net trend in the emission of acidic oxides from vehicles. In any case, industrial emissions are likely to be of greater importance.

### 4.2.3 Significance

**High to medium national significance** - For the transport sector, stakeholders have identified runoff from local authority roads to be of high significance (Table 5.1), classified here as a diffuse pressure, although sometimes referred to elsewhere as a point source pressure. Net adverse trends in this pressure are anticipated.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Transport	Diffuse sources generally	Medium	Medium	High
	Diffuse Sources – Acidification	High	Medium	Medium
	Point sources	Medium	Low	Medium
	Abstraction/flow	High	Low	Medium
	Morphological	Medium	Low	High

### 4.3 Industry

Industry related pressures include point source, abstraction and flow regulation, and acidification pressures.

#### 4.3.1 Gross Trends

**Pollution** - Future trends in the discharge of point source pollutants from industry are unknown and assumed to at least partly reflect the predicted growth or decline in each sector.

**Water consumption** - Similarly, future changes in industrial water consumption are unclear. Generally, a move away from highly water consumptive industries (because of manufacturing decline?) is predicted with some move towards the use of renewable energy sources that do

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<sup>11</sup> HA216 Road Drainage and the Water Environment (Design Manual for Roads and Bridges Volume 11 Section 3 Part 10)

not consume water. However, offset against these changes are predicted expansion for some industrial sectors.

#### 4.3.2 Policy/Mitigation and Net Trends

**Policies to reduce emissions** - The emission of acidic oxides from industry (that deposit and contribute to the acidification of soils and surface waters) are likely to reduce under European emissions protocols (e.g. the Gothenburg Protocol) that require quantifiable reductions in sulphur and nitrogen emissions, as well as under the Integrated Pollution Prevention and Control (IPPC) Directive. The Energy Review launched in January 2006 committed the Government to a requirement that by 2010, 10% of UK electricity will be produced by renewable sources. Modelling studies incorporating emissions reduction, from the latter, provide a prediction of recovery at numerous acidified sites throughout UK uplands.

**IPPC should reduce other pressures** - As the IPPC Directive is fully implemented, discharges to water (directly and as a result of waste disposal) are also likely to decrease.

**Major gap** - Overall, the industry sector remains a major information gap with trend information unclear.

#### 4.3.3 Significance

**Potentially high significance but very little information** - Industry associated pressures remain a significant information gap, although potentially both point source discharges and flow regulations pressures could be of high significance, at least for certain sectors (Table 5.1), causing adverse net trends.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Industry	Diffuse Sources	High	Low	High
	Point Sources	High	Low	Medium
	Abstraction/flow	High	Low	Medium
	Morphological	Medium	Low	High

#### 4.4 Agriculture

##### 4.4.1 Gross Trends

**Climate change and more intense rainfall** - Climate change is identified as increasing sediment, organic and faecal contamination pressures, due to a predicted increase in the frequency and intensity of winter rainfall. Groundwater residence times mean that historical land use and management will continue to influence certain pollutants, with increasing trends apparent in some groundwater bodies. Changes in livestock management have also been predicted e.g. fewer but larger dairy herds, an increase in the outdoor pig sector.

#### 4.4.2 Policy/Mitigation and Net Trends

**Local reductions in pollutant loads** - Under the influence of other (non-WFD) directives and strategies, stakeholders have predicted likely reductions in sediment, organic matter and faecal contamination pressures in some localities. Here, CAP Reform, the Nitrates and Bathing Waters Directives and a range of voluntary schemes will have an impact which is likely to vary locally. Whilst a general downward net trend in pressures is predicted, the timing and degree remain uncertain and are not quantified, in particular, because most changes will be associated with new policy measures where likely uptake levels are difficult to predict. In addition, the positive impact of other Directives and strategies may be partially offset by climatic changes. The changes will vary spatially as all of the above policies apply only in designated areas. Those areas likely to see improvements are where the High Level Entry schemes and/or Landcare initiatives are being applied (likely to be small areas), in nitrate vulnerable zones, sensitive areas and catchments draining to designated bathing waters.

**Abstraction and flow** - No clear trends in abstraction and flow regulation, and morphological pressures were identified.

**Pesticide pressures** - Known pesticide pressures (both agricultural and amenity) may diminish due to the Sustainable Use of Pesticides Strategy, although no quantitative estimates were provided by stakeholders. However, new pesticides will come onto the market and will change the nature of problems, albeit with the intention of environmental improvement. Awareness of pesticide issues is likely to become higher as monitoring techniques and strategies become better at detecting problems which may result in an apparent increase in the pressure due to pesticides. Reduced sheep dip use, the groundwater regulations, and cross-compliance initiatives should reduce pressures from sheep-dip.

#### 4.4.3 Significance

**National significance for some parameters, large local variation** - In the Agricultural Pressures Workshop, stakeholders identified sediment, faecal contamination and organic matter pressures as being of high significance, partly - for the latter two of these – because they are not encompassed by current Risk Assessments. Stakeholders debated whether faecal contamination or organic matter were directly addressed by the WFD, but felt that both were strongly in-directly related. Other aspects of agriculture, beyond the remit of this study (nitrates in particular), were also classified as being of high significance. Overall, however, stakeholders suggested that net positive trends were likely with respect to these pressures.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Agriculture	Diffuse sources	High	Medium	Mixed
	Point sources	Medium	Low	High
	Abstraction/flow	Medium	Low	High
	Morphological	Medium	Low	High

## 4.5 Forestry

### 4.5.1 Gross Trends

**Climate change may increase water demand** - Climate change could result in an extended growing season putting higher demand on water use. However, the effect is uncertain as higher carbon dioxide levels may help to offset this.

**Changing land-use** - The amount of land used for forestry is slowly increasing. From one perspective, this can be seen to be increasing the pressures from forestry, but as these are usually much lower than those from the existing land-use, which is usually agriculture, it will be reducing the pressures from that land. Sustainable forest management is leading to the re-design of conifer plantations, their removal from ancient woodland and the shift to continuous-cover forestry, which should reduce pressures from existing forests.

### 4.5.2 Policy/Mitigation and Net Trends

**Forests & Water Guidelines will reduce all pressures** - The Forestry Commission has established Forests & Water Guidelines (FAWG) that provide best practice for the protection of water. These have a regulatory status and must be adhered to. Under the FAWG, a move away from large scale planting within acid sensitive uplands and focus on re-designing existing forests with more broadleaves and open space should reduce the risk of acidification, but some waters are likely to remain at risk. Similarly, the guidelines outline practice aimed at minimising the risk of sediment loss associated with forest operations e.g. by reducing soil disturbance and preventing the transport of eroded soil through appropriate riparian management. The directions in trends are declared policy positions and the Forestry Commission is confident that the trends evident in the statistical data will reduce sediment and acidification pressures from forestry, to a level where they are insignificant, in terms of meeting the WFD requirements.

**Positive effects from changing land-use** - Woodland planting could help to reduce the high level of contamination associated with other land-uses, though the transfer from agriculture land to forestry is likely to be limited. Nevertheless, there is an opportunity to maximise the potential benefits by targeting planting to the most sensitive catchments. Better integration of forestry and agriculture could help to reduce a number of pressures.

**Pesticides likely to be insignificant** - The FAWG has sections on pesticide use including the need for consultation prior to application, the use of protective buffer strips and limiting applications to periods when the weather and ground conditions are favourable. Pesticide inputs from forestry are considered to be insignificant and subject to further declining net trends. This is also true for risks from other chemicals, fuel oils and lubricants, and morphology.

**Abstraction and flow pressures unclear** - Net trends in abstraction/flow regulation pressures under forestry are unclear. The FAWG addresses the effects of forestry on water yield, although the continued expansion of broadleaf woodland may have local adverse effects (e.g. planting on sandstone). The drive for sustainable energy production is leading to an increase in the planting of short rotation crops that, potentially, have a higher water use compared to grass.

Overall, moderate downward trends (i.e. less pressure) are anticipated for acidification, sediment, pesticide usage and abstraction/flow regulation pressures associated with forestry due to policies on sustainable forest management.

### 4.5.3 Significance

**Low significance, high confidence, regional variability** - Due to application of the 'Forests & Water' guidelines, moderate positive trends in all forestry related pressures are anticipated. Overall, pressures from forestry are considered to be not significant.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Forestry	Diffuse sources	Medium	High	Medium
	Point sources	Medium	High	Medium
	Abstraction/flow	Medium	High	Medium
	Morphological	Medium	High	High

## 4.6 Ports and Marinas

### 4.6.1 Gross Trends

**Increases in Seaborne trade, leisure craft and port and marina infrastructure** - Seaborne trade is expected to increase, as is the use of leisure craft. An associated growth in port and marina infrastructure is also anticipated.

### 4.6.2 Policy/Mitigation and Net Trends

**Many policies and initiatives** - A number of policies and initiatives are likely to impact upon the Ports and Marinas sector, including; the White Paper on European Transport Policy that encourages short sea shipping; the International Convention for the Control and Management of Ships Ballast Water and Sediment; the International Convention on the Control of Harmful Anti-fouling Systems; the International Convention for the Prevention of Marine Pollution from Ships; and the European Directive on the provision of adequate port reception facilities.

**Probable downward trends in TBT and reduced waste from ships** - There are few clear net trends in pressures impacting upon the Ports and Marinas sector. Stakeholders have identified a reduction of TBT in sediment owing to the ban in its use; a possible 50% reduction of TBT in sediment is predicted over the next 10 years, however, the increased use of alternative antifoulants may result. Reduced waste discharged from ships is also predicted due to EC Directive 2000/59/EC, which requires all ports to make available adequate reception facilities, although this net trend is not sufficiently clear for stakeholders to have provided a quantitative estimate.

**Local hydromorphological pressures expected** - In addition, further localised hydromorphological pressures are anticipated with the development of new port and marina infrastructure.

### 4.6.3 Significance

**Local significance** - For the Ports and Marinas sector, pressures are either considered not to be of significance, or are likely to be significant locally, rather than nationally (Table 5.1). For example, the future expansion of Port and Marina infrastructure at specific locations will impart hydromorphological pressures locally. However, there are not a sufficient number of affected locations to be nationally significant.

**National significance** - Dredging pressures are, however, thought to be of significance nationally.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Ports&Marinas	Morphological; dredging and infrastructure	Low	High	High
	Abstraction/flow	Medium	Medium	Medium
	Point source – oil	Low	High	High
	Point source – sanitary determinands	Low	High	Medium
	Diffuse source – pesticide (antifouling paints)	Medium	High	High
	Alien species pressure	Medium	High	Medium

## 4.7 Navigation

### 4.7.1 Gross Trends

**Greater use in waterways will increase pressures** - Increased morphological, diffuse and point source pressures are predicted for inland navigation since policies and aspirations are promoting the greater use of waterways for freight and leisure. For example, greater boat use will result in more turbid water, enhancing sediment pressure. In addition, the greater use of waterways is likely to lead to greater hydromorphological pressures through the need for greater bankside protection and engineered structures. However, changes in these pressures are not thought to be of significance other than locally.

### 4.7.2 Policy/Mitigation and Net Trends

No quantitative estimates of net trends are provided.

### 4.7.3 Significance

**Not nationally significant but local impacts** - Whilst adverse net trends in diffuse and hydromorphological pressures associated with Navigation are predicted, they are not considered to be of significance nationally, although local impacts may be greater (Table 5.1).

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Navigation	Morphological	High	High	High
	Abstraction/flow	Medium	Medium	Medium
	Point source – oil	Medium	High	Medium
	Point source – sanitary determinands	Low	High	Medium
	Diffuse source – pesticide (antifouling paints), enhanced turbidity	Medium	High	High
	Alien species pressure	High	Medium	Medium

## 4.8 Flood Defence

### 4.8.1 Gross Trends

**Climate change and behaviour will have a significant effect** - Risks of flooding and coastal erosion are set to increase over the next 100 years due to changes in the climate and in society. Climate change is a significant driver in terms of flood defence and the morphological pressures arising from them. Predicted gross trends include heavier, more intense rainfall leading to increased flooding, though there are expected to be regional differences in this. In coastal areas there are also expected to be increasing sea levels leading to more coastal flooding, increase in storm surges in coastal areas and estuaries, and increased storminess and wave activity increasing erosion. Coastal erosion and the loss of intertidal habitats will increase substantially because of increased coastal squeeze resulting from new sea defences.

**Local variation** - The responses to this will be different in different areas with new coastal flood defences being focused in high economic value areas, in less economically important areas coast realignment may be used.

**Tidal barrages increase dredging pressures** - Tidal barrages are increasingly being closed to contain fluvial (freshwater) floods. This leads to increased sedimentation in the seaward side of the barrages, and hence increased need for dredging.

**Population growth will lead to more flood defences** - The predicted increase in population and households will also potentially affect the pressures on water bodies in terms of building new defences in flood risk areas, such as river flood plains and some coastal areas. In addition to new housing proposed in existing regional planning guidance, 200,000 extra new homes may need to be created by 2016. Over 5 million people and 2 million homes and businesses are currently at risk from flooding in England and Wales. Climate change could see the number of people at 'high' risk of flooding rising from 1.5 million to 3.5 million by 2080. In 2004/05 there were 21 cases where the EA's advice was ignored on major developments. Urban flooding is expected to increase in response to more intense rainfall and increasing

urbanisation, and this is predicted to be a significant future threat for many towns and cities in England.

#### 4.8.2 Policy/Mitigation and Net Trends

**Whole catchment and shoreline approaches** - Defra's strategy (*Making space for water*) is taking a holistic approach to management of risk from all forms of flooding (river, coastal, groundwater, surface run-off and sewer) and coastal erosion, and seeking to ensure that the programme helps deliver sustainable development. It adopts a whole catchment and whole shoreline approach that is consistent with, and contributes to, the implementation of the WFD over the 20-year lifetime of the strategy. It looks to adapt to climate change, and aims to integrate strategy with other relevant Government policies.

**Habitats Directive sets compensatory requirements** - Another significant policy in place is the EU Habitats Directive that requires habitats lost to coastal erosion to be compensated for by creation of new habitats.

**Possible move to focus protection on urban areas** - Net trends are uncertain with limited information available. However potential trends could include; greater use of washlands and overflows and lower flood risk; concentration of investment in flood risk management around major habitations; trend towards abandonment or realignment of existing defences; improved flood risk management in major centres of population but declining safeguards in more rural and unpopulated areas; and, coastal erosion is likely to be insufficient to keep pace with demands for sediment in other parts of the coastline.

**Natura 2000 and managed retreat** - Defra's initial assessment is that the creation of an annual average of at least 100 ha of intertidal habitat associated with European sites in England that are subject to coastal squeeze, together with any more specifically identified measures to replace losses of terrestrial and supra-tidal habitats, is likely to be sufficient to protect the overall coherence of the Natura 2000 network. In a number of coastal areas where risk assessment has shown that sustainability (impacts on society, economy and the environment) is not unduly affected, the trend will be for allowance of coastal squeeze and managing this process via managed retreat.

#### 4.8.3 Significance

**Nationally significant but with regional differences** - Flood defence/management issues are likely to be of high significance at a national level particularly in relation to the predicted changes in climate. There may also be regional differences, for example in the SE of England where more intense rainfall, the increasing demand for housing, and development on flood plains may increase morphological pressures on water bodies. Sea level rise and coastal squeeze may also vary significantly regionally.

Activity/ Sector	Pressure	Potential Impact of new data	Confidence in the new data	Confidence in existing RA
Flood Defence	Morphological	High	Medium	Medium



## 5. CONCLUSIONS

The following section provides concluding remarks and draws together the evaluations of the significance of each activity-pressure combination for improving the risk assessment.

### 5.1 General Comments

1. The study revealed **relatively little quantitative trend information**. However, it was considered that much of the qualitative information and expert judgment was of value and could improve the baseline scenario for many of the activity-pressure relationships. The Common Implementation Strategy (CIS) document indicates<sup>12</sup> that the use of this type of **qualitative information is acceptable** in the absence of quantitative data. What is then required is a method for using and translating such qualitative trends when the risk of failing environmental objectives in 2015 in specific water bodies is assessed, taking into account the effectiveness of policies in place or those planned for the near future. These aspects should be investigated further, particularly for some of the least well quantified activity-pressure relationships. A possible approach would be to undertake a **sensitivity analysis where different levels of effectiveness for the specific measures** described by the consulted experts are applied to examine the implications (in terms of trends in status) in particular water bodies. This might be particularly appropriate where measures are aspirational rather than mandatory: many of the consulted stakeholders and experts believed that such aspirational measures will be more effective than sometimes thought.
2. Overall, the trend information gained from stakeholders is characterised by **significant uncertainty**. For many of the pressures, driving forces such as population change and climate change will cause an increase in gross trends. Counteracting this, for many sectors, there are policy measures already in place that will help to alleviate the increasing problems, in many cases it was difficult to determine the direction of the resulting net trend. Another source of uncertainty was the difficulty in estimating the level of uptake, and likely effectiveness, of policies and planned mitigation measures.
3. Despite this uncertainty, for **some pressure-activity relationships, stakeholders were confident** that planned policies and mitigation measures will lead to a decreasing trend in pressure by 2015, in some cases to the extent where the pressure will be of low significance when considering the need for new measures. Those pressure-activity relationships where confidence was highest were:
  - a. Forestry – all pressures, the Forestry Commission was confident that policies already in place should eliminate the impact of forestry on compliance risk for the WFD in most locations in England and that no further measures are anticipated;
  - b. Ports and Marinas – all pressures with the exception of abstraction and flow;

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<sup>12</sup> The CIS document on preparing a baseline scenario provides guidance on how to derive business-as-usual forecasts on pressures without relying on quantitative data. In such cases a qualitative approach is advocated., where, for example, "expert groups" provide a judgement on evolution, based on partial data plus deliberation.

- c. Navigation – all pressures with the exception of abstraction and flow and alien species.

Stakeholders were reasonably confident about:

- d. Urbanisation – abstraction and flow;
- e. Transport – diffuse sources;
- f. Agriculture - diffuse sources;
- g. Ports and Marinas – abstraction and flow;
- h. Navigation – abstraction and flow, and alien species.

The views expressed in this document for these sectors are of particular value in ongoing processes. For other sectors, the confidence in the information given was low.

- 4. Whilst all sectors were invited to share their views on baseline trends, information was not gained for all. **Some gaps in information** have been identified. The most important of these relates to Industry (excluding the Water Industry, the Energy Industry and Mining), where future trends in point source discharges and abstraction/flow regulation pressures are unknown, but potentially of importance.
- 5. Whilst all **key drivers** have been identified as having an impact upon at least one activity-pressure combination, population change, economic growth and climate change are identified as having the greatest influence.

## 5.2 Significance

- 1. Table 5.1 summarises the significance given to each pressure-activity relationship.

**Table 5.1 Significance ranking of each Activity-Pressure Combination**

Activity/ Sector	Pressure	Significance Ranking
Urbanisation	Diffuse sources	High Significance, particularly with respect to discharge to surface water sewers and CSOs. In addition, the current EA risk assessment for diffuse urban pressures is limited
Urbanisation	Point sources	High Significance; include sustainability issues with enhanced wastewater treatment
Urbanisation	Abstraction/flow	Significant but spatially and temporally varied
Urbanisation	Morphological	Significant locally, particularly with respect to flood defence
Transport	Diffuse sources generally	High Significance for Local Authority roads, not significant/moderate significance for highways
Transport	Diffuse Sources - Acidification	Not Significant – Moderate
Transport	Point sources	High Significance for Local Authority roads (see diffuse)
Transport	Abstraction/flow	Moderate
Transport	Morphological	Generally Moderate but may be significant locally

Activity/ Sector	Pressure	Significance Ranking
Agriculture	Diffuse sources	High Significance for sediment, organic enrichment and faecal contamination (other pressures not encompassed by this study)
Industry	Diffuse Sources	Unlikely to be of high significance, information lacking
Industry	Point Sources	Potentially High Significance, information lacking
Industry	Abstraction/flow	Potentially High Significance, information lacking
Industry	Morphological	Unlikely to be of high significance, information lacking
Agriculture	Point sources	Not Significant, although small point source discharges probably considered under diffuse
Agriculture	Abstraction/flow	Significance unclear
Agriculture	Morphological	Not Significant
Forestry	Diffuse sources	Low Significance
Forestry	Point sources	Low Significance
Forestry	Abstraction/flow	Low Significance
Forestry	Morphological	Low Significance
Ports & Marinas	Morphological; dredging and infrastructure	Probably significant at national as well as local level
Ports & Marinas	Abstraction/flow	Only an issue locally
Ports & Marinas	Point source – oil	Not Significant
Ports & Marinas	Point source – sanitary determinands	Not Significant, slight reduced trend
Ports & Marinas	Diffuse source – pesticide (antifouling paints)	Significant TBT reduction; possible copper increase
Ports & Marinas	Alien species pressure	Possibly Significant
Navigation <sup>13</sup>	Morphological	Only likely to be locally significant
Navigation	Abstraction/flow	Only likely to be locally significant
Navigation	Point source – oil	Not Significant
Navigation	Point source – sanitary determinands	Not Significant
Navigation	Diffuse source – pesticide (antifouling paints), enhanced turbidity	Not Significant
Navigation	Alien species pressure	Only likely to be locally significant
Flood Defence	Morphological	High Significance at national level but particularly in South East

2. The pressure-activity relationships where the potential impact of trend data was highest and where confidence was at least 'reasonable' are listed below. The information on trends contained in this document **should be considered in taking forward future risk assessments**:

- i. Diffuse sources- Agriculture;

<sup>13</sup> Largely inland waterways and canals

- ii. Morphology - Flood defence;
  - iii. Diffuse sources – Transport – acidification;
  - iv. Navigation – Morphology;
  - v. Navigation – Alien species.
3. The pressure-activity relationships where the potential impact of trend data was highest, but where confidence in the information provided on trends was low are listed below. It may be appropriate to undertake **further work to improve the confidence** in the trends and risk assessments associated with these pressure-activity relationships:
  - i. Diffuse sources – Urbanization;
  - ii. Point sources – Urbanization;
  - iii. Morphology – Urbanization;
  - iv. Abstraction and flow – Transport;
  - v. Point, diffuse sources, abstraction and flow – Industry.
4. The pressure-activity relationships where **high local variation** was highlighted are listed below. The consideration of these pressure-activity relationships will be particularly **relevant for the Regional Liaison Panels** in developing river basin district plans:
  - Diffuse sources – Urbanisation particularly with regards to CSOs and their programmes of improvement under the AMP programmes;
  - Morphology – Transport;
  - Agriculture – Diffuse source pollution, particularly in relation to the areas of land taking up the High Level Entry Schemes under CAP;
  - All pressures – Ports and marinas and navigation;
  - Morphological – Flood defence with particular pressure on the South East.

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## **APPENDIX A      TERMS OF REFERENCE FOR THE WORK UNDERTAKEN**

### **Project Appreciation**

Assessments of trends in activities in the absence of the Water Framework Directive Programme of Measures (business as usual) and the evolution of policies (policy baseline) is an essential step in preparing the economic analysis, both for cost-effectiveness analysis and disproportionate cost assessment. As a first step, therefore, such information will be needed within the preliminary cost-effectiveness analysis (pCEA) planned for mid 2006. The information is also relevant to the development of national measures which might need to be brought forward for the first Programme of Measures. Information on trends and the policy baseline will feed into the risk assessments. The risk assessments prepared for the initial river basin characterisation (RBC1) generally did not include information describing how pressures impacting upon water bodies might change between now and 2015 as a result of policies/ activities/ pressures already in place. Future assessments (RBC2) will be able to include such trend information to provide a more realistic scenario of the baseline for 2015.

Work is needed to:

- Identify, characterise and assess datasets that could provide trend information so as to improve the second river basin characterisation process.
- Inform ongoing work by the Environment Agency on the policy baseline as part of their Strategic Assessments.
- Inform a series of workshops planned at the river basin district level by the Environment Agency.

Given the broad range of pressures impacting on water bodies, information on trends will be held and understood by a wide range of stakeholders. The approach proposed, therefore, is to hold a workshop, or series of workshops, where stakeholders can input into this process by identifying, and characterising trend information, considering how to link activities to pressures, and deciding where best value can be added to the existing risk assessments.

It is essential that outputs are suitable for use in this next stage of the process and that the work is completed by the end of March, so that they are available for the pCEA. The focus will be on trends in activities in order to complement the already planned work on the policy baseline.

### **Proposed Work**

The work proposed by WRc would comprise the following steps:

**Step 1: Preparation:** Review previous correspondence relevant to risk assessments and conduct telephone interviews with stakeholders, to prepare a draft list of pressures and characterised datasets for discussion at a national workshop, to identify preferences for issues to be discussed, and to identify any issues for debate in the dataset assessment. This would be documented and circulated prior to the workshop for comment.

**Step 2: National workshop** (for central group of stakeholders): This will be designed to give an introductory review of risk assessments, enable discussion of broad national level pressures, allow identification and characterisation of datasets reflecting pressure trends, brainstorm the linking of activities to pressures and the evidence and confidence in the links, and gain an initial view on how value can be added to the existing risk assessments. The afternoon session will discuss data assessment for selected individual pressures. The national workshop will be facilitated by a professional facilitator with 5 break-out groups facilitated by DEFRA and WRc staff. Administrative support will be provided by WRc.

**Step 3: Additional pressure-based workshops** (for delegated representatives from stakeholders depending on pressures): These will provide a brief review of work to date, further explore and characterise datasets establishing trends affecting pressures, enable data assessment for selected individual pressures, and obtain a view on how value can be added to the existing risk assessments, including a significance ranking based on potential impact, usability, and certainty. There will be four further pressure meetings each facilitated by 2 members of WRc staff and located at the DEFRA offices where needed.

**Step 4: Reporting:** Thorough follow-up contact will be made via telephone interviews and email consultations to check findings and fill information gaps as far as possible. Reports will be prepared for each workshop and meeting, as well as an overall report of the project.

An important dissemination route for the information will be attendance at EA pressure policy meetings: The EA proposes to hold around six pressure policy meetings when their strategic assessments of pressures will be reviewed and discussed. The WRc project team will provide a representative for each of these meetings to facilitate the transfer of the findings from the DEFRA national and follow-up pressure workshops to the EA. It should be noted that permission from the EA will have to be obtained for this.

**Services to be provided by DEFRA:**

The following services will be required from DEFRA:

- Details of stakeholders to be included in the workshops;
- Confirmation of the selection of stakeholders for the national and pressure workshops/meetings;
- Agreement on the content of reports and key emails to stakeholders;
- At the national meeting, presentation on the introduction to the work and facilitation of some break-out sessions;
- For the pressure meetings, provision of meeting room facilities; and
- Any other information and assistance that WRc may reasonably require for the successful completion of the work described in this proposal.

**Key Milestones are:**

- Draft report from national workshop – 3 March 2006;
- Final report from national workshop – 15 March 2006;
- Reports from pressure workshops/meetings – within 1 week of being held;
- Draft project report - by the end of March 2006.



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## APPENDIX C SUMMARY OF THE PROCESS OF GAINING STAKEHOLDER INPUTS

**Table C.1 Summary of the Process of Gaining Stakeholder Inputs (2006)**

Process Stage	Nature of Communication	Stakeholders approached	Date
	<b>All sectors</b>		
1.	Email introduction to the project, invitation to national workshop and opportunity to input prior to workshop by email or telephone interview based on a questionnaire.	Initial list of 186 stakeholders	1 Feb
	Email reminder about national workshop, chance to input, and asking views on needs for sector based workshop.	186 stakeholders	8-16 Feb
2	Telephone calls to stakeholders from a representative range of sectors, inviting attendance at workshop, inputs to pre-workshop report and asking views on needs for sector based workshop.	38 Key stakeholders	14-20 Feb
3	Email Pre-workshop report outlining the information collected up to Feb 2006.	National workshop participants	17 Feb
4	National Workshop, London.	41 participants	21 Feb
	Email to workshop participants sending workshop report asking for confirmation of the findings recorded.	41 participants	10 Mar
	Email version of draft report asking for confirmation of findings.	Final list of 345 stakeholders	29 June
	<b>Industry</b>		
	Email to industry sector inviting inputs via email and telephone interviews.	30 industry stakeholders	15 Feb
5a	<b>Agriculture and forestry</b>		
	Email to key sector stakeholders with an invitation to workshop and opportunity to input by email or telephone interview based on a questionnaire <sup>1</sup>	23 stakeholders from agriculture sector	9 Mar
	Workshop participants sent a pre-workshop report outlining the information collected up to Feb 2006.	9 workshop participants	10 Mar
	Workshop on Agriculture and Forestry, London.	9 workshop participants	16 Mar
	Email draft workshop report to confirm findings recorded.	9 workshop participants	24 Mar
5b	<b>Ports, Navigation and Flood Defence</b>		
	Email to key sector stakeholders with invitation to sector workshop and opportunity to input by email or telephone interview based on a questionnaire <sup>1</sup> .	50 stakeholders from ports, navigation and flood defence sector	22 Mar
	Email pre-workshop report outlining the information collected to date.	9 workshop participants	31 Mar
	Workshop on Ports, Navigation and Flood Defence, London.	9 workshop participants	6 Apr
	Email draft workshop report to confirm findings recorded.	13 stakeholders	9 Apr
	<b>Urban, Transport and Water Industry</b>		
	Telephone calls to key sector stakeholders about possible workshop date	28 stakeholders	16-27 Feb
	Decision to collect information via telephone because of diverse range of inputs needed and pressing timescales.		15 Mar
	Email to key stakeholders from urban and transport sectors based on last years non-agricultural diffuse sources, copy of relevant sections from national workshop report and invitation to input information by email or telephone interview based on a questionnaire <sup>1</sup>	77 stakeholders from urban, transport and water industry sectors	16 Mar

Process Stage	Nature of Communication	Stakeholders approached	Date
5c	Telephone interviews with key sector stakeholders	13	24 Mar – 6 Apr
	<b>Government</b>		
5d	Email to key government policy leads, introducing project and inviting inputs via telephone interview based on a questionnaire	8 government policy leads	29 Mar
	Telephone interviews with government leads.	5 government leads	30 Mar – 28 Apr

Notes:

1 Numerous telephone calls were made to gather inputs via telephone interviews, of which approximately 30% received a positive response.

## APPENDIX D ENVIRONMENT AGENCY RISK ASSESSMENTS - INDIVIDUAL PRESSURES AND ASSOCIATED ACTIVITIES

	Source Pressures	Activities
<b>Rivers</b>	Diffuse Source Pressures - Mines and Minewaters	Mining
	Diffuse Source Pressures – Urban Discharges	Urbanisation
	Diffuse Source Pressures – Pesticides and Sheep Dip	Pesticide use
	Diffuse Source Pressures – Pesticide EQS failures	Based on observed data
	Diffuse Source Pressures – Nutrient Phosphorous	Fertiliser use (agriculture)
	Diffuse Source Pressures – Nutrient Nitrogen	Transport; Industry; Agriculture
	Diffuse Source Pressures - Acidification	Agriculture; Forestry
	Diffuse Source Pressures – Sediment Delivery	Arable and pasture on upland land use
	Abstraction and Flow Regulation Pressures	Sewage treatment; Water transfers; Abstractions
	Morphological Pressures	Urbanisation; Flood defence
	Alien Species Pressure	Introduction of alien species
	Point Source Pressures - Metals	Sewage treatment; Industry; Fish farming
	Point Source Pressures - Nutrients	Sewage treatment; Industry; Fish farming
	Point Source Pressures - Pesticides	Sewage treatment; Industry; Fish farming
	Point Source Pressures – Sanitary Determinands	Sewage treatment ; Industry; Fish farming
	Point Source Pressures – Other Determinands	Sewage treatment ; Industry; Fish farming
	Point Source Pressures – Dangerous Substances Directive	Industry - Discharges of metals
<b>Lakes</b>	Point Source Pressures – Nutrient Phosphorus	Fertiliser use (agriculture); Effluent discharges – Industry, Domestic
	Diffuse Source Pressures – Nutrient Phosphorus	Fertiliser use (agriculture); Effluent discharges -Industry, Domestic
	Diffuse Source Pressures - Acidification	Agriculture and forestry
	Abstraction and Flow Regulation Pressure	Sewage treatment; Unlicensed abstractions and discharges
	Morphological Pressures	Non-natural land use; Impoundments; Road/track usage
	Alien Species Pressures	Introduction of alien species
<b>Ground water</b>	Abstraction Pressures (Groundwater)	Water abstractions and discharges
	Abstraction Pressures (Dependent Rivers)	Water abstractions and discharges

	<b>Source Pressures</b>	<b>Activities</b>
	Abstraction Pressures (dependent terrestrial ecosystems)	Water abstractions and discharges
	Abstraction Pressures (Dependent Lakes)	Water abstractions and discharges
	Point Source Pressures	Landfill sites; Authorised discharge to ground; Petrol stations
	Diffuse Source Pressures - Urban discharges	Urbanisation
	Diffuse Source Pressures - Nutrient nitrogen	Fertilisers; Emissions from industry
	Diffuse Source Pressures - Nutrient Phosphorus	Land use and livestock
	Diffuse Source Pressures – Pesticides and Sheep Dip	Pesticide use - agriculture, forestry and amenity application; sheep dip disposal
	Diffuse Source Pressures – Mines and Minewaters	Mining
	Diffuse Source Pressures – Dangerous Substances (List I and II)	Spillages and leakages associated with handling and storage - based on monitoring data only
	Diffuse Source Pressures – Chlorinated Solvents	Associated with engineering activity – method uses observed data
	Diffuse Source Pressures – Upward chemical trends (nitrate)	Only monitoring data used
	Abstraction and Flow Regulation Pressures – Saline Intrusion	Groundwater abstractions for aquifer recharging
<b>Transitional Waters</b>	Diffuse Source Pressures – Nutrient nitrogen	Sewage Treatment Works; Industry; Agriculture
	Diffuse Source Pressures – Organic enrichment	Natural carbon; Sewage & industrial effluent; Organic waste from farms – based on monitoring data
	Point Source Pressures – Dangerous substances Directive (EQS failures and metals)	Permitted discharges for IPC and IPPC
	Diffuse Source Pressures – Pesticides (Tributyl Tin)	Leaching from biocide use in ship antifouling paints
	Abstraction and Flow Regulation Pressures – Catchment abstraction	Abstraction for drinking water supplies; Process industry; Power generation
	Morphological Pressures	Land claim; Shoreline Reinforcement; Dredging; Dredge Spoil Placement; Aggregate extraction; Barrages; Weirs and Sluices; Shellfish Fisheries; Commercial fisheries
	Alien Species Pressures	Introduction of non-native organisms
	Abstraction and Flow Regulation Pressures - Industrial abstraction (cooling water intakes)	Abstraction for power generation and process industry
	Point Source Pressures - Metals	Industry - Discharge of metals
<b>Coastal Waters</b>	Point Source Pressures – Sanitary Determinands	Point source discharge of sanitary determinands
	Diffuse Source Pressures – Nutrient nitrogen	Waste Water Treatment; Process Industry; Agriculture
	Diffuse Source Pressures – Organic enrichment	Natural carbon; Sewage and industrial effluent; organic waste from farms – based on monitoring data

<b>Source Pressures</b>	<b>Activities</b>
Point Source Pressures – Dangerous substances Directive (EQS failures and metals)	Permitted discharges for IPC and IPPC
Diffuse Source Pressures – Pesticides (Tributyl Tin)	Leaching from biocide use in ship antifouling paints
Morphological Pressures –	Land claim; Shoreline Reinforcement; Dredging; Dredge Spoil Placement; Aggregate extraction; Weirs and Sluices; Shellfish Fisheries; Commercial fisheries
Alien Species Pressure	Introduction of non-native organisms
Point Source Pressures - Metals	Industry - Point source discharge of metal
Point Source Pressures – Sanitary Determinands	Industry, Domestic Point source discharge of sanitary determinands
Diffuse Source Pressures – Nutrient nitrogen	Agriculture – livestock and leaching losses from crops



## APPENDIX E PRESSURE-ACTIVITY TABLES OF GROSS AND NET TRENDS

The majority of the information contained within the following tables consists of expert knowledge and/or judgements gathered from stakeholders at either a national workshop, a series of pressure-based workshops or via the telephone and/or email. Where possible the information provided by stakeholders has been substantiated. The following shorthand is used to describe the drivers: EconG (Economic growth/employment and output); DemoE (Demographic evolution/population and households); LUC (Land use change); Tech (Technological change); Cons (Consumption); Behav (Behavioural change); CC (Climate Change); and Gov (Governance).

**Table M1 Point Source Minewaters- Mining**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	<p>1 or 2 mines close per year<sup>14</sup>.</p> <p>88 mines prioritised for remediation, so far 22 schemes active. The coal authority were committed to remediate a further 8 mines per year, but due to funding cuts it will now be 1 per year<sup>14</sup></p> <p>30+ minewater blocks are being monitored any of which may require treatment before 2015<sup>14</sup></p> <p>Non-coal discharges are unquantified<sup>14</sup></p>	<p>EA operational programme to monitor discharges from abandoned coal mines<sup>15</sup>, to work with CA to agree a prioritised programme and ongoing prioritisation of minewater blocks to prevent pollution of groundwater and surface water<sup>15</sup></p>	<p>Local improvements in water quality</p>

<sup>14</sup> Expert opinion provided by email and/or telephone

<sup>15</sup> <http://www.environment-agency.gov.uk/science/922300/923147/923156/923164/?version=1&lang=e>

**Table U1a Diffuse Source Runoff– Urbanisation (includes Water Industry issues, but transport is covered separately)<sup>a</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
<p>Cons</p> <p>CC</p> <p>See note b</p> <p>Continued below</p>	<p>Increased developed area and intensification of use results in a greater amount of impervious land, including roads (see transport tables). This will increase diffuse runoff and associated pollution<sup>16</sup>.</p> <p>More intense and frequent winter rainfall may alter the pattern of discharge of diffuse pollution, but will not significantly affect the loading.</p> <p>Drier summers will lead to a greater build-up of urban pollutants between events, leading to increased concentration and loadings of pollutants in run-off once rainfall does occur<sup>16</sup>.</p> <p>Overall, climatic changes will alter the frequency of diffuse runoff and the concentration of pollutants within it, but it is not likely to change the average annual loading of pollutants. However, the extent and frequency of CSO discharges is likely to increase<sup>16</sup>.</p> <p>Data on the long-term trends in the quality of urban runoff is minimal. Indications are that Pb has declined by over 33% in the last decade but with Pt, Cu and Zn and PAH loads increasing<sup>17</sup>.</p>	<p>Water Industry Act 1991 – sections 94, and 98 to 106, encompass provision and extension of public sewers, sewer requisitioning, adoption of sewers, appeals with respect to adoption, right to communicate with public sewers.</p> <p>The un-limited right of connection has a damaging effect in allowing surface water discharges to foul sewers in some circumstances. This results in poor uptake of SUDS and increased CSO operation<sup>17</sup>.</p> <p>Current and future CSO improvement programmes under various AMP rounds have/will address many of the major problems<sup>16</sup>. However, this effect may be time limited, as flows and loads to the sewer system increase. Diversion of rainwater from the foul sewer is the best solution<sup>19</sup>.</p> <p>PPS25 promotes the use of Sustainable Urban Drainage Schemes<sup>20</sup> (SUDS) whilst PPG23 states that any adverse impacts on water quality must be considered including discharge of effluents and leachate<sup>21</sup>.</p> <p>PPG3 promotes the building of higher density housing<sup>22</sup></p> <p>Part H of the Building Regulations encourages rainwater harvesting and requires the use of soakaways for surface water disposal where possible<sup>17</sup>.</p> <p>A new Government strategy for flood and coastal erosion risk management in England ('Making space for water')<sup>23</sup> is taking a holistic approach to the management of risk from all forms of flooding. The strategy is addressing SUDS and, in particular, the ownership and responsibility for every element of surface water drainage. This includes possible amendment of Section 106 of the Water Industry Act (1991) – 'right of connection', to account for SUDS (e.g. one option is to provide no right to drain surface waters into foul waters where non-piped surface water drainage systems are provided). SUDS can aid attenuation of diffuse and point source pollutants, however, stakeholders state that responsibility/ownership for SUDS is unclear<sup>16</sup></p>	<p>SUDS can reduce diffuse urban runoff but uptake and net effects remain uncertain particularly with respect to retrofitting, which although potentially expensive and practically difficult may offer a cost effective alternative to capital expenditure on CSOs<sup>17</sup>. In addition, PPG3 with its requirement for greater housing densities, may limit SUDS options due to less available public space for the implementation of SUDS. However, there are many SUDS techniques, which will be effective in high-density developments. Other issues impacting the uptake of SUDS include; the degree to which owner/occupiers exercise any right to connect surface water to foul sewers; design – the right to refuse adoption for poorly designed/constructed SUDS; health &amp; safety issues concerning increased numbers of open water bodies in urban areas. Generally there is a stakeholder belief that uptake of SUDS will not be sufficient to have a significant effect<sup>16</sup>.</p> <p>Stakeholders varied in their assessment of net CSO pressures, but with agreement that impacts are likely to be spatially variable. CSO improvement programmes will have a positive impact, expansion of urban land and climatic changes may adversely impact water quality of receiving waters<sup>16</sup>.</p> <p>An overall net trend is very uncertain and likely to be highly spatially variable; dependent upon the degree to which the expansion of urban land is offset by mitigation. Given the scepticism regarding uptake of SUDS, an overall adverse net trend is likely but quantification is not possible<sup>16</sup>.</p>

<sup>16</sup> Expert judgement made at national workshop

<sup>17</sup> Urban diffuse pollution: key data information approaches for the Water Framework Directive, Paper for CIWEM, J Bryan Ellis BSc, MSc, FGS, MIWA\* and Gordon Mitchell BSc PhD, 2005

<sup>18</sup> Personal communication Bryan Ellis, July 2006.

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Cons CC	There is a growing baseline for urban runoff pollution loads and EMCs, however there are major gaps in areas like emerging pollutants e.g. PPCPs, PAH degradation products, sewer exfiltration pollutants etc <sup>18</sup> .	Planning and building control has a key role to play. Planners are now more aware of the water environment as a result of flooding, especially from sewers and the availability of guidance documents such as the ODPMs PPG25 <sup>c</sup> . The recent move to make the EA a statutory consultee on planning in areas subject to flood risk should enhance the use of existing guidance on controls.	As above
CC	CC together with changing groundwater levels will change the rate of transfer of pollutants from contaminated land to controlled waters, but extent unknown <sup>c</sup> .	Local Authorities have strategies in place to clean-up designated sites, but implementation is slow and the costs of clean-up may be prohibitive. Range of regulatory and non-regulatory tools in place including PPC/PPC, planning controls, and Part IIa, anti-pollution works notices, waste management licensing, consents to discharge, groundwater protection policy and codes of practice. Not all of these are being used effectively <sup>c</sup>	Overall downward trend but slow/ineffective implementation means this will be slow to develop unless action to improve implementation is taken. EIAs should prevent new problems emerging <sup>c</sup> .
Behav	Misconnections are increasing as the demand for extra bathrooms/toilets, conservatories and other building extensions, as well as for cleaning appliances increases <sup>c</sup> .	Ongoing work by EA and water companies to trace misconnections as part of water quality monitoring and the AMP3 process. Local EA campaigns are successful for limited periods.  Work to establish a common position on this at a national level with Water UK in progress <sup>19</sup> . The key issue is that building regulation enforcement is not effective <sup>c</sup> .	Unclear but unlikely to improve with current controls <sup>c</sup> .
DemoE	Leaking sewers a chronic problem with asset age increasing. Trends likely to vary locally.	AMP 3 and subsequent programmes tackling hotspots <sup>c</sup>	Likely to vary locally <sup>c</sup> .
DemoE CC	'Right of connection' is increasing likelihood of sewer flooding in some areas.	Defra considering modification of the right of connection <sup>19</sup> . AMP 3 and subsequent programmes <sup>c</sup>	
	Improper use of sewers. Possible increased awareness with public. Trends uncertain.	Campaigns such as 'bag it and bin it' and 'think before you flush' have some impact for short periods. <sup>c</sup>	Uncertain <sup>c</sup> , but likely to vary locally.
Behav, Gov (CoP fast food restauran	Run-off from cleaning activities likely to increase as the demand for cleanliness grows. This would be exacerbated in locations	Code of Practice for fast food restaurants.  Rapid growth in hand car wash operations at supermarket car parks etc <sup>19</sup> .	Run-off from cleaning activities likely to increase as the demand for cleanliness grows. This would be exacerbated in locations moving to separate sewer systems. <sup>c</sup>

<sup>19</sup> Personal communication P Chatfield, Environment Agency, July 2006

<sup>20</sup> <http://www.communities.gov.uk/index.asp?id=1143926>

<sup>21</sup> <http://www.communities.gov.uk/index.asp?id=1162059>

<sup>22</sup> <http://www.communities.gov.uk/index.asp?id=1143940>

<sup>23</sup> <http://www.defra.gov.uk/environ/fcd/policy/strategy.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
ts)	moving to separate sewer systems. <sup>c</sup>		
Gov (landfill directive)	Upwards trend in pressure from illegal disposal of hazardous waste as there will be far fewer sites officially licensed to take this waste and would not necessarily be located close to where the waste is being produced. <sup>c</sup>		Likely to vary locally.
CC	<p>Industrial estates, pressures arising from drainage, cleaning activities, waste storage and re-use on site, traffic, chemical storage, spillages and cooling systems.</p> <p>Construction industry pressures arising from sediment loss, oils, fuel and chemical leakage and spills, pesticides and waste materials (fly tipping).</p> <p>Trends in these pressures not clear but climate change may result in more intense rainfall periods, which could increase runoff potential.<sup>c</sup></p>	<p>Numerous mitigation measures, regulatory and non-regulatory (local partnerships and pollution initiatives) exist though they are not all thought to be applied very effectively, partially because they are not 'joined-up' and there is a poor awareness of drainage issues by the operator. The oil storage regulations are a good example where change has been managed.<sup>c</sup></p> <p>SUDS has the potential to alleviate many problems and has been successfully applied at a number of sites<sup>19</sup>. However, the understanding or motivation is not sufficient for it to be widely implemented.</p>	Some improvements, likely to vary from operator to operator. <sup>c</sup>

Notes:

- a Pressures covered in this table are: Diffuse Source Discharges (flushing of pollutants from impervious and grassed/amenity areas. Includes those pollutants emitted to, and washed-out from, the atmosphere); and Diffuse-to-Point Source Discharges (e.g. diffuse flow to surface water sewers, Combined Sewer Overflows (CSOs) discharges from commercial premises e.g. car washes, that are not always regulated, wash-out from construction sites).
- b Climate Change is likely to impact upon each of the specific pressures outlined for urbanisation through more frequent and intense winter rainfall and, in some parts of the country, hotter drier summers. This is despite a number of national and international initiatives. Population growth is forecast for most river basin districts<sup>24</sup>. In addition urban growth areas have been designated including Thames Gateway, Milton Keynes/South Midlands, London-Stanstead-Cambridge and Ashford. Associated increases in transport infrastructure and industry are anticipated. This predicted urbanisation is expected to influence all pressure categories. A range of 'policies' are in place, typically these impact generally upon urbanisation and its associated pressures. For example, the Regional Spatial Strategies<sup>22</sup> (replacing Regional Planning Guidance) provide a framework for future development including housing and transport and the provision for sufficient new homes and jobs, retail and leisure facilities. These are required to account for environmental priorities. In addition, Planning Policy Guidance Notes (PPG's) and their replacements Planning Policy Statements<sup>22</sup> (PPS's) are prepared by the Government for Local Authorities who must take their contents into account when preparing their development plans. The guidance may also be relevant to decisions on individual planning applications and appeals. Of particular relevance are those on sustainable development (PPS1), green belts (PPG2), housing (PPG3), rural areas (PPS7), pollution control (PPS23) and flood risk (PPS25)
- c Information extracted from a series of workshops on non-agricultural diffuse pollution, Defra 2004.

<sup>24</sup> <http://www.communities.gov.uk/index.asp?id=1143839>

**Table U1b Diffuse Source (Sewage Sludge) – Urbanisation (includes Water Industry issues)<sup>d</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
<p>See note b above</p> <p>Gov</p>	<p>Increased treatment required in response to other directives (UWWT and Habitats Directives) and an increasing population is likely to exacerbate non-discharge pressures from sewage treatment including increased sludge production<sup>25</sup></p> <p>Volume of sewage sludge has increased at South West Water, but so has the amount recycled to land: ~ 36,000 tonnes in 00/01 to 56,000 tonnes in 04/05<sup>26</sup></p> <p>Sewage sludge production shows a downward trend at Severn Trent – 165,313 tonnes in 95/96 to 158,777 tonnes in 99/00<sup>27</sup></p> <p>Wessex Water recycle 99.9% of sewage sludge produced<sup>28</sup></p>	<p>Sludge Regulations will limit pressures of certain contaminants. Sludge application to land is also well covered by RB209, which provides advice on application rates and approaches. Catchment Sensitive Farming (CSF) methods also set out requirements for sludge application. Nitrates Directive can restrict sludge application to land<sup>25</sup></p>	<p>A presumed increased net trend in sludge generation and disposal, energy consumption and emission of greenhouse gases<sup>25</sup></p>

Notes: d. Pressures covered in this table are those resulting from increased sewage treatment other than discharges i.e. greater generation and disposal of sludge, greater energy consumption and emission of greenhouse gases

<sup>25</sup> Expert judgement made at national workshop

<sup>26</sup> <http://www.wessexwater.co.uk/strikingthebalance2005/environment/index.aspx?id=1211>

<sup>27</sup> [http://www2.severntrent.com/downloads/htmlreports/environmentalreports/2000\\_stewardship/data/waste.htm](http://www2.severntrent.com/downloads/htmlreports/environmentalreports/2000_stewardship/data/waste.htm)

<sup>28</sup> <http://www.wessexwater.co.uk/strikingthebalance2005/environment/index.aspx?id=1211>

**Table U2 Point Source Pollution – Urbanisation (includes Water Industry issues)<sup>e</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
<p>See note b Table U1a DemoE</p>	<p>An increased population<sup>29</sup> and expansion of industry is likely to increase pressures from point source discharges<sup>30</sup></p> <p>Domestic habits may change, for example use of garbage grinders to enable waste disposal via the sink and hence discharge of organic matter may increase to sewers<sup>29</sup></p> <p>Discharge of point source pollutants from industry has generally been in steady decline for years and this decline is predicted to continue in the future</p>	<p>Existing requirements under Water Resources Act will allow no deterioration for existing determinands. But many pollutants are not consented for e.g. Metals<sup>30</sup></p> <p>EU Strategy on Mercury<sup>30</sup></p> <p>PPS23 states that any adverse impacts on water quality must be considered including discharge of effluents and leachate<sup>24</sup></p> <p>Asset Management Plans 4 (AMP4) set future environmental priorities for the water industry to be paid for between 2005 and 2010. These will reduce impacts of abstraction and point source discharge pressures<sup>30</sup></p> <p>The EU's regulatory framework for the Registration, Evaluation and Authorisation of Chemicals (REACH)<sup>31</sup> aims to improve the protection of human health and the environment through the better and earlier identification of the properties of chemical substances. REACH gives greater responsibility to industry to manage risks from chemicals<sup>30</sup></p> <p>The UWWT Directive requires additional treatment for discharges to sensitive areas, similarly the Habitats Directive may require more stringent control of discharges to Natura 2000 sites<sup>32</sup></p>	<p>AMP4 plans will help to minimise pressures from STW discharges, assuming they fully account for population and urban growth<sup>30</sup></p> <p>Reduced Mercury in trade effluent and therefore in STW discharges<sup>30</sup></p> <p>Pressures from other point source discharges may increase, for example for non-consented determinands<sup>30</sup></p> <p>UWWT and Habitats Directives will reduce point source discharge pressures locally<sup>30</sup></p> <p>Submission for United Utilities forecast a 14.3% decline in trade effluent load over the period 1998 to 2008 due to net closure of traditional industry and the effects of waste minimisation and on-site treatment. The 2004 submission predicts a steeper decline – 14% in the period 2004/5 to 2009/10.</p>

Notes: e. Point Source Discharges (from sewage treatment works, industry, domestic/household use, road runoff; metals, nutrients, sanitary determinands, priority substances)

<sup>29</sup> Population forecast to increase 4.6% across all RBDs: <http://www.defra.gov.uk/environment/water/wfd/economics/>

<sup>30</sup> Expert judgement made at national workshop

<sup>31</sup> <http://europa.eu.int/comm/environment/chemicals/reach.htm>

<sup>32</sup> [http://ec.europa.eu/environment/water/water-urbanwaste/index\\_en.html](http://ec.europa.eu/environment/water/water-urbanwaste/index_en.html)

**Table U3a Abstraction and Flow Regulation– Urbanisation<sup>f</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG Cons Gov	<p>Urban growth<sup>33</sup> is expected to increase abstraction and flow regulation pressures. In some parts of the country the problem will be exacerbated by predicted future hotter, drier summers<sup>34</sup>.</p> <p>If a projected 195,000 dwellings per annum were to be built up to 2016 it is estimated that an additional 50,000 megalitres of water per year would be required in 2015-16<sup>35</sup>.</p>	<p>The joint Defra, ODPM, Dti Sustainable Buildings Code<sup>36</sup> promotes the use of water efficient fittings and fixtures, and grey water re-use.</p> <p>Local plans and Unitary Development Plans (UDP)<sup>37</sup> identify areas as suitable for housing, industry, retail or other uses, and sets out the policies which the authority proposes to apply in deciding whether or not development will be permitted. UDP's are encouraging the subdivision of larger homes (to reduce house building) leading to a potential future increase in water consumption and sewage treatment requirements<sup>34</sup></p>	<p>Despite some initiatives, a net trend in increased abstraction and flow modification pressures is anticipated, exacerbated in some places by climate change<sup>34</sup>.</p>

Notes: f. Abstraction and Flow Regulation (abstraction for public supply and industry; impact of urban land upon the flow regime – increased peak flow, reduced base flow, increased flood risk)

<sup>33</sup> Households are predicted to increase 11.2% across all RBDs. <http://www.defra.gov.uk/environment/water/wfd/economics/>

<sup>34</sup> Expert judgement made at national workshop

<sup>35</sup> <http://statistics.defra.gov.uk/esg/reports/housing/appendc.pdf> - the figures in this report are based upon current water consumption and do not take account of reductions that could be achieved through water metering and innovations

<sup>36</sup> <http://www.defra.gov.uk/Environment/energy/betterbuildings.htm>

<sup>37</sup> <http://www.communities.gov.uk/index.asp?id=1144587>

**Table U3b Abstraction and Flow Regulation– Water Industry<sup>9</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE Cons	Increase in population and households <sup>29,33</sup> . More demand for water. On average by 1% per year <sup>38</sup>	As above	As above
	Increase in line with urban expansion <sup>39</sup>	SUDS – see Table U1a	Uncertain, may be an increase in point source discharges as a result of SUDS <sup>41</sup>
Tech Gov	The Government’s sustainable communities agenda <sup>39</sup> sets out a strategic approach to development and housing expansion in the South East of England. It also contains proposals to tackle weak housing demand and regeneration in the Midlands and North of England. The 200,000 extra new homes to be created by 2016 are in addition to those proposed in existing regional planning guidance. The Barker Review of Housing <sup>40</sup> Supply suggests that a further 70 – 120,000 new homes may need to be built each year <sup>41</sup> .	Proposed Code for Sustainable Homes under consultations may be incorporated into Building regulations: more efficient use of water - fitting dual or low flush toilets and reduced flow taps <sup>41</sup>	Effect expected to be positive in terms of reducing demand but net trend not certain. Proposed target for water use of no greater than 125 litres per head per day compared to OFWAT average figure of 154 litres per head per day at present <sup>42</sup> . EA indicates that high water efficiency standards applied to all the 1 million new homes planned for South East England could save 60 million litres a day – enough to supply water for 500,000 people <sup>43</sup>
Cons		Demand management measures <sup>39</sup>	These do not work without adequate levels of charging: net trend not known <sup>44</sup>
EconG DemoE Cons		Incentives to improve water use efficiency <sup>39</sup>	As these are optional no change is expected <sup>41</sup>
Tech		Targets for reduction of leakage <sup>39</sup>	Disagreement on who pays for leakage repair between supply and house can be a disincentive for metering, in addition , some water companies are not meeting their targets for reduction , e.g. Thames, therefore, net effect uncertain <sup>41</sup>

<sup>38</sup> [http://www.statistics.gov.uk/downloads/theme\\_compendia/regional\\_trends/RT35\\_03\\_POPN\\_HSHLDS.pdf](http://www.statistics.gov.uk/downloads/theme_compendia/regional_trends/RT35_03_POPN_HSHLDS.pdf)

<sup>39</sup> <http://www.defra.gov.uk/Environment/energy/betterbuildings.htm>

<sup>40</sup> [http://www.hm-treasury.gov.uk/media/053/C7/barker\\_review\\_execsum\\_91.pdf](http://www.hm-treasury.gov.uk/media/053/C7/barker_review_execsum_91.pdf)

<sup>41</sup> Expert judgement made at national workshop

<sup>42</sup> [http://www.ofwat.gov.uk/aprix/ofwat/publish.nsf/AttachmentsByTitle/wifl\\_210306.pdf/\\$FILE/wifl\\_210306.pdf](http://www.ofwat.gov.uk/aprix/ofwat/publish.nsf/AttachmentsByTitle/wifl_210306.pdf/$FILE/wifl_210306.pdf)

<sup>43</sup> <http://www.environment-agency.gov.uk/aboutus/512398/289428/902889/?lang= e>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Cons	As above	Water metering/charging <sup>39</sup>	Net effects not certain: is likely to reduce consumption by between 10-15% on average <sup>45</sup>
Tech		Water reuse and use of grey water <sup>39</sup>	As measures are voluntary, minimal effects are expected (see discussion on aspirations previously) <sup>41</sup>
		Infrastructure development to safeguard supplies <sup>42</sup> and meet new demand	Construction of more reservoirs, net effect uncertain particularly as these may not be constructed if leakage targets are not met <sup>41</sup>
		Infrastructure charges <sup>39</sup>	These are too low and hence will be worsening <sup>41</sup>
EconG DemoE LUC Gov		Catchment Abstraction Management Strategies (CAMS). Management of water resources in a sustainable way <sup>41</sup>	Used in EA risk assessments but net trend not known <sup>41</sup>
Gov	Less water available for abstraction in affected areas	Habitats Directive with required minimum flow objectives <sup>41</sup>	Less water available for abstraction in affected areas <sup>41</sup>

Notes: g. Pressures include those from abstraction and discharges from sewage treatment works and surface water sewers, which impact upon river flow

<sup>44</sup> Expert opinion provided by email or telephone post-national workshop

<sup>45</sup> <http://www.defra.gov.uk/environment/water/resources/water-scarcity/waterscarcity050301-docd.pdf>

**Table U4 Hydromorphology – Urbanisation<sup>h</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG LUC Tech Cons CC  See note b in Table U1a	A greater amount of impervious land associated with urbanisation may enhance runoff and flood risk. More intense and frequent winter rainfall will increase flood risk <sup>46</sup>	PPS25 states that developers should fund flood defences made necessary due to development, and that Local Planning Authorities should consult the EA on proposed development at risk of flooding. PPS25 also promotes the use of SUDS <sup>47</sup> . In addition, PPS23 states that suitable provision for the drainage of surface water must be made <sup>48</sup>  A new Government strategy for flood and coastal erosion risk management in England ('Making space for water') <sup>49</sup> is taking a holistic approach to the management of risk from all forms of flooding. The strategy is addressing SUDS and, in particular, the ownership and responsibility for every element of surface water drainage. This includes possible amendment of Section 106 of the Water Industry Act (1991) – 'right of connection', to account for SUDS (e.g. one option is to provide no right to drain surface waters into foul waters where non-piped surface water drainage systems are provided).	Despite planning policy guidance directing development away from flood zones, inappropriate development is occurring and is likely to continue to occur in the future, enhancing flood risk and, therefore, hydromorphological pressures <sup>44</sup>  SUDS and other flood management strategies have the potential to reduce risk, but likely future uptake/effectiveness is not clear <sup>44</sup>  Despite national and international policy, climate change is likely to increase flood risk and hence hydromorphological pressures <sup>44</sup>  An overall net trend with respect to hydromorphological pressures is far from clear. On balance, risks look likely to increase in the future but timing, magnitude and location remain highly uncertain <sup>44</sup>

Notes: h. Hydromorphological pressures, particularly those related to flooding (flood defence, dredging, riverbank engineering, reservoirs) and discharges from sewage treatment works and surface water sewers, impact upon hydromorphology.

<sup>46</sup> Expert judgement made at national workshop

<sup>47</sup> <http://www.communities.gov.uk/index.asp?id=1162059>

<sup>48</sup> <http://www.communities.gov.uk/index.asp?id=1143920>

<sup>49</sup> <http://www.defra.gov.uk/environ/fcd/policy/strategy.htm>

**Table I 1 Acidification Pressure – Industry<sup>i</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE Tech Cons	Once the Gothenburg Protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63%, its NOx emissions by 41%, its VOC emissions by 40% and its ammonia emissions by 17% compared to 1990.  Increased use of renewable energy sources with an associated reduction in acidic emissions.	Compliance with IPPC Directive by 2007. Outcomes of the current IPPC Directive review. EU-wide emissions protocols, e.g. Gothenburg Protocol.  Energy Review launched Jan 2006. Government White Paper commitment to a requirement that by 2010, 10% of UK electricity will be produced by renewable sources.	As for Gross trends: a decrease in emission of acidic oxides. A quantifiable recovery from acidification is predicted for UK uplands <sup>50</sup> .

Notes: i. Pressure is emission and subsequent deposition of acidic oxides, promoting acidification of soil and freshwaters

**Table I 2 Point Source Pressures – Industry<sup>j</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE Tech Cons	Decline in textile output, modest growth in chemicals and food manufacturing industries, no change in metals industry. However, SMEs will not be regulated by IPPC and this sector could potentially have a significant impact on water bodies as 99.9% of enterprises in the UK fall into this category <sup>51</sup>  Discharge of point source pollutants from industry has generally been in steady decline for years and this decline is predicted to continue in the future	Compliance with IPPC Directive by 2007. Outcomes of the current IPPC Directive review.	Unknown, presumed to at least partly reflect the predicted growth/decline in each industry  Submission for United Utilities forecast a 14.3% decline in trade effluent load over the period 1998 to 2008 due to net closure of traditional industry and the effects of waste minimisation and on-site treatment. The 2004 submission predicts a steeper decline – 14% in the period 2004/5 to 2009/10.

Notes: j. The pressure is discharge of Point Source Pollutants; COD, BOD, ammonia, lead, zinc, mercury, arsenic, cadmium, and chromium

<sup>50</sup> Evans et al. (2001). Freshwater Acidification and Recovery in the United Kingdom. Centre for Ecology and Hydrology. ISBN 1903741017

<sup>51</sup> Dti statistical press release 25 Aug 2005

**Table I 3 Abstraction and Flow Regulation Pressure – Industry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE Tech Cons Gov	<p>Move away from highly water consumptive industries, decline in textile output, modest growth in chemicals and food manufacturing industries, no change in metals industry.</p> <p>By 2015, output of electricity, gas, steam and hot water supply is expected to increase.</p> <p>Introduction of modern CCGT power stations that use less water in the cooling process than coal fired power stations because of their high efficiency</p> <p>Move towards renewable power – wind/tides, that do not consume water</p> <p>Change in the use of nuclear power unclear</p>	<p>CAMS – Management of water resources in a sustainable manner, balancing the needs of abstractors and environmental needs.</p> <p>IPPC Directive – implementation of BAT could reduce the amount of water used/consumed for cooling purposes.</p> <p>Energy Review launched Jan 2006. Government White Paper commitment to a requirement that by 2010, 10% of UK electricity will be produced by renewable sources<sup>52</sup>.</p> <p>Energy Efficiency Commitment<sup>53</sup></p> <p>Climate Change Levy</p>	<p>CAMS partly used in EA Risk Assessments, but net trends unknown.</p> <p>Difficult to quantify an overall net trend; for the power industry, it's dependent upon whether predicted increase in energy consumption is offset by technological changes and uptake of renewable sources. For example, the DTI assumes electricity generation from renewables will be 33TWh by 2010 and that there will be some new CCGT plants built by 2010<sup>54</sup>. By contrast the Association of Electricity Producers are concerned that projected emissions from the electricity generation sector are too low<sup>55</sup>. Electricity consumption in consumer electronics is expected to almost double between 1998 and 2020 to 27TWh<sup>56</sup></p> <p>Otherwise water consumption from other industrial sectors likely to be broadly in line with their predicted growth/decline.</p>

<sup>52</sup> <http://www.dti.gov.uk/energy/energy-sources/renewables/index.html>

<sup>53</sup> <http://www.defra.gov.uk/environment/energy/eec/> Under the EEC electricity and gas suppliers are required to achieve targets for the promotion of improvements in domestic energy efficiency

<sup>54</sup> DTI, (2006), UK Energy and Emissions Projections

<sup>55</sup> Information supplied by email and/or telephone interview

<sup>56</sup> <http://www.eci.ox.ac.uk/lowercf/cadence.html>

**Table A1a Sediment – Agriculture**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC Gov	Gross trends are very uncertain. Probably increasing due to increased frequency of high intensity rainfall due to climate change. However, longer and more rigorous crop growth may offset this to some degree in some locations by increasing ground cover and reducing soil moisture.	Incentive Schemes: <ul style="list-style-type: none"> <li>• Farming Regulation Charging Strategy</li> <li>• CAP reform and cross-compliance</li> <li>• Sustainable Farming and Food Strategy (with Entry Level Scheme (ELS) and High Level (HLS) Schemes)</li> </ul>	Highly uncertain and dependent upon uptake and effectiveness of Incentive and Voluntary Schemes, the impact of climate change, changes in land use and management, and, other Directives e.g. Bathing Waters Directive.
			Incentive Schemes provide a strong drive and should see sediment pressures decrease in some areas. HLS schemes will deliver high protection and decreased risk, but these are not extensive. Some local improvement – not nationally significant
		Bathing Waters Directive <sup>57</sup> – catchment measures likely to improve sediment pressures	Unknown
		Voluntary Schemes: <ul style="list-style-type: none"> <li>• LEAF audit</li> <li>• FWAG activities</li> <li>• Rivers trusts</li> <li>• LANDCARE (aims to improve river catchments of high conservation value, which have declining fisheries principally from sediment run-off from agricultural land. There are 5 Landcare projects led by the Environment Agency.)</li> <li>• Countryside stewardship</li> </ul>	Approaches such as LEAF and the Voluntary Initiative are having success locally and farmers who have opted for these voluntary approaches to responsible practice are now helping to communicate this best practice to other farmers through demonstration so wider benefits might be expected to follow <sup>58</sup> .  Rivers Trusts have a proven delivery of reduced sediment pressures locally and are expanding to other areas. Should be significant improvements in LANDCARE catchments <sup>55</sup> .
		Local trends are likely. For example, the Broads Authority report modelling predictions that suggest an increase in sediment pressures due to changes in cropping and land use.	

<sup>57</sup> [http://europa.eu.int/water/water-bathing/index\\_en.html](http://europa.eu.int/water/water-bathing/index_en.html)

<sup>58</sup> Personal Communication, LEAF, July 2006.

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC Gov	Marked reduction in livestock numbers. Fewer larger herds of dairy cows – disappearance of mid-sized herds, focus of production will be lowland. Pressures of dairying concentrated in specific area (more slurry to be stored) <sup>59</sup>	Cambridge University/SAC study: includes, CAP cross-compliance, Environmental Stewardship Schemes, Rural Development Regulation, Nitrates Directive, Catchment Sensitive Farming Initiative, Waste Framework Directive, IPPC Directive, Water Act 2003 <sup>59</sup>	Cross compliance and NVZs will have a mitigating effect. Mainly effect manure application (more targeted). Little expected impact from Entry Level Scheme <sup>60</sup>
	Fewer cattle and sheep will reduce problems with poaching <sup>60</sup>		Reduction of sediment loads to surface waters <sup>60</sup>

**Table A1b Organic Matter<sup>k</sup> – Agriculture (not discussed at the meeting but was rated as of high importance/significance by the meeting participants. The source of contamination would be from farmyard contamination, run-off and direct contamination)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC	Organic matter arising from agriculture will often be associated with faecal contamination, and so the trends and policies will be similar or the same to those described in table A1a (from where most of the following has been taken)  Nitrate levels in many English waters, both ground and surface waters, are increasing. Organic matter is also associated with this source of agricultural nitrate <sup>60</sup> .	DEFRA is consulting on proposed revisions to the Action Programmes required under the Nitrate Directive in England <sup>60</sup> . Revisions being considered in Nitrate Vulnerable Zones are: <ul style="list-style-type: none"> <li>• A reduction in the maximum manure and slurry application rates on grassland and arable land to 170 kilograms per hectare of nitrogen, averaged over the farm area.</li> <li>• The introduction of 'closed periods' across all soil types and an increase in the length of 'closed period' restrictions.</li> </ul>	The risk of Intermittent pollution from slurry spreading under inappropriate weather conditions may increase because of the reduction in possible time periods for spreading <sup>60</sup>  With proper control and implementation, there should be a net reduction of pollution from organic matter <sup>60</sup>

<sup>59</sup> Cambridge University/CAP Report

<sup>60</sup> Expert judgement made at Agriculture stakeholders meeting, 16 March 2006

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
		<ul style="list-style-type: none"> <li>A requirement for increased storage capacity for slurry, to cover the revised closed periods.</li> </ul>	
As above	Production, storage and use of silage – gross trend to be defined	Silage, Slurry and Agricultural Fuel Oil Regulations in England and Wales Code of Good Agricultural Practice for the Protection of Water <sup>61</sup>	Net trend not known
DemoE LUC Cons CC	Gross trends are unclear but suspect may be higher due to increased frequency of high intensity rainfall due to climate change	Incentive Schemes <sup>62</sup> : <ul style="list-style-type: none"> <li>Farming Regulation Charging Strategy</li> <li>CAP reform and cross-compliance</li> <li>Sustainable Farming and Food Strategy (with Entry Level Scheme (ELS) and High Level Schemes (HLS))</li> </ul> Provide a strong incentive and should see livestock numbers decrease in some areas. HLS schemes will deliver high protection and decreased risk, but these are not extensive. Other locations may see an increase in livestock numbers. No deadlines associated with these policies	Likely to be lower in some places where strong protection measures implemented, for example drinking water abstraction zones. In addition, decreased pressures should be realised under the Bathing Waters Directive for those catchments that drain to Bathing Waters.  However, unlikely to totally counter the increased frequency and intensity of winter rainfall may exacerbate problems in locations.
		For controlling potential contamination of drinking water supplies by Cryptosporidium, DWI are encouraging water companies to implement catchment protection measures such as fencing	Net effect not known though local improvement in drinking water catchments would be expected.
		Voluntary Schemes: <ul style="list-style-type: none"> <li>LEAF (Linking Environment And Farming) audit</li> <li>FWAG (Farming and Wildlife Advisory Group) activities</li> <li>Rivers trusts</li> </ul>	Change dependent on uptake of schemes and likely to vary locally. Approaches such as LEAF are having success locally and farmers who have opted for these voluntary approaches to responsible practice are now helping to communicate this best practice to other farmers through demonstration so wider benefits might be expected to follow <sup>63</sup> .  Rivers trusts have proven delivery of reduced problems locally and are expanding to other areas <sup>60</sup> .  Some local improvement – not nationally significant
	Marked reduction in livestock numbers Fewer larger herds of dairy cows – disappearance of	Cambridge University/SAC study: includes, CAP cross-compliance, Environmental Stewardship Schemes, Rural development regulation, Nitrates Directive, Catchment Sensitive Farming initiative, Waste	Cross compliance and NVZs will have a mitigating effect. Mainly effect manure application (more targeted). Little expected impact from ELS <sup>60</sup>

<sup>61</sup> <http://www.defra.gov.uk/environ/cogap/watercod.pdf>

<sup>62</sup> <http://www.defra.gov.uk/erdp/schemes/default.htm>

<sup>63</sup> Personal Communication, LEAF, July 2006.

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
	mid-sized herds, the focus of production will be in lowlands <sup>64</sup> .	Framework Directive, IPPC Directive, Water Act 2003 <sup>64</sup>	
DemoE LUC Cons CC	Pressures of dairying concentrated in specific area (more slurry to be stored) <sup>64</sup> . In some parts of country (SW) herds are already getting bigger <sup>65</sup>	More professional management in larger discrete units – less risk from slurry <sup>65</sup>	In the short term water quality may deteriorate, but by 2015 farms would be out of business or compliant, and hence there would be a positive trend and improvement by 2015 <sup>64</sup>
	Intensification of beef cattle maybe in housed units or free range, there will be regional differences <sup>65</sup>		Less contamination by slurry – net effect not known <sup>64</sup>
	Outdoor pig sector increasing to escape from measures required under IPPC Directive for installations for the intensive rearing of pigs (and poultry). Contamination pathways are run-off and the atmosphere for deposition of ammonium <sup>65</sup>	Major farmers will comply with Soil Management Plans/Soil Protection Reviews as part of Entry Level Scheme of the Environmental Stewardship scheme. These will reduce the risk of soil compaction, ponding, run-off and erosion, thereby limiting run-off to watercourse <sup>64</sup>  “Pig wise” is also a voluntary, agri-environment scheme working with pig farmers to encourage good farming by encouraging good farming practice through assessment of potential sites for pigs e.g. proximity to water courses <sup>65</sup>	Improvement in terms of faecal contamination, but not in terms of ammonium <sup>65</sup>
	At the moment farmers have no spare money to reduce the environmental impact of their activities <sup>65</sup>	CAP reform is a new driver if the farmer never received payments under the old policy <sup>65</sup>  The CAP Single payment scheme may be a new driver if there is net benefit to farmers <sup>65</sup>	There is an inherent risk with cross compliance: if gets too stringent then farmers will not take part – this is for all agriculture <sup>65</sup>  In the longer term there should be a net improvement though this may be geographically patchy <sup>65</sup>

Notes: k. Taken to be animal slurries and manures, and silage

<sup>64</sup> Cambridge University/CAP Report

<sup>65</sup> Expert judgement made at Agriculture stakeholders meeting, 16 March 2006

**Table A1c Pesticide Usage<sup>l</sup> – Agriculture**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC	New pesticides coming on the market will change the nature of the problem. Old issues will be less of a problem, but we will continue to uncover, as yet, unknown problems, particularly as monitoring sensitivities improve. This will be further heightened as the ecological monitoring required by the Directive leads to targeted investigative monitoring in locations currently unmonitored (e.g. headwaters) and at sampling times not currently used (i.e. looking at specific peak loadings and their impacts rather than averages). This will give lead to an increased awareness of problems (i.e. more problems to deal with) <sup>65</sup>	There are a wide range of initiatives to reduce the environmental impact of pesticides, mostly from agriculture, but in some cases from all uses (see below). The UK Sustainable Use of Pesticide Strategy <sup>66</sup> will be published in early March 2006 and will pull together the actions to reduce pesticides in water in a more strategic way. It will present time-limited targets and the action plans and funding mechanisms that will be used to deliver these including measures from all initiatives.  The EU Thematic Strategy on Sustainable Pesticides <sup>67</sup> will introduce a range of mandatory measures.	Stakeholders generally thought that currently, there are decreasing trends in pesticides in surface and ground waters. However, the number of drinking water sources contaminated with pesticides is rising.  The EU Thematic Strategy on Sustainable Pesticides will aid downward trends.
		Incentive Schemes <sup>68</sup> (IS): <ul style="list-style-type: none"> <li>• Farming Regulation Charging Strategy</li> <li>• CAP reform and cross-compliance</li> <li>• Sustainable Farming and Food Strategy (with Entry Level Scheme and High Level Schemes)</li> </ul>	IS's provide a strong incentive but the small amount of land likely under the more stringent High Level Schemes (HLS) may reduce impact overall.  Significant local decreased pressures are likely in response to reduced pesticide usage under HLS

<sup>66</sup> <http://www.pesticides.gov.uk/environment.asp?id=1539>

<sup>67</sup> <http://europa.eu.int/comm/environment/ppps/home.htm>

<sup>68</sup> <http://www.defra.gov.uk/erdp/schemes/default.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC	As above	Voluntary Schemes <sup>69</sup> : <ul style="list-style-type: none"> <li>• LEAF audit</li> <li>• FWAG activities</li> <li>• Voluntary Initiative (VI)</li> <li>• Rivers trusts</li> <li>• National Sprayer Testing Schemes (NSTS)</li> <li>• National Register of Sprayer Operators (NRSO)</li> <li>• Crop Protection Management Plans (CPMP)</li> <li>• Environmental Information Sheets (EIS)</li> </ul>	Dependent on level of uptake and likely to vary locally. Approaches such as LEAF and the Voluntary Initiative are having success locally and farmers who have opted for these voluntary approaches to responsible practice are now helping to communicate this best practice to other farmers through demonstration, so wider benefits might be expected to follow <sup>70</sup> .  Current levels of uptake <sup>71</sup> : <ul style="list-style-type: none"> <li>• NSTS has achieved 76% UK sprayed area coverage</li> <li>• NRSO 80% UK arable area covered</li> <li>• CPMP 34% arable area covered in 2004/5</li> <li>• EIS – Crop Association members representing c.85% UK market have provided sheets for 99% of their products</li> </ul> Overall net trend is uncertain <sup>72</sup>
	About 40% of pesticide pressure is from spills (policies for safer handling are relevant)	Employment of contractors for pesticide application  English Catchment sensitive farming delivery initiative in pilot catchments for reduction of point source incidence  Incentives for improved application and handling	Unknown trend <sup>72</sup>
	Gross Trends for pesticide usage in agriculture is uncertain	Countryside stewardship 6 m buffer strips under ELS, set aside plus crop protection plans under ELS.  Royal Commission on Environmental Pollution report on “crop spraying and the health of Bystanders” launched on 22 September 2005 recommends 6 m strip (residents) on health reasons – outcome of this report uncertain.	
Cons	Pressure from retailers for low residue foods (Include conflicting consumer demands for less residues in products but optimum performance) <sup>70</sup>		
DemoE LUC	Extensification of grassland utilisation, therefore, fewer sheep <sup>73</sup>	Cambridge University/SAC study: includes, CAP cross-compliance, Environmental Stewardship Schemes, Rural development regulation, Nitrates Directive, Catchment Sensitive Farming initiative, Waste Framework Directive, IPPC Directive, Water Act 2003 <sup>73</sup>	Reduction in sheep dip use, therefore should be improvement if good practice is followed <sup>72</sup>

<sup>69</sup> [www.voluntaryinitiative.org.uk](http://www.voluntaryinitiative.org.uk)

<sup>70</sup> Personal Communication, LEAF, July 2006.

<sup>71</sup> Personal communication P Goldsworthy, Crop Protection Association, July 2006.

<sup>72</sup> Expert judgement made at Agriculture and Forestry stakeholders meeting, 16 March 2006

<sup>73</sup> Cambridge University/CAP Report

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above		UK Groundwater regulations consent licence for disposal of sheep dip required <sup>72</sup>	Improvement in affected areas <sup>72</sup>
	Sheep dips using organophosphates are a potential problem for human health, and those based on pyrethroids are a problem for aquatic life <sup>72</sup>	Veterinary Medicines Directorate suspended the sale of cypermethrin-based products on 22 February 2006. Farmers holding stocks will still be permitted to use them. As a result, farmers may return to organophosphate sheep dips <sup>72</sup>  Cross compliance should improve situation <sup>72</sup>	

Notes: 1. Diffuse source pesticides entering surface and groundwater (causing failure of EQSs and leading to high levels of treatment of abstracted water for drinking water to meet the Drinking Water Directive standards)

**Table A1d Bacterial loadings/ faecal contamination<sup>m</sup> – agriculture (the source of contamination would be from farmyard contamination, run-off and direct contamination)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC	Unclear, but suspect may be higher due to increased frequency of high intensity rainfall due to climate change	Incentive Schemes <sup>74</sup> : <ul style="list-style-type: none"> <li>Farming Regulation Charging Strategy</li> <li>CAP reform and cross-compliance</li> <li>Sustainable Farming and Food Strategy (with Entry Level Scheme (ELS) and High Level Schemes (HLS))</li> </ul> Provide a strong incentive and should see livestock numbers decrease in some areas. HLS schemes will deliver high protection and decreased risk, but these are not extensive. Other locations may see an increase in livestock numbers. No deadlines associated with these policies	Likely to be lower in some places where strong protection measures implemented, for example drinking water abstraction zones. In addition, decreased pressures should be realised under the Bathing Waters Directive for those catchments that drain to Bathing Waters. However, this is unlikely to totally counter the increased frequency and intensity of winter rainfall, which may exacerbate problems in some locations.
	30% failure of bathing waters due to agriculture – related to climate change	Bathing Waters Directive	
		For controlling potential contamination of drinking water supplies by Cryptosporidium, DWI are encouraging water companies to implement catchment protection measures such as fencing	Net effect not known though local improvement in drinking water catchments would be expected.

<sup>74</sup> <http://www.defra.gov.uk/erdp/schemes/default.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above	Continued faecal contamination of water bodies from agricultural sources	Voluntary Schemes: <ul style="list-style-type: none"> <li>• LEAF (Linking Environment And Farming) audit</li> <li>• FWAG (Farming and Wildlife Advisory Group) activities</li> <li>• Rivers trusts</li> </ul>	Dependent on level of uptake and likely to vary locally. Rivers trusts have proven delivery of reduced problems locally and are expanding to other areas. Some local improvement – not nationally significant
DemoE LUC Cons CC	Marked reduction in livestock numbers, fewer larger herds of dairy cows, disappearance of mid-sized herds, the focus of production will be in lowlands <sup>75</sup> .	Cambridge University/SAC study: includes, CAP cross-compliance, Environmental Stewardship Schemes, Rural development regulation, Nitrates Directive, Catchment Sensitive Farming initiative, Waste Framework Directive, IPPC Directive, Water Act 2003 <sup>75</sup>	Cross compliance and NVZs will have a mitigating effect. Mainly effect manure application (more targeted). Little expected impact from ELS <sup>76</sup>
	Pressures of dairying concentrated in specific area (more slurry to be stored) <sup>75</sup> . In some parts of country (SW) herds are already getting bigger <sup>76</sup>	More professional management in larger discrete units – less risk from slurry <sup>75</sup>	In the short term water quality may be deteriorate but by 2015 farms would be out of business or compliant, and hence there would be a positive trend and improvement by 2015 <sup>76</sup>
	Intensification of beef cattle maybe in housed units or free range, there will be regional differences <sup>76</sup>		Less contamination by slurry – net effect not known <sup>76</sup>
	Outdoor pig sector increasing to escape from measures required under IPPC Directive for installations for the intensive rearing of pigs (and poultry). Contamination pathways are run-off and the atmosphere for deposition of ammonium <sup>76</sup>	Major farmers will comply with Soil Management Plans/Soil Protection Reviews at part of Entry Level Scheme of the Environmental Stewardship scheme. These will reduce the risk of soil compaction, ponding, run-off and erosion, thereby limiting run-off to watercourse <sup>76</sup>  Pig wise is also a voluntary, agri-environment scheme working with farmers to look at potential sites for pigs to encourage good farming practice by assessing proximity of sites to water courses etc <sup>76</sup>	Improvement in terms of faecal contamination but not in terms of ammonium <sup>76</sup>
	At the moment farmers have no spare money to reduce the environmental impact of their activities <sup>76</sup>	CAP reform is a new driver if the farmer never received payments under the old policy <sup>76</sup>  The CAP Single payment scheme may be a new driver if there is net benefit to farmers <sup>76</sup>	There is an inherent risk with cross compliance: if gets too stringent then farmers will not take part – this is for all agriculture <sup>76</sup>  In the longer term there should be a net improvement though this may be geographically patchy <sup>76</sup>

Notes: m. The WFD requires the achievement of standards and objectives set for protected areas in Community legislation: these include abstraction points for drinking water, designated bathing water and designated shellfish waters.

**Table A2 Abstraction and Flow Regulation - Agriculture**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC	Change in cropping types with potential changes in irrigation and increased evapo-transpiration (increased temperatures). Change of land use because of changes in climate	A range of policies introduced to mitigate effects of climate change.	Possibly no impact by 2015, in any case high level of uncertainty
LUC	Changes in cropping types because of CAP	Common Agricultural Policy	No effect on abstractions
Gov		Agri-environment schemes <sup>76</sup>	Small programme at the moment, insufficient incentives, small return for farmers, thus effect uncertain
EconG DemoE Gov		CAMS	Do not address WFD or impacts of climate change.
Tech Gov		Measures to improve irrigation efficiency	No measures in place because no control on abstraction below a certain limit (volume). Effect uncertain.
EconG DemoE LUC		Abstraction licenses <sup>76</sup> Water Act 2003 <sup>77</sup> requires all forms of irrigation >20 m <sup>3</sup> in 24 hours to be licensed. However, 20,000 current licenses below threshold <sup>78</sup> .	Uncertain trend
Tech	The use of less pesticides will lead to changes in crops grown and maybe less irrigation	Directive 91/414/EEC concerning the placing of plant protection products on the market requires the assessment of the risk of using pesticides including the risk to the water environment.	The link is tenuous and the net effect is not known.
LUC Gov	Increase planting of biomass (biofuel) crops (in response to developing renewable energy source)	Codes of practice indicate planting should be based on relative wet areas. Slow policy implementation	Little impact
	Abolition of set aside is likely to increase environmental pressure from agriculture as cropping land returns to production. More of an issue in east of country <sup>76</sup>	Cambridge University/SAC study: includes, CAP cross-compliance, Environmental Stewardship Schemes, Rural development regulation, Nitrates Directive, Catchment Sensitive Farming initiative, Waste Framework Directive, IPPC Directive, Water Act 2003 <sup>78</sup>	Uncertain trend

<sup>76</sup> Expert judgement made at Agriculture and Forestry's stakeholders workshop, March 16.

<sup>77</sup> <http://www.opsi.gov.uk/ACTS/acts2003/20030037.htm>

<sup>78</sup> Cambridge University/CAP Report

**Table A3 Morphological pressures<sup>n</sup> – Agriculture**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG LUC DemoE	Bank poaching: In south west England maybe getting worse: small holdings, horses, designer sheep and llamas, though it is also a national problem	Fencing of affected areas: <ul style="list-style-type: none"> <li>• Water-course fencing is a proposed item under the English Catchment Sensitive Farming delivery initiative capital grants scheme;</li> <li>• Under Higher Level Stewardship Schemes;</li> <li>• Encouraged by the Drinking Water Inspectorate for the control of cryptosporidium contamination</li> <li>• By Local Authorities</li> </ul>	Effects and trends not known
	Flood alleviation	Construction of interception ponds for the retention of flood waters	
	Drainage – piped networks used for high value land are deteriorating and may have consequences on water quality in due course. For example the drained land may become water logged	Soil strategy may become relevant with time.	Initially improvement in reducing flows, denitrification and potential NOx release. Eventually increased run-off
	Channel modification and dredging for agricultural drainage	Flood/agricultural polices as agreed under Internal Drainage Boards whose responsibilities include facilitation of drainage of new developments and maintenance of rivers, drainage channels and pumping stations.	More may be needed it relation to climate change and urbanisation – water bodies may be designated as heavily modified.
		Ditch management/bankside schemes under Entry Level Stewardship Schemes – agriculture only	Improvement in water quality in affected areas.

Notes: n. Activities such as: Poaching and erosion of river-banks by watering livestock, channel modification and dredging for land drainage

**Table F1a Sediment – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
<p>CC Gov</p>	<p><b>Sustainable forest management</b><sup>81</sup> involving the re-design of conifer plantations, their progressive removal from ancient woodland and a shift to continuous cover forestry in suitable locations. These changes should further reduce soil disturbance and the risk of sediment delivery to watercourses<sup>79</sup></p> <p>Climate change could increase rainfall intensity leading to more frequent flash floods, greater erosion and increased sediment losses<sup>79</sup></p> <p>There is no evidence to suggest that sediment is increasing from forestry<sup>79</sup></p>	<p>FAWGs provide best practice for protection of water and have a regulatory status (they must be adhered to). They were recently revised and form part of the UK Forestry Standard<sup>79</sup></p> <p>The Guidelines describe a methodical approach to protecting waters: considering available techniques and resources; assessing the potential environmental impacts of the work; and liaison with appropriate bodies to assess the sensitivity of the area and the existence of any legal requirements. Usually there is a need for a detailed site assessment and the production of a well annotated map (site plan) showing pertinent information, particularly site constraints<sup>79</sup></p> <p>Guidance is aimed at minimising the risk of sediment run-off associated with the following forest operations: ground preparation; managing riparian vegetation and large woody debris; road construction and maintenance; and harvesting. Measures are targeted at reducing soil disturbance and retaining any eroded soil on site, thereby protecting watercourses<sup>79</sup></p> <p>An EIA is required for forest road construction, quarrying and deforestation. Other felling for harvesting requires a felling licence. Non compliance with FAWG would preclude a licence and prevent passage through EIA.</p>	<p>Forestry represents a minor pressure in terms of <b>sediment delivery</b> to water bodies.</p> <p>The directions of trends are declared policy positions. Precise targets and time scales are not certain but the Forestry Commission is confident that the trends evident in the statistical data and those implied by policy statements and revisions to Codes of Practice are significant in reducing the sediment pressure exerted by forestry in already forested catchments to a level where they are insignificant in terms of meeting the WFD requirements.</p>
<p>LUC Gov</p>	<p>Continued steady expansion of woodland area to provide greater benefits for society and the environment<sup>79</sup></p>	<p>FAWG's and EIA as above.</p>	<p>Significant scope to reduce the high risk of sediment delivery associated with other land uses.</p> <p>A reduction in sediment delivery could be achieved by woodland replacing more polluting land uses, providing a downslope buffer for retaining sediment in run-off from surrounding land, and possibly by helping to reduce peak/flood flows.</p> <p>Potential to significantly reduce sediment delivery in non-forested catchments but limited by extent of new woodland planting. However, there is an opportunity to maximise the potential benefit by targeting planting to the most sensitive areas (e.g. erosion prone soils)<sup>79</sup></p>

<sup>79</sup> Expert judgement made at Agriculture and Forestry stakeholder meeting, 16 March 2006

**Table F1b Acidification – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC Gov	<p><b>Sustainable forest management<sup>81</sup></b> involving the re-design of conifer plantations, their progressive removal from ancient woodland and a shift to continuous cover forestry in suitable locations. The first two of these should lead to an overall reduction in the scavenging of acid deposition by forests, while the effect of the third remains uncertain.</p> <p>EU emission control agreements resulting in a continuing decline in acid deposition<sup>80</sup></p>	<p><b>Forests and Water Guidelines (4<sup>th</sup> edition) (FAWG):</b> sections on identifying catchments at risk of acidification from the restocking of existing forests and measures to prevent forestry causing further acidification<sup>80</sup>.</p>	<p>Acid water monitoring networks show that acid sensitive waters are continuing to recover from acidification. A further reduction in acidification is expected over the next 10 years but some waters are likely to remain at risk. Guidelines should ensure that forestry does not lead to further acidification of acid sensitive waters; the acidification pressure should continue to decrease in forested catchments. (Current EA risk assessment needs to be improved)<sup>80</sup></p>
LUC Gov	<p>Continued steady expansion of woodland area to provide greater benefits for society and the environment<sup>81</sup></p>	<p>FAWG's: sections also cover risk of new planting contributing to increased acidification.</p>	<p>Focus on planting broadleaves rather than conifers and move away from large-scale planting within acid sensitive uplands should pose little or no risk of acidification.</p>

<sup>80</sup> Expert judgement made at Agriculture and Forestry stakeholders meeting, 16 March 2006

<sup>81</sup> The two main aims of forestry policy are the sustainable management of existing woods and forests, and the continued steady expansion of woodland area to provide greater benefits for society and the environment. A range of national and regional targets are available, although these may be subject to change over the next 10 years. This is especially the case in England, where the England Forestry Strategy is currently being reviewed. Indications are that the annual new planting of woodland will be less than the current 5,000 ha in England and around 500 ha in Wales. Around 500-1000 ha of conifer plantations are likely to continue to be removed each year from ancient woodland sites and converted either to native (predominantly broadleaf) woodland or open habitats. A number of policy and strategy reviews are currently in progress, which could have a significant bearing on the trends indicated. These include the Climate Change Programme Review, the review of the England Forestry Strategy, the Energy Review and the development of the second phase of the England Rural Development Programme.

**Table F1c Pesticide Usage – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC Gov	<p>Low-level use compared to other activities, although it is recognised that in upland areas forestry is sometimes the only user of pesticides in sensitive catchments. Method of application (usually by hand) and choice of pesticides also limit risk of water contamination. As yet, very little evidence of problems in waters arising from pesticide applications to forests, even within sensitive upland catchments<sup>82</sup></p> <p><b>Sustainable forest management<sup>81</sup></b> places an emphasis on reducing pesticide use in forestry and promoting non-chemical methods where appropriate<sup>83</sup>.</p> <p>Shift towards more continuous cover forestry could further reduce use of pesticides<sup>83</sup></p> <p>Climate change could lead to greater insect problems, requiring control<sup>83</sup></p>	<p>FAWG: Sections on pesticide use and the storage and handling of chemicals, providing detailed guidance on measures to prevent water pollution: refers to several codes of good practice on the safe storage<sup>84</sup>, use and disposal of pesticides. Measures include the need for prior consultation, the use of buffer/protection strips, and limiting applications to periods when the weather and ground conditions are favourable<sup>83</sup></p> <p>UKWAS - Accreditation of UK woodlands, providing independent certification for forest management. Drive to reduce and where possible eliminate pesticide use in forestry. This is a voluntary scheme, but the Forestry Commission and most major forestry companies are certified and so it is widely applied<sup>83</sup></p> <p>Forest Practice Guide on reducing pesticide use in forestry.</p>	<p>Pesticide pressure already very low/insignificant from forestry but a further small downward trend expected in local areas</p> <p>The directions of trends are declared policy positions. Precise targets and time scales are not certain. Data on pesticide use collated by FC for FC Estate but not available for private forests.</p>
LUC Gov	<p>Continued steady expansion of woodland area to provide greater benefits for society and the environment<sup>83</sup></p>	<p>FAWG's</p>	<p>Woodland planting could help to reduce the high level of contamination associated with other land uses.</p> <p>A reduction in pesticide levels could be achieved by woodland replacing more polluting land uses or providing a downslope buffer for retaining pesticides in surface run-off from surrounding land.</p> <p>Potential to significantly reduce pesticide losses in non-forested catchments but limited by extent of new woodland planting. However, there is an opportunity to maximise the potential benefit by targeting</p>

<sup>82</sup> Amount of product in proportion to other sectors can be seen from the annual expenditure: Agric & Hort £362 million per year; Gardens £47 million; Forestry £0.5 million quoted by J Karthaus at the Agriculture and Forestry stakeholders meeting, 16 March 2006.

<sup>83</sup> Expert judgement made at Agriculture and Forestry stakeholders meeting, 16 March 2006

<sup>84</sup> About 40% of pressure from all activities is associated with spills (policies for safer handling are thus very relevant)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
			planting to the most sensitive catchments where high usage presents a problem <sup>85</sup>
LUC Cons CC Gov	Drive for Sustainable Energy Production leading to increased planting of short rotation coppice (SRC). Currently only few 100 ha, but 13,000 ha planned in England and 9,000 ha in Wales over the next 3 years under the Energy Crops Scheme. Uses more pesticides than traditional forestry, but still less than agricultural crops <sup>85</sup>	FAWG's	Potential small reduction at a local scale, depending on the land cover that SRC replaces <sup>85</sup> .
	Drive for Sustainable Energy Production potentially leading to the planting of short rotation forestry. Pesticide use intermediate between traditional forestry and SRC, with a harvesting cycle of 8-20 years. Thus, there is greater scope compared to SRC for reducing the level of contamination associated with other land uses <sup>85</sup>	FAWG's	Potential significant reduction at a local scale, depending on the land cover that SRF replaces <sup>85</sup>
Tech	New pesticides coming on the market could change the nature of the problem. Old issues will be less of a problem but as yet, unknown problems, may be uncovered, particularly as monitoring sensitivities improve. This will be further heightened as the ecological monitoring required by the Directive leads to targeted investigative monitoring in locations currently unmonitored (e.g. headwaters) and at sampling	The Sustainable Use of Pesticides Strategy <sup>86</sup> and The EU Thematic Strategy on Sustainable Pesticides <sup>87</sup> will introduce a range of mandatory measures.  Under EU Pesticides review programme many pesticides are being phased out or restricted, for example alpha-cypermethrin may go <sup>85</sup>	Will aid continuing downward trends for existing pesticides as these are replaced by more environmentally friendly chemicals.  Potential increased awareness of new problems, highly uncertain.

<sup>85</sup> Expert judgement made at Agriculture and Forestry stakeholder meeting, 16 March 2006

<sup>86</sup> <http://www.pesticides.gov.uk/environment.asp?id=1539>

<sup>87</sup> <http://europa.eu.int/comm/environment/ppps/home.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Tech	times not currently used (i.e. looking at specific peak loadings and their impacts rather than averages). This could lead to an increased awareness of problems (i.e. more problems to deal with).		Overall, pesticide inputs from Forestry were not considered to be significant, with assessments to date showing a general absence of water contamination within well-managed forests, even within sensitive upland catchments <sup>88</sup>

**Table F1d Other chemical contaminants – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Cons Gov	<b>Sustainable forest management</b> <sup>81</sup> places an emphasis on reducing the risk of chemical contamination <sup>88</sup> . FC has recently converted to only using bio-oils in their harvesting machinery and equipment.	FAWG's: Section on the storage and handling of chemicals, fuel oils and lubricants. Measures include the need for a contingency plan to be drawn up to deal with accidental spillage <sup>88</sup>  UKWAS - Accreditation of UK woodlands, providing independent certification for forest management. Drive to limit the risk of chemical contamination in forestry. This is a voluntary scheme but the Forestry Commission and most major forestry companies are certified and so it is widely applied <sup>88</sup>	Very low risk of chemical contamination from forestry but risk will be further reduced by switch to bio-oils.

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<sup>88</sup> Expert judgement made at Agriculture and Forestry stakeholders meeting, 16 March 2006

**Table F2 Abstraction and Flow Regulation – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC Gov	<b>Sustainable forest management</b> <sup>81</sup> involving the re-design of conifer plantations, their progressive removal from ancient woodland and a shift to continuous cover forestry in suitable locations. The first two of these should lead to an overall reduction in forest water use within existing forests, while the effect of the third remains uncertain.	FAWG's: section on addressing the effects of forestry on water yield and river flows as part of catchment planning.	Decreasing trend in overall forest water use within existing forests.
LUC Gov	Continued steady expansion of woodland area to provide greater benefits for society and the environment <sup>88</sup>	FAWG's and EIA which is required for all new planting.	Focus on planting broadleaves rather than conifers should result in little overall change in water yield/recharge compared to grassland (a small increase in recharge can be expected from woodland planting on chalk but a small decrease on sandstone).
LUC CC Gov	<p>Drive for Sustainable Energy Production leading to increased planting of short rotation coppice (SRC). Currently only few 100 ha but 13,000 ha planned in England and 9,000 ha in Wales over the next 3 years under the Energy Crops Scheme<sup>88</sup>. Government's response to the Biomass Task Force is also relevant, particularly the recommendation that the Forestry Commission should assess and prepare a strategy for the development and use of wood-fuel from all sources.</p> <p>SRC has a potentially higher water use compared to grass and thus the main pressure would be in reducing water yield.</p>	<p>SRC Hydrological Guidelines are in place to direct planting away from drought risk areas.</p> <p>Establishment of such crops is also subject to Environmental Impact Assessment in which impacts on the water environment would be taken into account. The Forestry Commission and Environment Agency can work together to manage the risk.</p>	Guidelines should ensure that SRC planting results in a negligible change in abstraction pressure.
	<p>Drive for Sustainable Energy Production leading to increased planting of short rotation forestry<sup>88</sup>. Government's response to the Biomass Task Force is also relevant, particularly the</p>	<p>Guidelines to be developed to ensure that planting does not threaten water supplies.</p> <p>Establishment of such crops would be subject to Environmental Impact Assessment in which impacts on the water environment would be taken into account. The Forestry Commission and Environment</p>	The development of guidance should ensure that SRF results in a negligible change in abstraction pressure.

<b>Drivers</b>	<b>Gross Trends</b>	<b>Policies in place/mitigation</b>	<b>Net Trends</b>
LUC CC Gov	<p>recommendation that the Forestry Commission should assess and prepare a strategy for the development and use of wood-fuel from all sources.</p> <p>SRF could involve the planting of species with a high water use, resulting in a significant reduction in water yield.</p>	Agency can work together to manage the risk.	As above
CC	Climate change could result in warmer, drier summers and an extended growing season, which could enhance forest water use to a greater extent than other land covers.	FAWG's	The overall effect on forest water use remains uncertain. Higher carbon dioxide levels could result in improved water use efficiency and help to offset any increase in water use due to climate warming.

**Table F3 Morphological pressures – Forestry**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC Gov	<b>Sustainable forest management</b> <sup>79</sup> involving the re-design of conifer plantations, including the opening-up of streamsides.	FAWG's: sections on riparian forestry and buffer areas, managing riparian vegetation and large woody debris, and ground preparation. These include measures to reduce morphological pressures, such as restoring and managing native riparian woodland to protect and enhance riparian and aquatic habitats, minimising the impact of site drainage by leaving a wide buffer area along main watercourses so that drains do not discharge directly into streams, and improving the design, construction and maintenance of forest road bridges and culverts to minimise the impact on watercourses.	Decreasing trend expected in morphological pressures exerted by existing forests (from a low base).
LUC CC Gov	Continued steady expansion of woodland area to provide greater benefits for society and the environment <sup>91</sup>	FAWG's. The extension and restoration of woodland riparian buffer areas can offer significant potential for reducing morphological pressures in non-forested catchments. For example, riparian woodland can help to exclude livestock and prevent them from damaging banksides, as well as provide much needed shade and shelter to limit high summer temperatures and aquatic weed growth.  An EIA is required for all new planting.	Potential to significantly reduce morphological pressures in non-forested catchments but limited by extent of new woodland planting. However, there is an opportunity to maximise the potential benefit by targeting planting to the most sensitive catchments where morphological pressures are high.
LUC Gov	Restoration and extension of wet woodland	UK BAP targets for wet woodland, including restoration of former native wet woodland on 3,200 ha of non-native plantations by 2015, and the establishment of 3,375 ha of wet woodland on unwooded sites or by the conversion of plantations by 2010.	Potential to significantly reduce morphological pressures in non-forested catchments.

**Table AM1 Pesticide Usage – Amenity**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
DemoE LUC Cons CC	<p>New pesticides coming on the market will change the nature of the problem. Old issues will be less of a problem but, as yet, unknown problems will continue to be uncovered, particularly as monitoring sensitivities improve. This will be further heightened as the ecological monitoring required by the Directive leads to targeted investigative monitoring in locations currently unmonitored (e.g. headwaters) and at sampling times not currently used (i.e. looking at specific peak loadings and their impacts rather than averages). This will give lead to an increased awareness of problems (i.e. more problems to deal with)</p> <p>The public's desire for everything to be 'neat and tidy' (i.e. weed-free pavements and lawns) may increase use<sup>89</sup>.</p> <p>Gross Trends uncertain</p>	<p>There are a wide range of initiatives to reduce the environmental impact of pesticides, mostly from agriculture, but in some cases from all uses (see below). These initiatives include guidance on best practice and training, controls on specific types of chemicals, and regulations on use and disposal. Of particular relevance here are the MoU between the EA the water industry and network rail, a voluntary reduction scheme for Local Authorities and the Voluntary Initiative Amenity scheme<sup>91</sup>. The Sustainable Use of Pesticide Strategy<sup>90</sup> published in early March 2006 pulls together the actions to reduce pesticides in water in a more strategic way. It presents time-limited targets and the action plans and funding mechanisms that will be used to deliver these including measures from all initiatives.</p> <p>The EU Thematic Strategy on Sustainable Pesticides<sup>91</sup> will introduce a range of mandatory measures.</p> <p>There is little guidance or control on domestic use<sup>93</sup>.</p>	<p>There is a lack of data on amenity and domestic use of pesticides<sup>93</sup> making it difficult to discern trends. Stakeholders generally thought that currently, there are decreasing trends in pesticides in surface wand ground waters. However, the number of drinking water sources contaminated with pesticides is rising. The UK Sustainable Use of Pesticide Strategy and the EU Thematic Strategy on Sustainable Pesticides will aid downward trends, but this may be countered by the appearance of new problems and heightened awareness, which may increase apparent trends ( see under gross trends).</p> <p>Overall net trend is uncertain</p>
Gov Behav	<p>Significant use of pesticides in the rapidly growing leisure industry (e.g. golf) and in amenity areas such as parks and playing fields. Also significant amateur use in gardens<sup>93</sup></p>	<p>National Pesticide strategy<sup>92</sup> has action plans for amenity use<sup>93</sup></p>	<p>New strategy – effect uncertain – particularly in terms of garden use<sup>93</sup></p>

<sup>89</sup> Information extracted from a series of workshops on non-agricultural diffuse pollution, Defra 2004

<sup>90</sup> <http://www.pesticides.gov.uk/environment.asp?id=1539>

<sup>91</sup> <http://europa.eu.int/comm/environment/ppps/home.htm>

<sup>92</sup> <http://www.pesticides.gov.uk/environment.asp?id=70>

<sup>93</sup> Expert judgement made at Agriculture and Forestry stakeholder's workshop, 16 March 2006

**Table T1 Diffuse Source Pollution; and Table T2 - Point Source Pollution – Transport (excluding water transport)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE LUC Cons CC Gov Tech	<p>Likely to increase due to expansion in transport infrastructure and vehicle usage. Linear construction projects are expected to increase over next 5-10 years in line with investment in road and railway infrastructure<sup>94</sup></p> <p>Many urban roads drain to combined sewers. A move to separate sewers will see less treatment of runoff<sup>94</sup>.</p> <p>Expansion of land associated with the transport sector including parking lots, petrol stations, car washes, industrial estates etc with associated pollution (oil loss, runoff)<sup>94</sup></p> <p>Climate change could impact winter de-icing activities. This could result in less materials being used if winters are milder. In recent years there has been an increase in use, as highways authorities have been very risk averse<sup>95</sup>.</p>	<p>Guidance on the assessment of road runoff is given in HA216 Road Drainage and the Water Environment (Design Manual for Roads and Bridges Volume 11 Section 3 Part 10). The guidance is aimed at ensuring that road projects result in no deterioration in the quality of a waterbody and no increase in flood risk. Best practice guidance on the use of vegetated drainage systems similar to SUDS is provided in HA103 Vegetated Drainage Systems for Highway Runoff (Design Manual for Roads and Bridges Volume 4 Section 4 Part 2).</p> <p>The Highways Agency has a programme of work designed to identify, prioritise and treat outfalls on the existing road network that pose a potential pollution risk. This programme directly contributes towards a key performance measure.</p> <p>Planning Policy Statement<sup>96</sup> PPS25 promotes the use of SUDS, whilst PPS23 states that suitable provision for the drainage of surface water must be made</p> <p>The new Government strategy for flood and coastal erosion risk management in England ('Making space for water')<sup>49</sup> is taking a holistic approach to the management of risk from all forms of flooding, including SUDS. Uptake of SUDS will reduce runoff and associated pollution from roads. However, stakeholders suggest that the responsibility for SUDS is not clear<sup>94</sup></p> <p>Road safety and traffic management improvement schemes</p> <p>Facilities at depots are improving, e.g. dedicated wash down areas connected to sewer instead of hosing down the plant in the yard<sup>94</sup>.</p> <p>CIRIA's study<sup>97</sup> on the control of water pollution from linear constructions projects will provide best practice guidance for the control of water pollution arising from linear construction<sup>94</sup></p>	<p>Mitigation of road runoff on new road projects should negate the effect of road expansion with no strong net trend in diffuse losses from highways<sup>98</sup></p> <p>Outfalls posing a potential pollution risk on the existing road network are identified, prioritised and treated as part of an ongoing programme of work.</p> <p>Non Highways Agency (i.e. local authority) roads may not be subject to the same mitigation (lack of funds/competition for limited resources), and an increase in pollutant runoff is possible. Retrofitting of measures is difficult with a large network to tackle.</p> <p>Future uptake of SUDS is uncertain, with a general stakeholder belief that uptake will not be sufficient to have a significant effect</p> <p>Expansion in transport infrastructure and vehicle usage may be offset by mitigation to some degree, but net outcomes are uncertain. In addition, increased frequency and intensity of winter rainfall is likely to increase flushing of road/rail pollutants. Overall net trends are uncertain<sup>92</sup></p> <p>With regard to specific chemicals, PAH problems will be reduced due to new formulation of tyres (phased out by 2009) and the move from leaded fuels and reduced lead in brake pads and in wheel balancing will decrease lead pressures. Asbestos has been removed from brakes. New techniques for targeted spreading of salt have been developed, used of reduced grain size is reducing salt load. Other products could reduce salt, but increase BOD in runoff.</p> <p>Conversely initiatives such as 'add-blue' which are good for engine efficiency and air quality may increase the range of pollutants being transported (involves 120l tanks of urea being carried). Alternative fuels will change composition of emissions but not significantly in near future<sup>94</sup></p> <p>A decrease in herbicide sprayed onto railways reaching both ground and surface waters.</p>

<sup>94</sup> Expert judgement made at national workshop

<sup>95</sup> Personal communication P Chatfield, Environment Agency, July 2006

<sup>96</sup> <http://www.communities.gov.uk/index.asp?id=1143926>

<sup>97</sup> <http://www.ciria.org/rp708.htm>

<sup>98</sup> Personal Communication from the Highways Agency, July 2006.

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above	As above	<p>Safety and traffic improvement schemes may result in a modest reduction in tyre wear and oil leakage and, therefore, release of some pollutants. Localised and small impact.</p> <p>Stakeholders identified an increase in rural/agricultural traffic but also tighter controls (advisory code of practice) on products (diuron/substitutes) used for verge – both road and rail – management. Also improvements in herbicide/pesticide application<sup>94</sup></p> <p>New de-icing products have been introduced, which reduce salt use, but may have a BOD penalty<sup>95</sup>.</p>	As above
Gov (new responsibility for HA in traffic management)	Likely to lead to a quicker response to incidents and better control and containment of accidental spillages <sup>99</sup> .	New HA guidance in HD 33 HD 33 Surface and Sub-surface Drainage Systems for Highways (DMRB Volume 4 Section 2 part 3) & HA216 Road Drainage and the Water Environment (Design Manual for Roads and Bridges Volume 11 Section 3 Part 10) provide improved guidance for spillage risk assessment and signing of pollution control devices.	Better management of accidental spillages on the strategic road network and a reduction in the number of polluting incidents.
Behav, CC	Increasing trend as public expectation counters the reduced use per application due to improved application techniques. Also a need to treat more side roads, pavements and interchange areas. Impact of alternatives a concern <sup>94</sup> . Airport expansion will increase pressures. Climate change will have an unpredictable effect.	<p>Local airport policies for de-icing and spill management</p> <p>BAA policy to mitigate pollution runoff at airports, discharge consents set by EA<sup>100</sup>.</p>	Unclear, although there is a predicted increase use in de-icer and potential pollutant loss in line with airport expansion. Net effect is dependent upon incorporation and effectiveness of mitigation measures <sup>94</sup>
Behav Gov		Simazine and Atrazine have not been bought by network rail since 1989 making diuron and glyphosate the main herbicides used. A spray control agreement between network rail and WaterUK prevents use of diuron in areas of high groundwater vulnerability or in high risk areas for public water supply <sup>111</sup>	Downwards trend particularly where groundwater is abstracted. Atrazine and Simazine legacy will resolve slowly <sup>94</sup> .
Gov - policy on incineration -Changes in the value of scrap metal	<p>Increase in tyres needing alternative disposal, possible increase in dumping.</p> <p>Growth in the number of multiple car households<sup>101</sup></p> <p>Decrease in number of abandoned vehicles</p>	<p>Modernisation of DVLA vehicle registration system now in place, whereby responsibility for a vehicle remains with the registered keeper until the DVLA is notified that it has been scrapped, stolen, exported or a statutory off road notification declared. Registered keepers liable for penalties if vehicle is dumped etc.</p> <p>Clean neighbourhoods and Environment Act 2005 gives local authorities better powers to tackle problem of abandoned vehicles<sup>102</sup></p>	Uncertain, possible overall decrease in inappropriate disposal

<sup>99</sup> Personal Communication from the Highway's Agency June 2006.

<sup>100</sup> [http://www.baa.co.uk/assets/B2CPortal/Static%20Files/water\\_quality2002.pdf](http://www.baa.co.uk/assets/B2CPortal/Static%20Files/water_quality2002.pdf)

<b>Drivers</b>	<b>Gross Trends</b>	<b>Policies in place/mitigation</b>	<b>Net Trends</b>
Gov - policy on incineration	Continuing increase in volume of fuel oil needing disposal  Network Rail report that the Association of train operators (ATOC) observed a recent 50% annual reduction in oil spills due to implementation of company schemes.	New Directive 2000/76/EC <sup>103</sup> aims to prevent or reduce adverse effects of waste incineration	Unknown but not significant other than locally
Gov - modal shift towards trains	Rolling stock companies are improving their general maintenance standards with a resultant decrease in general leakage. Network Rail report that new rolling stock have fewer flushing toilets	Not currently regulated	Unknown, but not significant other than locally

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<sup>101</sup> The National Travel Survey 2004, Department of Transport

<sup>102</sup> <http://www.opsi.gov.uk/ACTS/acts2005/20050016.htm>

<sup>103</sup> [http://ec.europa.eu/environment/wasteinc/newdir/2000-76\\_en.pdf](http://ec.europa.eu/environment/wasteinc/newdir/2000-76_en.pdf)

**Table T1a Air Pollution/Acidification - Transport (excluding water transport)<sup>o</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
<p>Cons</p> <p>Gov - air transport policy – (location/ Planning)</p>	<p>Expansion of transport likely to lead to increased emissions</p> <p>The Association of Train Operating Companies (ATOC) are driving an industry switch to low sulphur fuel (from the current low grade diesel fuel) which should be completed by 2008<sup>104</sup>.</p> <p>The UK market in biofuels is continuing to grow. With the current measures in place, DfT estimate that the UK could achieve as much as 12 million litres a month in 2005 - a six-fold increase over 2004 sales<sup>103</sup></p>	<p>Directive 2003/30/EC<sup>105</sup> – Member States should set an indicative target of 5.75% renewable road transport fuel in the UK by 2010.</p> <p>DfT 'Powering Future Vehicles' Strategy<sup>106</sup> promotes the development, introduction and uptake of clean, low carbon vehicles and fuels. Two targets by 2012: 1) 10% of all new car sales will be cars emitting 100 g/km CO<sub>2</sub> or less; 2) 600 or more buses coming into operation each year will be low carbon.</p> <p>Planning policies (see urbanisation), but these currently exclude trains</p> <p>Air Quality Strategy (EU and UK review pending)<sup>107</sup></p> <p>Biofuel Strategy<sup>108</sup></p> <p>Thematic Strategy to encourage local authorities to adopt a more integrated approach to urban management<sup>109</sup></p> <p>Some support for public transport, e.g. free transport on buses for OAP's.</p> <p>Policies on climate change will have effects on other pollutants</p>	<p>Unclear whether mitigation and policy impacts can keep pace with the expansion of transport. Industrial emission of acidic oxides may be of greater significance.</p> <p>Trends uncertain - biofuels for road transport remain relatively expensive when compared to other low carbon technologies<sup>110</sup></p>

Notes: o. Vehicle emissions resulting in the deposition of acidic oxides, nutrients, metals and aldehydes

<sup>104</sup> <http://www.atoc-comms.org/Document/c423969.pdf>

<sup>105</sup> [http://europa.eu.int/comm/energy/res/legislation/doc/biofuels/en\\_final.pdf](http://europa.eu.int/comm/energy/res/legislation/doc/biofuels/en_final.pdf)

<sup>106</sup> [http://www.dft.gov.uk/stellent/groups/dft\\_roads/documents/page/dft\\_roads\\_506885.hcsp](http://www.dft.gov.uk/stellent/groups/dft_roads/documents/page/dft_roads_506885.hcsp)

<sup>107</sup> <http://www.defra.gov.uk/environment/airquality/index.htm>

<sup>108</sup> [http://www.dft.gov.uk/stellent/groups/dft\\_roads/documents/page/dft\\_roads\\_028393-06.hcsp](http://www.dft.gov.uk/stellent/groups/dft_roads/documents/page/dft_roads_028393-06.hcsp)

<sup>109</sup> [http://europa.eu.int/comm/environment/urban/thematic\\_strategy.htm](http://europa.eu.int/comm/environment/urban/thematic_strategy.htm)

**Table T2 Abstraction/Flow Regulation - Transport (excluding water transport)<sup>p</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov DemoE	Potentially increased peak flow and decreased baseflow caused by an expansion of impervious surfaces	As for Point and Diffuse pressures (see Table T1)	As for Point and Diffuse pressures (see Table T1)

Notes: p. Changes in flow regime from an expansion of impervious runoff

**Table T3 Hydromorphology – Transport (excluding water transport)<sup>q</sup>**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov DemoE CC EconG	<p>Potentially increased peak flow and decreased baseflow caused by an expansion of impervious surfaces, may increase the need for flood control and hence hydromorphological change<sup>110</sup>.</p> <p>Impermeable surfaces are not associated with the rail network, other than car parks. These are currently undergoing assessment with respect to drainage<sup>111</sup>.</p> <p>Essential transport infrastructure i.e. strategic highways can be undertaken in floodplains, hence further pressure is expected in this respect in the future<sup>110</sup></p>	As for point and diffuse pressures (see Table T1)	As for point and diffuse pressures (see Table T1)

Notes: q. Hydromorphological – Changes in flow regime from transport infrastructure, increased flood risk and hence hydromorphological pressure.

<sup>110</sup> Expert judgement made at national workshop

<sup>111</sup> Expert opinion provided by email and/or telephone

**Table P1 Ports (infrastructure and associated navigation channels) and marinas – Diffuse source pressures – pesticides (antifouling paints)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov Behav EconG	Waterborne traffic may increase in the future resulting in a potential increase in diffuse pressures <sup>112</sup>	<p>The International Convention on the Control of Harmful Anti-fouling Systems<sup>112</sup> on ships. By 1 January 2008, the presence of organotin compounds in anti-fouling systems on ships will be prohibited. It will also establish a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. The Convention will enter into force 12 months after 25 States representing 25% of the world's merchant shipping tonnage have ratified it. As of February 2006<sup>113</sup>, 16 States representing 17.3 % of the world's tonnage had ratified the Convention.</p> <p>Existing ships will have to have TBT scrapped off in dry docks – for safe disposal</p> <p>CEFAS action levels for TBT in sediment may have to change in light of the WFD Article 16 Daughter Directive on Priority Substances.</p>	<p>Reduction of TBT in sediment; possibly by 50%<sup>114</sup> over the next 10 years. However, the replacement of TBT based antifoulants with copper-based products may lead to increased concentrations of copper in water and/or sediment.</p> <p>There are increasing copper EQS failures in Thames but these are not due to sediments or shipping.</p> <p>Water quality should be improving</p>
	<p>The WFD Article 5 risk assessments indicated that 12 out of 136 transitional water bodies and 3 out of 99 coastal water bodies in England and Wales were at risk of failing their environmental objectives because of TBT.</p> <p>Despite the restrictions in use, there remain significant numbers of failures for TBT<sup>115</sup>. In 2004 there were 15 EQS failures in freshwaters as a result of TBT, down from 29 in 2003. The</p>	<p>In 1990 the IMO recommended that Governments adopt measures to eliminate the use of antifouling paints containing TBT on non-aluminium hulled vessels less than 25 m in length. Their use on boats has been banned since 1987 in the UK<sup>116</sup>.</p> <p>Its use as an antifoulant is now banned in Europe<sup>117</sup>. TBT compounds used for other biocidal purposes (e.g. as wood preservatives, in textiles) must be withdrawn from the European market by September 2006.</p>	<p>Releases to controlled waters have been decreasing since the late 1990's<sup>118</sup>; if current trends continue there would be an expectation that amounts of TBT will continue to decrease</p>

<sup>112</sup> [http://www.imo.org/Conventions/mainframe.asp?topic\\_id=258&doc\\_id=1494](http://www.imo.org/Conventions/mainframe.asp?topic_id=258&doc_id=1494)

<sup>113</sup> [http://www.imo.org/Conventions/mainframe.asp?topic\\_id=247](http://www.imo.org/Conventions/mainframe.asp?topic_id=247)

<sup>114</sup> Expert judgement made at national workshops

<sup>115</sup> [http://www.environment-agency.gov.uk/yourenv/eff/1190084/business\\_industry/agri/pests/917555/?lang=e&theme=&region=&subject=&searchfor=TBT&any\\_all=&choose\\_order=&exactphrase=&withoutwords](http://www.environment-agency.gov.uk/yourenv/eff/1190084/business_industry/agri/pests/917555/?lang=e&theme=&region=&subject=&searchfor=TBT&any_all=&choose_order=&exactphrase=&withoutwords)

<sup>116</sup> [http://www.environment-agency.gov.uk/commondata/acrobat/water\\_tbt\\_compounds\\_818268.pdf](http://www.environment-agency.gov.uk/commondata/acrobat/water_tbt_compounds_818268.pdf)

<sup>117</sup> [http://www.environment-agency.gov.uk/yourenv/eff/1190084/business\\_industry/agri/pests/917555/?lang=e&theme=&region=&subject=&searchfor=TBT&any\\_all=&choose\\_order=&exactphrase=&withoutwords](http://www.environment-agency.gov.uk/yourenv/eff/1190084/business_industry/agri/pests/917555/?lang=e&theme=&region=&subject=&searchfor=TBT&any_all=&choose_order=&exactphrase=&withoutwords)

<sup>118</sup> [http://www.environment-agency.gov.uk/commondata/acrobat/water\\_tbt\\_compounds\\_818268.pdf](http://www.environment-agency.gov.uk/commondata/acrobat/water_tbt_compounds_818268.pdf)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov Behav EconG	majority of these failures were in the north west of England, around the Manchester Ship Canal and tributaries to the Mersey Estuary. Other rivers with a lot of boat activity had failures, such as the Thames. In marine waters in 2004 there were EQS failures at 50 sites, down from 86 in 2003 <sup>114</sup> . Problems in the marine environment often occur close to docks and boat yards (e.g. Fal estuary, Cornwall).	As above	As above
Gov Behav EconG	A new range of antifouling products introduced to replace TBT, typically added to copper based paints to improve their efficacy. Booster biocides can be released from the paints surface during normal use and as a result of pressure washing of vessels.	<p>Following a review by the UK Health and Safety executive in 2000 restrictions were placed on the use of specific booster biocides in the UK<sup>119</sup>. Only zinc pyrithione, zineb or dichlofluanid can be used now in paints applied to vessels &lt;25 m in length and irgarol 1051, chlorothanil and Sea-nine 211 only on vessels over this length.</p> <p>The Green/Blue initiative is undertaking boat washdown trials to reduce the impact of anti-fouling biocides from recreational boats in marinas<sup>120</sup>.</p>	Net effect not known

<sup>119</sup> Defra (May 2005) Water quality: A diffuse pollution review: Chapter 3: sources of diffuse water pollution

<sup>120</sup> <http://www.thegreenblue.org.uk/sciencematters/index.asp>

**Table P2a Ports and marinas – Point source pressures – sanitary determinands**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov Behav EconG	Waterborne traffic may increase in the future potentially causing an increase in sanitary determinand pressure <sup>121</sup>	Directive 2000/59/EC <sup>122</sup> requires all ports to make available adequate reception facilities; transposed via the Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003 (SI 203/1809)	Reduced waste discharged from ships. Further reduction as a result of new regulations
		The International Convention for the Prevention of Marine Pollution from Ships (MARPOL): Annex 4 deals with the Prevention of pollution by sewage from ships and is an optional Annex that came into force September 2003.	Reduced waste discharged from ships.
	Water-based sports: 9.5 % increase in participation between 1988 and 1994, number of craft over 6.5 m estimated to be increasing by 5,000 to 6,000 per year <sup>123</sup> .	Loophole in current measures – in terms of volume of holding tank requiring emptying before leaving harbour, but discharged at sea instead.	Uncertain, but only likely to be a significant issue at local level.
	As above	The Green/Blue is the environmental awareness (voluntary) initiative developed by the British Marine Federation and the Royal Yachting Association includes sewage and greywater disposal	Improvement if best practice is followed.

<sup>121</sup> Expert judgement made at national workshop

<sup>122</sup> <http://europa.eu.int/scadplus/leg/en/lvb/l24199.htm>

<sup>123</sup> Defra (May 2005) Water quality: A diffuse pollution review: Chapter 3: sources of diffuse water pollution.

**Table P2b Ports and marinas – Point source pressures - oil**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov Behav EconG	Waterborne traffic may increase in the future increasing the risk of oil pollution	Directive 2000/59/EC <sup>124</sup> on “port reception facilities for ship-generated waste and cargo residues” requires all ports to make available adequate reception facilities; transposed via the Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003 (SI 203/1809)	Reduced waste discharged from ships Reduction over last few years – should continue to decrease under current measures
		Oil spill contingency plans are in place	Net benefits
	Increased risk of oil pollution due to increased oil tanker traffic	The UK Government has identified 32 Marine Environmental High Risk Areas (MEHRA), which should restrict the movement of shipping and reduce the risk of pollution in those areas	Potential impacts and risks moved to other areas, increased densities in other areas, net increased risk.
		EC initiatives to introduce double-hulled tankers should reduce risk of accidental spills. All single hulled oil tankers are banned from EU ports.	Net trend not quantified.
Water-based sports: 9.5 % increase in participation between 1988 and 1994, number of craft over 6.5 m estimated to be increasing by 5,000 to 6,000 per year <sup>125</sup> .	The Green/Blue is the environmental awareness (voluntary) initiative developed by the British Marine Federation and the Royal Yachting Association <sup>126</sup> (educational programme for users and manufacturer on aspects such as oil and fuel, antifouling and marine paints, sewage and greywater disposal, wildlife disturbance (including noise), habitat modification, effects of anchoring on sensitive habitats, bank erosion (particularly on inland waters). Even though it is a voluntary initiative the EA would have regulatory control.	Improvement (i.e. reduced number of pollution incidents) if best practice is followed.	

<sup>124</sup> <http://europa.eu.int/scadplus/leg/en/lvb/l24199.htm>

<sup>125</sup> Defra (May 2005) Water quality: A diffuse pollution review: Chapter 3: sources of diffuse water pollution.

<sup>126</sup> <http://www.thegreenblue.org.uk/>

**Table P3 Ports (infrastructure and associated navigation channels) and marinas – morphological pressures (including dredging impacts; re-suspension of contaminated sediment/fine material)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG, DemoE, Tech	<p>World Bank estimates that (on average) world seaborne trade will increase at a rate of 4 % a year over the next decade, almost doubling current volumes by the year 2010<sup>127</sup>. Similar figures exist for trends in UK ports where it is estimated that between 2004 and 2030, the volume of container traffic will grow by 178% as measured by TEU and HGV units by about 112%, while bulk traffics are forecast to grow by 8%. Total tonnes for the UK are forecast to grow by 37%. Unit load cargoes are forecast to grow from about 27% of total UK tonnes (including Channel Tunnel traffic) in 2004 to about 42% in 2030. The report concludes that these trends imply an urgent need for additional port handling facilities, given that there appears little potential to further expand the productivity of existing infrastructure<sup>128</sup>.</p> <p>Relatively higher increase for container vessels, relatively lower for bulk cargoes (wet/dry bulk carriers).</p>		<p>Continuing trend to container transport, and fewer bigger vessels (of all types). Therefore requirement for physical modification of estuaries, more dredging needed. Same for big and smaller ports. +/-50 estuaries possibly affected<sup>129</sup>.</p> <p>Increased gas and oil transport, increased infrastructure already in place.</p>
Gov	Waterborne transport is not being used	<p>UK's Sustainable transport policy.</p> <p>Freight facilities grants available but budget declining. Has had some localised impact on the west coast of Scotland.</p>	<p>Infrastructure not in place to achieve this: the required investment not in place and industry cannot afford to invest itself. The net effect will be increased road transport and associated environmental degradation, but no net effect on the water environment</p>

<sup>127</sup> British Shipping: charting a new course. [http://www.dft.gov.uk/stellent/groups/dft\\_shipping/documents](http://www.dft.gov.uk/stellent/groups/dft_shipping/documents)

<sup>128</sup> UK Port Demand Forecasts to 2030: [http://www.dft.gov.uk/stellent/groups/dft\\_shipping/documents/page/dft\\_shipping\\_611699.pdf](http://www.dft.gov.uk/stellent/groups/dft_shipping/documents/page/dft_shipping_611699.pdf)

<sup>129</sup> Expert judgment made at the Ports, Navigation and Flood Defence stakeholders meeting, 6 April 2006

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	Policy forcing road transport onto trunk routes rather than onto water.	Highways Agency's road transport policy for trunk routes	No impact on water environment
Gov Tech	New development (e.g. container ports) leading to increased hydromorphological pressures, driven by a predicted 3-5% per year increase in container traffic. Impacts of associated infrastructure construction expected during the next 5-10 years <sup>130</sup> .	Future developments may be referenced in the Ports Policy Review 2006.	The new container ports with existing consents will be developed between 2006 and 2010/15. These would be compliant with Habitats Directive requirements, and likely to be in designated heavily modified water bodies, in which case they would be expected to be compliant with good ecological potential by 2015. Any further developments are expected between 10 and 15 years after 2015.
EconG Tech	RSPB/EN <sup>131</sup> study indicates: trade growth of 4-5% per annum with the higher rates of growth for deep sea containers; the size of required vessels is expected to grow; for ro-ro terminals estimated an extra 3.3 km of new quays will be required (excluding Felixstowe, Tilbury and Thamesport improvements) by 2015; for ro-ro terminals an extra 201 hectares of cargo assembly areas will be required.  Trends in RORO traffic have not been quantified	The Government's 10 year plan for rail freight and EU's proposals for short sea shipping will both impact on the UK's ports industry. Conversion of freight from road to rail will generally benefit by concentrating cargo on the larger ports, which are rail linked and offer the critical mass to fill trains.	The environmental impact of this pressure will almost certainly be minimised by concentrating investment where existing channels, road and rail infrastructure can be best exploited.
EconG, DemoE, Tech, CC, Gov	From the above projections, waterborne traffic may increase in the future if policy is implemented successfully <sup>132</sup> .	The 2001 "White Paper on European Transport Policy for 2010: Time to decide" <sup>133</sup> sets targets to ensure competitiveness and sustainability of mobility; short sea shipping (SSS) is expected to help curb the 50% increase in heavy goods vehicle traffic. Review of this White Paper is taking place in 2006.  European community actions to reinforce SSS include: 1) A Directive standardising reporting formalities for ships to arrive in and/or depart	As for the gross trend, since policies are encouraging the expansion of short sea shipping. Quantifying net trends in morphological pressures is difficult.

<sup>130</sup> Expert judgement made at national workshop

<sup>131</sup> RSPB and English Nature: Supply and demand in the GB ports industry, 2000 to 2020, March 2002

<sup>132</sup> "Expert comment made at national workshop – the impact of this policy needs to be considered in the light of the resulting decrease in land-based traffic and hence the environmental impacts thereof"

<sup>133</sup> [http://www.europa.eu.int/comm/transport/white\\_paper/documents/doc/lb\\_texte\\_complet\\_en.pdf](http://www.europa.eu.int/comm/transport/white_paper/documents/doc/lb_texte_complet_en.pdf)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
		from ports in Member States. 2) Proposal for a new support programme. 3) Proposal for a Directive on market access to port services. NB this was recently rejected.	
EconG, DemoE, Tech, CC, Gov	Increase of marine transport and development of ports on the designated "motorways". Increased risk of increasing pressures on coastal waters and from ports.	"Motorways of the Sea" <sup>134</sup> concept proposed in above White Paper. Four corridors have been designated including the "Motorway of the Sea of western Europe" which includes North and Irish Sea	Net trend uncertain
		A Green Paper on future EU Maritime Policy, to be adopted by the Commission in the first half of 2006, will constitute a first step towards the establishment of an all-embracing EU Maritime Policy, in line with the Commission's strategic objectives.	Too early to judge
	Development of new port and marina infrastructure	The Environmental Impact Assessment Directive <sup>135</sup> requires an EIA to be carried out for major port schemes, harbour works, marinas, land reclamation and certain coastal defence works. This draws together an assessment of likely significant environmental effects of a project for consideration in the planning application process.  Habitats Directive	Morphological changes have to be addressed, (realignment, sediment management – for WFD),  The Habitats Directive has a target for no net loss of biodiversity: habitats compensation may thus be required in mitigation to offset development losses or damage (this is also the case for other gross trends described in this table). Aim for net benefit/restoration or a neutral effect
	Maintenance of new port infrastructure and associated navigation channels – increased morphological impacts in certain water bodies	In most cases the Food and Environment Protection Act 1985 <sup>136</sup> (FEPA) requires a licence to be issued for disposal or beneficial placing of dredged material. The licensing is to be reviewed in Defra's new Marine Bill, a draft bill should be ready in November 2006	Net trend uncertain
Tech EconG	Continuing maintenance dredging, increased capital dredging (latter locally important)	Dredging practice and equipment has evolved considerably in recent years (UK marine SAC reference) to increase dredging efficiency and to minimise potential effects on the environment by selecting the most appropriate method according to local conditions.	Difficult to quantify but impacts of dredging undertaken according to licence should be minimal (or compensated).
Gov EconG	Agitation dredging likely to be undertaken in some places where there is no current dredging.  Also an increase in agitation dredging replacing other forms	Agitation dredging not regulated under the FEPA licensing process.  Issue of licensing likely to come up in the Marine Bill	The net effect, is the retention of sediment in the water body (which is beneficial to the ecosystem), Usually undertaken in sediments with low oxygen demand, and therefore expect only a small decrease in water dissolved oxygen concentrations.  Impacts on benthic communities in dredged areas (as with conventional dredging), also temporary increase in suspended solids in the water column.

<sup>134</sup> [http://europa.eu.int/comm/transport/intermodality/motorways\\_sea/index\\_en.htm](http://europa.eu.int/comm/transport/intermodality/motorways_sea/index_en.htm)

<sup>135</sup> <http://europa.eu.int/comm/environment/eia/home.htm>

<sup>136</sup> [http://www.mceu.gov.uk/MCEU\\_LOCAL/FEPA/FEPA-start.htm](http://www.mceu.gov.uk/MCEU_LOCAL/FEPA/FEPA-start.htm)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
LUC (demographics).	Reduction in dredging suggested in some small ports (e.g. those that are relatively far from the sea); those closer to the sea may see an increase in use and hence dredging in future years <sup>137</sup> . For example, the port of Norwich is now defunct, and Great Yarmouth is being relocated seaward (more dredging in the latter case).  Housing may be built around former ports but marinas may subsequently be created in the old port area.	Local authorities are keen to encourage this type of development	In short term decrease in dredging, however by 2015 maybe renewal of old infrastructure but for recreational boating requiring deepening (increased dredging) for marinas and sailing.
EconG, DemoE, Tech, CC, Gov	Size of ships is increasing including in small ports  Increased dredging associated with increased port infrastructure and navigation channels	Commercial shipping lines forcing a move to bigger vessels  Landfill Directive <sup>138</sup> (relevant because of need to dispose of dredged spoil).  Lagoons for the collection of dredged silt and dedicated sites for dredged material are excluded from the requirements of this Directive <sup>137</sup> .  More heavily contaminated dredged material must go to licensed landfill but there are issues regarding disposal of wet material in landfills.  There is a DEFRA initiative to look at alternative disposal routes/options for marine material. DEFRA may increase regulation on some current practices.  It is a Government target for around 25% of waste to be incinerated.  The WFD Article 16 daughter directive containing EQSs for Priority Substances could have potentially huge implications for dredged material disposal depending on the levels at which the EQSs are set: the proposal may be published in 2006.	Uncertain but may mean more dredging in local areas and specific water bodies.  Possible increase in restrictions on disposal to landfill and to sea: net effect not certain.  The in-situ capping of contaminated sediments may increase.

<sup>137</sup> Expert judgment made at the Ports, Navigation and Flood Defence stakeholders meeting, 6 April 2006

<sup>138</sup> [http://europa.eu.int/comm/environment/waste/landfill\\_index.htm](http://europa.eu.int/comm/environment/waste/landfill_index.htm) - The Directive targets are to reduce biodegradable municipal waste landfilled to: a) 75% of that produced in 1995 by 2010; b) 50% of that produced in 1995 by 2013 and c) to 35% of that produced in 1995 by 2020.

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above	Marine and coastal navigation and shipping – bigger vessels leading to larger boat washes and increased morphological pressures. e.g. for example in the Orwell estuary.	Harbour Authority byelaws/Harbour Master controls. Hulls design leading to less wash.	Speed limits are often in place but may not be enforced (e.g. due to high costs) <sup>137</sup> New larger, low wash design vessels will only be introduced slowly – long term net benefit.
EconG, DemoE, Tech, CC, Gov	Water-based sports: 9.5 % increase in participation between 1988 and 1994, number of craft over 6.5 m estimated to be increasing by 5,000 to 6,000 per year <sup>139</sup> .  Nationally on average there are 3.5 to 4 million participants a year in water sports (inland and marine) but there has been a slight decrease over past 5 years – recreation follows economy (water sports review).  Inland recreational use growing 2% a year over last 10 to 20 years – lack of mooring spaces and to build new marinas, increase in water to fill marinas and increased dredging.  Marinas also increasing in size and numbers.  Size of craft (motorboats) and numbers of moorings increasing.	No policies identified	Net effect: bigger and more boats; hence morphological pressures are increasing due to dredging requirements.  Possible increase in canoeing and rowing in relation to publicity of Olympics.
	Increasing use of leisure craft and their moorings in estuaries – tidal movement and dragging of mooring chains can cause significant damage to the bed in some estuaries.	No policies identified	Possible increasing use of swinging moorings because of costs of marina berths. NB: Swinging moorings can cause increasing siltation.

<sup>139</sup> Defra (May 2005) Water quality: A diffuse pollution review: Chapter 3: sources of diffuse water pollution.

**Table P4 Ports and marinas – Alien species pressure**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG CC	International waterborne traffic expected to increase in the future leading to an increased risk of introduction of alien species.	<p>IMO – International Convention for the Control and Management of Ships' Ballast Water and Sediment<sup>140</sup>. The Convention will enter into force 12 months after ratification by 30 states representing 35% of world merchant shipping tonnage. As of February 2006 only 6 countries representing 0.62 % of world tonnage had ratified the Convention<sup>141</sup>.</p> <p>The Convention requires the introduction of mandatory ballast water management from 2009, but not later than 2016, in order to eliminate the common practice of vessels loading or discharging untreated ballast water. In future, ballast water will have to be treated on board. It also contains regulations concerning the sea areas where ships are allowed to exchange ballast water during the transition period, until treatment facilities are available on board the ships: the area must be at least 200 nautical miles from the nearest land and have a water depth of at least 200 metres. Where that is not possible, the ships should stay at least 50 nautical miles from the nearest land, at a water depth of 200 metres. Special areas for ballast water exchange may be designated jointly by neighbouring states. The guidelines are expected to be adopted by March 2006.</p> <p>14 guidelines are being written for the uniform implementation of the convention. The guidelines will provide flag administrations and port state authorities with guidance on procedures and principles to minimise the risk of transferring harmful aquatic organisms. Treatment technologies for ballast water are being developed and tested for possible application over the next few years.</p>	<p>Elimination of established communities is difficult or impossible.</p> <p>A predicted increasing or static trend for alien species pressures</p>
		<p>The Maritime and Coastguard Agency (MCA) has instigated a European scoping study for ballast water management and will assess treatment technologies and other measures. If it is deemed that treatment technology is not yet advanced enough for discharge water to be compliant with the Convention, ballast water exchange will then be the main management option available<sup>142</sup>.</p>	<p>Could reduce the risk of new invasive species being introduced.</p> <p>Should reduce the risk of new invasive species being introduced.</p>
	In-water hull cleaning is allowed in UK waters but is banned in other countries.	Potential gap in regulation.	Increased risk of introduction of new invasive species

<sup>140</sup> [http://www.imo.org/Newsroom/mainframe.asp?topic\\_id=848&doc\\_id=3475](http://www.imo.org/Newsroom/mainframe.asp?topic_id=848&doc_id=3475)

<sup>141</sup> [http://www.imo.org/Conventions/mainframe.asp?topic\\_id=247](http://www.imo.org/Conventions/mainframe.asp?topic_id=247)

<sup>142</sup> [http://www.mcga.gov.uk/c4mca/mcga-environmental/mcga-dqs\\_qual\\_eq\\_environmental\\_quality/ds-eg-bw.htm?printout=1](http://www.mcga.gov.uk/c4mca/mcga-environmental/mcga-dqs_qual_eq_environmental_quality/ds-eg-bw.htm?printout=1)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above	Increasing amount of biological material in low productivity waters	Policy on hull design – New material mimics shark, prevent attachment of species, links to antifoulants	Net trend not known
Gov	The Chinese Mitten crab is native to Asia but arrived in Europe a century ago <sup>143</sup> . Populations have greatly increased in estuaries such as the Thames. They can cause significant damage to riverbanks.	Chinese Mitten crabs now being harvested in Thames: this measure is being assessed to see if it can be used to control/reduce populations and migration into river systems.	Net trend not known
Gov CC	Opening of new (inland) waterways requiring source for water supply, engineering works and perhaps more water transfers.	BW no longer proactively seek to undertake Inter-basin Water transfers to meet its water needs, but may respond to proposals from other water abstractors to do so.	Locally there may be increased storage of water. There could be 50 to 100 miles of new waterways by 2015 (see Table N1)

**Table P5 Ports and marinas – Other pressures**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	Noise from ships and sonar – impacts on fauna Air emissions	None identified	Uncertain
EconG, DemoE, Tech, CC, Gov	Waterborne traffic may increase in the future. Disposal of sulphur scubbings and waste may be a problem as facilities are limited and the EEA suggested incineration (i.e. release of the sulphur).	Maritime and Coastguard Agency. The International Convention for the Prevention of Marine Pollution from Ships (MARPOL): Annex 6 deals with the Prevention of Air pollution from ships entered into force May 2005. A recent amendment to the Annex will establish the North Sea SOx Emission Control Area – this should enter into force in November 2006. Use of low sulphur fuels in east coast and north Sea EC Directive on sulphur content of marine fuels <sup>144</sup>	Decrease in emissions from this source and reduction in atmospheric deposition on land and sea

<sup>143</sup> <http://www.nhm.ac.uk/nature-online/life/other-invertebrates/chinese-mitten-crabs/chinese-mitten-crabs.html>

<sup>144</sup> <http://europa.eu.int/comm/environment/air/transport.htm>

**Table N1 Navigation– morphological pressures<sup>q</sup> (including dredging, upgrading of wharves, bank protection and other works, sediment disturbance)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG, DemoE, LUC, Cons	British Waterways (BW) indicate increased future boat usage for freight and leisure <sup>145</sup>  28% increase in boat traffic on BW waterways by 2025 <sup>146</sup>		Increased morphological, diffuse and point source pressures since policies/aspirations are promoting greater use of waterways  Net trend/effect uncertain
EconG, DemoE	Opening of new (inland) waterways requiring source for water supply, engineering works and perhaps more water transfers.  Restoration of abandoned or derelict waterways by e.g. Waterways Trust and Wildlife Trusts	BW: Waterways 2025 – lists restoration projects to 2025: this will be updated in summer 2006.  The Inland Waterways Amenity Advisory Council (IWAAC) reviewed restoration projects in 2001, when all 102 projects were underway: to be updated in November 2007.  BW no longer proactively seek to undertake Inter-basin Water transfers to meet its water needs, but may respond to proposals from other water abstractors to do so.	Locally there may be increased storage of water There could be 50 to 100 miles of new waterways by 2015 <sup>147</sup> .  Increased dredging could lead to conflicts with the conservation status of existing water bodies: this should be dealt with through EIA though WFD reference conditions will change.
EconG, DemoE, LUC, Cons	Increased boat traffic lead to additional facilities being needed such as bank protection, dredging, online moorings, off-line marinas and sanitary stations.	BW aim to double the number of visits to waterways by 2012 <sup>147</sup> , some of which will be as increased boat traffic.	Increased turbidity, morphological pressures, (through boat wash and bank protection).  There may also be some negative impacts on some aquatic plants from increased boat wash.  Excavations for new off-line marinas may create new artificial water bodies.
	Doubling of amount of freight moved on waterways. If current demand for moorings continues, boat numbers will increase significantly: increased morphological pressures (moorings) – nationally small pressure. Wharves may need to be upgraded or constructed from new, and dredging, bank protection, and other works may be needed on some routes.	BW aim to double the amount of freight moved on its waterways by 2012 <sup>148</sup> .  The bigger waterways such as the Severn, Trent, Aire and Calder, South Yorkshire Navigation, Lee, and Weaver are those most likely to be used.	Locally there could be significant impacts and increased morphological pressures – e.g. in tidal Lee for construction material for Olympics 2012.

<sup>145</sup> Information provided by email or telephone interview prior to the national workshop

<sup>146</sup> DEFRA Study Water Framework Directive Economic Analysis for England and Wales: Case Study From British Waterways

<sup>147</sup> Expert judgment made at the Ports, Navigation and Flood Defence meeting on 6 April 2006

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
As above	Increased dredging – the same pressures as for the ports sector – see Table P1.	Control on contaminated waste	Deeper draft and more vessels leading to more dredging
Gov Behav  EconG	Increase in the numbers of boats being used 5% by 2007.	EA policy to promote recreational boating. ‘Your Rivers For Life 2004-2007’ <sup>149</sup> .  This recent EA Policy statement repeats BW projections.	Net effect not certain
		An existing EC Directive <sup>150</sup> (82/714/EC), which lays down technical standards for inland waterway vessels, is being amended. Standards will be implemented in the UK once the new Directive is adopted, probably 2007/8.  The MCA is looking for a derogation from the above Directive as it is aimed at European mainland waterways and the UK is not connected to these inland waters	
Gov		Salmon and Freshwater Fisheries Act 1975 – requirements relating to fish passes will be reviewed in 2007, and the current exemptions for inland waterways may be changed, requiring more fish passes through waterways infrastructure	Decreasing hydromorphological pressures leading to more dispersed and increased fish populations, and increased (river) continuity.
		Policy on hull design: studies on this were undertaken during the 1980s and 1990 studies but nothing has been implemented on this <sup>151/152</sup> .	Uncertain
Behav EconG	Increasingly there may be a need for access onto towpaths and bankside for heavy machinery for bankside protection/stabilisation engineering works.	Health and Safety legislation: there have been accidents where machinery has fallen into canals.	More heavily engineered banks to support load hence increasing morphological pressures – may only be of local importance.

Notes: q: Largely inland waterways including canals

<sup>148</sup> Defra Study, Water Framework Directive Economic Analysis for England and Wales: Case Study From British Waterways

<sup>149</sup> <http://www.environment-agency.gov.uk/subjects/navigation/?lang=e>

<sup>150</sup> [http://europa.eu.int/eur-lex/pri/en/oj/dat/2004/l\\_225/l\\_22520040625en00030107.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2004/l_225/l_22520040625en00030107.pdf)

<sup>151</sup> Expert judgment made at the Ports, Navigation and Flood Defence meeting on 6 April 2006

<sup>152</sup> Economic incentives for eco-hulls would be required to reduce morphological impacts arising from boat wash.

**Table N2a Navigation and waterways - Water Abstraction and flow regulation**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE CC	British Waterways indicate increased future boat usage for freight and leisure  28% increase in boat traffic on BW waterways by 2025.  Will need more water, or better water use efficiency, more water recycling (increased energy consumption)		Net trend uncertain.  Depend on licensing but could be net increases in abstraction
EconG DemoE	Opening of new waterways requiring source for water supply and perhaps more water transfers.  Marinas: there is pressure for more offline marinas to meet demand either new digs or conversion of gravel pits.	Exemption from abstraction licensing removed by Water Act 2003. CAMs will determine licence conditions	Trend will depend on EA regulation Locally could be very significant  Increasing morphological and abstractions pressures (through increasing lockage). Could be locally significant.
EconG DemoE Tech		Mitigation measures: control of losses through fixing of leaks and backpumping.	Net trend uncertain
CC	Flow regulation and river abstraction leads to shoaling and making navigation (tidal and inland) less possible.  Possible related issue with increased frequency of droughts.		Increased shoaling due to climate change and population pressure – regionally different (South East England most affected)  Morphological changes in some estuaries as a result of extreme events after periods of droughts.  Net trend uncertain
	Ports are also not getting enough compensation water in tidally affected reaches.		Increased demand for freshwater locally in associated with affected Ports. [There is a Thames EA notice to licence holder that permanent lock closures may occur over summer 2006].
Gov		Management of related waterway SSSIs	Increased water usage through better management systems –no net trend

**Table N2b Navigation and waterways - Point source pressures – oil (discharge of sewage and grey water waste associated with leisure/freight)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	British Waterways indicate increased future boat usage for freight and leisure <sup>153</sup>  28% increase in boat traffic on BW waterways by 2025	Green/blue, boat safety scheme requiring boats to prevent on board oil contamination in the future.	Improvement from what is currently a low level of impact on water quality
	Water-based sports: 9.5 % increase in participation between 1988 and 1994, number of craft over 6.5 m estimated to be increasing by 5,000 to 6,000 per year <sup>154</sup> .	Dealt with in Table P2b	Dealt with in Table P2b

**Table N2c Navigation and waterways – Point source pressures – sanitary determinands (discharge of sewage and grey water waste associated with leisure/freight)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE LUC	British Waterways indicate increased future boat usage for freight and leisure  28% increase in boat traffic on BW waterways by 2025	Sewage contained on board and then pumped out at bankside facilities – not an issue.  Grey water not significant though may have to do something in marinas.	Insignificant impact at the national level though could be locally significant (grey water) <sup>155</sup> .  Net positive trend in the longer term.
Cons	Water-based sports: 9.5 % increase in participation between 1988 and 1994, number of craft over 6.5 m estimated to be increasing by 5,000 to 6,000 per year <sup>154</sup> .	Dealt with in Table P2b	Dealt with in Table P2b

<sup>153</sup> Information provided by email or telephone interview prior to the national workshop

<sup>154</sup> Defra (May 2005) Water quality: A diffuse pollution review: Chapter 3: sources of diffuse water pollution.

<sup>155</sup> Expert judgment made at the Ports, Navigation and Flood Defence meeting on 6 April 2006

**Table N2d Navigation and waterways – Diffuse source pressures – pesticides (antifouling paints)**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE LUC Cons	British Waterways indicate increased future boat usage for freight and leisure  28% increase in boat traffic on BW waterways by 2025	Antifouling paints are not normally used on inland boats.  However, it may be an issue locally where sea going vessels enter freshwater systems, for example on the Norfolk Broads.  The Green Blue initiative includes anti-fouling and marine paints as one of the issues requiring information for users on how to minimise or avoid environmental impacts.	Potentially increasing impact if voluntary initiatives are not successfully implemented.

**Table N2e Navigation and waterways – Alien species pressure**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoE LUC Cons	British Waterways indicate increased future boat usage for freight and leisure  28% increase in boat traffic on BW waterways by 2025		Uncertain
	Alien species are not likely to be introduced via inland waterways navigation so no change/trend in pressure, questionable as to whether inter-catchment water transfers are an issue.	Biodiversity action plans  Salmon and freshwater fisheries act 1975	
	Alien aquatic plants (seeds) spread by vessels (Zander has become a problem in a few cases). May be e.g. of local introductions e.g. of a species of Russian shrimp on canoes <sup>156</sup> . More of an issue if water transfers occur	The Green/Blue Initiative does not tackle this issue.  Weeds are controlled by mechanical cutting; pesticides are not used.	Increasing problems particularly with aquatic weeds – but net trends uncertain

<sup>156</sup> Expert judgment made at the Ports, Navigation and Flood Defence meeting on 6 April 2006

**Table F Flood Risk Management (inland and coastal) – morphological pressures**

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC	<p>Heavier more intense rainfall leading to increased flooding – regional differences</p> <p>Increasing sea levels leading to more coastal flooding</p> <p>Increase in storm surges in coastal areas and estuaries</p> <p>Increased storminess and wave activity increasing erosion</p> <p>Risks of flooding and coastal erosion are set to increase over the next 100 years due to changes in the climate and in society<sup>156</sup></p> <p>Nearly 2 million properties in flood plains along rivers, estuaries and coasts are potentially at risk of river or coastal flooding.</p> <p>80,000 properties are at risk in towns and cities from flooding caused by heavy downpours that overwhelm urban drains –the so-called ‘intra-urban’ flooding.</p> <p>Coastal erosion will increase substantially under the baseline assumption – i.e. spending on coastal defence continues at present levels. The annual average damage is set to increase by 3 - 9 times by the 2080s, although the worst case (£126 million per year) is still much less than current flood losses (£1 billion</p>	<p>Research led by HR Wallingford reviewed climate change scenarios developed by the Defra-sponsored UK Climate Impacts Programme (UKCIP) for 2020’s and 2080’s which were published in April 2002. The research suggested that current allowances for sea-level rise and sensitivity allowances for increased river flow are still appropriate. It also recommends that sensitivity allowances should be added for increases in offshore waves. These recommendations are endorsed by Defra and the Environment Agency and should be applied to all future applications for grant aided flood and coastal defence projects. The recommendations are summarised in the table above<sup>156</sup>.</p> <p>However, the recommendations pre-date the most recent UKCIP work into the foresight report and UKCIP’s four scenarios of World Markets, National Enterprise, Local Stewardship and Local Sustainability still needs to be understood in the context of flood risk management. This is currently under discussion.</p>	<p>Net trends are uncertain, with limited information available.</p> <p>However, potential trends could include: greater use of washlands and overflows and lower flood risk; concentration of investment in flood risk management around major habitations; trend towards abandonment or realignment of existing defences; improved flood risk management in major centres of population but declining safeguards in more rural and unpopulated areas; and, coastal erosion likely to be insufficient to keep pace with demands for sediment in other parts of the coastline<sup>157</sup>.</p> <p>UKCIP is currently considering further which of the four scenarios are most likely. If mass automation and capitalism continues without any abatement, then the World Markets scenario is seen by many as the only outcome. World Markets represents the worst case scenario in terms of climate change. Defra FM’s policy here, is more linked to climate change allowances to consider in the design and appraisal of flood risk management activities. The policy will only reduce the impact brought upon the receptors to climate change and not climate change itself, according to Foresight<sup>158</sup>.</p>

<sup>157</sup> Expert judgment provided by phone and/or email

<sup>158</sup> [http://www.foresight.gov.uk/Previous\\_Projects/Flood\\_and\\_Coastal\\_Defence/index.html](http://www.foresight.gov.uk/Previous_Projects/Flood_and_Coastal_Defence/index.html)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
	per year) <sup>156</sup>		
CC	<p>Coastal squeeze: 61% of the English and Welsh coastline had steepened, 33 % had flattened and 6 % remained the same. Coastal squeeze was most evident where there where existing sea defences<sup>159</sup>.</p> <p>Intertidal habitat loss is mainly occurring in the south and east of England.</p> <p>Increased coastal squeeze because of new sea defences leading to increased erosion.</p>	<p>EU Habitats Directive requires habitats lost to coastal erosion to be compensated for by creation of new habitats.</p> <p>Policies aim to keep sediment in the system, erosion not necessarily a bad thing locally, as long as sediment is retained in the system as a whole.</p> <p>Defra has policy guidance relating to Coastal Squeeze<sup>160</sup>.</p>	<p>Defra's initial assessment is that the creation of an annual average of at least 100 ha of intertidal habitat associated with European sites in England that are subject to coastal squeeze, together with any more specifically identified measures to replace losses of terrestrial and supra-tidal habitats, is likely to be sufficient to protect the overall coherence of the Natura 2000 network<sup>161</sup>. This assessment takes account of intertidal habitat loss from European sites in England that is caused by a combination of all flood risk management structures and sea level rise.</p>
EconG DemoG LUC Cons Behav CC Gov	<p>Increased new development activity leading to increasing risks to the environment. Flood and coastal erosion risk management activities would be included in this</p>	<p>Defra's line to take on SEA is found in the most recent SMP guidance (on the Defra website – SMP Vol 1 Section 3.4). The extract recommended by our Environmental Advisor for use in these tables is below. SEA is important, as it requires options to consider environmental impacts before a preferred option is chosen. This is unlike the earlier EIA process where a preferred option is then closely considered in terms of it's environmental acceptability before a final planning decision.</p> <p>Under Directive 2001/42/EC of the European Parliament and European Council on the assessment of the effects of certain plans and programmes on the environment a strategic environmental assessment (SEA) must be made of plans and programmes, subject to certain criteria, which are likely to have significant environmental effects. Shoreline Management Plans (SMPs) have much in common. Defra recommend that operating authorities assess policies using the approach described in the Directive. The assessment should be done at a level appropriate to the wide-ranging scale of SMPs. It should take account of the fact that more detailed environmental assessments will be done at the strategy or project stage, and should try to avoid repeating work unnecessarily. As with other aspects of developing SMPs, you should use the best available information.</p>	<p>This policy is not covered by UK legislation for option choice to apply to SMPs but this sets out the UK Government position and preference for the guidance to be adhered to.</p> <p>SEA, if implemented, would go some way to incorporating a number of the requirements of the WFD<sup>162</sup>.</p>

<sup>159</sup> [http://www.guardian.co.uk/uk\\_news/story/0,,1315830,00.html](http://www.guardian.co.uk/uk_news/story/0,,1315830,00.html)

<sup>160</sup> <http://www.defra.gov.uk/environ/fcd/policy/csqueeze.htm>

<sup>161</sup> <http://www.defra.gov.uk/environ/fcd/policy/csqueeze.pdf>

<sup>162</sup> Expert judgment (Karl Hardy, DEFRA)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
EconG DemoG LUC Cons Behav CC Gov	As above	<p>The SMP should include:</p> <ul style="list-style-type: none"> <li>• an assessment of the environmental implications of all other policy options you considered;</li> <li>• a description of measures designed to prevent, reduce and, as fully as possible, compensate for any significant effects the plan has on the environment; and</li> <li>• a statement of the monitoring measures designed to identify any unexpected negative effects of the plan.</li> </ul> <p>The general implications of environmental laws on flood and coastal management and the responsibilities of operating authorities is shown elsewhere in Defra guidance<sup>158</sup>. This guidance (which is not repeated here) covers all levels of planning and assessment for managing risks from floods and coastlines, including assessing and choosing policies for SMPs</p>	As above
Gov		Port Development: can involve managed realignments within estuary flood risk management strategies. There can be reconstruction of habitats such as in the case of the Humber and Harwich.	This has been an increasing trend over the last 6 years, but may not happen so much in the future.
EconG DemoG LUC Cons Behav CC Gov	New coastal flood defences are focused in high economic value areas – hence in some areas e.g. the Thames estuary, may have more barriers, in less economic important areas coast realignment may be used. One option being considered is to put a large barrier in the outer Thames estuary: whilst this would have an immense morphological impact, this may be the only viable solution to protecting London from flooding.	There is a Defra policy on this provided <sup>163</sup> , which covers uneconomic sea defences.	<p>In a number of coastal areas where risk assessment is shown that sustainability (impacts on society, economy and the environment) is not unduly affected, the trend will be for allowance of coastal squeeze and managing this process via managed retreat.</p> <p>A greater pressure for compensation payments to cover for any losses from a managed retreat policy may emerge. However, since flood and coastal defence legislation in England and Wales is permissive, it does not confer a right to protection, except in very limited circumstances. For flood defence works funded by the taxpayer, decisions on where to invest, or continue to invest, should be made in the light of the dangers to life, potential damage to assets measured in national economic terms and legal requirements; the aim being to maximise the public benefits within the available budget.</p> <p>Where there is no legal requirement to provide flood defence there is similarly no provision for compensation to offset the disadvantage suffered by any landowners that may be flooded as a result of a change in flood management practices.</p>
CC Gov	Tidal barrages are being increasingly closed for containing fluvial (freshwater) floods. This	There is no current policy relating to this <sup>165</sup> .	Uncertain but could be increased morphological pressures in affected water bodies.

<sup>163</sup> <http://www.defra.gov.uk/environ/fcd/default.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC Gov	<p>leads to increased sedimentation in the seaward side of the barrages, and hence increased need for dredging<sup>164</sup>.</p> <p>Barriers reduce the flushing of tidal creeks leading to increased siltation and increased dredging. – mainly along the East Coast of England.</p> <p>The reflected waves from water hitting the barrages from the seaward side leads to erosion of banks.</p>	As above	As above
EconG, DemoE, LUC	<p>Increase in population and households<sup>166</sup>.</p> <p>200,000 extra new homes to be created by 2016, in addition to those proposed in existing regional planning guidance<sup>167</sup>.</p>	The Governments sustainable communities agenda <sup>168</sup> sets out a strategic approach to development and housing expansion in the South East of England. It also contains proposals to tackle weak housing demand and regeneration in the Midlands and North of England.	No information
	<p>Barker Review of Housing supply<sup>169</sup>: further 70,000 to 120,000 new homes may need to be built each year.</p>		<p>Added pressure on flood risk management budget, especially in SE England.</p> <p>Many studies and reports have considered the Barker review to be placing significant pressures on 1) transport, 2) Utilities (water supply) and 3) flood risk.</p>
CC	<p>Changes in climate such as more severe storms and wetter winters, together with sea level rise, will tend to increase the likelihood of floods and coastal erosion. Around 1.8 million households and 140,000 commercial properties in England are at risk, corresponding</p>	<p>Defra's new strategy (<i>Making space for water</i>)<sup>49</sup> is taking a holistic approach to management of risk from all forms of flooding (river, coastal, groundwater, surface run-off and sewer) and coastal erosion, and seeking to ensure the programme helps deliver sustainable development. It adopts a whole catchment and whole shoreline approach that is consistent with, and contributes to the implementation of the WFD over the 20-year lifetime of the strategy. Looks to adapt to climate change. Aims to integrate strategy with other relevant</p>	<p>Trends not certain because it is too early to see what the effect of the strategy will be, However potential effects include improved flood risk management in major centres of population but declining safeguards in more rural and unpopulated areas.</p>

<sup>164</sup> Expert judgment made at the Ports, Navigation and Flood Defence meeting on 6 April 2006

<sup>165</sup> Expert Judgment, Defra 12 April

<sup>166</sup> [http://www.statistics.gov.uk/downloads/theme\\_compendia/regional\\_trends/RT35\\_03\\_POPN\\_HSHLDS.pdf](http://www.statistics.gov.uk/downloads/theme_compendia/regional_trends/RT35_03_POPN_HSHLDS.pdf)

<sup>167</sup> [http://www.odpm.gov.uk/index.asp?id=1139880#P633\\_78025](http://www.odpm.gov.uk/index.asp?id=1139880#P633_78025)

<sup>168</sup> <http://www.odpm.gov.uk/index.asp?id=1139870>

<sup>169</sup> [http://www.hm-treasury.gov.uk/consultations\\_and\\_legislation/barker/consult\\_barker\\_index.cfm](http://www.hm-treasury.gov.uk/consultations_and_legislation/barker/consult_barker_index.cfm)

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
CC	<p>to some 4 to 5 million people.</p> <p>Flood and coastal erosion risk management<sup>170</sup>.</p> <p>Past risks included:</p> <ul style="list-style-type: none"> <li>- development not being sustainable enough in the face of climate change</li> <li>- not considering the problems in a holistic way, nor looking catchment wide; only locally.</li> <li>- not fully learning lessons from past flood events, regarding our preparedness and response to flooding.</li> </ul>	<p>Government policies.</p> <p>In response to abating the above trends, Defra's new Strategy states on page 11:</p> <p><i>The intention is that the new strategy:</i></p> <ul style="list-style-type: none"> <li>- <i>builds upon work to take account of sustainable development and the Government's strategic priorities</i></li> <li>- <i>addresses the messages from the Foresight Future Flooding report and reflects lessons learned from flood events from the previous past</i></li> <li>- <i>addresses the challenges and pressures we will face in the 21<sup>st</sup> Century such as climate change, development pressures and rising levels of cost and risk and</i></li> <li>- <i>develops a more integrated and holistic approach to the management of flood and coastal erosion using a portfolio of measures.</i></li> </ul>	As above
Gov	<p>Large Public investment projects are increasing in cost. Government expenditure is constrained. The Treasury Green Book therefore sets out the Government's advice on ensuring wise and sustainable public investment, in the face of increasing costs and a constrained budget.</p> <p>FCERM projects in the past have not met their aims and objectives in terms of effectively managing flood and coastal erosion risk management, perhaps due to previous narrow perspective both at policy and delivery levels. The cost of delivery is high with a high percentage of delivery devoted to planning costs rather than delivery (bricks and mortar) costs.</p> <p>Past investment may not</p>	<p>DEFRA produces Project appraisal guidance: procedural guidance<sup>171</sup> for operating authorities for the management of flood risk, coastal defences and erosion with the purpose of assisting sustainable investment decision making</p> <p>Defra and it's delivery agencies/partners agree Higher Level Targets and Outcome Measures, set out the service delivery obligations for delivery bodies to deliver sustainable programme of flood and coastal erosion risk management.</p>	No information: still need time to see how changes in policy will be successful.

<sup>170</sup> Defra (March 2006) Flood and coastal erosion risk management

<sup>171</sup> <http://www.defra.gov.uk/environ/fcd/pubs/pagn/default.htm>

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	<p>previously have been targeting the social or environmental aspects of sustainability, such as not ensuring equity and fairness between interested groups or not considering the need for improved environmental assets such as wetlands.</p> <p>Past investment may not have focussed on a catchment wide or a shoreline management perspective in the past.</p>	As above	As above
EconG DemoE LUC Cons Behav CC Gov	<p>The annual monitoring report (2004/05) from the Environment Agency (EA) and Local Government Association on 'Development and Flood Risk' records the performance of all local authorities in England on developments where the EA has provided flood risk advice. Over 5 million people and 2 million homes and businesses are currently at risk from flooding in England and Wales<sup>172</sup>. Climate change could see the number of people at 'high' risk of flooding rising from 1.5 million to 3.5 million by 2080<sup>173</sup>.</p> <p>In 2004/05 there were 21 cases where the EA's advice was ignored on major developments</p> <p>The requirement for flood risk assessments to accompany planning applications is still being ignored by some developers - the lack of these assessments account for more than half (53%) of all Environment Agency sustained objections.</p>	<p>Where a local authority wishes to grant planning permission for a major development contrary to the advice of the EA, this should be referred to central government to consider calling in the case.</p> <p>The Office of the Deputy Prime Minister (ODPM) leads on development planning policy and has given local planning authorities clear guidance to ensure that where new development is necessary in areas of flood risk, it is appropriate and safe, does not increase flood risk elsewhere, and where possible, reduces flood risk overall. ODPM's Planning Policy Guidance Note 25 Development and Flood Risk (PPG25).<sup>174</sup> PPG20 covers coastal issues.</p>	No information

<sup>172</sup> [http://www.environment-agency.gov.uk/news/1294851?lang=e&theme=&region=&subject=&searchfor=planning+applications&any\\_all=&choose\\_order=&exactphrase=&withoutwords=](http://www.environment-agency.gov.uk/news/1294851?lang=e&theme=&region=&subject=&searchfor=planning+applications&any_all=&choose_order=&exactphrase=&withoutwords=)

<sup>173</sup> <http://www.environment-agency.gov.uk/subjects/flood/763964/763974/?version=1&lang=e>

<sup>174</sup> Defra (March 2006) Flood and coastal erosion risk management

Drivers	Gross Trends	Policies in place/mitigation	Net Trends
Gov	Disparate flood management decisions not taking into account wider catchment impacts or opportunities. Limited National perspective of flood risk management requirements or priorities	EA's Catchment (CFMP's) and Coastal Authority Shoreline Management Plans (SMPs), River Basin Management Plans. SMPs comprise measures to hold the line; advance the line; managed realignment; and, no active intervention. EA's Catchment Flood Management Plans and SMPs include recommendations for the best ways of managing the risk of flooding within catchments over the next 50 to 100 years. Includes measures to build flood defences or let excess water drain natural across uninhabited agricultural land	Proactive approach to flood management improved co-ordination between different water management and environmental issues at the catchment scale leading to some multipurpose schemes or better and more transparent decision making.
	Internal Drainage Boards established under the Land Drainage Act 1991 have permissive powers to undertake work on drainage and water level management and to undertake flood risk management works on watercourses other than main rivers <sup>175</sup> . IDBs maintain over 500 pumping stations, 22,000 km of water courses, and have a part in providing flood protection to 879,000 properties and 600,000 people. Need to integrate their activities with those of the Environment Agency.	'Making Space for Water' <sup>49</sup> is looking at Authorities' responsibilities and Duties with a view to improving effectiveness.	Too early to tell.
EconG DemoE LUC Cons Behav CC Gov	Urban flooding: More run-off in response to more intense rainfall and increasing urbanisation.  Predicted to be a significant future threat for many towns and cities in England <sup>176</sup>	'Making Space for Water' <sup>49</sup> takes forward the concept of integrated urban drainage management enabling the different authorities responsible for different parts of the urban drainage system to work together: local authorities, highways authorities, water companies, the EA etc.	No information but hard engineering solutions could cause significant increased morphological pressures.  Increased volumes of non-treated run-off could cause significant deterioration in water quality in affected water bodies.

<sup>175</sup> Internal Drainage Board Review, Final Report, February 2006.

<sup>176</sup> <http://www.defra.gov.uk/news/2005/050324b.htm>

## APPENDIX F      MATRIX OF SIGNIFICANCE

Activity/ Sector	Pressure	Potential Impact of the new data	Confidence in new data	Confidence in existing RA
Urbanisation	Diffuse sources	2.00	0.33	2.00
Urbanisation	Point sources	1.67	0.67	1.00
Urbanisation	Abstraction/flow	1.33	1.00	1.00
Urbanisation	Morphological	1.67	0.33	2.00
Transport	Diffuse sources generally	1.67	1.00	2.00
Transport	Diffuse Sources - Acidification	1.67	1.00	1.33
Transport	Point sources	1.67	0.33	1.33
Transport	Abstraction/flow	1.67	0.33	1.33
Transport	Morphological	1.33	0.33	2.00
Agriculture	Diffuse sources	2.00	1.33	1.67
Industry	Diffuse Sources	1.33	0.00	2.00
Industry	Point Sources	1.67	0.00	1.00
Industry	Abstraction/flow	1.67	0.33	1.00
Industry	Morphological	1.33	0.33	2.00
Agriculture	Point sources	1.33	0.67	1.67
Agriculture	Abstraction/flow	1.00	0.67	1.33
Agriculture	Morphological	0.67	0.33	2.00
Forestry	Diffuse sources	1.33	2.00	1.33
Forestry	Point sources	1.33	2.00	1.33
Forestry	Abstraction/flow	1.33	2.00	1.00
Forestry	Morphological	1.00	2.00	1.67
Ports&Marinas	Morphological; dredging and infrastructure	1.00	1.67	2.00
Ports&Marinas	Abstraction/flow	0.67	1.00	1.33

<b>Activity/ Sector</b>	<b>Pressure</b>	<b>Potential Impact of the new data</b>	<b>Confidence in new data</b>	<b>Confidence in existing RA</b>
Ports&Marinas	Point source – oil	0.67	1.67	1.67
Ports&Marinas	Point source – sanitary determinands	0.67	1.67	1.33
Ports&Marinas	Diffuse source – pesticide (antifouling paints)	1.33	2.00	1.33
Ports&Marinas	Alien species pressure	1.33	1.67	1.33
Navigation	Morphological	1.67	1.67	2.00
Navigation	Abstraction/flow	1.33	1.33	1.33
Navigation	Point source – oil	0.67	2.00	1.33
Navigation	Point source – sanitary determinands	0.67	2.00	1.33
Navigation	Diffuse source – pesticide (antifouling paints), enhanced turbidity	1.33	1.67	1.67
Navigation	Alien species pressure	1.67	1.33	1.00
Flood Defence	Morphological	2.00	1.67	1.67