

October  
2008

## Regulation

### vol. 2 Reports on assets, benchmarking, cost assessments, impacts of metering, innovation, regulatory monitoring and serviceability

The UKWIR research programme is currently divided into the following topic areas: drinking water quality and health; toxicology; water resources; climate change; wastewater treatment; biosolids; water mains and services as well as regulatory and customer issues. Earlier regulation reports were listed in the Customer, Environment & Regulation catalogue.

Regulation research centres around the *Common Framework for Capital Maintenance* (CFCM - 03/RG/05/3) which has been adopted by the water industry and the regulators as the process for company business planning and reporting.

Supporting this work is the *Water Industry Database of Equipment Reliability* (WIDER - 08/RG/05/23&24).

Information on a wide range of explanatory variables helps in predicting failures and in calculating future spending schedules.

Cost Benefit Analysis (08/RG/07/9&10) is also a key element in investment planning.

All this research supports the water industry's approach to efficient asset management, as illustrated in figure 1.

It is vital that regulation supports, and is not a barrier to, innovation.

*Barriers to Innovation in the UK Water Industry* (06/RG/10/1) addresses this and looks well beyond the current five year regulation and investment cycle.

Building on this approach is UKWIR's *A Road Map of Strategic R&D Needs to 2030* (07/RG/10/3) with the main themes

**UKWIR reports can only be purchased via the UKWIR website:**

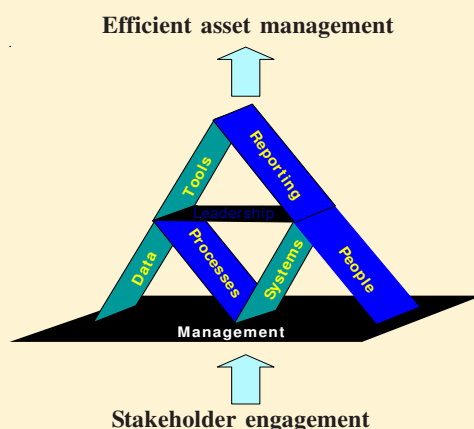
**[www.ukwir.org](http://www.ukwir.org)**

**The website also provides information about current and proposed UKWIR research programmes**

**You can also download the latest version of UKWIR NEWS to obtain an update on recent projects, publications and technology transfer workshops**

illustrated in Table 1.

**Figure 1. Characteristics of efficient asset management**



**Table 1. Road map themes**

**Energy Management.** *Energy-optimised conventional treatment and networks new carbon-neutral and carbon-negative processes.*

**Underground Assets.** *Real-time condition monitoring and early warning of failure with full 3D location and mapping.*

**Leakage.** *Localisation and repair of leaks in live systems within an agreed 'sustainable-level-of-leakage' regulatory framework.*

**Intelligent Metering.** *Universal metering with tariff structures that support demand management and provide real-time data on consumption.*

**Chemical Free Treatment.** *Biological nutrient removal from wastewater at all scales, 'chemical-free' production of drinking water and accepted direct re-use of wastewater.*

UKWIR was set up by the UK water industry in 1993 to provide a framework for the procurement of a common research programme for UK water operators on 'one voice' issues. UKWIR's subscribers comprise 24 water and sewerage undertakers in England and Wales, Scotland and Northern Ireland to whom these publications are freely available.

Work is often carried out in collaboration with government departments and regulators including the Department for Environment, Food and Rural Affairs; the Drinking Water Inspectorate and the Environment Agency. Work is also done in collaboration with research organisations internationally, including the Global Water Research Coalition.

The work is undertaken by a wide range of companies, academic institutions and other organisations in the UK and overseas. Project management is undertaken by both UKWIR members and individuals employed by UKWIR.

## Assets

### GWRC Tool for Risk Management of Water Utility Assets

Contractor: Mott MacDonald

Ref: 08/RG/05/25, ISBN 1 84057 502 6, 93pp, £250

The methodology is designed for application to different types of assets under a wide range of risk scenarios and within the differing cultures and stakeholder environments of GWRC member countries. It will help water utilities to manage risks at both a strategic level and in day-to-day asset management, taking into account the regulatory regime within which the utilities operate, the level of service that is currently provided, the typical expenditure and means of finance, and the rate of deterioration of the asset base. Factors such as design; operation and maintenance risks; costs and benefits, sufficiency of supply; handling high consequence-low probability risks; corporate and reputational impacts; and the effect of uncertainty in forecasting, can be accommodated.

### Capital Maintenance Planning: Asset Deterioration Database (WIDER)

#### Vol. I - Project Report

Contractor: Pearson-Harper

Ref: 08/RG/05/23, ISBN 1 84057 505 0, 82pp, £300

#### Vol. II: Protocol for the Collection and Submission of Data for Water Treatment Works and Sewage Treatment Works

Ref: 08/RG/05/24, ISBN 1 84057 506 9, (sold with above)

The third phase of the Water Industry Database of Equipment Reliability (WIDER) project comprises a three year implementation and delivery stage. Volume I presents an outline record of the activities undertaken, outputs achieved and the benefits to be gained from a co-operative approach, and makes recommendations for improving company data and systems. The WIDER database is available only to UKWIR subscribers via a secure web service.

### Review of Water Mains Serviceability Indicators and Condition Grading

#### Vol. I - Serviceability Indicators

Contractor: Tynemarch

Ref: 07/RG/05/21, ISBN 1 84057 466 6, 62pp, £200

#### Vol. II - Mains Condition Grading

Ref: 08/RG/05/22, ISBN 1 84057 480 1, 82pp, £200

Volume I presents the results of a review of potential new serviceability measures for focusing of investment in water distribution assets. Reviews current practice by water companies and other UK utility industries, in consultation with regulators, with trials and subsequent analysis of selected new measures. Three indicators, property-minutes of interruption, traffic disruption and customer complaints are trialled. Volume II reviews existing and potential approaches to condition grading of water mains. Recommendations include the adoption of observed burst rate as the single basis for mains condition grade.

### Distribution: Development of National Deterioration Models

Contractor: Tynemarch

Ref: 07/RG/05/20, ISBN 1 84057 458 8, 162pp, £400

A set of burst rate models has been developed for use by the UK water industry. Data sets were received from the UKWIR National Mains Failure Database contractors and from three UK companies. Third-party data on soil type, land use and weather are incorporated. A model calibration toolbox is provided that allows company-specific data to be imported and used either to re-calibrate, or for comparison with the models. Conclusions are provided regarding the best performing model types, and statistically significant explanatory variables.

### Asset management Planning Assessment Process - Methodology for Self-Assessment

#### Vol. I - Project Report

Contractor: Mott McDonald

Ref: 07/RG/05/18, ISBN 1 84057 457 7, 54pp, £150

Provides a methodology to facilitate self-assessment of water company approaches to asset management planning. The assessment process is founded on the principles of the Capital Maintenance Planning Common Framework, but extends beyond it, also covering leadership, management, people, processes, systems and reporting. The assessment process is also expandable beyond base maintenance into other policy areas and may be developed further for benchmarking approaches to asset management planning as part of price setting.

## Deterioration Models & Tools for Non-Infrastructure Assets

Contractor: Ewan

Ref: 07/RG/05/17, ISBN 1 84057 436 4, 124pp, £400

Develops deterioration models for above-ground assets which allows companies to input their data and draw their own conclusions. A suite of life distribution and repair rate modelling tools are developed to cover a range of mechanical, electrical and instrumentation assets. These may be used to forecast asset renewal rates, support lifecycle costing and system reliability calculations and are included on a CD. The modelling tools were tested on a selection of water companies' data and nine life distribution models and twenty-nine repair rate models were produced with acceptable results. Investigations on data quality performed during the project showed a need for further improvements to understand the use and value of the data being collected and these aspects are discussed.

### Capital Maintenance Planning: Failure Data and Analysis Methodology for Water Mains

Contractor: Bodycote Materials Testing

Ref: 06/RG/05/16, ISBN 1 84057 427 5, 60pp, £300

Describes the creation of the UKWIR National Mains Failure Database for water mains that provides robust and validated data on which deterioration modelling and asset investment strategies can be based, its structure and a protocol for future data collection. Case studies of how the database has been utilised by some water companies are provided. The data comprises records of UK water supply mains listed by material, age, diameter and length. The database preserves the anonymity of the data providers. Broad statistics on assets and failure rates are presented.

### Deterioration Rates of Sewers

Contractor: Ewan

Ref: 06/RG/05/15, ISBN 1 84057 411 9, 40pp, £175

Examines the data available in the UK on which a determination of the rate of deterioration of different classes of sewers could be based. A method of predicting future rates of deterioration of sewers is proposed and is tested on two pilot sewer systems. Due to present data limitations this is based on groups of adjacent sewers. The extension of the method to individual pipe level when suitable data is available is described. The need for further sewer condition survey is discussed.

### Capital Maintenance Planning Common Framework: Review of Current Practice

Contractor: Tynemarch

Ref: 05/RG/05/14, ISBN 1 84057 395 3, 138pp, £250

The effectiveness of the Capital Maintenance Planning Common Framework (CMPCF) is reviewed from the perspectives of companies and regulators in the context of PR04 and future requirements for capital maintenance planning. Successful analytical approaches used at PR04 are identified, together with areas where further guidance or research may be beneficial. The processes involved in the application of the CMPCF by companies and the assessment of company submissions by Ofwat are examined and recommendations made for improvement.

### Capital Maintenance Planning: Implications for Maintenance of Growth in the Asset Base

Contractor: Ewan

Ref: 03/RG/05/9, ISBN 1 84057 315 5, 32pp, £150

The methodology, and supporting model, provide a significant component in building future capital maintenance requirements due to growth in the asset base, contributing to stage B of the UKWIR Common Framework. The two-staged methodology allows an initial 'first-cut' to focus the study. Where there is a significant impact a more detailed analysis may be prepared using either the service life profile model or the historic expenditure profile model.

### Nationally Agreed Failure Data and Analysis Methodology for Water Mains

#### Vol. I - Overview and Findings

Contractor: Bodycote Materials Testing

Ref: 03/RG/05/7, ISBN 1 84057 305 8, 40pp, £250

#### Vol. II - Protocol for the Capture and Reporting of Data on Mains Failures

Ref: 03/RG/05/8, ISBN 1 84057 306 6, 30pp (sold with above)

Provides an account of the development of a national failure database for water mains (WIDER) which includes a suggested common protocol for data collection. Volume I sets out the principles on which the protocol was written and a description of the work involved in forming the national database. Volume II is the detailed protocol and offers a practical way forward for companies when opportunities allow for improvements in existing systems and practices.

## Capital Maintenance Planning: A Common Framework Vols. I - IV

Contractor: Tynemarch

Ref: 02/RG/05/3, ISBN 1 84057 265 5, 494pp, £500

Involves wide consultation within the UK water industry and the active involvement and contribution of the economic and quality regulators. The Common Framework is founded on risk-based principles so that in most cases capital maintenance will be justified on the current and future probability of asset failure and the resultant consequences for customers, the environment and water service providers, including the costs arising. The Framework has been piloted by three water service providers for selected asset groups.

## Forecasting Serviceability and Asset Performance Indicators

Contractor: WRc

Ref: 02/RG/05/2, ISBN 1 84057 264 7, 170pp, £200

Describes the development of a common technical and economic framework for capital maintenance planning. A reference document for water industry staff considering the levels of capital maintenance needed to maintain asset serviceability. Reviews a range of indicators from the perspective of their suitability for estimating future capital maintenance needs and describes the deterioration process of the principal asset groups and discusses possible tools for forecasting the indicators.

## Benchmarking

### Application of Time Series Analysis to Relative Efficiency Assessment

Contractor: Reckon LLP

Ref: 08/RG/04/3, ISBN 1 84057 487 9, 252pp, £500

Ofwat carries out relative efficiency analysis as part of its price control reviews. Ofwat's analysis has focused on cross-sectional methods. Presents a series of time series panel data models for water service and sewerage service operating expenditure. It provides guidance on the specification and interpretation of time series models. It explains how these models could contribute to relative efficiency analysis for price control reviews. The project also included the development of time series datasets and a software tool to specify and estimate time series models.

### Review of the Approach to Efficiency Assessment in the Regulation of the UK Water Industry

Contractor: Reckon LLP

Ref: 07/RG/04/2, ISBN 1 84057 437 2, 204pp, £600

Could Ofwat conduct price control reviews without relying on econometric modelling and imposing the data collection burden that this entails? Could Ofwat find more robust and transparent ways of analysing and combining evidence about companies' future expenditure requirements? Considers these questions in response to the recommendation for a 'joint industry review of efficiency studies and econometric approaches' included in the independent report to Ofwat on the conduct of the 2004 periodic review. Includes how Ofwat could develop its current approach and radical alternatives to the current approach. The use of panel data analysis and other econometric techniques, the role of top-down productivity studies and the reconciliation of evidence from different sources and techniques.

### International Benchmarking of Water Industry Costs and Performance

Contractor: WRc

Ref: 00/RG/04/1, ISBN 1 84057 208 6, 4pp, £150

Recommends a methodology for conducting process benchmarking on a collaborative basis. The methodology was tested and refined by conducting a case study. In addition, a review of benchmarking activity in the water industry worldwide is contained in the report.

## Cost assessments

### Consequences of Controls on Organic Chemicals in Sludge

Ref: 08/RG/07/16, ISBN 1 84057 508 5, 79pp, £250

Examines the risks, options and costs to the UK water industry associated with sewage sludge non-compliance against organic chemical limits proposed for inclusion in future revisions to the 1986 EU Sludge Directive. Using the limited data available, source assessments and fate modelling have highlighted di(2-ethylhexyl)phthalate (DEHP) as being the compound of primary concern with respect to compliance risk. Thermal destruction and composting have been identified as the primary treatment options to mitigate the risks of non-compliance across all compounds.

## Operating Cost Implications of Capital Investment

Contractor: Atkins

Ref: 08/RG/07/14, ISBN 1 84057 490 9, 66pp, £400

### Opex Forecasting Tool User Guide

Ref: 08/RG/07/15, ISBN 1 84057 491 7, 50pp, (sold with above)

Develops a best practice approach to forecasting operating expenditure arising from capital expenditure. Provides detailed guidance on how to develop an opex forecast using a range of top down and bottom up methods. Provides a software tool user guide and examples for practitioners with a user guide for practitioners.

## The Role and Application of Cost Benefit Analysis Vol. I - Generic Guidance

Contractor: ICF Consulting

Ref: 07/RG/07/9, ISBN 1 84057 455 0, 225pp, £250

### Table 2. Five stages of cost benefit analysis

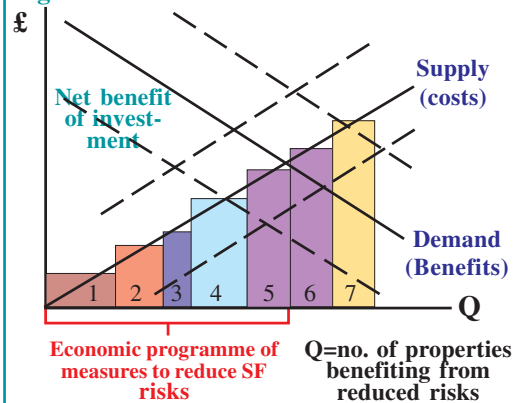
1. Defining the objectives for your CBA
2. Establishing the baseline and investment impacts
3. Measuring cost & benefits in monetary terms
4. Analysis of these impacts on cost and benefits
5. Consideration of distributional impacts.

## Vol. II - Sewer Flooding Guidance

Ref: 07/RG/07/10, ISBN 1 84057 456 9, 120pp, £250

Presents generic guidance on the application of cost benefit analysis (CBA) to water industry investment planning based on a 5-step approach. The issues facing water industry investment planners at each stage of applying CBA are examined, the appropriate analytical tools are identified and examples are used throughout to illustrate the application of those tools. Volume II presents guidance on the application of cost benefit analysis to the alleviation of sewer flooding risks.

Figure 2. Economic reduction of sewer flooding



## Accommodating the Implications of the Revised EU Sludge Directive

Contractor: WRc

Ref: 06/RG/07/8, ISBN 1 84057 401 1, 54pp, £250

Provides information to influence the development of the soil protection strategy of the European Union, and specifically any revisions to the EU Sludge Directive. The focus is on reviewing the implications, risks and threats that might arise from the emerging and existing legislation. The information should help to build confidence in the safety of recycling of sewage sludge to land and avoid unnecessary restrictions on this outlet which is generally considered to be the 'best practicable environmental option' (BPEO).

## Issues and Practice Concerning Supply Pipes

Contractor: Tynemarch

Ref: 04/RG/07/5, ISBN 1 84057 336 8, 82pp, £225

Provides an overview of policies and practice relating to supply pipes. Both water company and customer views have been obtained on issues including common supplies, lead supply pipes and free leak repair schemes. Although the arrangements for supply pipes could be considered essentially fair, there is little understanding of them among the public and there could be significant benefit from providing more information to customers and property professionals. A variety of alternative arrangements for the supply pipe are considered. The costs and benefits of alternatives are difficult to assess as there is insufficient reliable data available relating to the supply pipe asset and its condition.

## The Economics of Achieving Good Water Status with Water Industry Measures: An Assessment of the Scale and Scope of Potential Costs Associated with the Water Framework and Related Directives

Contractor: Stone & Webster

Ref: 03/RG/07/3, ISBN 1 84057 309 0, 140pp, £150

The objective of this project was to review issues concerning the implementation of the Water Framework Directive (WFD) and to consider the scale and scope of the potential cost impacts. The WFD represents an important departure from previous EC legislation on water quality. It introduces an integrated and co-ordinated approach to water management in Europe based on the concept of river basin management planning. Implementation of the WFD will present decision-makers with difficult choices about the scale, scope, timing and financing of future water quality improvements.

The findings of this study should help to provide valuable information about the scale of WFD implementation costs and emphasises the need for water quality improvements to be considered over longer time horizons than the current AMP cycles.

## Impacts of metering

### Towards an Environmentally Effective and Socially Acceptable Strategy for Water Metering in the UK Summary Paper

Contractor: OXERA

Ref: 98/RG/02/1, ISBN 1 84057 125 X, 40pp, £25

### Technical Report

Ref: 98/RG/02/2, ISBN 1 84057 126 8, 140pp, £40

Identifies a series of questions that need to be answered in order to devise an environmentally effective and socially acceptable water-metering strategy for the UK. The study provides a detailed review of the available options at each stage. A case study for the Severn Trent water company area, it is shown that the environmental and social consequences of metering are critically sensitive to the design of the measured tariff structure.

## Innovation in Water

### The Regulatory Cycle and its Impact on the Efficiency of Supply Chain Delivery

Contractor: Ewan

Ref: 07/RG/10/4, ISBN 1 84057 459 3, 126pp, £50

Explores the root causes of the expenditure cycle and quantifies its economic impact, based on detailed information provided by Ofwat, the water companies and a diverse cross section of suppliers. Identifies specific costs attributable to the expenditure cycle. Highlights growing concerns about the impact that uncertainty is having on recruitment and retention of specialist skills within the sector. Recommends integrated action by regulators, water companies and suppliers which could help to minimise the adverse impacts of the cycle and lead to more sustainable long-term arrangements for delivering investment programmes.

### A Road Map of Strategic R&D Needs to 2030

Contractor: WRc

Ref: 07/RG/10/3, ISBN 1 84057 453 4, 98pp, £25

The road maps (underground assets, sustainable leakage, intelligent customer metering, energy efficiency, and chemical free treatment) address key issues facing the water sector. Mapping capital and operational spend by the water sector against the UKWIR strategic matrix provides a strategic overview of how the industry has responded to historic regulatory drivers and how it might respond to future drivers. The long-term maps will inform the 25-year view that water and wastewater companies are developing for submission to the regulators.

### Barriers to Innovation in the Water Sector: Output from the Project Dissemination Conference, DTI Conference Centre December 2006

Contractor: Policy Research in Engineering, Science & Technology

Ref: 07/RG/10/2, ISBN 1 84057 428 3, 50pp, £10

Contains the proceedings and output from a conference to discuss the findings of the UKWIR Barriers to Innovation project report 06/RG/10/1. The purpose of the conference was to agree joint actions. Representatives of stakeholders

including Ofwat, water companies and the supply chain each provided a perspective on the research and alignment of action was explored through facilitated group working. Delegates concluded there was a need to bring all stakeholders and policy makers together to agree the long term strategic goals for the sector to which innovation could contribute.

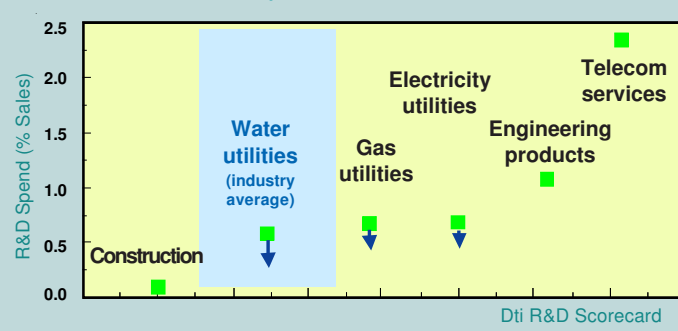
### Barriers to Innovation in the UK Water Industry

Contractor: Policy Research in Engineering, Science & Technology

Ref: 06/RG/10/1, ISBN 1 84057 423 2, 70pp, £50

Explores enablers and barriers focusing on the application of new technological products and processes. Ten innovation cases are researched involving interviews, opinions and evidence from over 100 stakeholders. Regulatory and non-regulatory influences upon success or failure are determined and relevant data, literature, reports and policy materials reviewed. Within the limits of the evidence the project concludes there is misalignment of expectations between the supply-chain, the water companies, the regulators and government which limits the sector's ability to fully exploit its capacity for technological innovation to sustainably meet future needs and challenges of UK and world markets.

Figure 3. Comparing reported R&D investment in UK utility market sectors (1995-2005)



## Regulatory monitoring

### Long Term/Least Cost Planning for Wastewater Supply-Demand

Contractor: Atkins

Ref: 07/RG/08/2, ISBN 1 84057 451 8, 72pp, £500

Presents an outline wastewater supply-demand planning framework. A standard approach to long term least cost planning is set out, taking account of whole life costs and external impacts. Presents a range of tools and approaches for planning in the face of uncertainty and presents definitions of key terms such as 'urban creep' and 'headroom'. The results of five case studies are presented to demonstrate the application of the methodology.

## Serviceability

### Review of Serviceability Indicators

Contractor: Ewan

Ref: 06/RG/01/2, ISBN 1 84057 416 X, 68pp, £300

Reviews various customer service, environmental performance, public health compliance and asset performance measures, collectively referred to as serviceability indicators. Brings clarity to the serviceability assessment process, whereby Ofwat assesses companies' capital maintenance requirements and monitors and influences the delivery of capital programmes, between price reviews.

### Quantification of Serviceability - Final report

Contractor: London Economics

Ref: 98/RG/01/1, ISBN 1 84057 137 3, 96pp, £100

Clarifies the meaning of 'serviceability' and considers whether it is feasible to optimise it. Considers both the regulation of serviceability and the methods of analysis that can be used by companies to improve it. Concludes it is not practical to identify optimum levels, but a methodology is developed and described which will allow companies to make incremental cost-effective improvements.

Statements contained in this UKWIR catalogue do not necessarily represent the views of UKWIR or the Water Industry