



## R&D Technical Summary W5A-061/TS

# Scoping study into the hydraulic performance of bridges and other structures, including effects of blockage, at high flows

### Background to R&D project

The effects of bridges and similar structures on flood levels during high flows can be considerable, and can cause flooding where otherwise none would occur, especially if blockages occur. Hydraulic modelling needs to take account of such structures, but there is no consistent approach. A wide range of methods are currently used, not all of which are relevant for any particular case of structure and channel geometry and flow conditions. This project was initiated to review the knowledge and methods that are currently available, to guide practitioners when choosing appropriate methods of afflux estimation at structures, and to identify future research that would improve knowledge and tools available to practitioners, as well as providing underpinning science. (“Afflux” is a measure of the change in water level caused by the structure).

### Results of R&D project

In-depth reviews of a wide range of methods of afflux estimation used in the UK and other countries were carried out. As afflux is an essential component of hydraulic river modelling packages the methods adopted for a number of packages were also reviewed. The review stage included a questionnaire survey of selected practitioners.

The project also built on the existing analysis and guidance relating to blockage of structures produced by the Environment Agency’s South West Region. This was reviewed as part of this project (See Annex 5). However, it was found that little or no data on blockages exists, and therefore this aspect of the project could not be taken further in the short term other than summarising best available practice.

The scoping study identified where further research is needed to fill gaps of knowledge relating both to blockage and to afflux caused by structure geometry.

### R&D Outputs and their Use

The main output for practitioners from the scoping phase project is an R&D Technical Report (W5A-061/TR1) that provides authoritative guidance on current knowledge and the methods available to determine afflux at structures during flood flows. This will enable improved assessments of potential flood levels upstream of such structures, and thus assist in quantifying flood risk. The target audience includes designers, river modellers, regulators and those carrying out flood risk assessments.

A further output is a short Project Report which reviewed the options for further research. This was produced principally for internal use by Defra and the Environment Agency to identify the immediate “Targetted Programme” of research and development to be undertaken to produce improved tools and guidance for practitioners. A programme of research and software development to produce the so-called “Afflux Estimation System” commenced in February 2004 under JBA Consulting. The Project identifies where current knowledge is lacking, and what further work is required to fill these knowledge gaps – as such it is of interest to other potential researchers, end users and funding institutions.

Six separate expert papers on specific themes were produced to provide background knowledge and information for the Scoping Study. These are published separately as Project Records and are available to those who wish to investigate the background and theory of the main outputs in more detail.

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This R&D Technical Summary relates to R&D Project No. W5A-061 and the following R&D outputs:

R&D Technical Report W5A-061/TR1 – **Afflux at bridges and culverts – Review of current knowledge and practice** (ISBN 1 8443 2291 2)

R&D Project Record W5A-061/PR1 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 1: A Review of Current Knowledge on Bridge Afflux.**

R&D Project Record W5A-061/PR2 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 2: Hydraulic Model Implementation of Bridge and Culvert Afflux and Blockage.**

R&D Project Record W5A-061/PR3 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 3: A Review of Current Practice in the USA.**

R&D Project Record W5A-061/PR4 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 4: A Review of Current Practice for Afflux and Blockage Estimation in the UK, Europe and Asia.**

R&D Project Record W5A-061/PR5 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 5: A Review of the Environment Agency South West Region Study ‘Risk Assessment of Structure Blockage During Flood Flows’.**

R&D Project Record W5A-061/PR6 - **Afflux at bridges and culverts – Review of current knowledge and practice – Annex 6: Bridge Afflux Experiments in Compound Channels.**

R&D Project Record W5A-061/PR7 - **Scoping Study into Hydraulic Performance of Bridges and Other Structures, including Effects of Blockages, at High Flows – Proposed Research Programme.**

Publication Status: Internal - Released to Regions and Areas      External - Released to Public Domain

Project Manager: Andy Pepper, ATPEC Ltd, External Advisor to Engineering Theme

Research Contractor: JBA Consulting – Engineers & Scientists, South Barn, Broughton Hall, Skipton, North Yorkshire, BD23 3AE

The above outputs are available on the Defra / Environment Agency webpages for the Joint Flood and Coastal Erosion Risk Management R&D Programme. These are currently at [www.environment-agency.gov.uk/floodresearch](http://www.environment-agency.gov.uk/floodresearch), and will be incorporated into the new Defra-hosted webpages at [www.defra.gov.uk/enviro/fcd/research](http://www.defra.gov.uk/enviro/fcd/research) (use the search tool located on the project information and publications page). W5A-061/PR1 to 7 are e-published only.

Copies of W5A-061/TR1 are held at the EA Information Centre. They can be purchased from the EA National Customer Contact Centre by emailing [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk) or by telephoning 08708 506506.

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