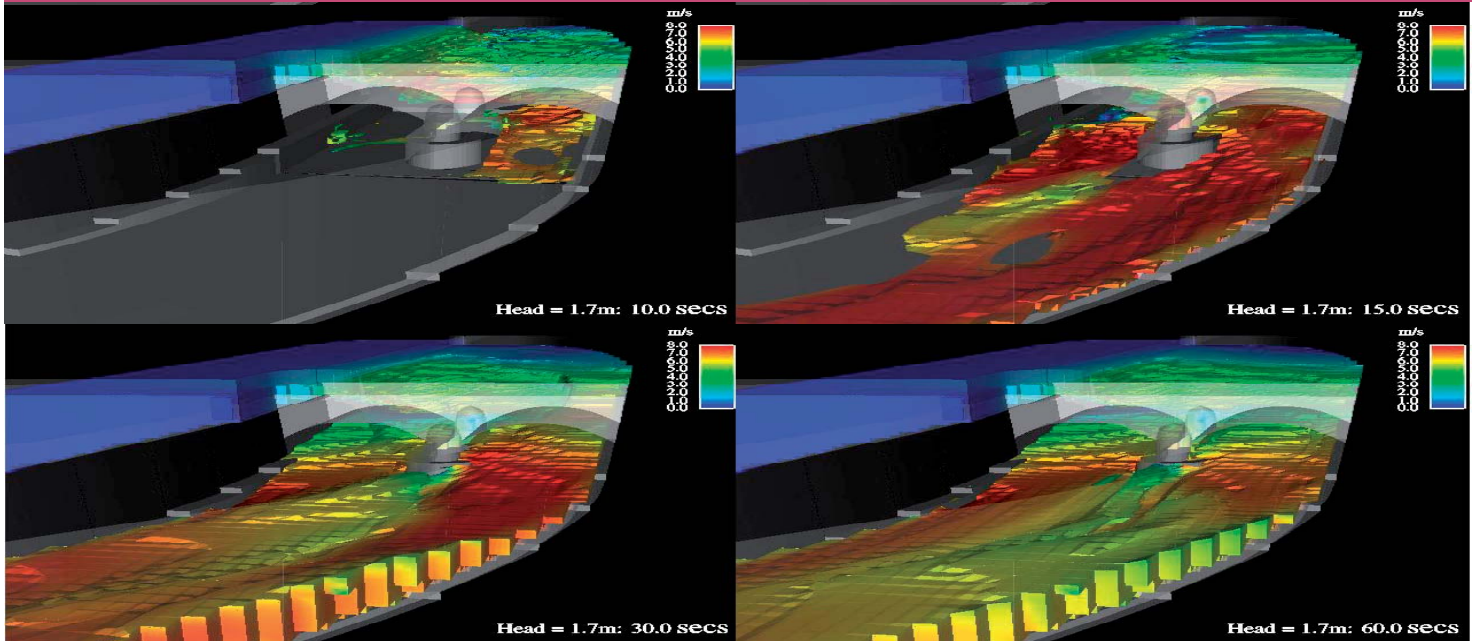


# Hydrology and Hydraulic Modelling

Arup have extensive capability in the provision of hydraulic modelling services for a wide range of projects



## Hydrology

Arup have extensive experience in undertaking hydrological studies and use methods of flood estimation that are appropriate to each project.

We utilise a wide range of up to date hydrological references and software in our studies. The Flood Estimation Handbook (and the associated suite of ISIS-HYDROLOGY for hydrological flood estimation and routing) and Flood Studies Report techniques are used as the basis for hydrological estimation of flood flows in the United Kingdom and Ireland respectively.

We make extensive use of the Institute of Hydrology MicroFSR program for flood estimation in Ireland and have been involved in the Beta-testing of upgrades.

## Hydraulic Modelling

Arup have comprehensive capability in the provision of hydraulic modelling services for a wide range of projects, including:

- Flood Alleviation Schemes
- Bridge and culvert crossings
- Flood risk assessment for new developments
- Estimation of hydraulic loadings on structures
- Reservoir flood routing and spillway hydraulics
- Low flow and water resource studies

Arup provide Coastal/Estuarine/Riverine steady state and hydrodynamic modelling in 1D/2D/3D as appropriate to each project.

We typically use industry standard software such as MIKE11, ISIS STEADY and HEC-RAS to model river hydraulics for steady state backwater analysis.

We use ISIS FLOW, INFOWORKS, MIKE11, MIKE FLOOD, TUFLOW and MIKE21 (2D Modelling) for unsteady flow analysis.

Arup can provide Computational Fluid Dynamics (CFD) modelling services and can manage physical modelling studies for complex hydraulic situations.

Arup are experienced in the specification and supervision of hydrographic surveys and the use of LiDAR to facilitate data collection over large areas.

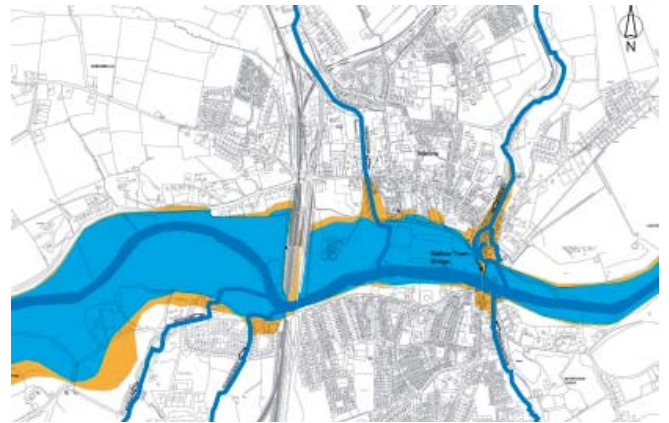
Hydraulic modelling software can be linked with Geographic Information Systems (GIS) to improve data handling and presentation of results.

# Hydrology and Hydraulic Modelling

## Case Studies

### Case Study 1 1D Modelling - Mallow Flood Alleviation Scheme

Hydrological and hydraulic modelling using ISIS was undertaken to assess flood frequency and design flood levels in support of the development of a flood alleviation scheme. An analysis was performed using the methods of the Flood Studies Report, making use of local gauge data, verified by hydraulic modelling to improve hydrological certainty. Options subject to specific hydrological assessment included flood warning and upstream storage (both floodplain washland storage and upland reservoir storage). Joint probability modelling of the Blackwater and its tributaries in Mallow town was also undertaken.



*New bridge over the River Usk*

### Case Study 2 2D Modelling - New M4 project

2D modelling in MIKE 21 assessed the impact of the new route of the UK's M4 motorway on tidal flood water elevations and tidal breach scenarios for an SSSI using a 73.5 km<sup>2</sup> digital terrain model of the floodplain area. A major new bridge over the River Usk was assessed in terms of the impacts on local water quality and scour, as well as flood water levels. Dynamically linked 1D and 2D hydraulic models were built to assess suspended sediment concentrations, dissolved oxygen, local scour depths around the piers and hydrodynamics in a number of joint probability scenarios.

### Case Study 3 3D Modelling - Northwich

Arup developed a 3-Dimensional visualisation tool for the local planning authority for the town of Northwich, integrating gaming technology with hydraulic modelling outputs and LiDAR information. This permits a "fly through" view of the town during a flood event, with the potential to interrogate the model for hydraulic data such as depth or velocity at any location.

This approach to flood simulation and flood risk mapping could have many uses, especially at high-profile sites where flooding is a key planning issue. The tool can be relayed to 3rd parties via a web link, and allows the planning authority to inform planning decisions and to engage with the public and other key stakeholders.

